

New York Stock Exchange Achieving the Promise of SOA

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Enterprise Systems Development



Agenda

- ✍ The New York Stock Exchange
- ✍ Enterprise Architecture Program
- ✍ NYSE Enterprise Architecture
- ✍ Business Agility

New York Stock Exchange

- ✍ World's Largest Exchange by Market Cap
 - \$21.4 Trillion
- ✍ Listed Companies
 - 2,773 (Common and Preferred)
 - 3,615 (All)
- ✍ 341 Member Firms / 1366 Trading Licenses
- ✍ Average Daily Volume: 1.6 billion shares

NYSE: Major Changes

Hybrid Market

- New Trading Venue
- Enables Customer Choice

Merger with Archipelago

- High Performance Execution
- Platform for New Trading Products

NYSE Non-Trading Domains

- ✍ Regulatory & Compliance
- ✍ Global Corporate Client Group
- ✍ Competitive Positions Group
- ✍ Market Data Products
- ✍ Research
- ✍ Corporate: Finance, Legal, HR

Enterprise Drivers

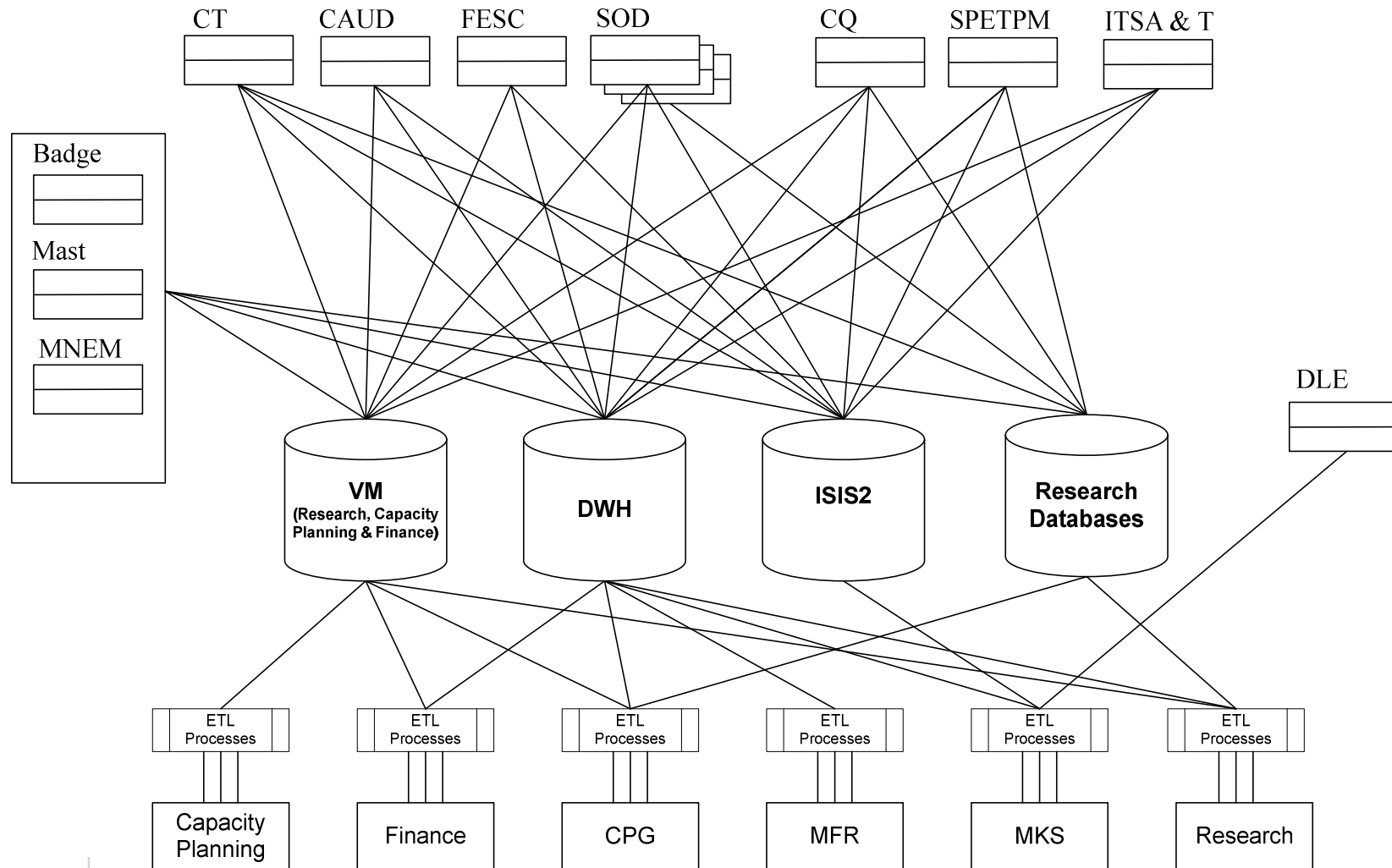
- ✍ Improve Information Quality
- ✍ Business Agility
- ✍ Operational Efficiencies
- ✍ Reduced Costs

Current Environment Challenges

- ✍ Complexities involving data & technologies
- ✍ Performance issues as volumes continue to grow
- ✍ Increasing Time-to-Market & Costs
- ✍ Lack of transparency of information and business rules

Current Environment

Current Data Sources & Stores



Enterprise Architecture Strategy

Business Optimization:

- provide an environment which supports the business by engineering the enterprise
- organizing information and functions as business services

Architecture Governance

- Implementation & Enforcement of Enterprise Technology Standards

Project vs. Enterprise Level SOA

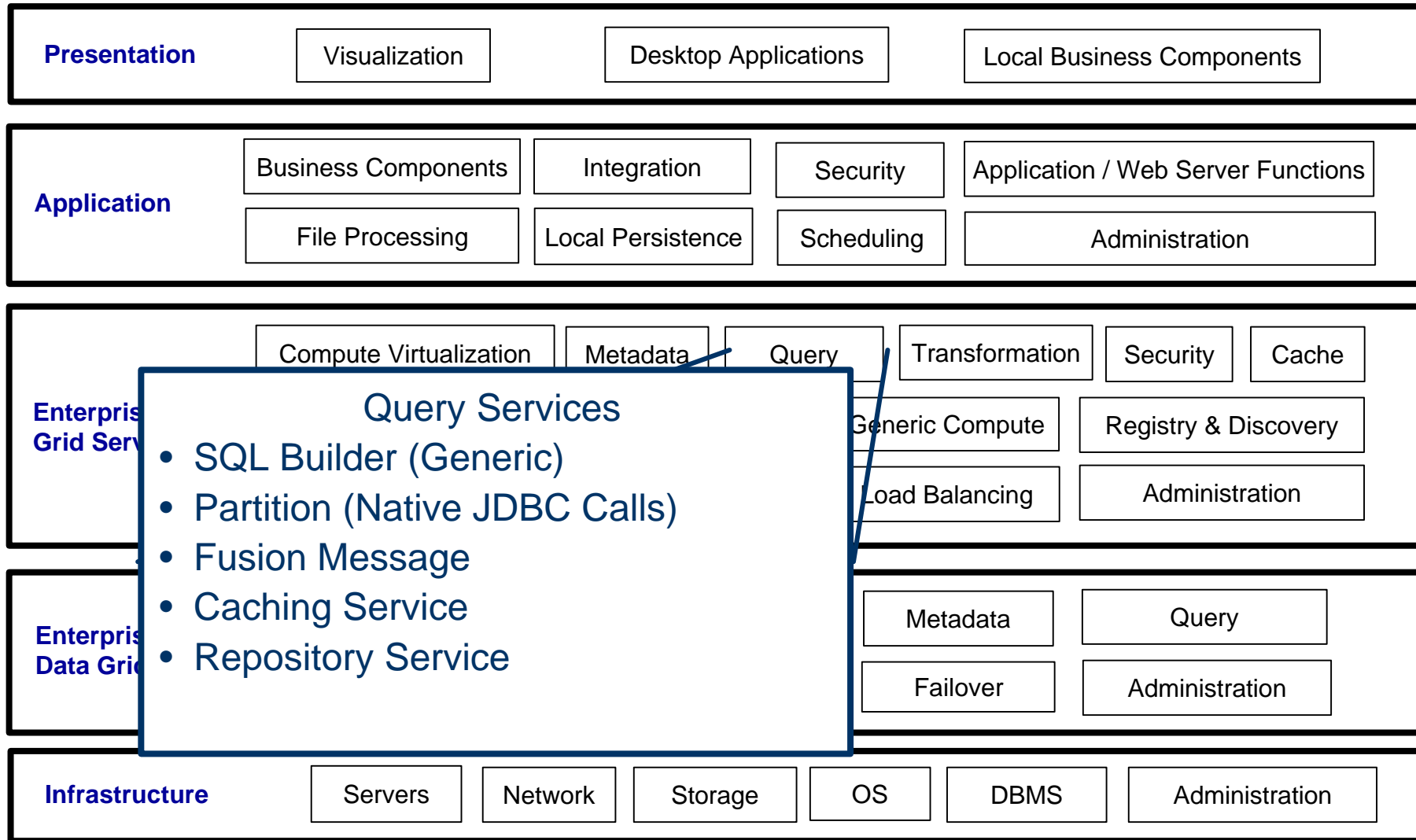
Enterprise-level **SOA** requires more preparation and coordination with:

- a formal approach to service portfolio planning
- platform planning
- governance

Guiding Principles

- ✍ Loose Coupling
- ✍ Vendor & Technology Independence through Open Standards
- ✍ Utility Based Computing
- ✍ Consistency in Data, Processes & Technology
- ✍ Performance
- ✍ Flexibility

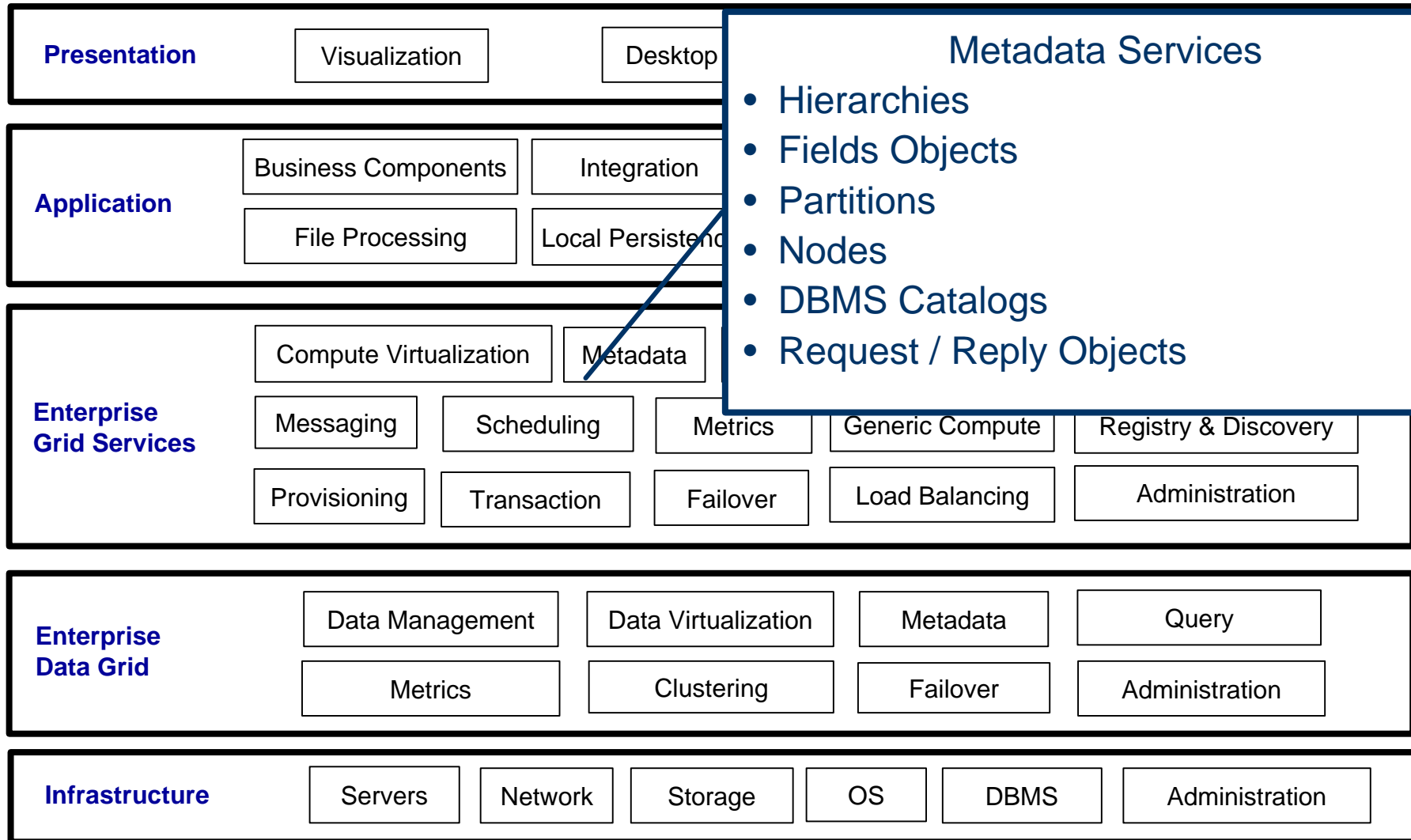
NYSE EA Services Reference Model



Query Services

- SQL Builder (Generic)
- Partition (Native JDBC Calls)
- Fusion Message
- Caching Service
- Repository Service

NYSE EA Services Reference Model

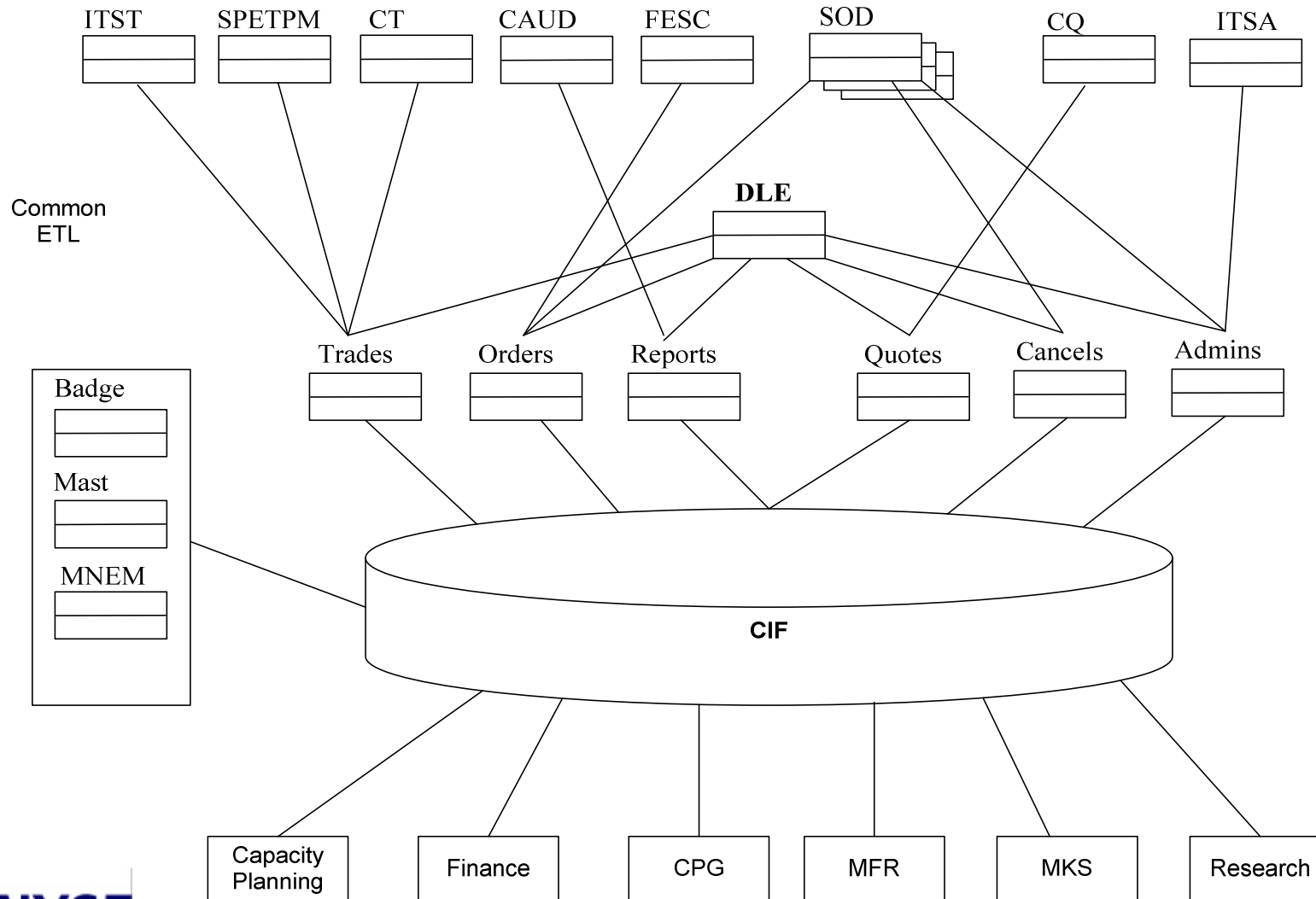


Corporate Information Factory

- ✍ High Performance Computing and Data Warehouse Environment
- ✍ Lightweight, Grid Service Oriented Architecture
- ✍ Reusable Frameworks and Common Services
- ✍ Model Driven, Pattern Based Architecture

CIF Data Sources and Uses

CIF Data Sources



NYSE Enterprise SOA Solution

- ✍ Complexities involving data & technologies
 - Establish an enterprise data warehouse (models & dictionary)
 - Establish & enforce enterprise technology standards
- ✍ Performance issues as volumes continue to grow
 - Horizontal scaling & parallelism
- ✍ Increasing Time-to-Market & Costs
 - Reusable services and Run-time assembly
 - Engineer & deploy low-cost commoditized components
- ✍ Transparency of information and business rules
 - Expose data & business rules through models & metamodels

Grid Service Oriented Architecture

- ✍ Economies of Scale & Performance through Distribution
- ✍ Computer Resource Virtualization (“Grid Computing”)
- ✍ Master-Worker Pattern offers simple and elegant solution
- ✍ Request / Responses are Service Oriented using layered architecture
- ✍ Distribute Cache across “Grid”
- ✍ Heterogeneous software and hardware cooperate as one virtual “system”

CIF Architecture Features

- ✍ Computer Resource Virtualization
- ✍ Federated Database for Trading, Market and Surveillance Source Data
- ✍ Metadata Repository
 - *“The Enterprise Data Dictionary”*
- ✍ Data Access Middleware
 - Metadata driven / Services Oriented
- ✍ Parallel Data Transformation & Load Engine
 - Grid Enabled

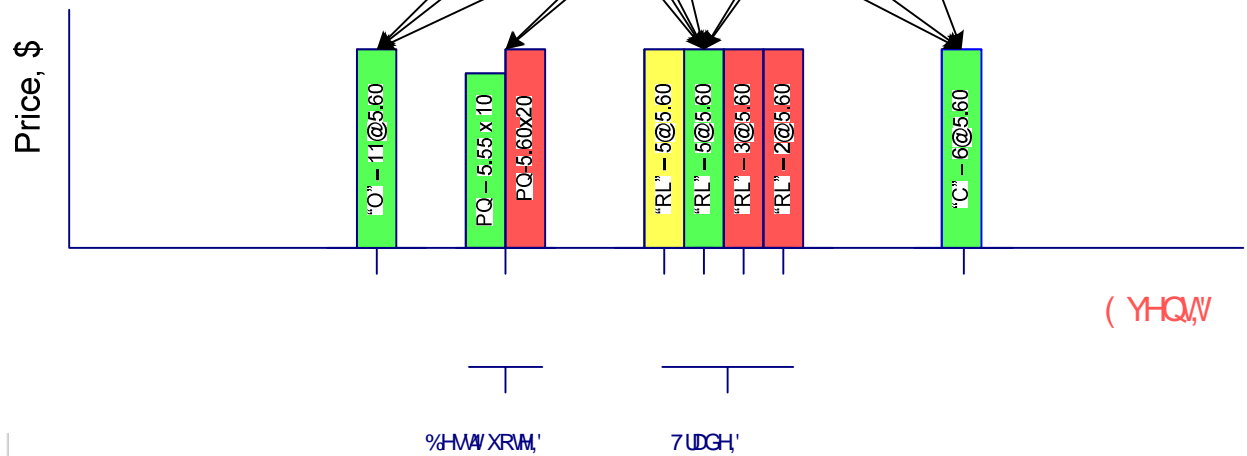
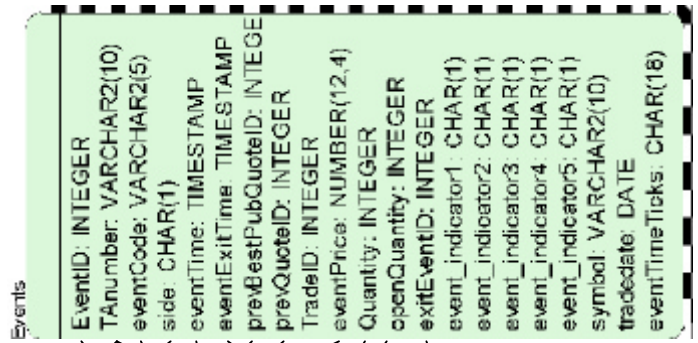
Metadata Repository

- ✍ Logical views of distributed data (“Model”)
- ✍ Model data dictionary
 - (entities, attributes, fields, nodes, partitions)
- ✍ Hierarchical entity join relationships
- ✍ Data navigation hierarchies and business segmentation
- ✍ Logical data partitions
- ✍ Linkages to shared-nothing and/or federated databases
- ✍ User security and entitlements
- ✍ Data sources and providers

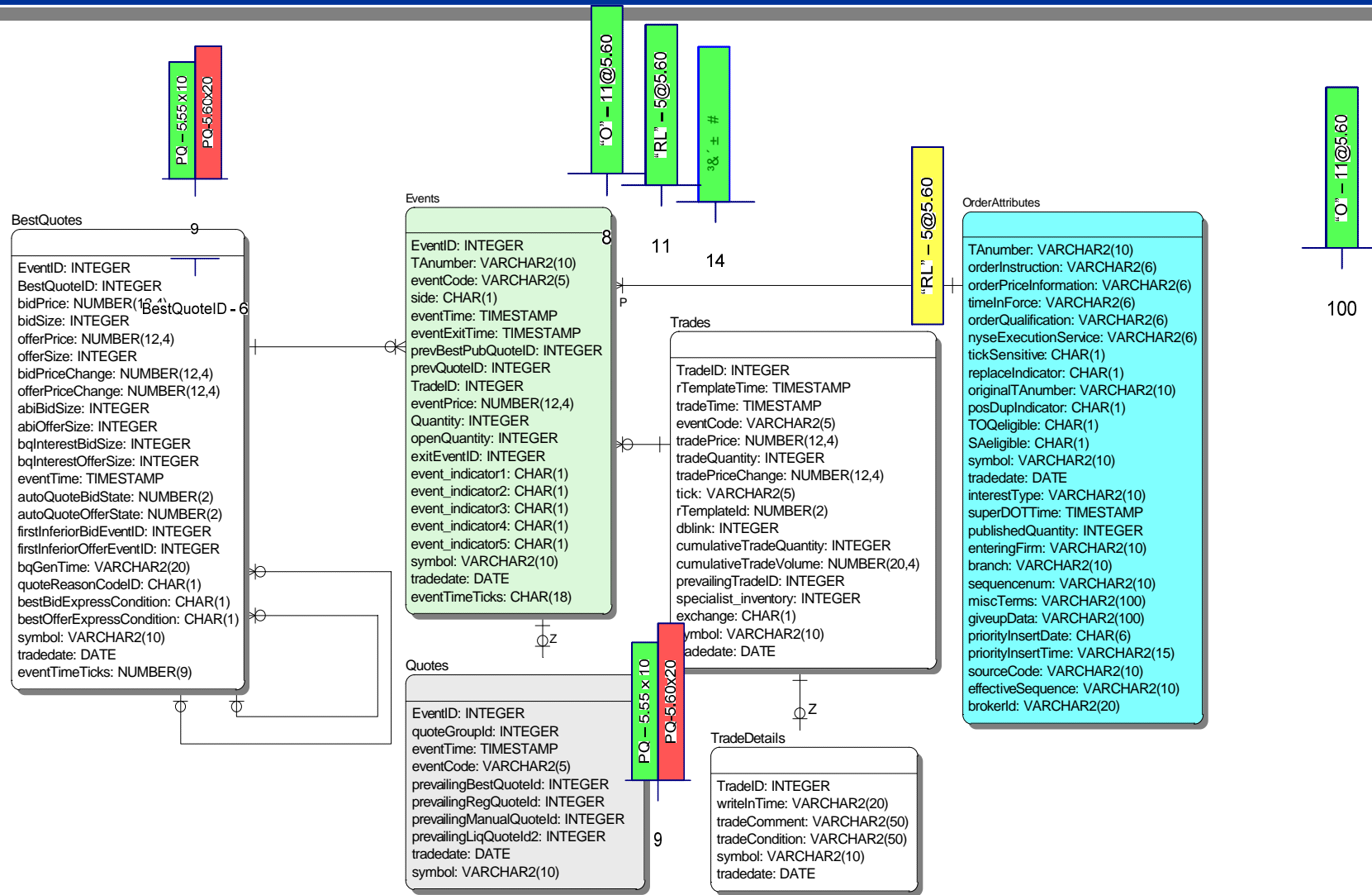
Architecture Methodology

It starts with Business Activity and Data Architecture

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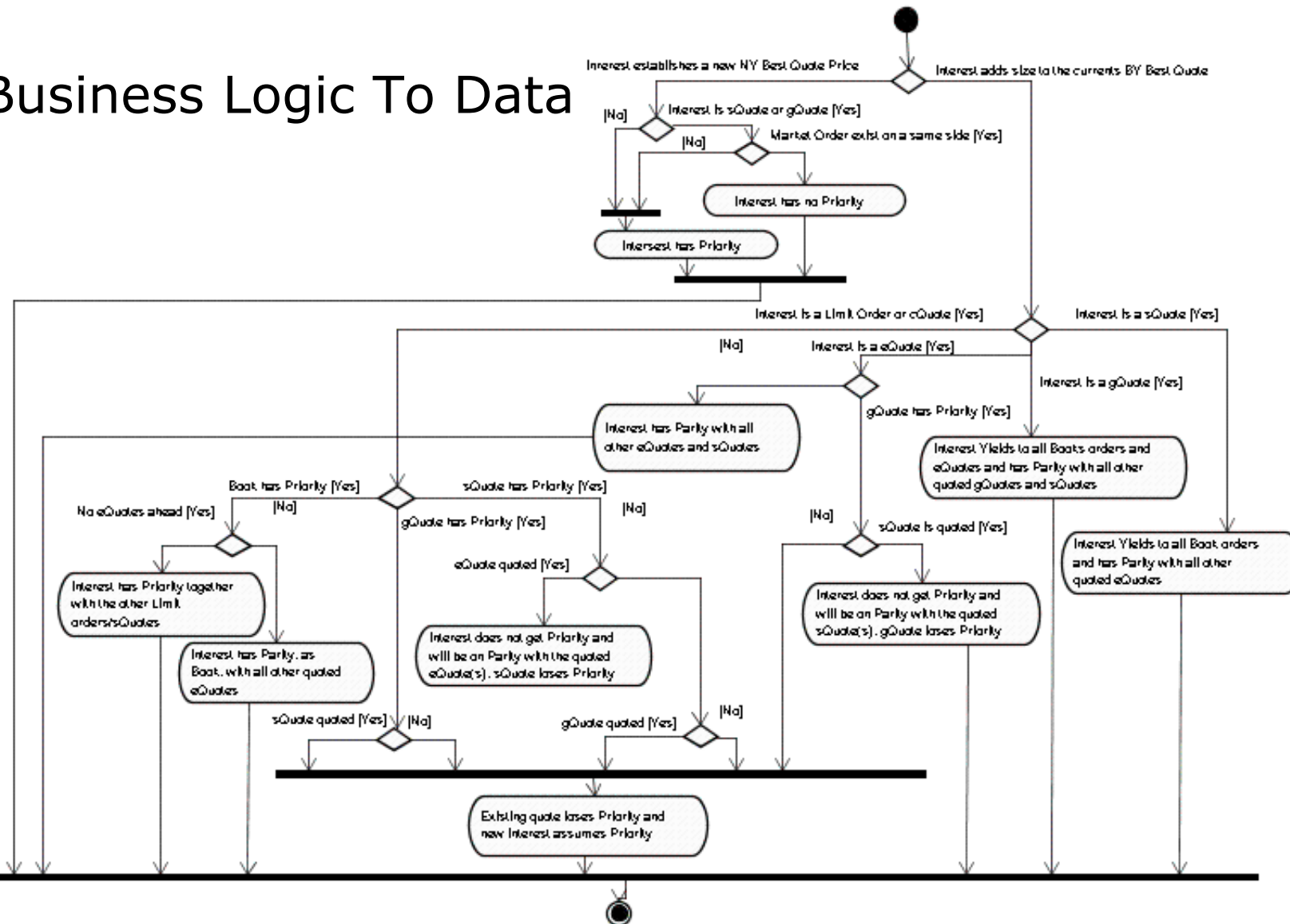


Architecture Methodology



Architecture Methodology

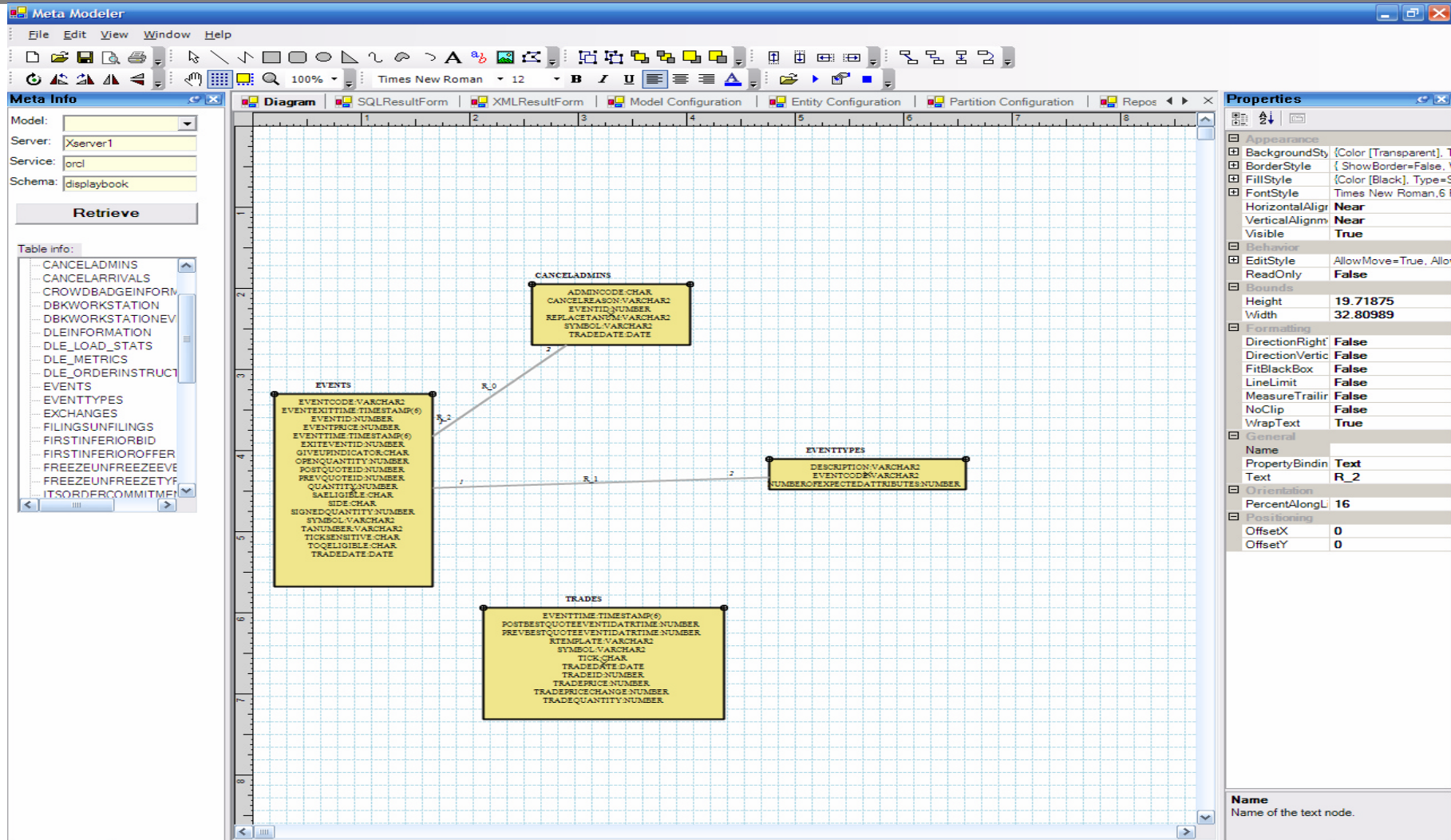
Map Business Logic To Data



Metadata Repository : Model-Driven Architecture

- ✍ A tool for integrating logical data models, DBMS systems, component services, security and business vocabulary
- ✍ Streamlines and centralizes metadata management, administration and deployment.
- ✍ Provides a Hierarchical business structure
 - structured data (relational)
 - unstructured data (documents, files, objects in cache)
 - Virtual Databases can be built rapidly, by logically linking these entities.
- ✍ Supports every type of data architecture; Federated Databases, Parallel and MPP Databases, Hierarchical Databases, ROLAP Databases

Metadata Repository



Metadata Repository Management

Both thick and thin clients can access the metadata repository using common and simple interfaces (API)

WebForm1 - Microsoft Internet Explorer

Address: http://localhost/viewers/

Meta data view

Server: Xserver1 Service: orcl Schema: META

User: meta Password: **** Page: 1521

MODELID	ENTITYID	LOGICALNAME	PHYSICALNAME	DATATYPE	SUMMABLE	NULLDEFAULT	ROLLUPMASK	JOINMASK	ISHIDDEN	DESCRIPT
M_O	E_0	EVENTS EVENTID	EVENTID	N	Y		0	0	N	
M_O	E_0	EVENTS EVENTPRICE	EVENTPRICE	N	Y		0	0	N	
M_O	E_0	EVENTS EVENTTIME	EVENTTIME	D	N		0	0	N	
M_O	E_0	EVENTS EXITEVENTID	EXITEVENTID	N	Y		0	0	N	
M_O	E_0	EVENTS GIVEUPINDICATOR	GIVEUPINDICATOR	C	N		0	0	N	
M_O	E_0	EVENTS OPENQUANTITY	OPENQUANTITY	N	Y		0	0	N	
M_O	E_0	EVENTS POSTQUOTEID	POSTQUOTEID	N	Y		0	0	N	
M_O	E_0	EVENTS PREVQUOTEID	PREVQUOTEID	N	Y		0	0	N	
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M_O	E_0	EVENTS SIDE	SIDE	N	Y		0	0	N	
M_O	E_0	EVENTS SIGNEDQUANTITY	SIGNEDQUANTITY	N	Y		0	0	N	
M_O	E_0	EVENTS SYMBOL	SYMBOL	C	N		0	0	N	
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M_O	E_0	EVENTS TICKSENSITIVE	TICKSENSITIVE	C	N		0	0	N	
M_O	E_0	EVENTS TOQELIGIBLE	TOQELIGIBLE	C	N		0	0	N	
M_O	E_0	EVENTS TRADEDATE	TRADEDATE	D	N		0	0	N	
M_O	E_1	CANCELADMINS ADMINCODE	ADMINCODE	C	N		0	0	N	
M_O	E_1	CANCELADMINS CANCELREASON	CANCELREASON	C	N		0	0	N	
M_O	E_1	CANCELADMINS EVENTID	EVENTID	N	Y		0	0	N	
M_O	E_1	CANCELADMINS REPLACETANUM	REPLACETANUM	C	N		0	0	N	
M_O	E_1	CANCELADMINS SYMBOL	SYMBOL	C	N		0	0	N	
M_O	E_1	CANCELADMINS TRADEDATE	TRADEDATE	D	N		0	0	N	
M_O	E_0	EVENTS EVENTCODE	EVENTCODE	C	N		0	0	N	
M_O	E_0	EVENTS EVENTEXITTIME	EVENTEXITTIME	D	N		0	0	N	
dbkworkstation	EventTypes	eventCode	eventCode	C	0		0	0	N	description
dbkworkstation	EventTypes	description	description	C	0		0	0	N	description
dbkworkstation	EventTypes	numberOfExpectedAttributes	numberOfExpectedAttributes	N	0	0	0	0	N	description
dbkworkstation	BunchingParameters	EventID	EventID	N	0	0	0	0	Y	description
dbkworkstation	BunchingParameters	bunchingParameter	bunchingParameter	N	0	0	0	0	N	description
dbkworkstation	BunchingParameters	symbol	symbol	C	0	0	0	0	N	description
dbkworkstation	BunchingParameters	tradedate	tradedate	D	0	01-JAN-1900 12:00:01.0001 AM	0	0	N	description
dbkworkstation	AddStock	EventID	EventID	N	0	0	0	0	Y	description
dbkworkstation	AddStock	pubMode	pubMode	C	0	0	0	0	N	description
dbkworkstation	AddStock	unitOfTrade	unitOfTrade	N	0	0	0	0	N	description
dbkworkstation	AddStock	mpv	mpv	N	0	0	0	0	N	description
dbkworkstation	AddStock	priceDenominator	priceDenominator	N	0	0	0	0	N	description
dbkworkstation	AddStock	symbol	symbol	C	0	0	0	0	N	description
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dbkworkstation	DLEInformation	EventID	EventID	N	0	0	0	0	Y	description
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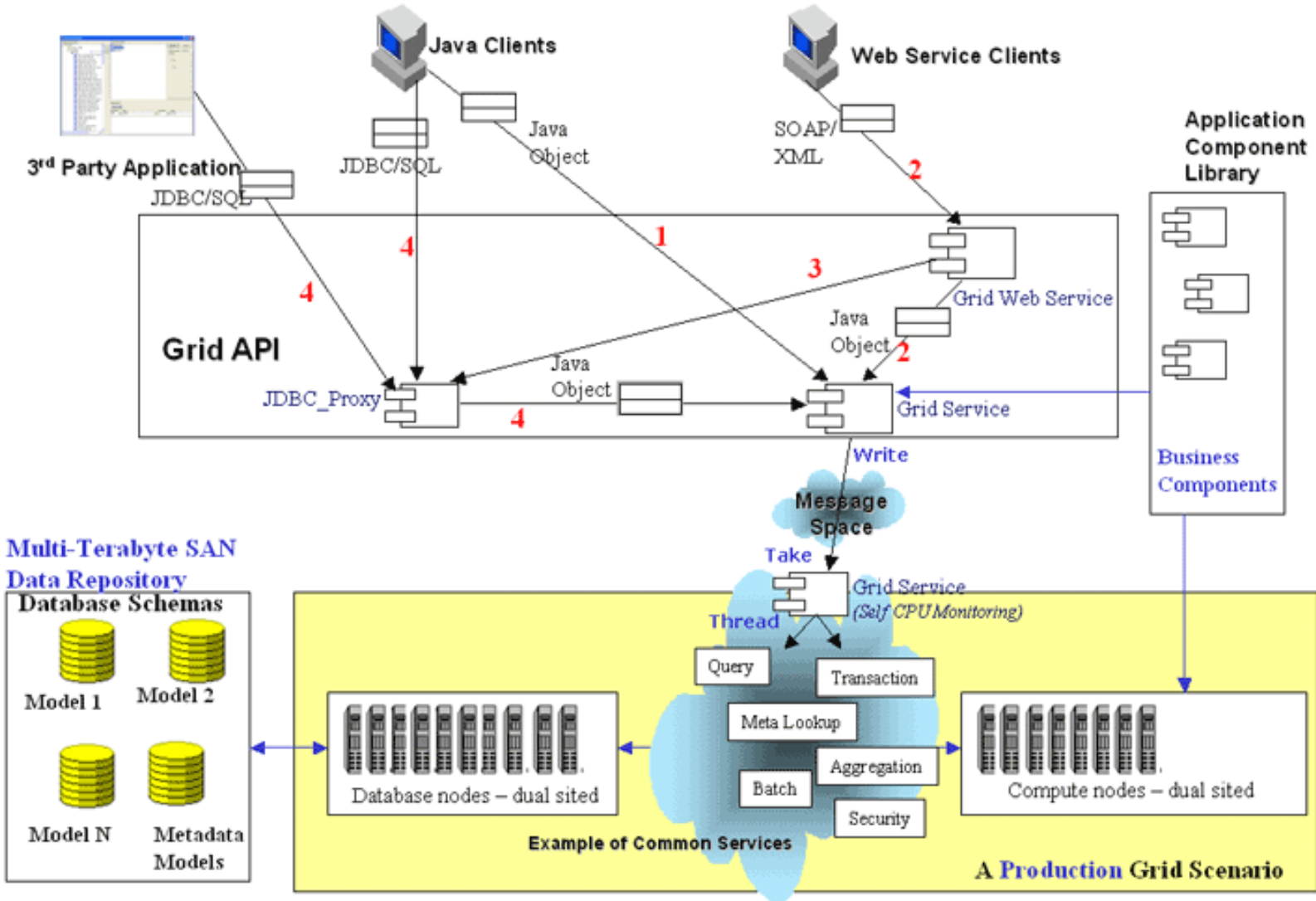
Grid Query

- Excel Add-in Query tool provides ad-hoc reporting capabilities to distributed data that is defined in the CIF metadata repository

The screenshot shows the Xperia BI Designer interface within Microsoft Excel. The main window displays a grid with columns labeled 'Field', 'symbol', 'side', 'quantity', 'eventPrice', 'tradedate', and 'TOqeligible'. A 'Save Request' dialog box is open, showing a tree view of NYSE CIF data sources. The 'Global Filter' table is also visible, with columns for 'Concatenation', 'Field', 'Compare Operator', and 'Value'.

Concatenation	Field	Compare Operator	Value
	quantity	BETWEEN	1000000
	side	'S'	10000000

Service Oriented Grid Topology



Results to Date

- ✍ Data Quality & Integrity
- ✍ Time-to-Market Improvements
- ✍ Data, Services & Infrastructure Reuse
- ✍ Cost Savings

Key Strategy Points

- ✍ Business pain drives SOA investments
 - Select areas the business cares about
 - Must deliver quick business value (“trader’s mindset”)
- ✍ Evolutionary approach with a long-term vision
 - Cannot approach SOA as a conversion project
 - SOA is an approach, not the solution
 - Keep reinforcing “the vision”
 - Implement using a just-in-time approach

Critical Success Factors

- ✍ Partnership with Business Sponsors
 - Shared vision & Internal dialogue
 - Supporting development of business architectures
- ✍ Technology management leadership
 - Support of vision
 - Focus on high-impact areas
- ✍ Identify and Select appropriate services
 - Right definition and use of services
 - Developing modeling and design skills

Q&A

Thank You !