

Data Processing & Data Integration Platform

# STREAM HORIZON



## About StreamHorizon...



- Data Processing & Data Integration Platform
- Data Processing throughput of 1 Million Records per second (single commodity server)
- Quick Time to Market – deploy StreamHorizon & **deliver** your Data integration project in a single week
- Fully Configurable via XML – making a project ideal outsourcing candidate
- Utilizes skills of your IT staff - requires no ETL platform specific knowledge
  
- Total Project Cost / Data Throughput ratio = 0.2 (20% of budget required in comparison with Market Leaders)
- 1 Hour Proof of Concept – download and test-run StreamHorizon's demo Data Warehousing project
  
- Runs on Big Data clusters: Hadoop, HDFS, Kafka, Storm, Hive, Impala and more...
- Run your StreamHorizon Data Processing Cluster (ETL grid)
- Runs on Compute Grid (alongside grid libraries like Quant Library or any other)
  
- Horizontally & Vertically scalable, Highly Available (HA) , Clusterable
- Running on Linux, Solaris, Windows, Compute Clouds (EC2 & others)

# Targeted Program & Project profiles

## Greenfield project candidates:

- Data Warehousing
- Data Integration
- Business Intelligence & Management Information
- OLTP Systems (Online Transactional Processing)

## Brownfield project candidates:

Quickly enable existing Data Warehouses & Databases which:

- Struggle to keep up with loading of large volumes of data
- Don't satisfy SLA from query latency perspective

## Latency Profile:

- Real Time (Low Latency - 0.000000666 seconds per record - average)
- Batch Oriented

## Delivery Profile:

- <5 days Working Prototypes
- Quick Time to Market Projects
- Compliance & Legislation Critical Deliveries

## Skill Profile

- Low-Medium Skilled IT workforce
- Offshore based deliveries

## Data Volume Profile

- VLDB (Very Large Databases)
- Small-Medium Databases

## Industries (not limited to...)



Finance - Market Risk, Credit Risk, Foreign Exchange, Tick Data, Operations



Telecom - Processing PM and FM data in real time (both radio and core)



Insurance - Policy Pricing, Claim Profiling & Analysis



Health – Activity Tracking, Care Cost Analysis, Treatment Profiling



ISP - User Activity Analysis & Profiling, Log Data Mining, Behavioral Analysis

# The Problem



## Complexity

- Data Integration = set of large (in numbers), interdependent & usually trivial units of ETL transformations

## Performance

- Long loading time windows
- Frequent SLA breaks
- 'Domino Effect' execution & dependencies (Waterfall paradigm)

...above are consequence of batch oriented rather than 'Real Time' & 'Data Streaming' design paradigms

## Query Latency

- Longer than expected query response times
- Inadequate Ad-Hoc query capability

# Our Solution



## Data Throughput of StreamHorizon platform enables:

- Indexing of Data Warehouses to extent previously unimaginable (4+ indexes per single fact table)
- Extensively indexed database delivers load throughput of 50-80% compared to model without indexes, however, it reduces query latency (intentional sacrifice of load latency for query performance)
- StreamHorizon **fully supports OLAP integration** (please refer to FAQ page). OLAP delivers slice & dice and drill-down (data pivoting) capability via Excel or any other user front end tool.
- No need to utilize OLAP cubes or equivalents (In-Memory solutions) acting as 'query accelerators'. Such solution are dependent on available memory and thereby impose limit do data volumes system can handle.
- Horizontal scaling of In-Memory software comes with a price (increased latency) as queried data is collated from multiple servers into single resultset
- No need to purchase exotic or specialist hardware appliances
- No need to purchase In-Memory/OLAP hardware & licence
- Simple software stack:

StreamHorizon  
+  
Vanilla Database

VS.

ETL Tool  
+  
Database (usually exotic)  
+  
OLAP/In-Memory solution (usually clustered)

## Our Solution - (continued)



- Time to market of project delivery - measured in days rather than months.
- IT Skills required for development are reduced to basic IT knowledge.
- Manage data volumes typical only for Financial Exchanges, Telecom blue chips and ISP's.
- Desktops running with StreamHorizon platform have more data processing bandwidth than commodity servers with state of the art (read complex and expensive) ETL tools and dozen of CPU's.
- Generic & Adaptable ETL platform
- Simple to setup (XML configuration)
- Platform geared to deliver projects of high complexity (low latency or batch oriented fashion)

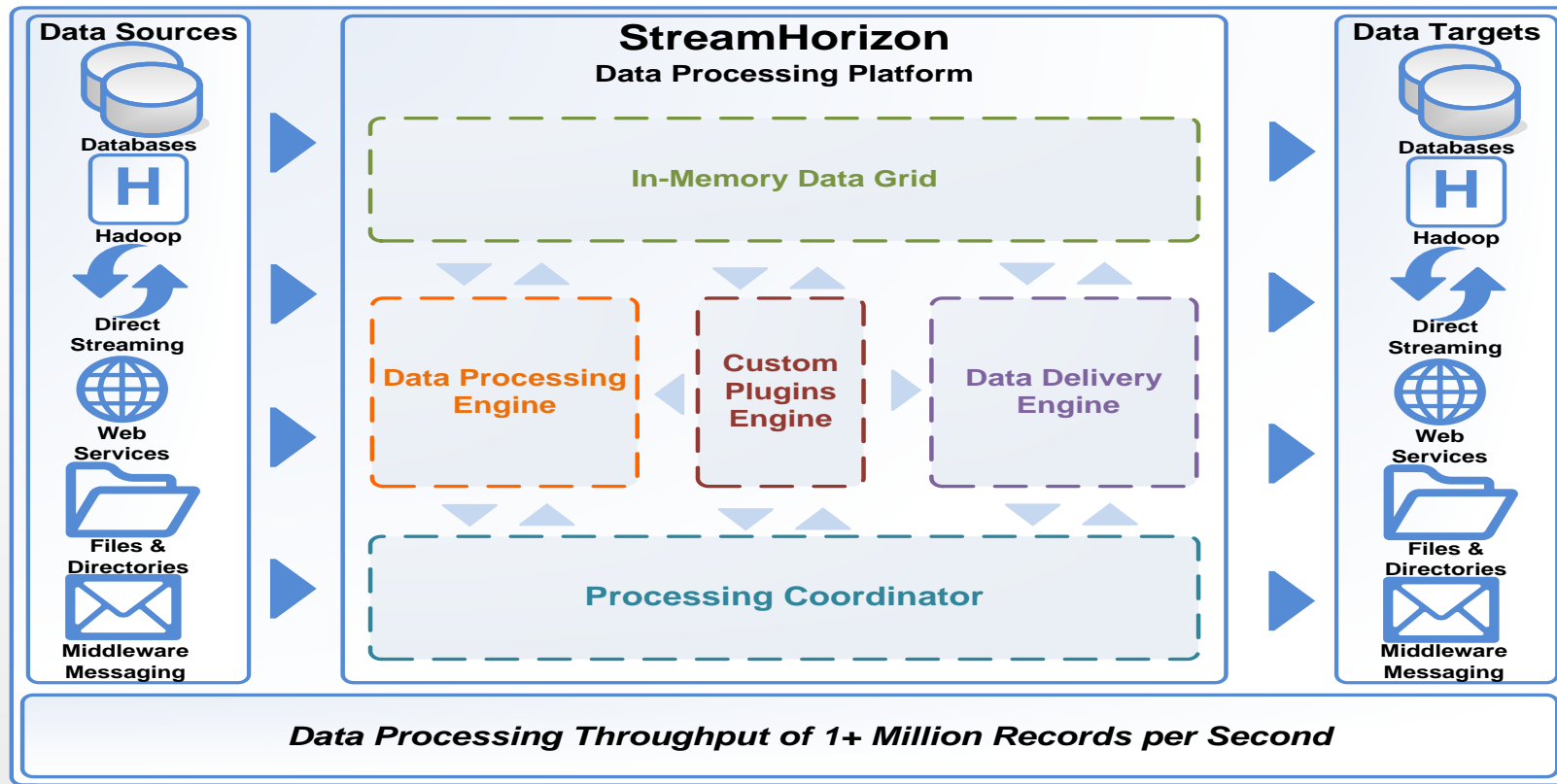
# STREAM HORIZON



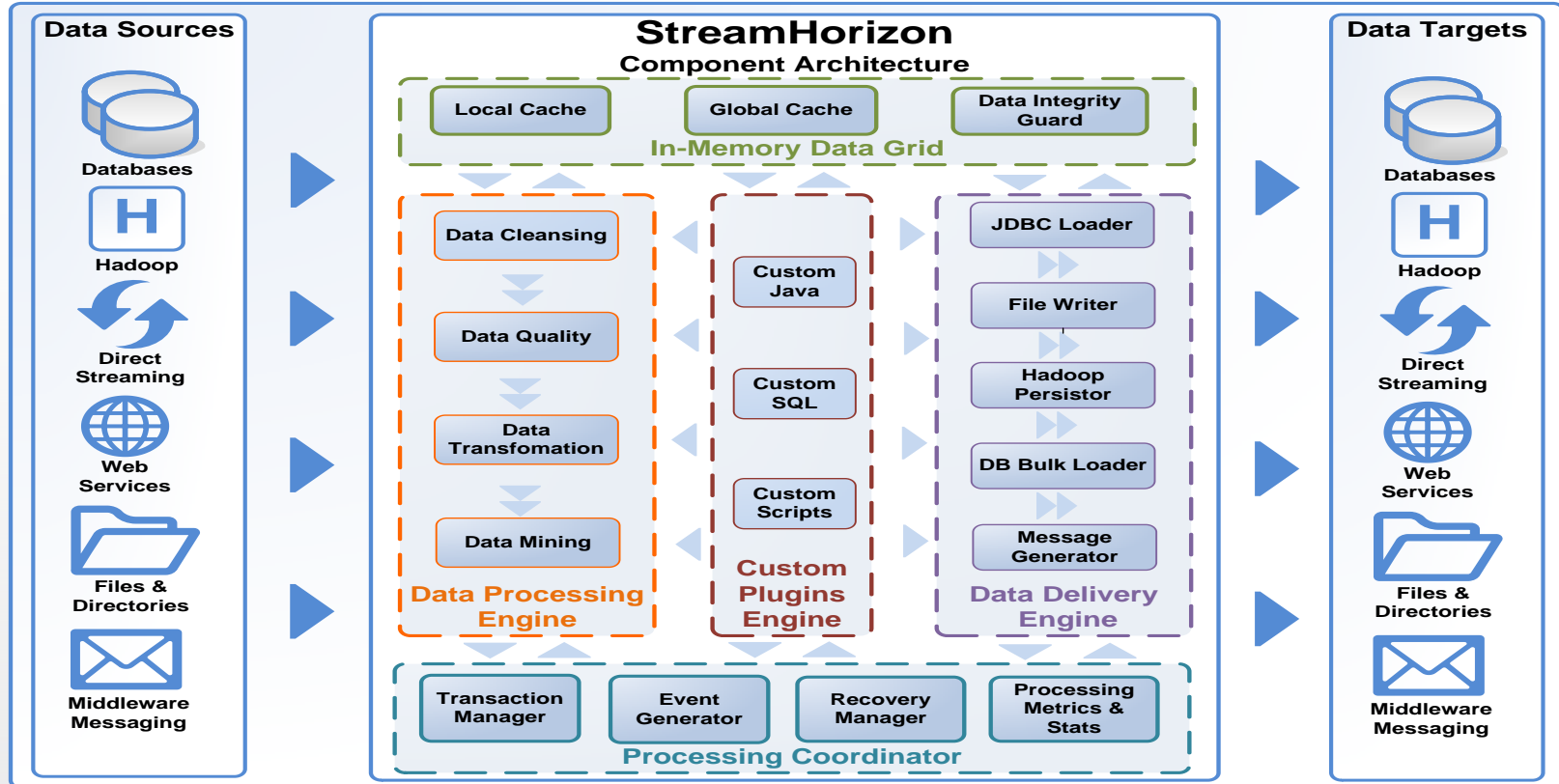
## Architecture



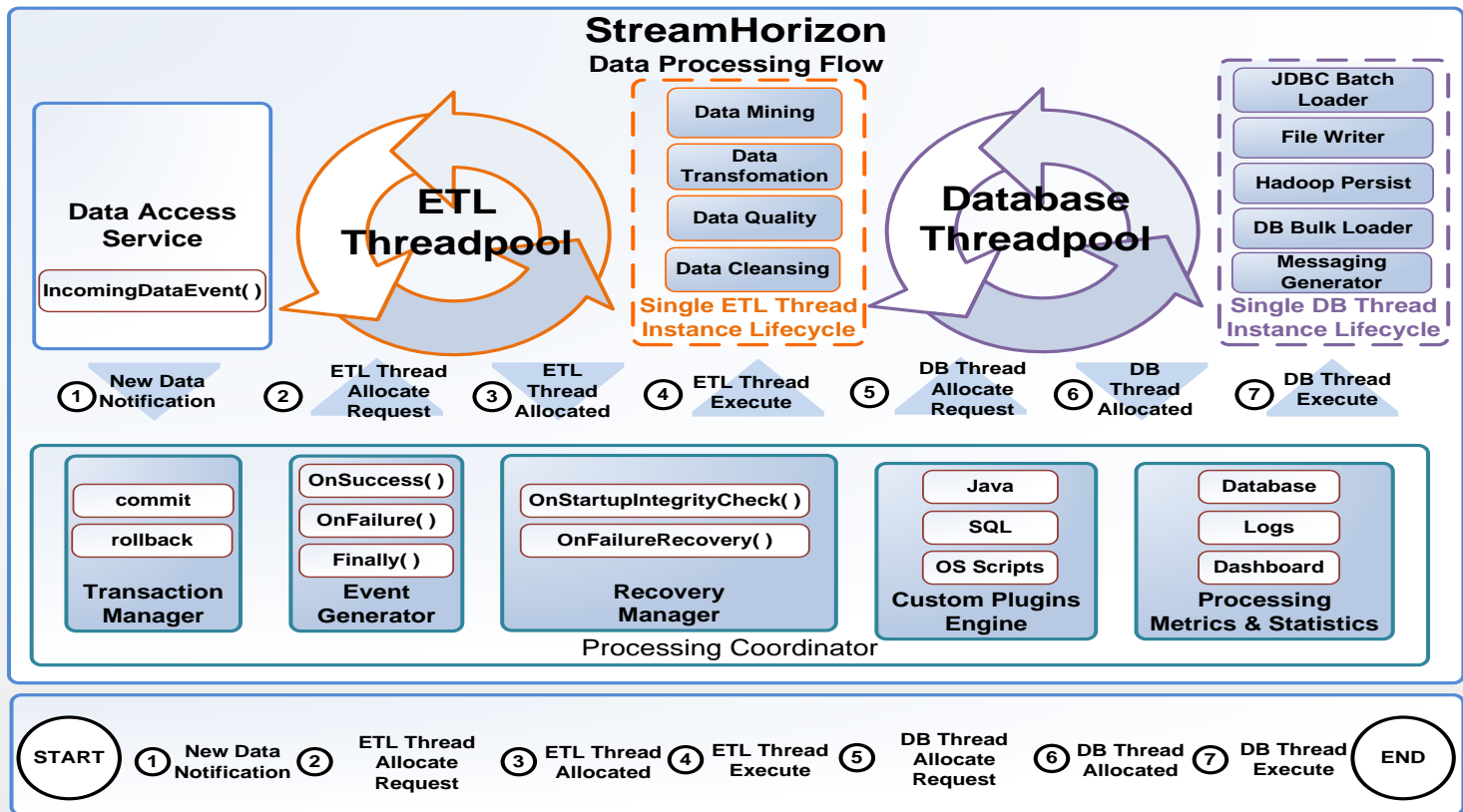
## High Level Architecture



# Component Architecture



# Data Processing Flow



# STREAM HORIZON



## Benchmarks

# Benchmarks



	Reading Method	Writing Method	Database Load Type	Throughput	Deployment Method	Instances & Threadpools	Comment
Benchmark 1	Buffered File Read (JVM Heap)	Off	Off	2.9 million/sec	Local Cluster (single server)	3 instances x 12 ETL threads per instance	<ul style="list-style-type: none"> <li>This is theoretical testing scenario (as data is generally always persisted)</li> <li>Shows StreamHorizon Data Processing Ability without external bottlenecks</li> <li>Eliminates bottleneck introduced by: <ul style="list-style-type: none"> <li>DB (DB persistence is switched Off)</li> <li>I/O (Writing Bulk files is switched Off) and I/O (Reading Feed files is switched Off)</li> </ul> </li> </ul>
File to File	Read File (SAN)	Write Bulk File or Any other File (feed)	Off	1.86 million/sec	Local Cluster (single server)	3 instances x 12 ETL threads per instance	<ul style="list-style-type: none"> <li>Throughput for feed processing with StreamHorizon Local Cluster running on a single physical server</li> <li>This test shows ability to create output feed (bulk file or any other feed (file) for that matter by applying ETL logic to input file (feed)</li> </ul>
BULK Load	Read File (SAN)	Write Bulk File (Fact table format)	Bulk Load	1.9 million/sec	Single Instance (single server)	1 instance x 50 DB Threads	<ul style="list-style-type: none"> <li>Throughput for DB Bulk Load (Oracle – External Tables) with single StreamHorizon instance running on a single physical server</li> </ul>
JDBC Load	Read File (SAN)	Off	JDBC Load	1.1 million/sec	Local Cluster (single server)	3 instances x 16 ETL threads	<ul style="list-style-type: none"> <li>Throughput for JDBC Load (Oracle) with StreamHorizon Local Cluster running on a single physical server</li> </ul>

# Benchmarks (setup & dependency)



## Benchmarks performed with:

- 200 million loaded records
- Individual file size of 100K records
- Each record :  
minimum 400 bytes / 36 attributes
- Data generated by Quant Library
- Target schema is Data Mart
- Kimball design methodology
- Fact table contains:
  - 6 Dimensions
  - 3 Measures
- Performing housekeeping tasks

## Housekeeping tasks performed by StreamHorizon:

- Files moved from source to archive directory
- Bulk files created and deleted during processing
- Metrics gathered (degrades performance on average by approx 20%)
- Files moved from source to error directory (corrupted data feeds)













# STREAM HORIZON



**Cost - Effectiveness**

## Functional & Hardware Profile



	StreamHorizon	Market Leaders
Horizontal scalability (at no extra cost)		
Vertical scalability		
Clusterability, Recoverability & High Availability (at no extra cost)		
Runs on Commodity hardware*		
Exotic database cluster licences	Not Required	Often Required
Specialized Data Warehouse Appliances (Exotic Hardware)	Not Required	Often Required
Linux, Solaris, Windows and Compute Cloud (EC2)		
Ability to run on personal hardware (laptops & workstations)*		

\* - Implies efficiency of StreamHorizon Platform in hardware resource consumption compared to Market Leaders



## Cost-Effectiveness Analysis - I

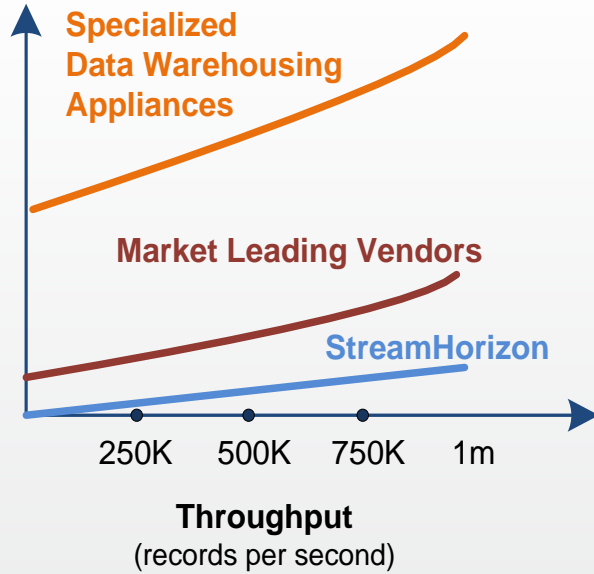
Target Throughput of 1million records per second	StreamHorizon	Market Leaders
Hardware Cost	1 unit	3 - 20 units
Time To Market (installation, setup & full production ready deployment)*	4 days	40+ days
Throughput (records per hour) **	3.69 billion (Single Engine)	1.83 billion (3 Engines)
Throughput (records per second) **	1 million (Single Engine)	510K (3 Engines)
Requires Human Resources with specialist ETL Vendors skill	No	Yes
Setup and administration solely based on intuitive XML configuration	Yes	No
FTE headcount required to support solution	0.25	2

\* - Assuming that file data feeds to be processed by StreamHorizon (project dependency) are available at the time of installation

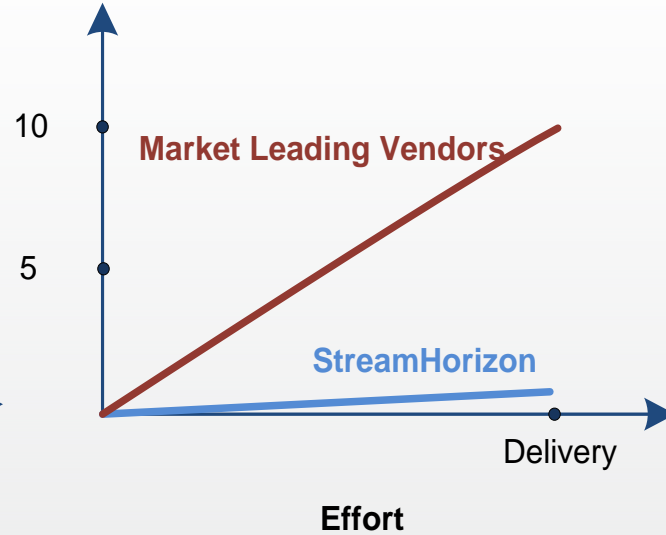
\*\* - Please refer to end of this document for detailed description of hardware environment

## Cost-Effectiveness Analysis - II

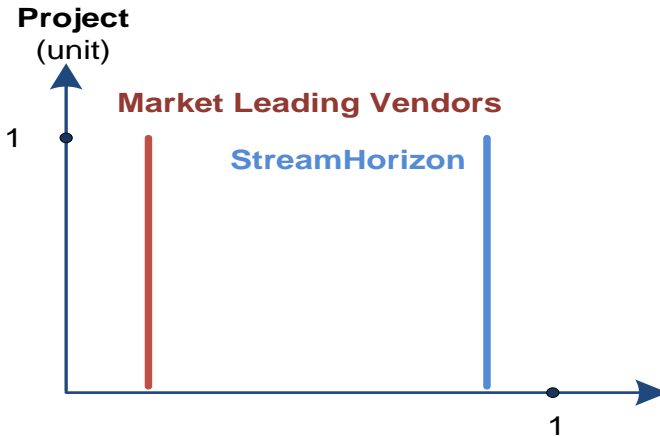
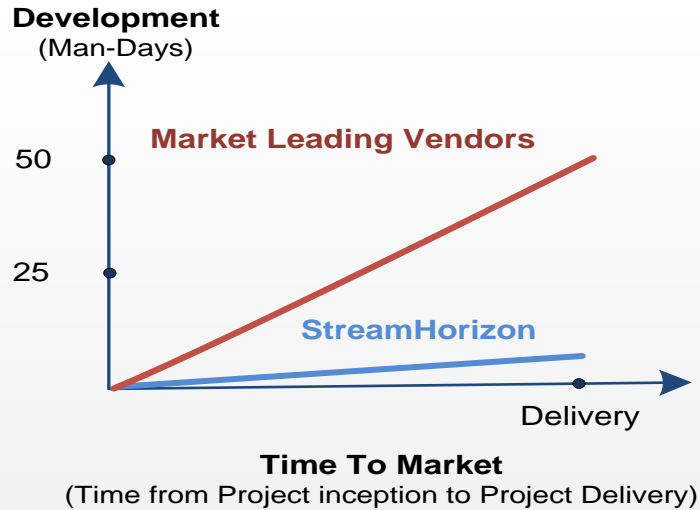
Hardware Cost (\$)



Cost of ownership  
(Man-Days per Month)



## Cost-Effectiveness Analysis - III



### Overall cost-effectiveness ratio

comparison based on:

- Total Costs (licence & hardware)
- Speed of Delivery
- Solution Complexity
- Maintainability

# STREAM HORIZON

Three dots are positioned to the right of the word 'HORIZON', aligned with the horizontal line that separates the two words.

Use Case study

# Use Case Study



## **Delivering Market Risk system for Tier 1 Bank**

- Increasing throughput of the system for the factor of 10
- Reducing code base from 10,000+ lines of code to 420 lines of code
- Outsourcing model is now realistic target (delivered solution has almost no code base and is fully configurable via XML)

## **Workforce Savings:**

- Reduced number of FTE & part-time staff engaged on the project (due to simplification)

## **Hardware Savings:**

- \$200K of recycled (hardware no longer required) servers (4 in total)

## **Software Licence Savings:**

- \$400K of recycled software licences (no longer required due to stack simplification)

## **Total**

- Negative project cost (due to savings achieved in recycled hardware and software licences)
- BAU / RTB budget reduced for 70% due to reduced implementation complexity & IT stack simplification

## Use Case Study - continued



- Single server acts as both StreamHorizon (ETL Server) and as a database server
- Single Vanilla database instance delivers query performance better than previously utilized OLAP Cube (MOLAP mode of operation).
- By eliminating OLAP engine from software stack:
  - User query latency was reduced
  - ETL load latency reduced for factor of 10+
  - Ability to support number of concurrent users is increased
- Tier 1 Bank was able to run complete Risk batch data processing on a single desktop (without breaking SLA).

# STREAM HORIZON

Three dots are positioned to the right of the word 'HORIZON', aligned with the horizontal line that separates the two words.

## ROI & Risk Management

# Reduced Workforce demand



## Development

- Reduced development headcount (due to simplicity of StreamHorizon platform)
- Enables utilization of skills of your current IT team
- No need to hire extra headcount with specialized (ETL platform specific) knowledge
- Customizations and extensions can be coded in Java, Scripts and SQL
- Supports agile development methods

## Infrastructure & Support

- Install at one location – run everywhere
- Not required - Dedicated teams of experts to setup and maintain ETL servers
- Not required - Dedicated teams of experts to setup and maintain ETL platform Repository

## BAU / RTB / Cost of ownership

- BAU budgets are usually 20% compared to cost of ownership of traditionally implemented Data Integration project
- Simple to outsource due to simplicity of delivered solution



# Environment Risk Management



- Ability to run multiple versions of StreamHorizon simultaneously on same hardware with no interference or dependencies
- Simply turn off old and turn on new StreamHorizon version on the same hardware
- Seamless upgrade & rollback performing simple 'File Drop'
- Backups taken by simple directory/file copy
- Instant startup time measured in seconds
- ESCROW Compliant

## Planned platform extensions



- **Infraction** - StreamHorizon 'In-Memory' Data Store designed to overcome limitations of existing market leading OLAP and In-memory data stores.
- Feed streaming to support massive compute grids and eliminate data feed (file) persistence and thereby I/O within Data Processing Lifecycle
- StreamHorizon streaming is based on highly efficient communication protocol (analog to ProtoBuffer by Google)

STREAM  
HORIZON

...

Deployment Topologies

# StreamHorizon Connectivity Map



## Databases

ORACLE  
MSSQL  
DB2  
Sybase  
SybaseIQ  
Teradata  
MySQL  
H2  
HSQL  
PostgreSQL  
Derby  
Informix  
Any Other JDBC compliant...

## Messaging

JMS (HornetQ, ActiveMQ)  
AMQP  
Kafka

## Hadoop ecosystem

Storm  
Kafka  
TCP Streams  
Netty  
Local File System  
Any Other via plugins....

Hive  
Impala  
HBase  
Any Other via plugins...

## Non-Hadoop file systems

Any file system excluding mainframe

## Acting as

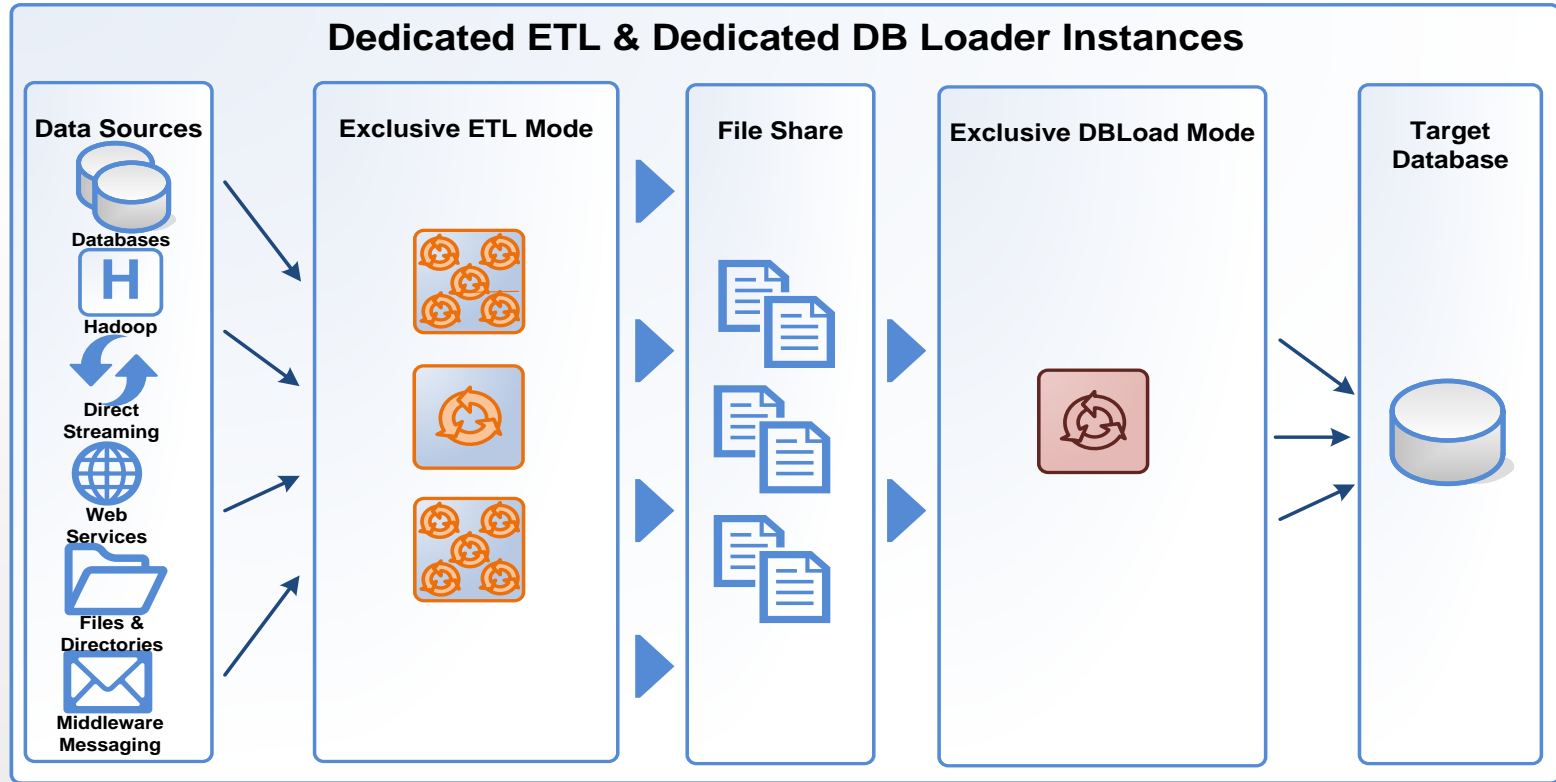
Hadoop 2 Non-Hadoop ETL bridge  
&  
Non-Hadoop 2 Hadoop ETL bridge

# StreamHorizon OLAP Integration



- Seamless integration with OLAP & In-Memory servers
- Supported integration modes:
  - **Real Time** – Data uploaded to the OLAP server immediately after every successful completion of ETL or DB task by StreamHorizon
  - **Batch Oriented** – Data uploaded to the OLAP server in batches rather than immediately after processing of each data entity (file, message, SQL query)
- OLAP integration is available in all StreamHorizon operational modes
  - JDBC
  - Bulk Load
  - Thrift
  - Hadoop
  - Messaging
  - Any other connectivity mode supported by StreamHorizon
- More information is available on [StreamHorizon FAQ](#) page

## Deployment – Biased

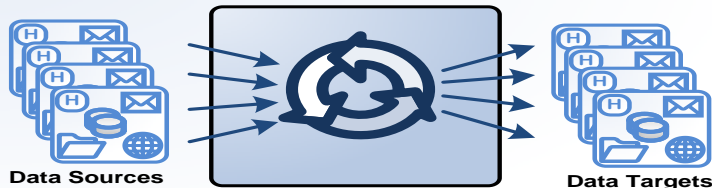


## Deployment – Vanilla & Grid

### StreamHorizon

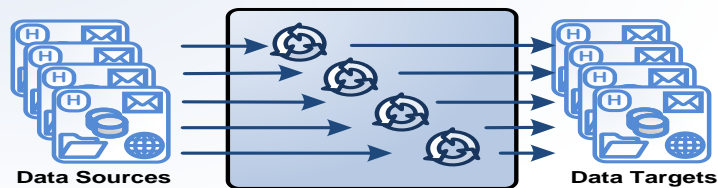
#### Deployment Topologies

##### Single Instance (Single Server Deployment)



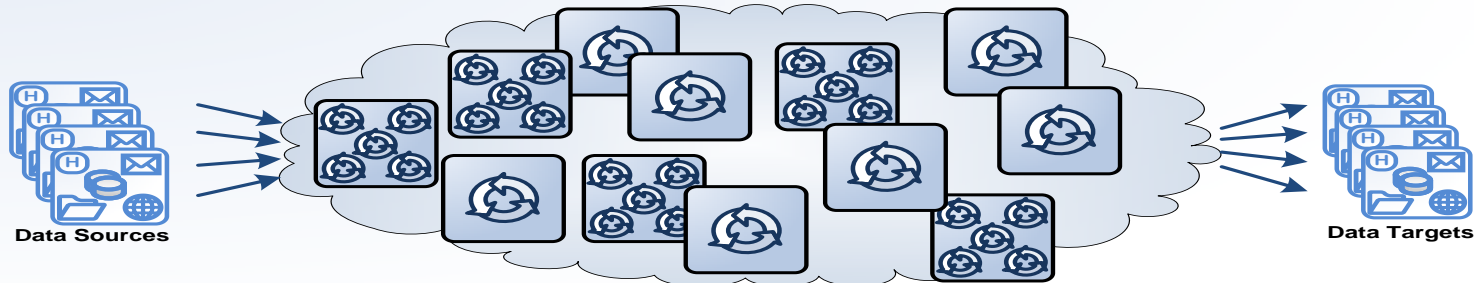
- Single StreamHorizon Instance
- Massively Parallel Threadpool
- Running on commodity server

##### Local Cluster (Single Server Deployment)



- Multiple StreamHorizon Instances
- Parallel Threadpools
- Running on commodity server

##### Data Processing Grid (Multi Server Deployment)



- Single Instance & Local Cluster StreamHorizon Deployments
- Running on commodity servers

# Data Processing Grid - ETL cluster



## Data Processing Grid Deployment

- Enables your organisation to build Data Processing grid, that is, cluster of ETL (Data Processing) servers (analogue to Compute Grid for computation tasks).
- Enables IT infrastructure to reduce total number of ETL servers by approximate factor of 4
- Ability to seamlessly upgrade your Data Processing grid via your compute grid scheduler (Data Synapse or other) or any other management software (Altiris etc.)

## Compute Grid Deployment

- StreamHorizon enables you to process data (execute ETL logic) at your compute grid servers as soon as data is created (by Quant Library for example).
- Helps to avoid sending complex/inefficient data structures (like middleware messages, XML or FpML) via network
- Utilize StreamHorizon to process your data at compute grid nodes and directly persist your data to your persistence store
- Eliminates need for expensive In-Memory Data Grid Solutions



# Data Processing Grid & XML



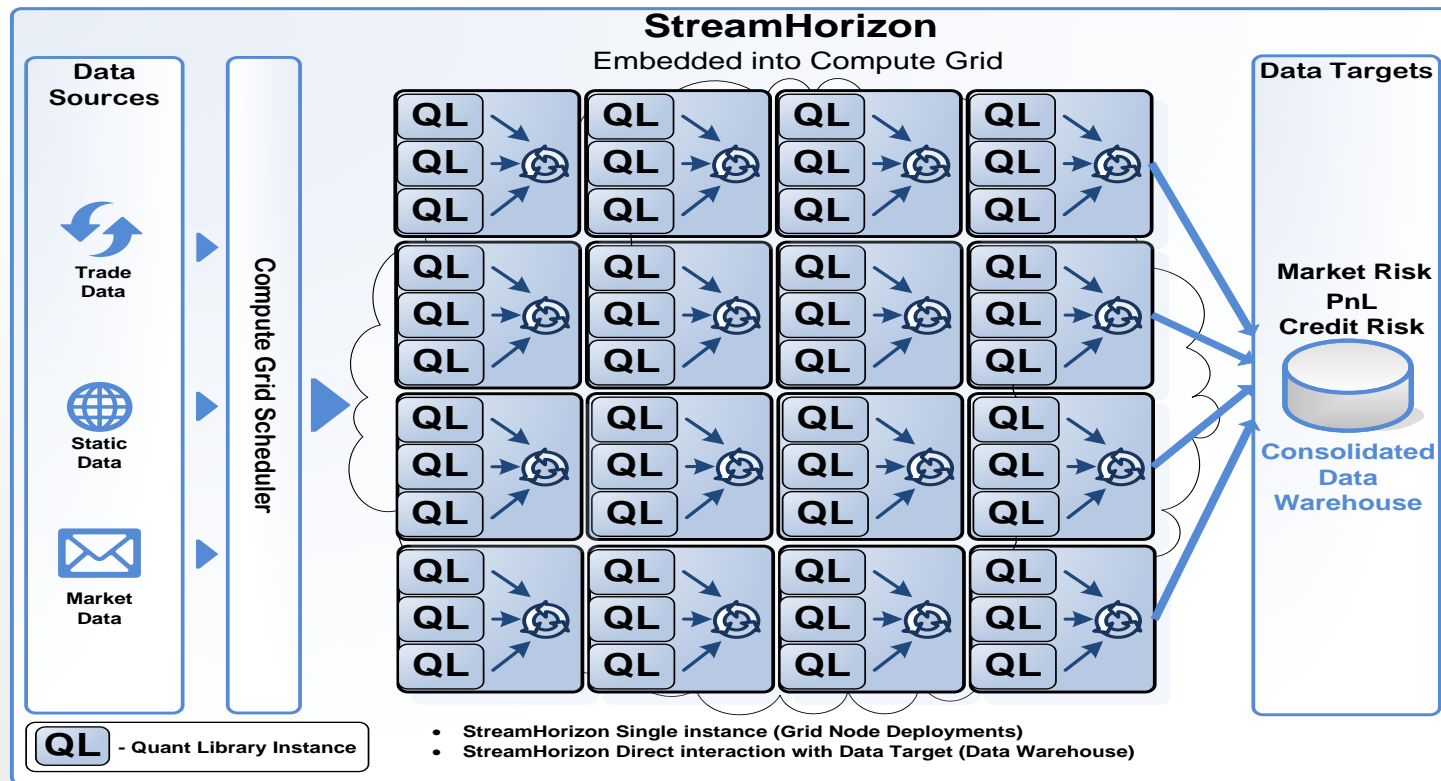
## Data Volumes Shipped via Network vs. XML (performance vs. readability)

- Due to challenging volumes numerous architectural solutions gravitate away from XML (self descriptive, human readable data format, but not storage effective)
- XML message size is unnecessarily large, dominated by metadata rather than data itself (over 80%)
- XML does however makes daily job easier for your IT staff and Business Analysts as it is intuitive and human readable as data format

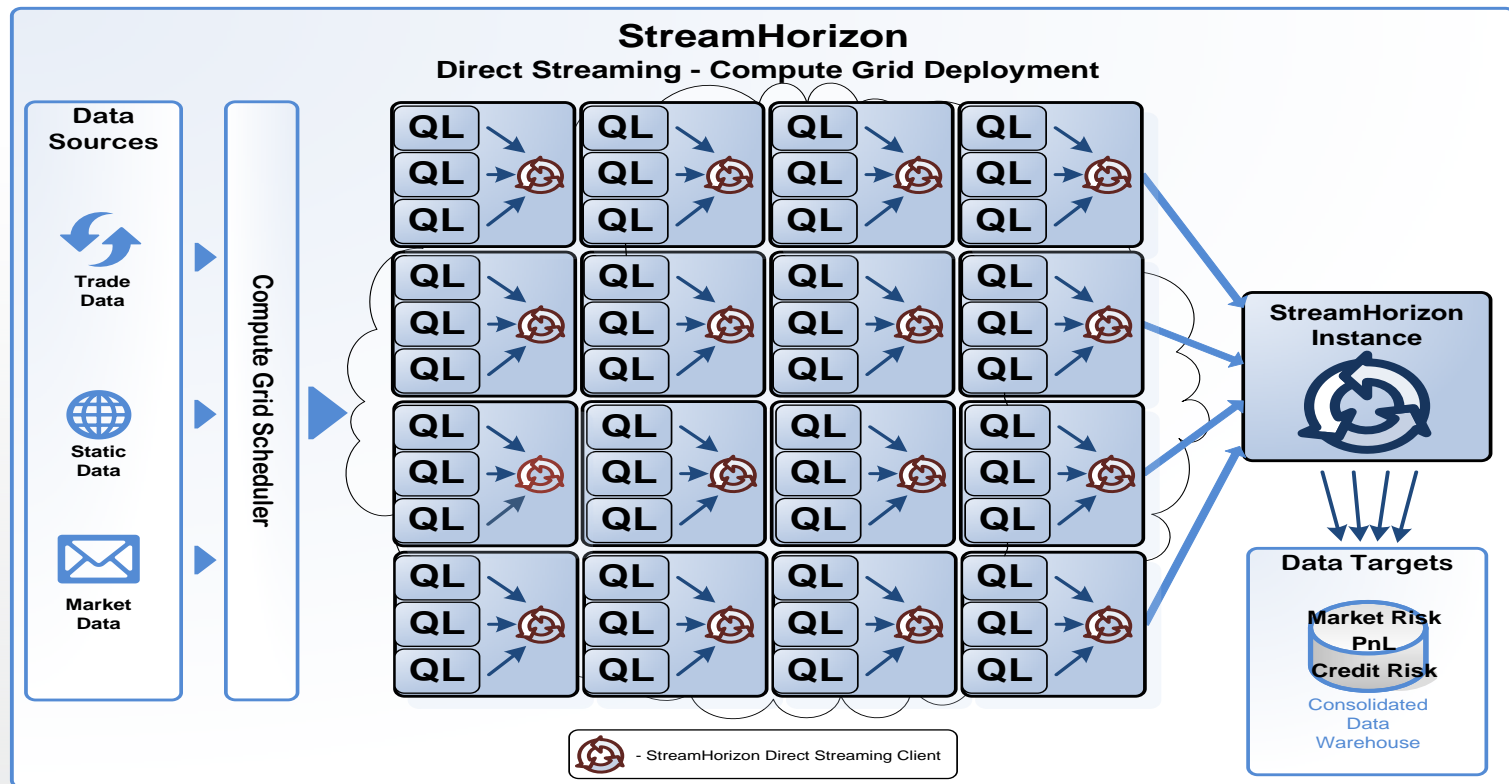
## The Solution – Best of both worlds

- StreamHorizon deployed at your compute grid nodes enables you to keep XML as inter-process/inter-component message format – without burdening the network traffic.
- StreamHorizon persist directly to your persistence store (most commonly a database) only data, thereby achieving minimal network congestion and latency (as if you where not using XML as cross component communication format).

## Compute Grid - Distributed Deployment (Example: Finance Industry)



## Compute Grid – Data Streaming (Example: Finance Industry)



# STREAM HORIZON

...

## Big Data Analytics - Accelerated

# StreamHorizon & Big Data



## Integrates into your Data Processing Pipeline...

- Seamlessly integrates at any point of your your data processing pipeline
- Implements generic input/output HDFS connectivity.
- Enables you to implement your own, customised input/output HDFS connectivity.
- Ability to process data from heterogeneous sources like:
  - Storm
  - Kafka
  - TCP Streams
  - Netty
  - Local File System
  - Any Other...

## Accelerates your clients...

- Reduces Network data congestion
- Improves latency of Impala, Hive or any other Massively Parallel Processing SQL Query Engine.
  - *Impala*
  - Hive
  - HBase
  - Any Other...

## And more...

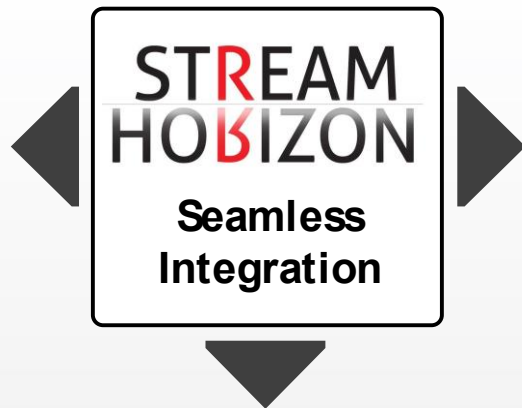
- Portable Across Heterogeneous Hardware and Software Platforms
- Portable from one platform to another

# StreamHorizon - Flavours – Big Data Processing



## Storm - Reactive, Fast, Real Time Processing

- Guaranteed data processing
- Guarantees no data loss
- Real-time processing
- Horizontal scalability
- Fault-tolerance
- Stateless nodes
- Open Source



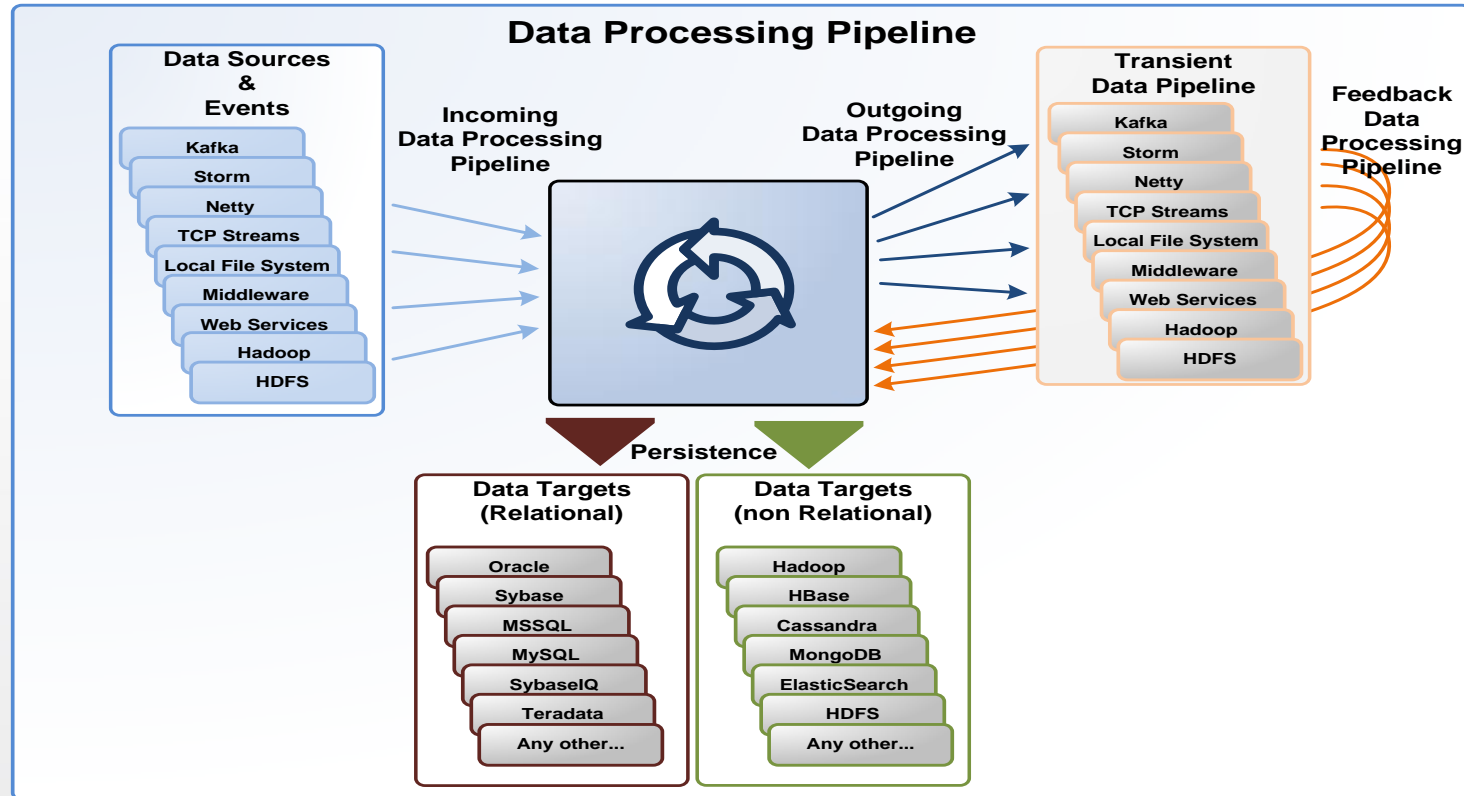
## Hadoop – Big Batch Oriented Processing

- Batch processing
- Jobs runs to completion
- Stateful nodes
- Scalable
- Guarantees no data loss
- Open Source

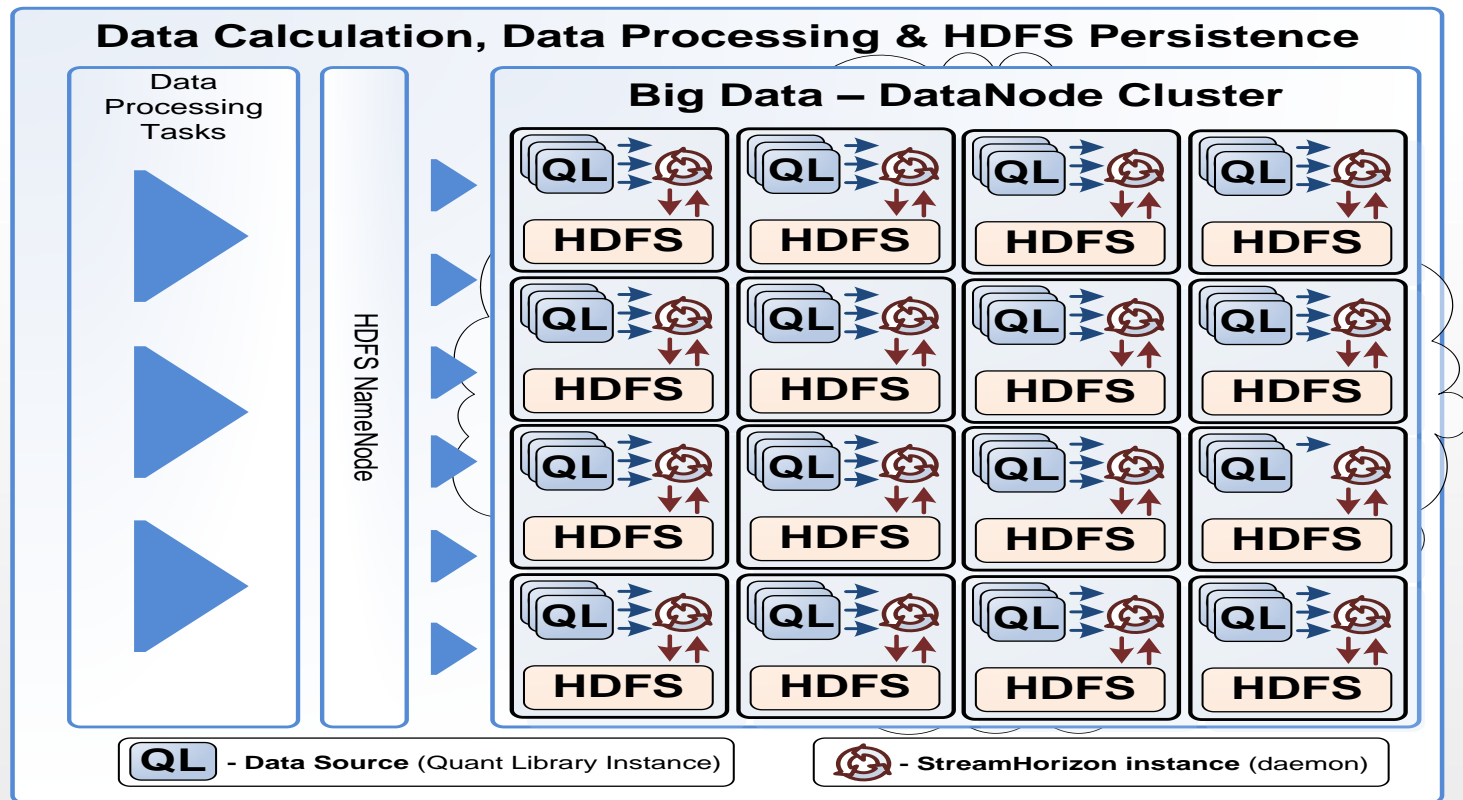
## Kafka

- Designed for processing of real time activity stream data (metrics, KPI's, collections, social media streams)
- A distributed Publish-Subscribe messaging system for Big Data
- Acts as Producer, Broker, Consumer of message topics
- Persists messages (has ability to rewind)
- Initially developed by LinkedIn (current ownership of Apache)

# StreamHorizon – Big Data Processing Pipeline

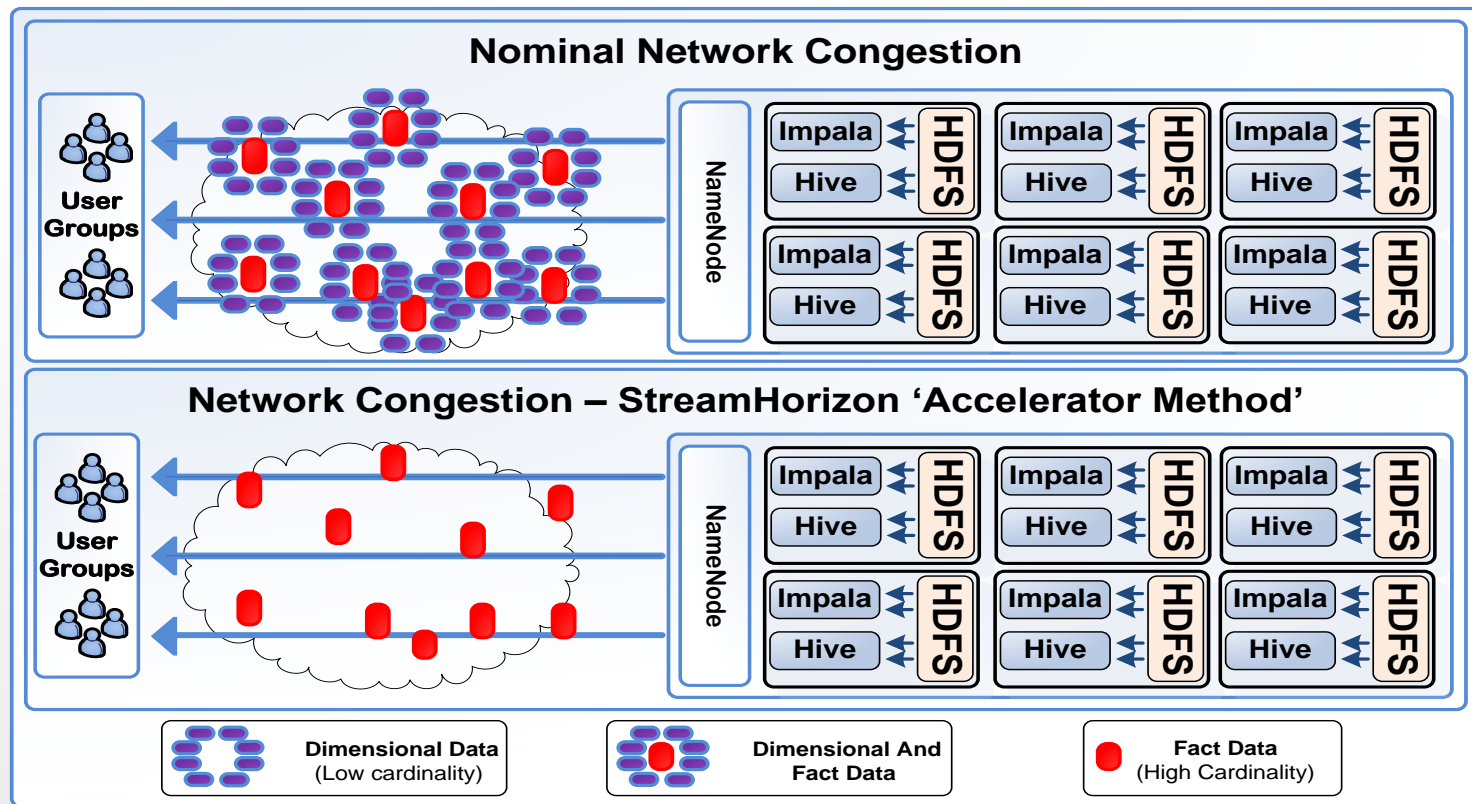


## Big Data & StreamHorizon – Data Persistence (Example: Finance Industry)





## Big Data & StreamHorizon – Data Retrieval (Example: Finance Industry)



## Streaming Data Aggregations – impact on Big Data Query Latency

	Out of the Box		With Streaming Data Aggregations	
	Impala	Hive	Impala	Hive
Query Latency	Medium-Low	Medium-High	Low	Medium-Low
Memory Footprint	High	Nominal	Medium - Low	Nominal - Low
Processing Footprint	Medium-Low	High	Low	Low
Space Consumption	Medium	High	Low	Low

## Other Technical details



- Pluggable Architecture - extend and customize StreamHorizon platform without recompilation
- Integrates with RDBMS vendors via JDBC (Oracle, MSSQL, MySQL, SybaseIQ, Sybase, Teradata, kdb+ and others)
- Seamless integration with major programming and script languages (Java, SQL, Shell, Python, Scala, Windows Batch etc.)
- Utilizes leading industry standard software development practices (GIT, Maven, TDD, IMDG...)
- Instant startup time measured in seconds

# Commodity Server Deployment

## (details of StreamHorizon benchmark environments)



Target throughput of 1 million records per second

- Commodity Tier 2 SAN storage (no SSD, no local storage was used)
- Commodity AMD 2.1 GHz Processors 6 processors (4 cores each)
- Files of size of 100K records (of a minimum single line size of 400 bytes)
- 35 attributes per line which comprise 13 Dimensions (Kimball Star Schema Data Model, fact table has 18 attributes in total)
- Tested with heavily indexed Database tables tuned to respond to queries scanning up to 10 million fact table records within 1.4 seconds (without use of aggregate tables, material views or equivalent facilities. Standard (no RAC, non Parallel Query) Enterprise Edition Oracle database instance)
- Testing Query profile:
  - Aggregate up to 10 million transactional records & return results
  - Return up to 10,000 of transactional records without aggregation
  - All queries execute against single table partition which contains 500 Million records

# Desktop Hardware Deployment

## (details of StreamHorizon benchmark environments)



Target throughput of 250K records per second

- Target hardware: laptops or workstations (commodity personal hardware)
- Local (not SSD) Hard Disk storage used (single Hard Disk)
- 2 AMD (A8) processors (4 cores)
- Files of size of 100K records (of a minimum single line size of 400 bytes)
- 35 attributes per line which comprise 13 Dimensions (Kimball Star Schema Data Model)

# STREAM HORIZON



## Q&A