DP-900 cheatsheet

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Data Core Concepts

Data — units of information
Data Documents — types of abstract groupings of data
Data Sets — unstructured logical grouping of data
Data Structures — structured data

- Unstructured — a bunch of lose data that has no organization or possibly relation
  - Flat files — various files that can reside in a file system
- Semi Structured — data that can be browsed or searched (with limitations) eg. CSV, XML, JSON, Parquet
  - XML — markup language that looks like html eg. <hello><world>earth</world></hello>
  - JSON — a text file that is composed of dictionaries and arrays eg. {“hello”: [“earth”,”mars”]}
  - RCFiles — a storage format designed for MapReduce framework
  - ORC — a columnar data structure, 75% more efficient than RCFiles, limited compatibility , works great well will HIVE
  - AVRO — a row-wise data structure for hadoop systems
  - Parquet — a columnar data-structure that has more support for hadoop systems than ORC
- Structured — data that can be easily browsed or searched eg. tabular data
  - **Tabular data** — data that is arranged as tables, think excel spreadsheets

Data Types — how single units of data are intended to be used

Azure data roles

Database Administrator — configures and maintains a databases eg. Azure Data services or SQL server.

Responsibilities	Common Tools
Database management	Azure Data Studio
Manage security, granting user access	SQL Server Management Studio
Backups	Azure Portal
Monitors Performance	Azure CL

Data Engineer — Design and implement data tasks related to the transfer and storage of big data

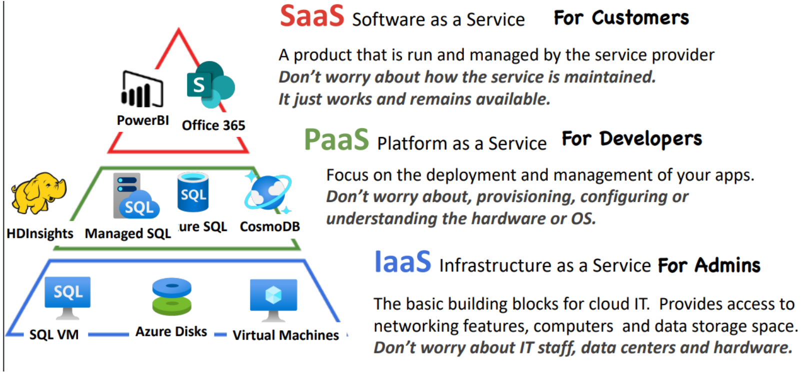
Responsibilities	Common Tools
Database pipelines and process	Azure Synapse Studio
Data ingestion storage	SQL
Prepare data for analytics.	Azure CLI
Prepare data for analytical processin	

Data Analyst — Analyzes business data to reveal important information

Responsibilities	Common Tools
Provides insights into the data	Power BI Desktop
Visual reporting	Power BI Portal
Modelling data for analysis	Power BI services
Combines data for visualization and analysis	Power BI report bulder

Type of cloud computing

Software as a Service (SaaS) — A product that is run and managed by the service provider
Platform as a Service (PaaS) — Focus on the deployment and management of your apps.
Infrastructure as a Service (IaaS) — basic building blocks for cloud IT. Provides access to networking, computers and data storage space



SaaS Software as a Service **For Customers**

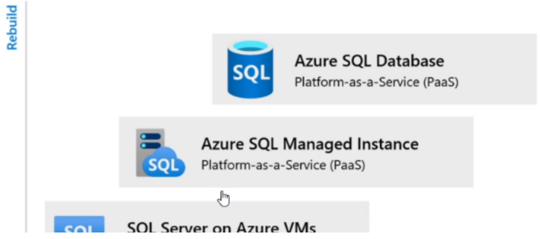
A product that is run and managed by the service provider
Don’t worry about how the service is maintained.
It just works and remains available.

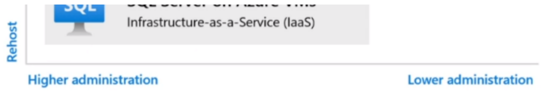
PaaS Platform as a Service **For Developers**

Focus on the deployment and management of your apps.
Don’t worry about, provisioning, configuring or understanding the hardware or OS.

IaaS Infrastructure as a Service **For Admins**

The basic building blocks for cloud IT. Provides access to networking features, computers and data storage space.
Don’t worry about IT staff, data centers and hardware.


Rebuild
Azure SQL Database
Platform-as-a-Service (PaaS)
Azure SQL Managed Instance
Platform-as-a-Service (PaaS)
SQL Server on Azure VMs



Datastores — unstructured or semi- structured data to housing data, a board term than can encompass anything that stores data
Databases — structured data that can be quickly access and searched (generally relational, row-based, tabular data for OLTP)
Data warehouses — structured or semi-structured data for creating reports and analytics ((column based, tabular data for OLAP)
Data marts — a subset of data warehouse for a specific business data task
Data lakes — combines the best of data warehouses and data lakes
Notebooks — data that is arranged in pages, designed for easy consumption
Batching — When you send batches (a collection) of data to be processed. Not real-time
Streaming — When data is processed as soon as it arrives. Is real time
Relational data — Data that uses structured tabular data and has relationships between tables

- One-to-one — a monkey has a banana
- One-to-Many — a store has many customers
- Many-to-Many — a project has many tasks, and tasks can belong to many projects
- Join/Junction Table — A student has many classes through enrollments and A class has many students through enrollments
- Row-store — data organized in rows, optimized for OLTP (general computing and transactions)
- Column-store — data organized in columns, optimized for OLAP (analytics)
- Indexes — a data structure that improves the reads of databases

Pivot Table — is a table of statistics that summarizes the data of a more extensive table from a: Database, Spreadsheet or Business intelligence (BI) tool
Non-relational data — Data that is semi-structured data, associated with Schemaless and NoSQL databases

- Key Value — Each value has a key, Designed to scale, Only simple lookups
- Document — Primary entity is a XML or JSON-like data-structure called a document
- Columnar — Has a table-like structure but data is stored around columns instead of rows
- Graph — Data is represented with nodes and structures. Where relationships matter

Data Modeling — an abstract model that organizes elements of data and standardizes how they relate to one another and to real-world entities
Schema — a formal language to describe the structure of data used by databases and data stores during the data modeling phase
Schemaless — generally used when upfront data modelling can be forgo because the schema is flexible, normally used with NoSQL databases
Data Integrity — the maintenance and assurance of, data accuracy and consistency over its entire life-cycle.
Data Corruption — the act or state of data not being in the intended state and will result in data loss or misinformation
Normalized — A schema design to store non-redundant and consistent data
Denormalized — A schema that combines data so that accessing data (querying) is fast
Extract, Transform and Load (ETL) — transform data from one data store to another, loads data in an intermdiate stage, doesn't work with data lakes
Extract, Load and Transform (ELT) — transformations done at the target data store, works with data lakes, more common in cloud services.

Query — when a user requests data from a data store by using a query language to return a data result
Data Source — A data source is **where data originates from**. analytics and data warehouses tools may be connected to various data sources
Data consistency — When data being kept in two different place and **whether the data exactly match** or do not match

- Strongly Consistent — Every time you request data (query) you can expect consistent data to be returned within a time
- Eventually Consistent — When you request data you may get back inconsistent data (stale data)

Synchronization — continuous stream of data that is synchronized by a timer or clock (guarantee of time)
Asynchronization — continuous stream of data separated by start and stop bits (no guarantee of time)
Data Mining — The **extraction of patterns and knowledge** from large amounts of data **(not the extraction of data itself)**
Data Wrangling — The process of transforming and mapping data from one "raw" data form into another format

Data Analytics — Data analytics is examining, transforming, and arranging data so that you can **extract and study useful information.**
Key Performance Indicators — type of performance measurement that a company or organization to determine **performance over time**

Descriptive Analytics (What happened?) — Accurate, comprehensive , live-data and effective visualizations eg. dashboards, reports, KPI, ROI
Diagnostic Analytics (Why did it happen?) — drill down to investigate root cause, focused on subset of descriptive analytics dataset
Predictive Analytics (What will happen?) — use historical data with statistics and ML to generate trends or predictions
Predictive Analytics (What will happen?) — using hybrid data with ML to predict future scenarios that are exploitable
Cognitive Analytics (What-if this happens?) — Using ML and NLP to determine what-if scenarios to create plans if they happen

One Drive — storage and storage synchronization service for a single user
SharePoint — storage and storage synchronization service for an organization

Power BI

Business Intelligence (BI) — both a data-analysis strategy and **technology** for business info. helps organizations make data-driven decisions
Power BI Desktop — A desktop app to design interactive reports from various data sources and can be published to Power BI Service
Power BI Service — A web-app to view reports, and create interactive shareable dashboards by pinning various dataset and report visualizations
Power BI Mobile — a mobile web-app to view BI reports on the go
Power BI Report Builder — windows application build pixel-perfect printable reports (used to build paginated reports)
Power BI Embedded — embed Power BI visualizations into web-apps
Interactive Reports — Reports in Power BI, drag visualizations, load data from many data sources (Both in Desktop and Service)
Paginated Reports — pixel-perfect printable report file format. Tabular data laid out in page format
Dashboards — Build sharable dashboards by pinning various Power BI visulzations (a single page report designed for a screen) Only Service
Dashboard Tiles — A tile represent a visualization that his been pinned to a dashboard
Visualizations — A visualization is a chart or graph that is backed my a dataset.

Relational Databases

Structured Query Language (SQL) — designed to access and maintain data for a relational database management system (RDBMS)
Online Transaction Processing (OLTP) — frequent and short queries for transactional information eg. Databases
Online Analytical Processing (OLAP) — complex queries for large databases to produce reports and analytics eg. Data Warehouses
MySQL — MySQL is a pure relational database (RDBMS) it is easy to setup and use, most popular open-source relational database
MariaDB — MariaDB is an fork of MySQL
Postgres — Postgres is an object-relational database (ORDBMS), it is more advanced and well liked among developers

Read Replicas – a duplicate of your database kept in-sync with the main to help to reduce reads on your primary databases
Azure SQL — An umbrella service for different offerings of MS SQL databases hosting services

- SQL VMs — for lift-and-shift when you want OS access and control, or you need to bring-your-own-license (BYOL) for Azure Hybrid Benefit
- Managed SQL —for lift-and-shift when you the broadest amount of compatibility with SQL versions
  - you can use Azure Arc to run this service on-premise
  - gives you many of the benefit of a fully-managed databases
- SQL Databases — Fully managed SQL databases
  - Run a single server
  - Run as a database (collection of servers)
  - Run in an Elastic Pool (databases of different sizes residing on one server to save costs)

Connection Policy

- Three modes:
  - Default — choose Proxy or Redirect initially depending on if the server is within or outside the Azure Network
  - Proxy — outside the Azure network, proxied through a gateway
    - listen on port 1443 when connecting via Proxy mode through a gateway outside the Azure Network
  - Redirect — redirected within the Azure Network

Database Security

MS SQL Database Authentication
Two modes when setting up MS SQL server (remoted into Windows Machine):

- Windows Authentication mode — enables Windows Authentication and disables SQL Server Authentication
- Mixed mode — enables both Windows Authentication and SQL Server Authentication

- Windows Authentication (recommended) — authenticate via windows users
- SQL Server Authentication — username and password, connect from anywhere

Network Connectivity

- Public Endpoint — reachable outside the Azure Network over the internet (use server firewall for protection)
- Private Endpoint — only reachable within the Azure Network (use Azure PrivateLinks to keep traffic within Azure Network)

Azure Defender SQL — a unified package for advanced SQL security capabilities for Vulnerability Assessment and Advanced Threat Protection
Server Firewall Rules — an internal firewall that resides on the database server, All connections are rejected by default to database
Always Encrypted — a feature that encrypts columns in an Azure SQL Database or SQL Server
Role-Based-Access-Control (RBAC) for databases:
SQL DB Contributor — manage SQL databases, but not access to them, can't manage their security-related policies or their parent SQL servers
SQL Managed Instance Contributor — manage SQL Managed Instances and required network configuration, can't give access to others
SQL Security Manager — manage the security-related policies of SQL servers and databases, but not access to SQL servers
SQL Server Contributor — manage SQL servers and databases, but not access to them SQL servers
Transparent Data Encryption (TDE) — encrypts data-at-rest for Microsoft Databases
Dynamic Data Masking — you can choose your database columns to that will be masked (obscured) for specific users
Azure Private Links — allows you to establish secure connections between Azure resources so traffic remains within the Azure Network

T-SQL

Transact-SQL (T-SQL) is a set of programming extensions from Sybase and Microsoft that add several features to the Structured Query Language (SQL).
For Microsoft SQL Server there are five groups of SQL Commands:

- Data Definition Language (DDL)
  - used to define the database schema
- Data Query Language (DQL)
  - used for performing queries on the data
- Data Manipulation Language (DML)
  - manipulation of data in the database
- Data Control Language (DCL)
  - rights, permissions and other controls of the database
- Transaction Control Language (TCL)
  - transactions within the database

Azure Tables and CosmosDB

Azure Tables — a key / value data store

- can be hosted on Account Storage, its designed for a single region and single table
- can be hosted on CosmosDB, its designed for scale across multiple regions

CosmosDB — A fully-managed **NoSQL** service that supports multiple NoSQL engines called APIs

- Core SQL API (default) — a document database, you can use SQL to query documents
- Graph API — a graph databases, you can use Gremlin to traverse the nodes and edges
- MongoDB API — a mongodb database (document database)
- Tables API — Azure Tables Key/Value

Apache TinkerPop — an open-source framework to have an agnostic way to talk to many graph databases

- Gremlin — graph traversal langauge to traverse nodes and edges

MongoDB — an open-source document database

- Binary JSON (BSON) — An storage and compute optimized version of JSON, introduces new data types

ComosDB Explorer — a web-ui to view cosmos databases

Account Storage

Azure Storage Accounts — an umbella serivce for various forms of managed storage:

- Azure Tables
- Azure Blob Storage
- Azure Files

Azure Blob Storage — Object storage that is distributed across many machines.

- Data which is stored as **objects** instead of files.
- Object storage is distributed storage (spanning multiple machines) for **unstructured data**

- Supports 3 types:
  - Blob blobs — store text and binary data, blocks of data that can be managed individually, up to 4.7TiB
  - Append blobs — Optimized for append operations, ideal for logging
  - Page blobs — store random access files up to 8 TB in size.

Azure Files — a fully managed file share in the cloud.

- To connect to the file share a network protocol is used:
  - Server Message Block (SMB)
  - Network File System (NFS)

Azure Storage Explorer — a standalone cross-platform app to access various storage formats within Azure Storage accounts

Hadoop

Apache Hadoop — open-source framework for distributed processing of large data sets

- Hadoop Distributed File System (HDFS) — a resilant and redudent file storage distrubted on clusters of common hardware
- Hadoop MapReduce — writes apps that can process multi-terabyte data in-parallel on large clusters of common hardware
- Hbase — a distributed, scalable, big data store
- YARN — manages resources, nodes, containers and performs scheduling
- HIVE — used for generating reports using an SQL language
- PIG — A high-level scripting language to write complex data transformations

Apache Spark — can perform is 100x faster in memory and 10x faster than disk than Hadoop, supports ETLs, Streaming and ML flows
Apache Kafka — a streaming pipeline and analytics service
HDInsights — is managed service to run popular open-source analytics service. It is fully-managed hadoop system
Apache Ambari is an open-source Hadoop management web-portal for provisioning, managing, and monitoring Apache Hadoop clusters

Apache Spark and DataBricks

Apache Spark —an open-source unified analytics engine for big data and machine learning

- 100x faster in memory than hadoop
- 10x faster than disk than hadoop
- perform ELT (batch), streaming and ML workloads
- The Apache ecosystem is composed of:
  - Spark Core — The underlying engine and API.
  - Spark SQL — Use SQL and also a new data structure called DataFrame to work with data
  - Spark Streaming — ingest data from many streaming services
  - GraphX — distributed graph-processing framework
  - Machine Learning Library (MLib) — a distributed machine-learning framework
- Resilient Distributed Dataset (RDD) is a domain specific language (DSL) to execute various parallel operations on an Apache Spark cluster.

Databricks is a software company specializing in providing fully managed Apache Spark clusters
Azure Databricks is a partnership between Microsoft and Databricks to offer the Databricks Platform within the Azure Portal running on Azure compute services

- Azure Databricks offers two environments:
  - Azure Databricks Workspace —DataBrick Platform with integrations to Azure data-related services for building big data pipelines.
  - Azure Databricks SQL Analytics — run query your data lake

Azure Synapse and Data Lake

A data lake is a centralized data repository for unstructured and semi-structured data

- A Data Lake is intended to store vast amounts of data
- Data lakes generally use object (blobs) or files as its storage medium.

Azure Data Lake Store (Gen 2)

- Azure Blog storage which is has been extended to support big data analytics workloads
- In order to efficiently access data, Data Lake Storage adds a hierarchical namespace to Azure Blob Storage
  - ACLs, Throttling Management, Performance Optimizers
- You access the data lake via (Blob)wasbs:// or (File system) abfs://

Azure Synapse Analytics — a **data warehouse** and unified analytics platform

- Has two underlying transformations engines: SQL Pools and Spark Pools
- Synapse SQL is T-SQL but designed to be distributed
  - SQL Dedicated Pools — reserves compute for processing
  - Serverless Endpoints — on-demand, no guarantee of performance
- Data is stored on Azure Data Lake Store (Gen 2)
- Operations are performed within the Azure Synapse Studio
- PolyBase — enables your SQL Server instance to query data with T-SQL (used to connect many relational data sources)

ETL and SQL Tools

Azure Data Factory is a managed service for ETL, ELT and data integration

- Create data-driven workflows for orchestrating data movement and transforming data at scale
- Build ELT pipelines visually without writing any code via a web-interface

SQL Server Integration Services (SSIS) — a platform for building enterprise-level data integration and data transformations solutions

- a low-code tool for builing ELT pipelines, very similar to Azure Data Factory but existed 15 years prior.
- Integrates with Azure Data Factory

Azure Data Studio — An IDE similar Visual Studio Code, that is cross-platform and works with SQL and non-relational data, has many extensions.
SQL Server Management Studio (SMSS) — an IDE for managing any SQL infrastructure that only works for Windows. More mature than Data Studio
SQL Server Data Tools (SSDT) — Visual Studio extension to work and design visually SQL databases