

Architecture Spotlight:  
Vertical Markets | The Consumer Web

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Preliminary – Not for Publication

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# Static Model

- Batch updates
- Standardized reports
- Real-time analytics

# Dynamic Model

- Huge transaction volumes
- Data science and complex analytics produced in real time
- User-driven, on-demand reporting
- Network effects

# Pioneers

- Google
- Facebook
- Netflix
- Amazon

# New Technologies

- NoSQL and graph databases
- Cloud computing
- Small, scalable servers
- Fault tolerance

# Data Flow – Consumer Site

## *User Actions*

- Page Views
- Searches
- Purchases
- Uploads

## *User Content*

- Stories
- Suggestions
- Ads

## *Analytics*

- Trends
- Clustering
- Profiles
- Histories

## *External Events*

- News Reports
- Market Movements
- Product Offerings

## *Reports*

- Content Refinement
- Usage Statistics
- Revenue

# Data Flow – Finance

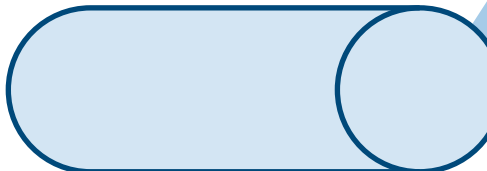
## Live and Static Trade Data

ID	Book	Security	NbShares
	18579	ORCL	220
1	2142039	COST	8423
2	12145	ALTR	3520
3	21121	AKAM	10020
4	2036915	AAPL	3383
5	2055103	VMED	4954
6	15316	CMCSA	8461

## Streaming Market Data

ID	Security	Bid	Ask
	ATVI	63.90	64.05
1	ADBE	14.55	16.52
2	AKAM	340.20	341.49
3	ALXN	5.37	6.86
4	ALTR	443.04	444.54
5	AMZN	59.82	60.94
6	AMGN	60.29	60.82

## Static Reference Data



*Huge user base,  
diverse needs*

*Live, rich, big  
interactive reports*

**RDx Explorer (HTML5 Grid)**

**RDx Explorer**

HPivotView

Expand All Collapse All Share Actions

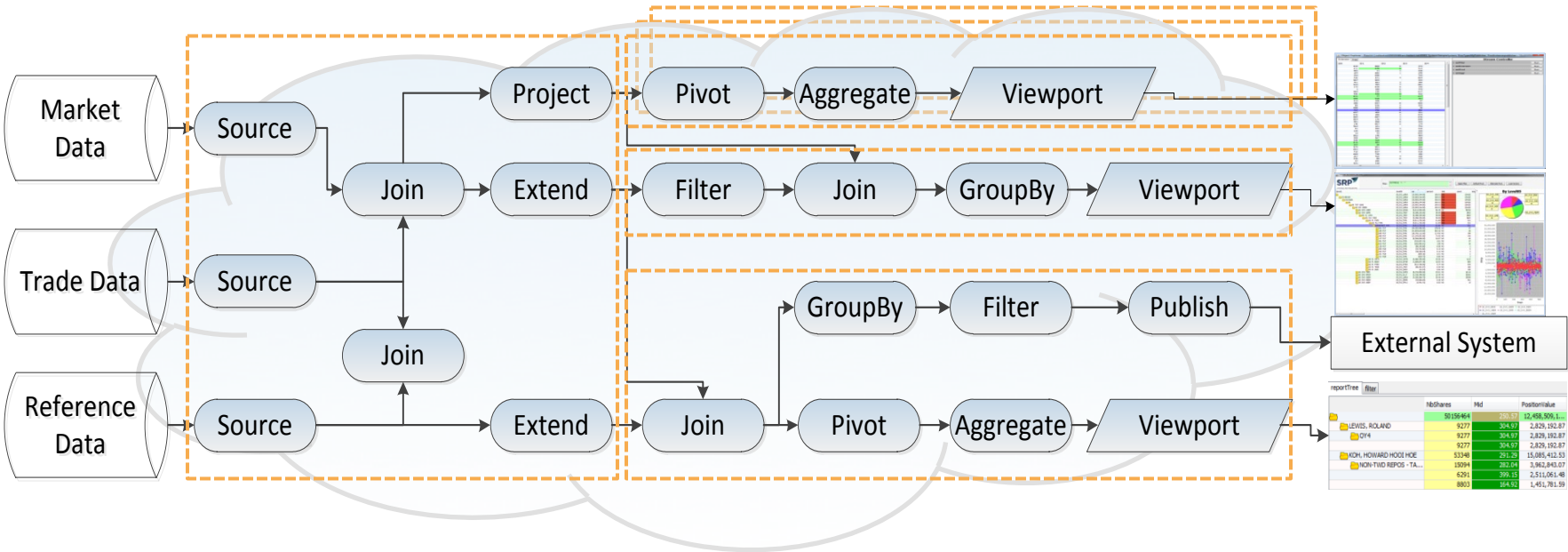
[Book_Name...	Book_Name	Book_Trader	PositionV...	ADJ	BNK	CAP	EXP	TRD	BookCategory	BusinessCon...
			11,872,362.70...	2,598,347.538...	1,093,908.906...	171,346,019.46	4,416,337.77	8,004,343.906...		
PE for Cl...	PE for Cluster...		9,377,399.99	0.00	0.00	9,377,399.99	0.00	0.00	25CC	
JPY Repo	JPY Repo		1,178,053.12	0.00	0.00	0.00	0.00	1,178,053.12	QVC0	
ECM Hon...	ECM Hong Ko...		6,962,748.95	6,962,748.95	0.00	0.00	0.00	0.00	30JG	
Investors...	Investors-DID		893,064.59	893,064.59	0.00	0.00	0.00	0.00	QEV0	
DNH HA...	DNH HACHIM...		747,734.32	0.00	0.00	0.00	0.00	747,734.32		
DIGB6 C...	DIGB6 CSFBI...		5,059,551.59	5,059,551.59	0.00	0.00	0.00	0.00	QC4U	
MTG1	MTG1		4,665,318.33	0.00	0.00	0.00	0.00	4,665,318.33	16B2	

# Platform Elements

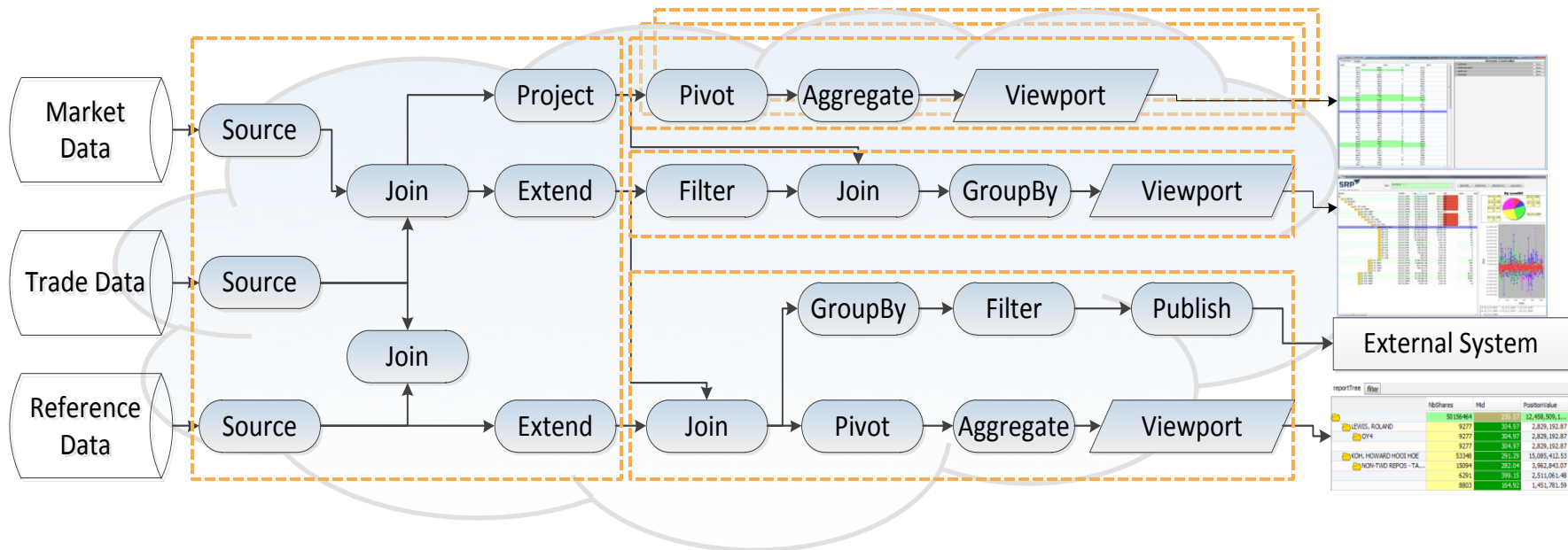
- Data capture and audit
- Grid calculation
- Real-time data flow
- Visualization



# Real-Time Data Algebra



# Distributed Runtime



**Records** Typed tuples  
Stored as a Java class of primitive types (no boxing!) by synthesizing JVM byte code on-the-fly

**Operators** Highly optimized building blocks  
Build complex live systems by functional composition of algebraic operators

**Expressions** Java language support  
Predicates, expressions, aggregations can all be dynamically changed at runtime

**Messaging** Compact delta messaging  
Only changes are propagated thru the system using a very compact message format

**Processes** System-level deployment  
Global namespace, load-balancing, failover, and elasticity provided by design

# Benefits of Common Platform

- Rapid development
- Handles infrastructure complexities
- Ensures consistency

# Commonalities with massively scaled Web sites

- Volume & Velocity
- Real-time decision-making
- Dynamic, flexible views
- Graph-like data model
- Use of open-source tools
- Synthesis of real-time data from many sources
- Failover, load balancing, fault tolerance

# Advantages over consumer sites

- Well-defined problem space
- Steady feedback leads to tailored refinement
- Demanding, insightful users
- Techniques translate directly to large set of applications across industries



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**Q&A**