Wilyin Gao - Capstone Project Documentation

- **Service Features**
  - Azure NAT Gateway -
    - Facilitates outbound internet connectivity within a virtual network.
  - Azure Bastion -
    - Fully managed service that simplifies secure remote access to virtual machines within a virtual network.
  - Azure Database for PostgreSQL -
    - Provides a scalable and secure platform for deploying, managing, and scaling databases without the need for extensive administrative overhead.
  - Azure Service Bus -
    - Facilitates reliable and secure communication between applications and services.
  - Azure Monitor -
    - Comprehensive monitoring and observability service designed to ensure the health and performance of applications and infrastructure.
  - Azure Key Vault -
    - Secure and fully managed service designed to safeguard sensitive information such as cryptographic keys, secrets, and certificates.

- **Scalability and Performance**
  - Azure NAT Gateway -
    - Used in conjunction with Azure Load Balancer to distribute network traffic across multiple resources to ensure scalability and availability. Metrics are provided to track potential scaling needs.
  - Azure Bastion -
    - Fully managed service. Handled by Azure.
  - Azure Database for PostgreSQL -
    - Provides auto-scaling capabilities for read replicas, allowing you to dynamically scale read workloads based on demand.

- Azure Service Bus -
  - Scaled manually by adjusting the number of messaging units or using Premium tier features such as auto-inflate based on throughput needs.
- Azure Monitor -
  - Fully managed service, and its infrastructure is scaled by Microsoft Azure to handle varying workloads transparently.
- Azure Key Vault -
  - Fully managed service, and its infrastructure is scaled by Microsoft Azure based on demand, providing transparent scalability.

Reliability and Availability

- Azure NAT Gateway -
  - Designed for high availability
  - Has a SLA with uptime guarantee with multiple faulty domains to provide fault tolerance.
- Azure Bastion -
  - Covered by SLAs, guaranteeing a high level of availability.
  - Built with redundancy and fault tolerance in mind.
- Azure Database for PostgreSQL -
  - Azure offers SLAs for Azure Database for PostgreSQL.
  - Includes built-in fault tolerance mechanisms, such as automated backups, geo-replication for disaster recovery, and automatic failover for high availability.
- Azure Service Bus -
  - Has SLAs guaranteeing a certain level of uptime, ensuring reliable message processing.
  - ncludes fault tolerance mechanisms, such as message replication across multiple message brokers and automatic retries for message delivery.

- Azure Monitor -
  - Being a critical monitoring service, it benefits from Azure's SLAs to ensure consistent availability.
  - Leverages Azure's fault-tolerant infrastructure to ensure continuous monitoring and alerting, even in the face of transient failures.
- Azure Key Vault -
  - Designed for high availability, and SLAs are provided by Microsoft Azure.

❖ **Security and Compliance**

- Azure NAT Gateway -
  - NAT Gateway uses encryption in transit to secure communication between resources and the internet.
  - Access controls for Azure NAT Gateway are implemented through network security group (NSG) rules and other network-level configurations.
- Azure Bastion -
  - Azure Bastion ensures secure communication through encryption protocols, safeguarding remote access to virtual machines.
  - Access controls for Azure Bastion are managed through Azure Active Directory and role-based access control (RBAC).
- Azure Database for PostgreSQL -
  - Azure Database for MySQL and PostgreSQL enforces encryption in transit and at rest to protect data during communication and storage.
  - Azure Database services support various authentication mechanisms, including username/password and Azure AD-based authentication.
- Azure Service Bus -
  - Access controls are enforced through Shared Access Signatures (SAS) and Azure AD-based authentication, allowing granular control over access.

        - Supports various authentication mechanisms, providing flexibility in securing communication channels.
    - Azure Monitor -
        - Azure Monitor encrypts data in transit and at rest, ensuring the confidentiality of telemetry data.
        - Access controls are managed through RBAC and Azure AD, allowing fine-grained control over who can access monitoring data.
    - Azure Key Vault -
        - Azure Key Vault employs encryption at rest and in transit to safeguard cryptographic keys and secrets.
        - Azure Key Vault complies with industry standards and holds certifications, ensuring a secure key management solution.

- **Data Storage and Management**
    - Azure NAT Gateway -
        - Azure NAT Gateway is primarily a networking service and does not involve direct data storage. It manages network address translation for outbound traffic.
    - Azure Bastion -
        - Azure Bastion is a service for secure remote access to VMs and doesn't involve direct data storage.
    - Azure Database for PostgreSQL -
        - Azure Database for MySQL and PostgreSQL provides fully managed relational database services with storage options based on performance tiers.
    - Azure Service Bus -
        - Azure Service Bus is a fully managed messaging service that stores messages temporarily during communication between applications.
    - Azure Monitor -
        - Azure Monitor stores telemetry data, metrics, and logs generated by monitored resources.

- Azure Key Vault -
  - Azure Key Vault securely stores cryptographic keys, secrets, and certificates.

❖ **Integration Capabilities**

- Azure NAT Gateway -
  - It seamlessly integrates with other Azure networking services and resources.
- Azure Bastion -
  - It integrates seamlessly with Azure Virtual Machines and does not have direct integration capabilities with external services.
- Azure Database for PostgreSQL -
  - It integrates seamlessly with various Azure services and supports common database connectors for external integrations.
- Azure Service Bus -
  - It integrates seamlessly with various Azure services and supports industry-standard protocols for interoperability.
- Azure Monitor -
  - It integrates seamlessly with various Azure services and supports third-party integrations through APIs.
- Azure Key Vault -
  - It integrates seamlessly with various Azure services and supports external integrations through APIs.

❖ **Cost and Pricing Model**

- Azure NAT Gateway/Virtual Network -
  - $2.00 per 100 GB of a virtual network + $37.35 per NAT Gateway
- Azure Bastion -
  - $0.190 per unit/hour
- Azure Database for PostgreSQL -
  - $255.79 per server and $0.115 per GiB of storage, $0.10 per Gib for backup storage
- Azure Service Bus -
  - $0.05 per 1 million operations

- Azure Monitor -
  - Analytic Logs = Daily logs (GB/day) x 30 days x $2.30
  - Basic Logs = (GB/day) x 30 days x $0.50
  - Data Ingestion = Daily logs (GB/day) x 30 x $2.30
  - Data Retention = Total monthly ingestion (months) x Additional retention (months) x $0.10
  - Multi-step Web Test = Test x $10.00(per month)
  - Alert Rules Metric Signals = Resources monitored x metric time-series monitored per resource x $0.10
  - Log Signals Monitored = Number of Log Signals x metric time-series monitored per resource x $0.10
  - $2.00 per 100,000 emails & push notifications
  - $0.60 per 1,000,000 web hooks
- Azure Key Vault -
  - Operations = Operations x $0.30 Per 10,000 operations
  - Advanced Operations = Operations x $0.150 Per 10,000 operations
  - Certificate Renewals = Renewals x $3.00 Per renewal
  - Hardware Security Module Protected Keys = HSM Keys x $1.00 Per key
  - Advanced Hardware Security Module Protected Keys = HSM Keys x $5.00 per key
  - Managed HSM Pools = HSM Pools x Hours X $3.20 per HSM pool per hour

- **Management and Monitoring**
  - Azure NAT Gateway -
    - Azure NAT Gateway integrates with Azure Monitor, providing metrics and logs for monitoring and management.
  - Azure Bastion -
    - Azure Bastion integrates with Azure Monitor, providing metrics and logs for monitoring. It also supports Azure Activity Logs for management.
  - Azure Database for PostgreSQL -

        - Azure Database services offer built-in monitoring and management features, including metrics, logs, and intelligent performance tuning.
    - Azure Service Bus -
        - Azure Service Bus integrates with Azure Monitor, providing metrics and logs. It supports diagnostics logs and Azure Alerts for management.
    - Azure Monitor -
        - Azure Monitor provides a comprehensive set of features, including dashboards, logging, metrics, alerts, and automation capabilities.
    - Azure Key Vault -
        - Azure Key Vault integrates with Azure Monitor for monitoring and provides auditing features for management.

- **Service-Level Agreements (SLAs)**
    - Azure NAT Gateway -
        - Azure NAT Gateway is covered by Azure's overall SLAs for networking services.
    - Azure Bastion -
        - Azure Bastion is covered by Azure's overall SLAs for virtual machines.

    - Azure Database for PostgreSQL -
        - Azure Database services have SLAs for uptime and availability.
    - Azure Service Bus -
        - Azure Service Bus has SLAs for uptime and availability.
    - Azure Monitor -
        - Azure Monitor has SLAs for uptime and availability.
    - Azure Key Vault -
        - Azure Key Vault has SLAs for uptime and availability.