XML

XML is a markup language, To define a syntax for encoding documents which are both humans and machines

It is standards file format for exchange between applications.

Example:

```
<?xml version="1.0" encoding="UTF-8"?>
<book>
<name>A Song of Ice and Fire</name>
<author>George R. R. Martin</author>
<language>English</language>
<genre>Epic fantasy</genre>
</book>
```

```
<students>
<student>
 <name>Rick Grimes</name>
 <age>35</age>
 <subject>Maths</subject>
 <gender>Male</gender>
</student>
<student>
 <name>Daryl Dixon </name>
 <age>33</age>
 <subject>Science</subject>
 <gender>Male</gender>
</student>
<student>
 <name>Maggie</name>
 <age>36</age>
 <subject>Arts</subject>
 <gender>Female
</student>
</students>
```

Performance:

- The redundant nature of the syntax causes higher storage and transportation cost when the volume of data is large.
- Not splitable since XML has an opening tag at the beginning and a closing tag at the end. You cannot start processing at any point in the middle of those tags.

JSON

- JavaScript Object Notation is a schema-less, text-based representation of structured data that is based on key-value pairs and ordered lists.
- It is used for storing and exchanging the data between computers, more commonly used in network communication
- JSON is language independent used by any programming language
- JSON allows you to create a hierarchical structure of your data.

JSON represents data in two ways:

- **Object**: a collection of name-value (or key-value) pairs. An object is defined within left ({) and right (}) braces. Each name-value pair begins with the name, followed by a colon, followed by the value. Name-value pairs are comma separated.
- Array: an ordered collection of values. An array is defined within left ([) and right (]) brackets. Items in the array are comma separated.

Example:

```
{
    "name": "John",
    "salary": 56000,
    "married": true
}

Json document with information about books
{
    "book":[
    {
        "id":"444",
        "language":"C",
        "edition":"First",
        "author":"Dennis Ritchie "
        },
    {
        "id":"555",
    }
}
```

```
"language":"C++",

"edition":"second",

"author":" Bjarne Stroustrup "

}
]
```

Json Applications:

- It is widely used for JavaScript-based application, which includes browser extension and websites.
- You can transmit data between the server and web application using JSON.
- Web services and Restful APIs use the JSON format to get public data.
- JSON is a widely used file format for NoSQL databases such as MongoDB, Couchbase and Azure Cosmos
 DB.
- JSON is naturally the raw data for "source of truth", which is always needed,

Performance:

- JSON is lightweight text-based format in comparison to XML
- JSON as a simple but not so efficient format is very accessible
- JSON is naturally the raw data for "source of truth used for data from web API and NoSQL databases
- It is supported by all major big data query engines, such as Apache Hive and SparkSQL which can directly query JSON files

AVRO Format

- **Avro** is an row based, open-*source* schema specification for data serialization that provides serialization and data exchange services for Apache Hadoop.
- Language-agnostic
- Rich data structure
- The Data is stored in a binary format making it compact and efficient.
- Schema definition is stored in JSON format making it easy to read and interpret.
- Supports Schema Evolution

Application:

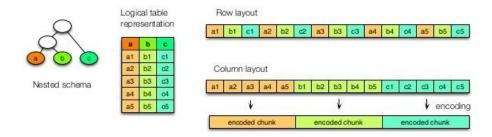
- Avro format is preferred for loading data lake landing because downstream systems can easily retrieve table schemas from files, and any source schema changes can be easily handled.
- Consider Avro file format in cases where your I/O patterns are more write heavy, or the query patterns
 favour retrieving multiple rows of records in their entirety.
- Works well with Event Hub or Kafka that write multiple events/messages in succession.

PARQUET

Parquet

- Columanar storage, used by Hadoop systems, such as Pig, Spark, and Hive
- Supports efficient data compression and encoding schemes that can lower data storage costs.
- It is cross platform and language independent format.
- It stores Metadata
- Services such as <u>Azure Synapse Analytics</u>, <u>Azure Databricks</u> and <u>Azure Data Factory</u> have native functionality that take advantage of Parquet file formats.

Columnar storage



Performance:

- Unlike row-based file formats like CSV, Parquet is optimized for performance.
- You can focus only on the relevant data very quickly. Moreover, the amount of data scanned will be way smaller and will result in less I/O usage

Note: Consider Parquet when the I/O patterns are more read heavy or when the query patterns are focused on a subset of columns in the records.

AVRO vs. PARQUET

- 1. AVRO is a row-based storage format, whereas PARQUET is a columnar-based storage format.
- 2. PARQUET is much better for analytical querying, i.e., reads and querying are much more efficient than writing.
- 3. Writing operations in AVRO are better than in PARQUET.
- 4. AVRO is much matured than PARQUET when it comes to schema evolution. PARQUET only supports schema append, whereas AVRO supports a much-featured schema evolution, i.e., adding or modifying columns.
- 5. PARQUET is ideal for querying a subset of columns in a multi-column table. AVRO is ideal in the case of ETL operations, where we need to query all the columns.

- Delta is a data format based on Apache Parquet.
- It's an open source project (https://github.com/delta-io/delta), delivered with Databricks runtimes and it's the default table format from runtimes 8.0 onwards.
- You can use Delta format through notebooks and applications executed in Databricks with various APIs
 (Python, Scala, SQL etc.) and also with Databricks SQL.
- Delta is made of many components:
 - o Parquet data files organized or not as partitions
 - Json files as transaction log
 - Checkpoint file

```
Transaction Log
Single Commits

my_table/
delta_log/
000000.json
000001.json
000002.json
.:
00000010.json
0000010.checkpoint.parquet
date=2019-01-01/
file-1.parquet
date=2019-01-02/
file-2.parquet
```

All of this is built on top of your data lake which can be hosted on AWS S3, Microsoft Azure DataLake, or Google Storage service.

- Delta is, like Parquet, a columnar oriented format. So, it's best fitted for analytic workloads.
- With Delta transaction log files, it provides ACID transactions and isolation level to Spark.