Meta

Shared Foundations: Modernizing Meta’s Data Lakehouse

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Agenda

1. Recent Trends
2. Background
3. Shared Foundations
4. Consolidation Efforts

Recent Trends

Usage Trends

- Data Explosion
- Machine Learning
- Freshness and Latency
- External Analytics
- Complex Data Models
- Richer Query Methods

Environmental Trends

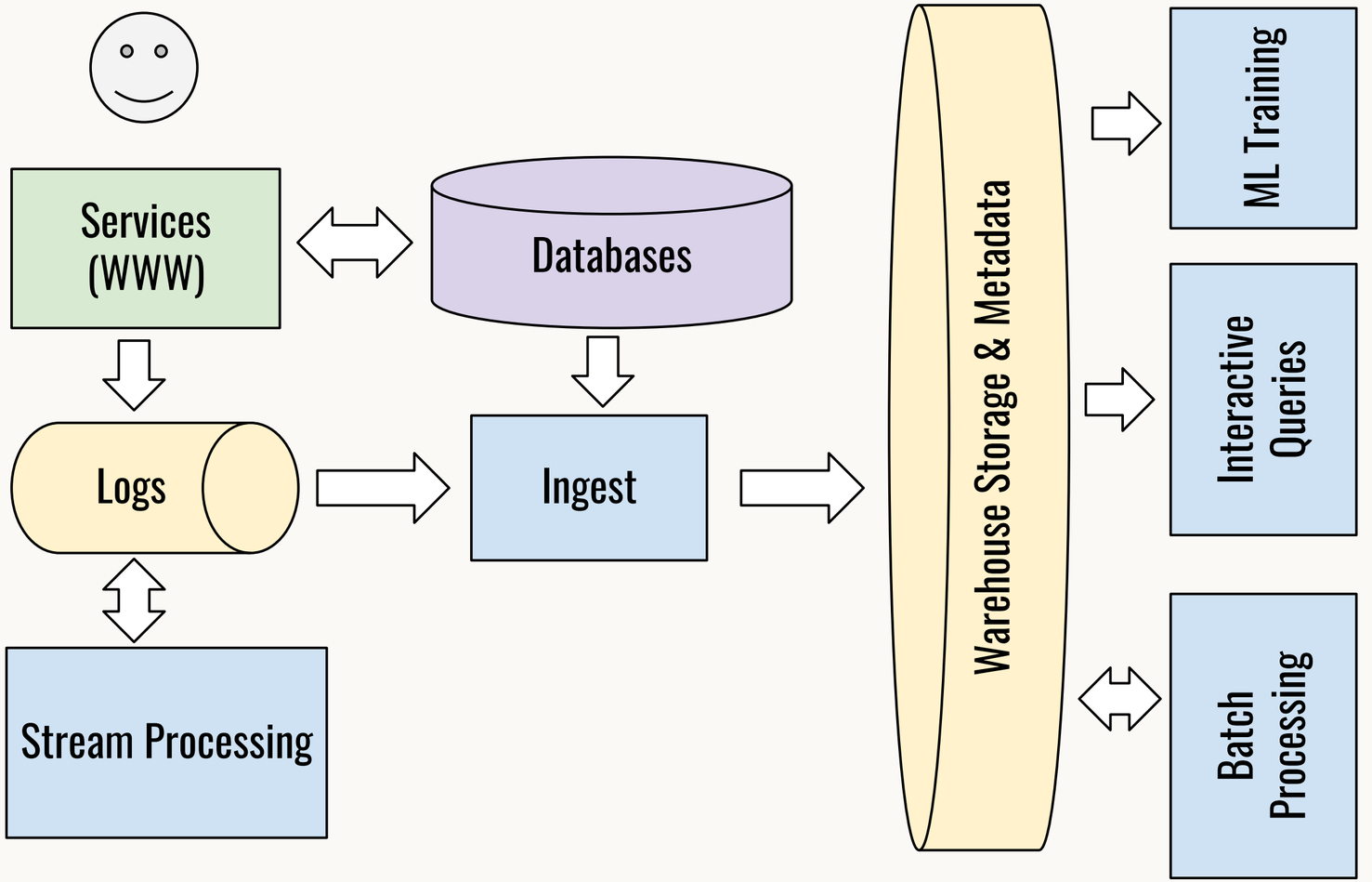
- Disaggregation
- Horizontal Scaling
- Elastic Compute
- Power Efficiency
- Global Optimization
- Engineering Efficiency

Solution: Open Data Lakehouse Analytics

- Direct data access:
  - Disaggregated storage
  - Open file formats
  - Open metadata APIs
- Diverse applications:
  - Batch
  - Interactive
  - Streaming
  - Machine Learning

Background

Open Data Lakehouse @Meta



The Problem: Fragmentation

Layer	Scope	Challenges
Language	SQL dialects, functions, entity & type metadata	SQL dialect fragmentation, lack of expressibility
Distribution/Runtime	Distributed execution, shuffle, resource management	Scalability, Efficiency, Fragmentation
Execution	Evaluation at node, caching	Latency, efficiency, Java / C++, dialect fragmentation
Data Access	Formats, storage, disaggregation	Library fragmentation, not data driven, poor encodings

Impact and Solution

- How does this impact us?
  - Hard to maintain and enhance:
    - Poor innovation velocity
  - Inconsistent user APIs:
    - Poor user experience
- What can we do about it?
  - Building **Shared Foundations!**

Shared Foundations

The Solution: Shared Foundations

- Principles:
  - Fewer systems
  - Shared components
  - Consistent APIs
- Goals:
  - Engineering efficiency
  - Faster innovation
  - Better user experience

Consolidation Efforts

Language Consolidation

- Half a dozen SQL dialects being actively used at Meta:
  - Presto SQL, HiveQL (in Spark), PQL (Puma), Scuba SQL, Cubrick SQL and MySQL.
- Ideal dialect:
  - Standard-compliant
  - Rich feature set
  - Wide adoption
- Presto SQL -> **CoreSQL**
- Two component are needed:
  - C++ parser/analyzer library
  - Execution library

Execution Consolidation

- Unified execution engine: **Velox**
- Reusable across engines (Analytics, Stream Processing, ML, and more)
- Provides fully compatible implementation of **CoreSQL.**

Engine Consolidation - Interactive Analytics

- Many interactive analytics engines:
  - Presto, Raptor, Cubrick, Scuba
- Ideal system:
  - Full and rich SQL support -> CoreSQL
  - Operate directly on lakehouse
  - Low query latency
- Presto -> **RaptorX:**
  - Hierarchical caching
  - Affinity
- Data freshness:
  - Near real time support

Engine Consolidation - Interactive Analytics (2)

- RaptorX -> **Prestissimo**
  - Presto running on Velox
- **Result:**
  - Single engine
  - Language consolidation (CoreSQL)
  - Low latency (local caching)
  - Data freshness (NRT)
  - Efficient execution (Velox).

Engine Consolidation - Batch Analytics

- Batch engines:
  - Presto, Spark
- Ideal system:
  - Full and rich SQL support -> CoreSQL
  - Large scale scalability
- **Presto-on-Spark**
- **Result:**
  - Language consolidation (CoreSQL)
  - Scalability (Spark runtime)
  - Efficient execution (Velox)

Engine Consolidation - Stream Processing

- Programming language diversity (C++, Java, Php)
- Abstraction level (procedural, declarative - SQL-like)
- Next generation -> **XStream**:
  - CoreSQL (added streaming extensions)
  - Velox for execution
- **Result:**
  - Language consolidation (CoreSQL)
  - Efficient execution (Velox)
  - Single engine.

Engine Consolidation - Machine Learning

- Custom eval engine -> move to Velox.
- File format inefficiencies -> **Alpha**
  - Alpha available in other engines via Velox.
- **Result:**
  - Language consolidation (TorchArrow, CoreSQL functions)
  - Efficient and unified execution (Velox)
  - Efficient decoding (Alpha).

Conclusion

Conclusion

- Generational leap in the data infrastructure landscape:
  - More modern, composable, and consistent stack.
  - Fewer components, richer features, and better performance.
- In the process we have:
  - Deprecated several large systems
  - Removed hundreds of thousands of lines of code
  - Open sourced several components
    - Velox, DWIO, Prest on Spark, RaptorX and TorchArrow
  - Improved engineering velocity and decreased operational burden.

What’s Next?

- This journey is 1% finished!
  - Projects in different stages of completion.
- Unified SQL is great (CoreSQL); how about beyond-SQL?
- Consistent UDFs across engines:
  - Universal UDFs

What’s Next?

- This journey is 1% finished!
  - Projects in different stages of completion.
- Unified SQL is great (CoreSQL); how about beyond-SQL?
- Consistent UDFs across engines:
  - Universal UDFs
- **Composability is the future of data management:**
  - Language, Execution, Data Access
  - …, Optimizers?
  - Hardware acceleration

Thank you!

Q/A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