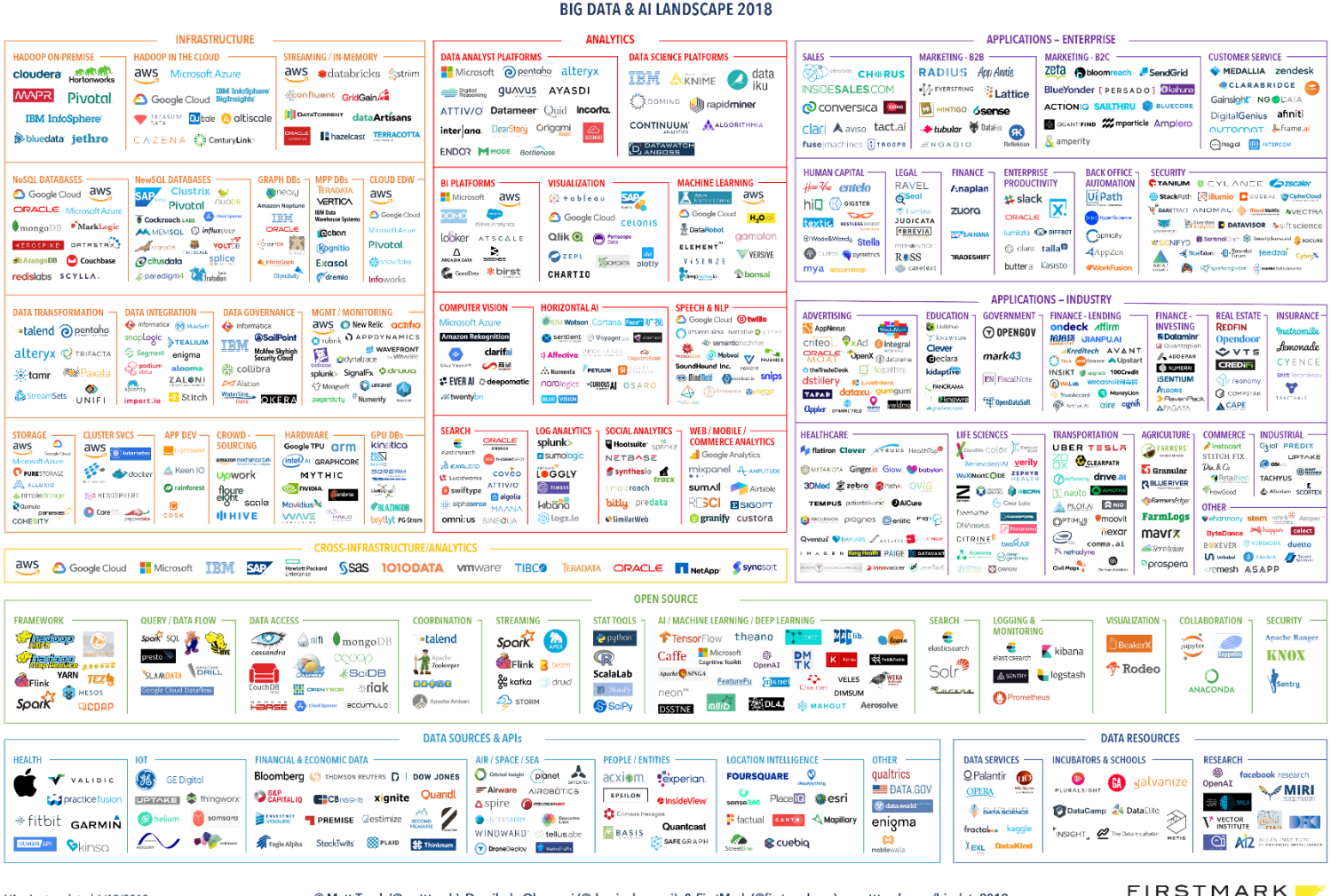
Big-data Management

Topics not Covered

What We Covered

- Storage (HDFS)
- Query processing (MapReduce, RDD, Hyracks)
- Higher-level data flow engines (Pig, SparkSQL, Spark Streaming)
- Storage formats (row, column, hybrid)
- Indexing (Global/local and LSM)
- Application-specific (Big Spatial Data)

Big Data Landscape 2018



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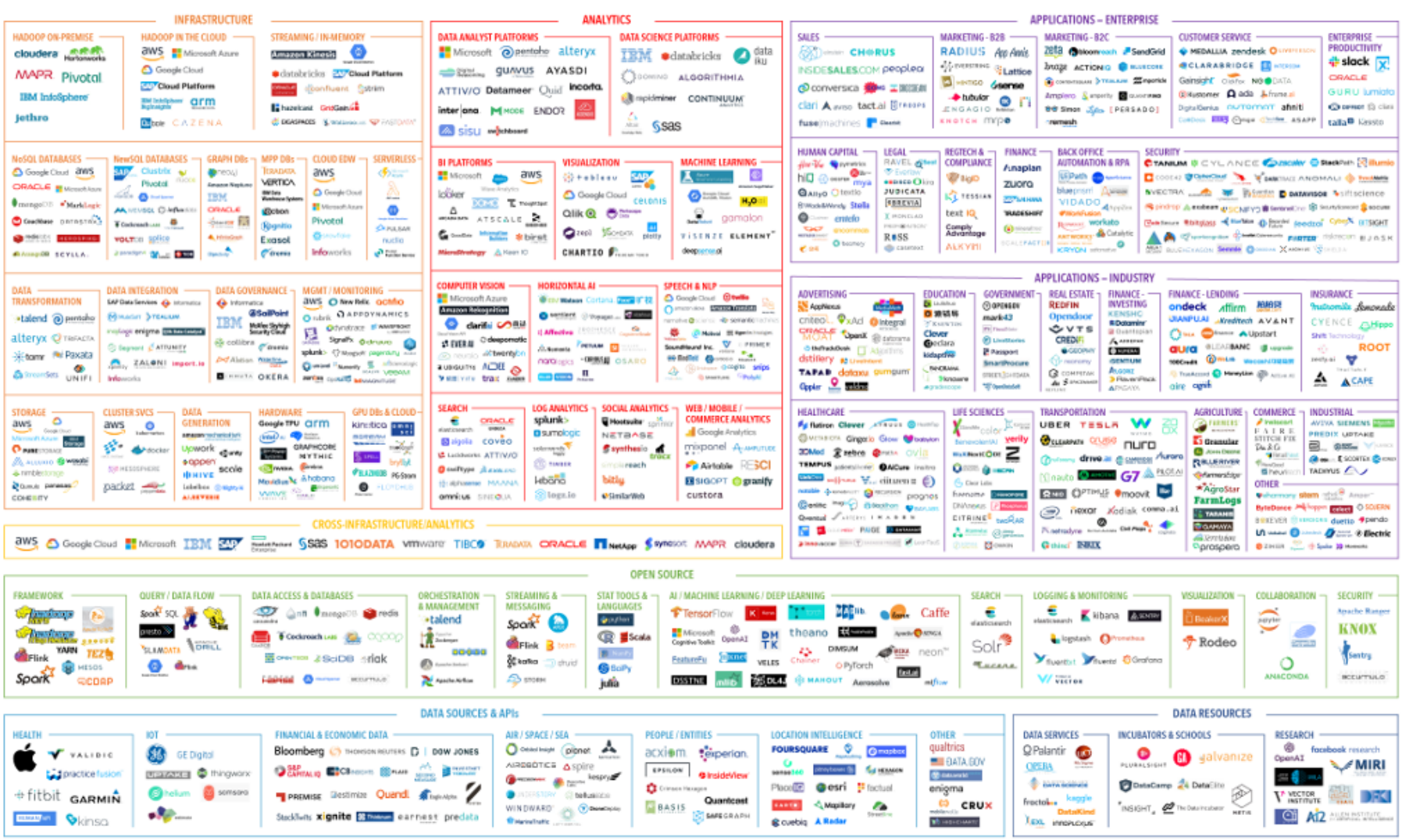
Data & AI Landscape 2019



Topics not Covered

- Key-value stores
- Big graph analytics
- Visualization
- Streaming
- Coordination
- Cloud platforms

Key-value Stores

- Provides a simple API to insert/delete/update/search key-value pairs
- Records are indexed by key (typically a string)
- Internal structure is typically a Log-structured-merge tree (LSM)
- Not generally suitable for large-scale analytics

Accumulo Examples

Insert a record

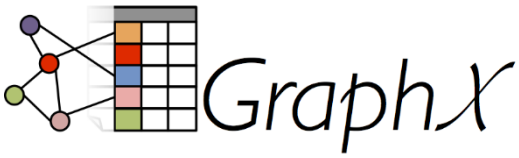
```
Text rowID = new Text("row1");
Text colFam = new Text("myColFam");
Text colQual = new Text("myColQual");
ColumnVisibility colVis = new
ColumnVisibility("public");
long timestamp =
System.currentTimeMillis();

Value value = new
Value("myValue".getBytes());

Mutation mutation = new
Mutation(rowID);
mutation.put(colFam, colQual, colVis,
timestamp, value);
```

Search for records

```
// specify which visibilities we are
allowed to see
Authorizations auths = new
Authorizations("public");

Scanner scan =
    conn.createScanner("table",
auths);

scan.setRange(new
Range("harry","john"));
scan.fetchColumnFamily(new
Text("attributes"));

for(Entry<Key,Value> entry : scan) {
    Text row =
entry.getKey().getRow();
    Value value = entry.getValue();
}
```

Big Graph Analytics

- Graphs are usually processed using a node-centric processing model
- Nodes and edges are both treated as first-class citizens
- Processing is normally iterative with a lot of iterations



Visualization

- Sometimes called Business Intelligence (BI)
- Focuses more on the end-user interface while producing nice graphs (e.g., bar charts and line graphs)
- Internally, the data is managed using the common big-data platforms but the systems are tuned to provide fast query response for ad-hoc queries

Streaming

- Some applications need to process data in real-time with a very small latency
- Examples: Twitter search, IoT applications, and social network trends
- Works primarily off main memory
- Keeps only the latest records to ensure real-time response

Coordination

- Most big-data systems are designed for shared-nothing large-scale analytics
- No coordination between machines is part of the design
- Coordination systems provide an easy way to coordinate the work in these distributed platforms, e.g., a catalog of information, work queue, and a global system status

Cloud Platforms

- Maintaining your own cluster is costly
- It could be underutilized most of the time
- Cloud platforms allow you to rent virtual machines to do your work and dispose them after
- They are well-integrated with big data platforms (such as Hadoop and Spark) to give the best user experience
- All you need is an internet connection and a credit card

Learning Materials

- Always start with the official project page
- Google for articles with code examples, questions on StackOverflow, and YouTube for presentations
- Read research papers
- Dig into the source code if you need to understand more