WinCC OA NextGen Archiver:
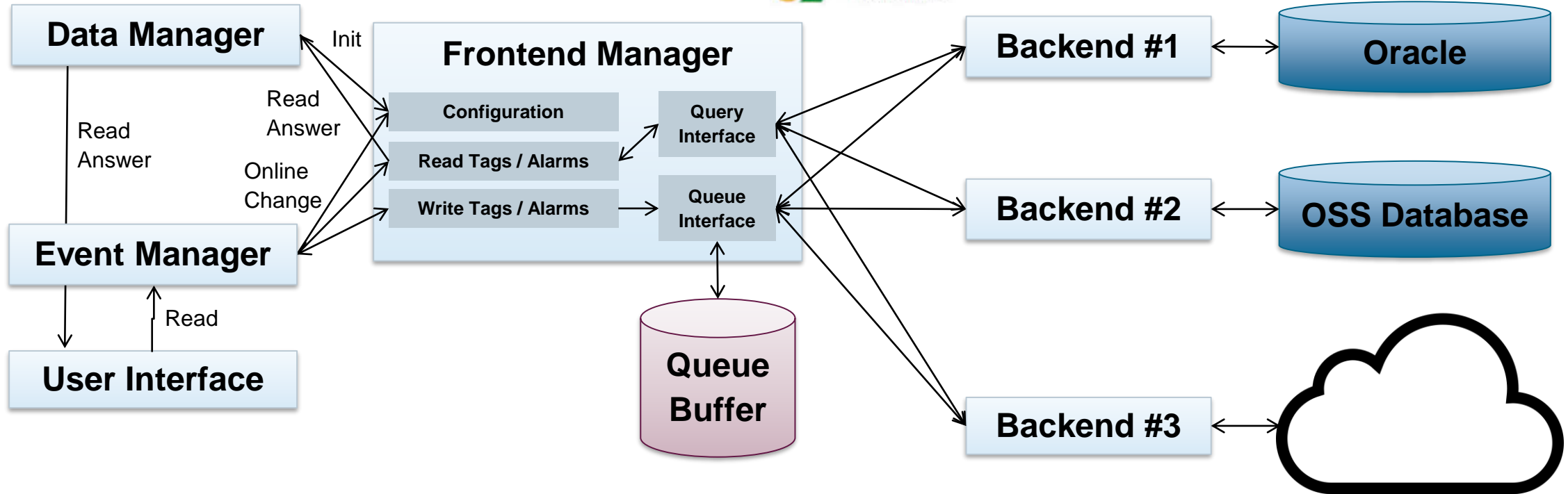
OSS Database selection process

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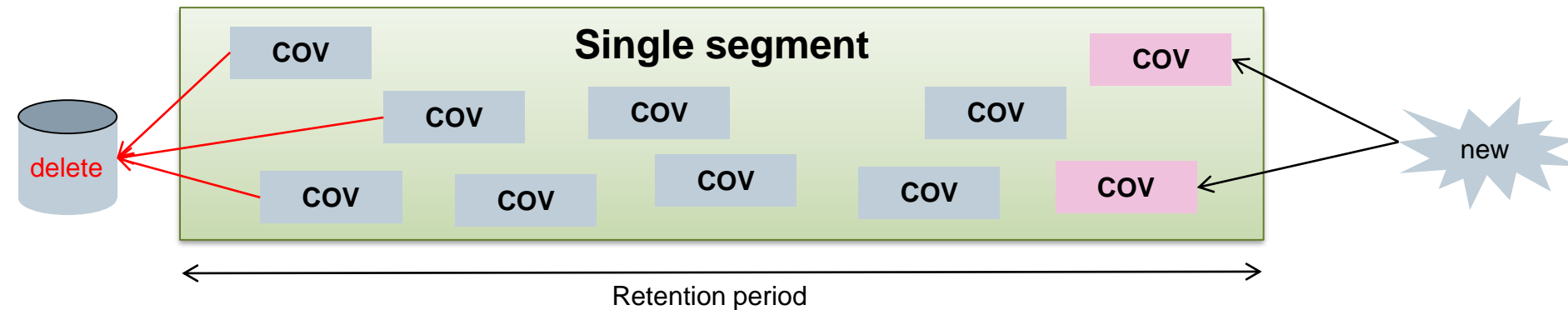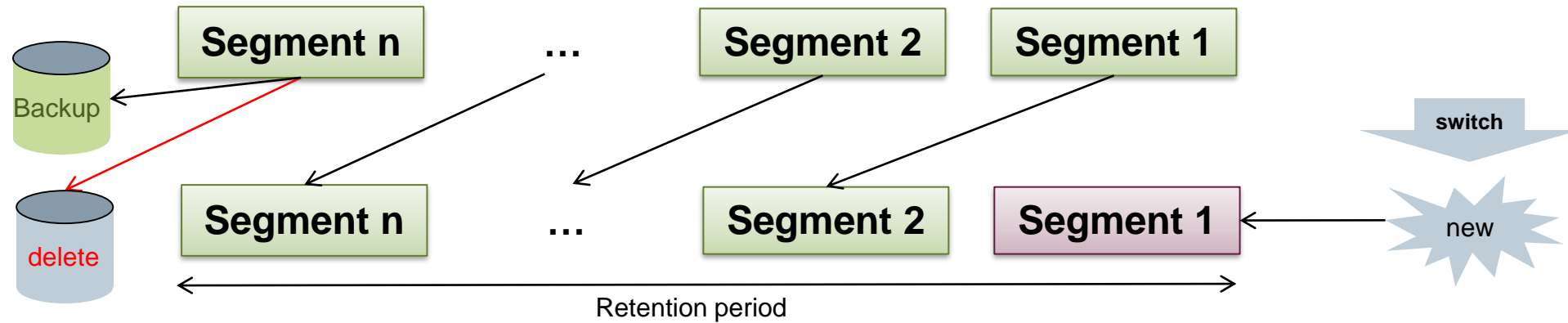
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Concept: Next Gen Archiver – General Concept

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Segmentation

One segment „line" per archive group

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MongoDB – General Infos

Document Oriented Databases

• A collection of documents
• Data in this model is stored inside documents.
• A document is a key value collection where the key allows access to its value.
• Documents are not typically forced to have a schema and therefore are flexible and easy to change.
• Documents are stored into collections in order to group different kinds of data.
• Documents can contain many different key-value pairs, or key-array pairs, or even nested documents.
• Collection / table, document / row, columns / key-value pairs („field").

MongoDB Features

• Indexes (unique and non-unique)
• Primary index on specific _id field
• Fields stored in JSON / BSON format
• Simple joins
• (CRUD)
• 3-node redundancy („replication")
• Sharding
• Embedded installation
• Drivers for multiple languages (including C++)
• Cloud Services available (Atlas / DocumentDB)
• No segmentation
• No transactions (but zero-voltage-safe)
• No relational integrity
• No stored procedures

Document Structure

```
{
        "_id" : {
                "dpid" : {
                        "sys" : 1,
                        "dp" : NumberLong(66),
                        "el" : 78
                },
                "ts" : NumberLong("1501164409807000000")
        },
        "user" : NumberLong(0),
        "manager" : NumberLong(16843777),
        "status" : NumberLong("-9007199254737846015"),
        "value" : "example"
        "valuetype" : string

}
```

mongoDB®

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InfluxDB – General Infos

Time Series Databases (TSDB)

- Every „record" includes timestamp as index field
- Queries are optimized for time based access
- Aggregation functionality built-in
- Optimized for large amount of data
- Metadata can be stored separately (JOIN) or within record (tags and fields)
- Efficient storage (compressions, deltas)
- Optimized for INSERTs, not UPDATEs or DELETEs
- High write performance

DB Structure
- One common database holding one or more WinCC OA system(s)
- One table („Measurement") for events, one for alerts
- One series per tag
- Each record („point") has a different timestamp
- Multiple retention periods (user defined, „Archive Groups")
- Tags (indexed) for tag ID, name, metadata
- Fields for value and quality
- Multiple value fields (numeric and string)
- Array data („Dyn") ist stored within one record
- Optional fields (correction value)

InfluxDB Features

- HTTP(S) API
- Retention policies, segmentation
- Aggregates „on the fly" or persisted
- High write performance
- Automatic data compression
- Multi-level data compaction (for read optimization)
- Support for metadata (tags and fields)
- SQL-like query language
- Message splitting (http chunking)
- Simple joins
- Consistent writes (Write Ahead Log)
- Embedded installation
- Cloud Services available (InfluxCloud)
- 2-node redundancy („replication") – only commercial
- Clustering (multi-node) – only commercial
- Simple backup / restore mechanism

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MongoDB vs. InfluxDB – Selection Criteria - Comparison

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Criteria	MongoDB	InfluxDB
License / Siemens Clearing	OK (GNU AGPL)	OK (MIT)
Embedded Installation	OK	OK
Installation Footprint	Small	Small
Time Series Data	Not optimized	Optimized
Segmentation Handling	None	Available (shards)
Database Scaling	Possible, but only in commercial version	Possible, but only in commercial version
Write Performance	Average	Very good
Read Performance	Average	Very good
Data Size	Good	Very good
Backup & Restore	To be implemented by us	Available (full and incremental backup)
Cloud capable	Yes (Atlas)	Yes (InfluxCloud)

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MongoDB – Pros and Cons

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Pros

- Average performance (equal to or better than Oracle, candidate for SWP)
- Suitable for small and large size data
- License free (except for clustering option)
- Cloud support (Document DB Azure, MongoDB Atlas)
- Support for low-end hardware (64 bit, no precompiled 32 bit version)
- Space efficient (compressed BSON, 27 bytes per event)
- Established developer user base and community
- Support available
- NoSQL document store (multi-purpose)

Cons

- Scaling / sharding „expensive" – only for specific customers (no replacement for Oracle cluster)
- 3rd node for redundancy required – redundancy has to be handled by NGA
- Export / import to be implemented by us - Mongodump utility can be used
- Segmentation not available – either implemented manually (multiple collections) or no segmentation

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InfluxDB – Pros and Cons

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Pros

- Very good performance for writing, good for reading
- Suitable for small and large size data
- License free (except for clustering option)
- Segmentation possible (retention policies, „shards"), similar to current WinCC OA segmentation
- Cloud support (InfluxCloud)
- Support for low-end hardware (Raspberry Pi)
- Very space efficient (delta compression)
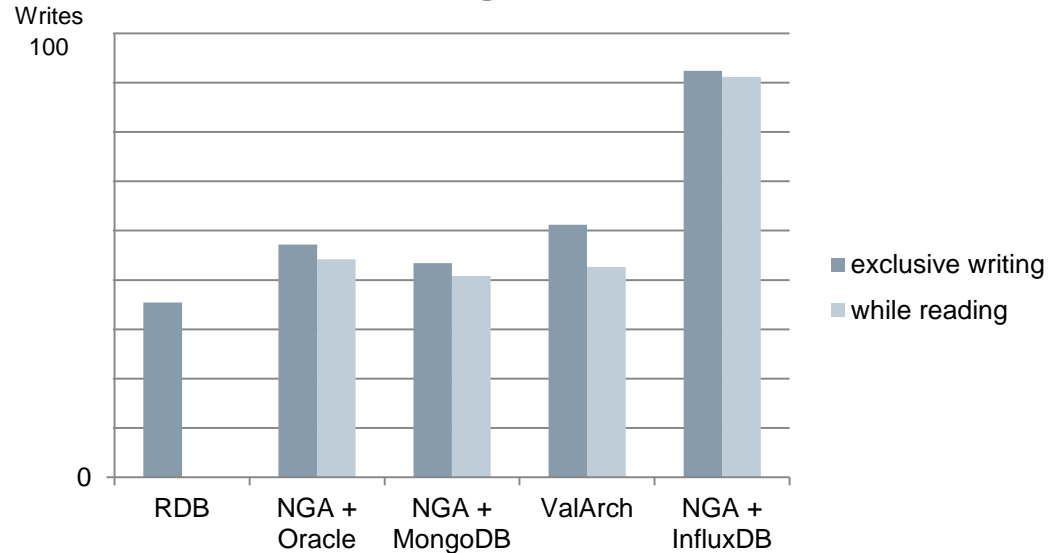- SQL like query language
- Timestamp up to nanosecond

Cons

- OSS policy was changed over time (redundancy and clustering are commercial features now)
- Schema design not as flexible as in MongoDB
- Restore of data not fully available
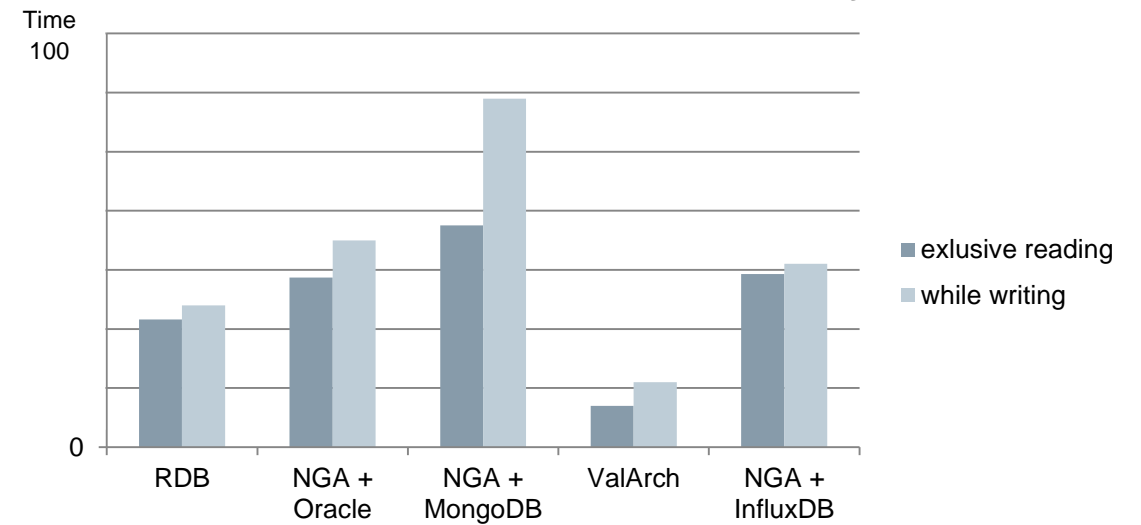- Relatively new, still in development

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Performance Measurements

Writing 100 DPEs

Read 5000 values via dpQuerySplit

System CPU Usage in %

Single Server (Windows), one disk used
WinCC OA running on same system
100 DPEs (float)
Single client read
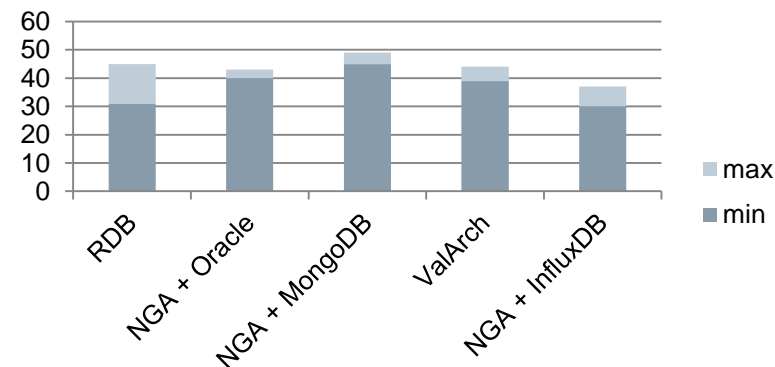
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