Risk and Profitability Analytic Environments

Objectives, Challenges, and Long Term Benefits

eBIS

Section I.

Objectives and Risks

Risk and profitability solutions customarily originate out of one or more corporate goals. Within the corporate profitability realm, firms may seek to achieve enterprise-wide risk-adjusted profitability insight with multi-dimensional analytic capability. The emergence of international capital accords, such as Basel I-III, requires comprehensive reporting of a firm's risk positions, necessitating a central risk reporting platform. Such a platform can also address compliance reporting needs in areas not linked directly to capital adequacy. Finally, a goal of better internal risk monitoring and compilation of an economic model often drives solution initiatives.

GOAL 1: Multi-Dimensional Profitability Analysis

- Net Interest Margin (NIM) calculations
- Overhead cost allocation to revenue-generating dimensions (Department, Customer, Product, etc.)
- Budgeting and Forecasting capabilities with comparisons to realized Actuals

GOAL 2: Regulatory Compliance

- Provision of comprehensive Basel I credit capital calculation inputs
- Provision of comprehensive Basel II credit capital calculation inputs
- Disclosure of credit risk capital adequacy under Pillar III
- Provision of credit and non-credit (where feasible) data for non-Basel regulatory reporting needs

GOAL 3: Internal Risk Monitoring and Portfolio Management

- Provision of comprehensive Economic Model calculation inputs for Credit, Market, and Operational risk
- Provision of comprehensive Loan Reserve calculation inputs
- Reporting of Economic Model and Loan Reserve outputs, as well as facility and concentration risk monitoring

Business Risks

The largest business risks of large enterprise solutions center on institutional support for project work and adoption of the "new paradigm" in risk and profitability architecture.

Business Risks	Definition	Mitigating Approach
1. Institutional Commitment	Lack of commitment across the organization to support the size and scope of ongoing development efforts, stemming from a misunderstanding of the size, scope, and structure of the solution	–**Educate user community on size and structure of initiatives and opportunities to leverage data for their needs** –**Commit to the goals, size and scope of the solution** by senior executives, both business and information technology –**Communicate commitment** across business units and down organizational layers –Reinforce commitment through **regular communication updates** on **solution status and areas requiring attention**
2. Institutional Readiness	Lack of planning, budgeting, staffing, knowledge transfer and communication in support of ongoing development efforts	–Adequately **budget, plan, and staff projects** –Hire **internal staff to own and support the solution, with sufficient time allocated for knowledge transfer and training.** –**Identify all key internal areas** required to support development phases –**Appoint single point of contact in each key area**, external to project team but critical to project success. Contact must be fluent in given area's business practices and resources.
3. Missed Opportunities For Uses	Failure to leverage a solution for value-added benefit	–Communicate and **promote current solution architecture** –**Identify current reporting processes that could leverage newly available data** –**Provide roadmap for potential future uses of solution**

Section II.

Intrinsic Challenges

Intrinsic Challenges to Enterprise Solutions: Operations Framework

Coordination is necessary across source data providers, data consumers, solution owners, and development teams. An Operational Framework must emerge to facilitate this coordination vertically through the enterprise and horizontally within the solution team.

Solutions require a formalization of daily operations procedures to ensure the quality of content served to external data consumers. Formation of an Operations framework and support team can provide a vehicle through which all external constituents are served. Operations is intended to serve six primary functions:

Internal to Solution

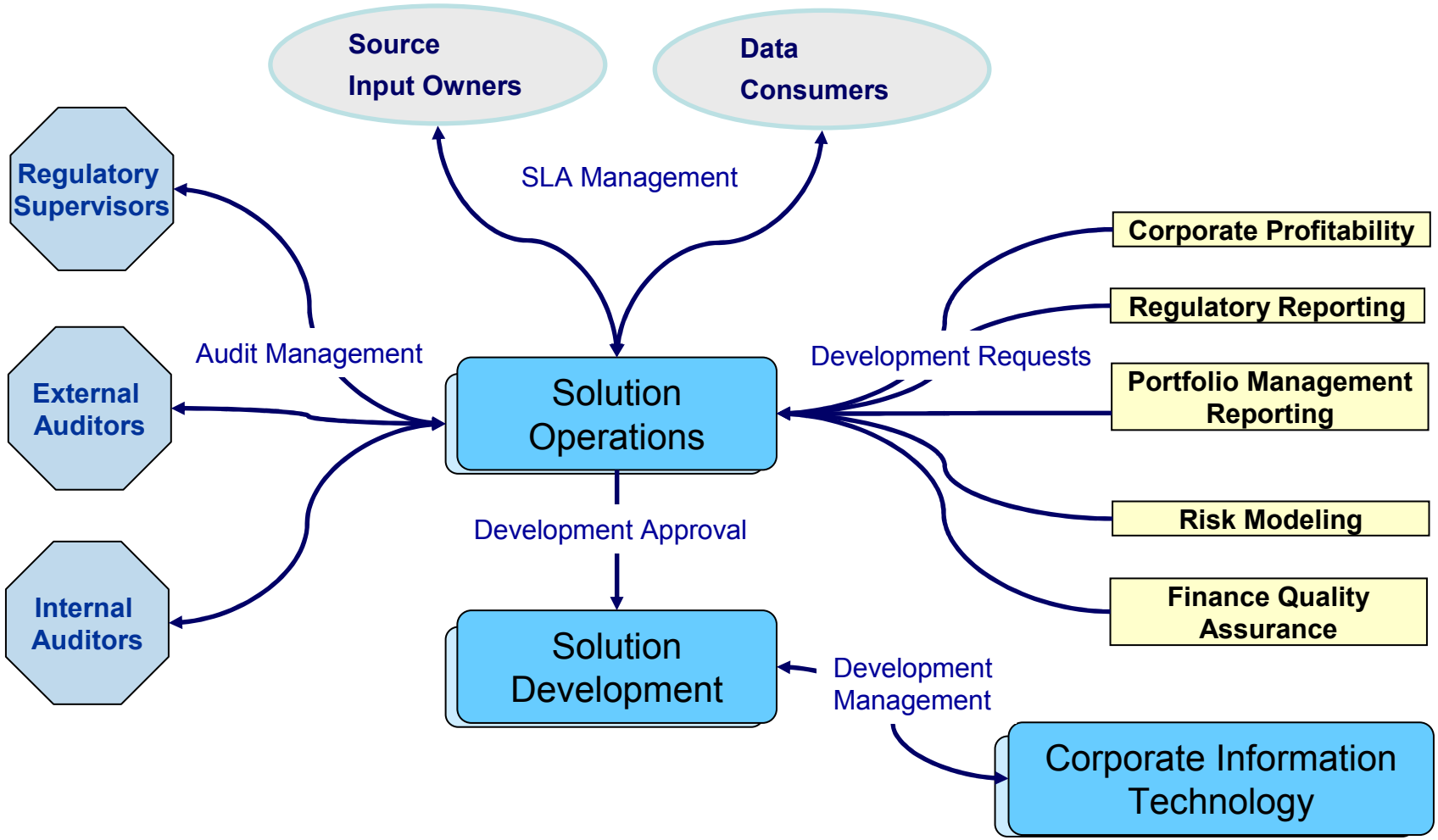
1. Validation of source data inputs and analytic processing outputs
2. Maintenance of business rules and processing metadata
3. Management of documentation, both functional and technical

External Interaction Points

4. Management of Internal and External (including regulatory) audits
5. Management of Service Level Agreements (SLAs) with input systems and data consumers
6. Analysis and approval of incremental work requests

Points 4 thru 6 imply a procedure to manage requirements of and for external entities, with associated procedures documentation to govern how the Operations team with interact with these various parties.

Solution Operations Team: Potential Points of Interaction



Intrinsic Challenges to Enterprise Solutions: Production & Development Management

Enterprise software solutions require large, chronic, multi-phased projects, usually encompassing a complex patchwork of technologies. Management of these projects must evolve as the solution grows over time and incrementally deploys application software to a production environment. Current and future phases of solution deployment will need to account for two categories of work:

1) Production maintenance and fixes; 2) Development projects

The work management process must include resource projections across these two areas, projections that will require recalibration as the solution evolves, since the succession of projects will serve to increase the solution's size, complexity, and associated production maintenance. The IT & Operations teams will begin with staffing levels appropriate at a point in time. Their adequacy in the execution of ongoing development project work must be assessed to determine incremental resource needs.

Work Category	Solution Responsibility Area	
	Operations & Development	**Information Technology**
1. Production Maintenance and Fixes	–**Validate** source **inputs** and analytic **outputs** –**Remediate source system problems** –Compile **daily scorecard** of production processing **against SLAs** –**Maintain** and update **processing business rules**	–Manage the **technology infrastructure of production** environments –Monitor **daily batch execution** in the Production databases –Identify and **remediate technical problems** encountered in Production –Log **issue resolution** and build **knowledge base of remediation** approaches
2. Development Projects	–**Review** and approve **development requests** from constituents –**Manage the Initiate, Define, Test and Support phases of a delivery lifecycle** for approved projects –**Manage scope and delivery** of approved projects	–Manage **code patches and technical enhancements** related to production defects –Manage the **Design, Development, and Deploy phases of a delivery lifecycle** for approved projects –Manage **technology infrastructure of test environments** and batch scheduling to support test cycles

Intrinsic Challenges to Enterprise Solutions: Intellectual Capital Management

The need for intellectual capital is evident in a large and complex enterprise solution. Intellectual capital is needed across numerous areas, which could include:

a) Risk management
b) Risk & profitability modeling
c) Regulatory and legal definitions
d) Internal processes and procedures
e) General Ledger & Product systems architecture
f) Data warehousing
g) Application architecture

A key challenge lies in cultivating intellectual capital, harvesting it, and then distributing it to others.

Intellectual Capital Approach	Description
1. Cultivate	–**Staff** each intellectual capital area with a **mix of junior & senior resources**, and assign **mentoring pairs**. –Supplement internal staff with **consulting experts**. Conduct training and **knowledge sharing sessions** with consultants.
2. Harvest	–**Retain senior resources** and take steps to **promote achievers**. –Provide a mechanism, e.g., wiki technology, through which to **build knowledge communities and capture new knowledge in real time**. –**Thoroughly document** all areas of knowledge capital.
3. Distribute	–Implement a system to **catalogue all forms of knowledge capital**, e.g., wiki content, presentations, documents, queries, etc. –**Provide robust inquiry capability** across all content forms. –Create **training, user guides, and procedures for content management**.

The very nature of enterprise software is change: modeling requirements, data volumes, and processing definitions naturally change as a solution evolves and matures. A key challenge in solution management is proactively monitoring and projecting technical infrastructure needs. These needs include:

1. **Capacity Planning (CPU, Memory, SAN, etc.)**
2. **Performance Management**
3. **Software and hardware monitoring**
4. **Strategic technology assessments on software against enterprise standards**
5. **Software maintenance, support and upgrade paths**
6. **Operating Level Agreements with internal IT departments**

A firm's internal technology services group will normally address these needs. An assessment of an enterprise solution should be initiated regularly as part of a Reliability, Availability, and Serviceability (RAS) review. **A tight partnership between a solution development team a technology services group is needed to support ongoing infrastructure assessment, given the (normally) continuous nature of solution deployment.**

Case Study: Hardware and Database Capacity Upgrades

On one eBIS project, development included an Incremental Infrastructure workstream, which internally assessed current and projected future solution capacity and performance needs and recommend hardware, database, and application improvements. Central to these recommendations was the installation of:

- **6 new databases; 6 new servers; 4 new server boxes; 25 terabytes of additional space**

in support of expanded production capacity and robust development test cycles. Implementing these infrastructure improvements required coordination across numerous client areas:

Client Area	Function
1. **BSOL**	Business Solutions (recommends hardware solutions)
2. **CSM**	Hardware Forecast and Budget (Space usage against budget)
3. **DBA**	Database Administration (script definition, configuration management, etc.)
4. **DBM**	Database Management (instance creation, etc.)
5. **DES**	Database Enterprise Services (script execution, etc.)
6. **DCAT**	Data Center Acceptance Testing (database and hardware testing)
7. **DMA/IPM**	Database Monitoring and Analysis (performance evaluation)
8. **ESSU**	Enterprise Systems Services (implementation of physical disc)
9. **LAP**	Logistics and Planning (hardware costing, configuration and implementation)
10. **OTS**	Open Systems Technical Services (Tivoli tape archive, TSM management)
11. **TSM**	Tivoli System Management (Database and log file backup)
12. **USS**	Unix Support Services (Allocates space requests for application owners)

Understanding client organizations well enough to navigate through these areas requires adequate documentation, sometimes necessitating an upgrade in internal support procedures. These support procedures need to take the form of process support documentation, developed and managed within solution initiatives and in partnership with internal support areas.

Section III.

Long Term Benefits

Development work on a central repository of risk and profitability information can represent a “Generational Change” in data availability. Therein lies an opportunity for clients to expand the uses and user base of these warehouses, potentially progressing the solution toward a true Enterprise Data Warehouse (EDW). The future EDW could serve all users of financial, human resource, dimension, risk and profitability data. Future corporate goals of the solution could expand to include:

Future Goal 1:

Leverage a Data Archive for Reporting and Data Mining

Future Goal 2:

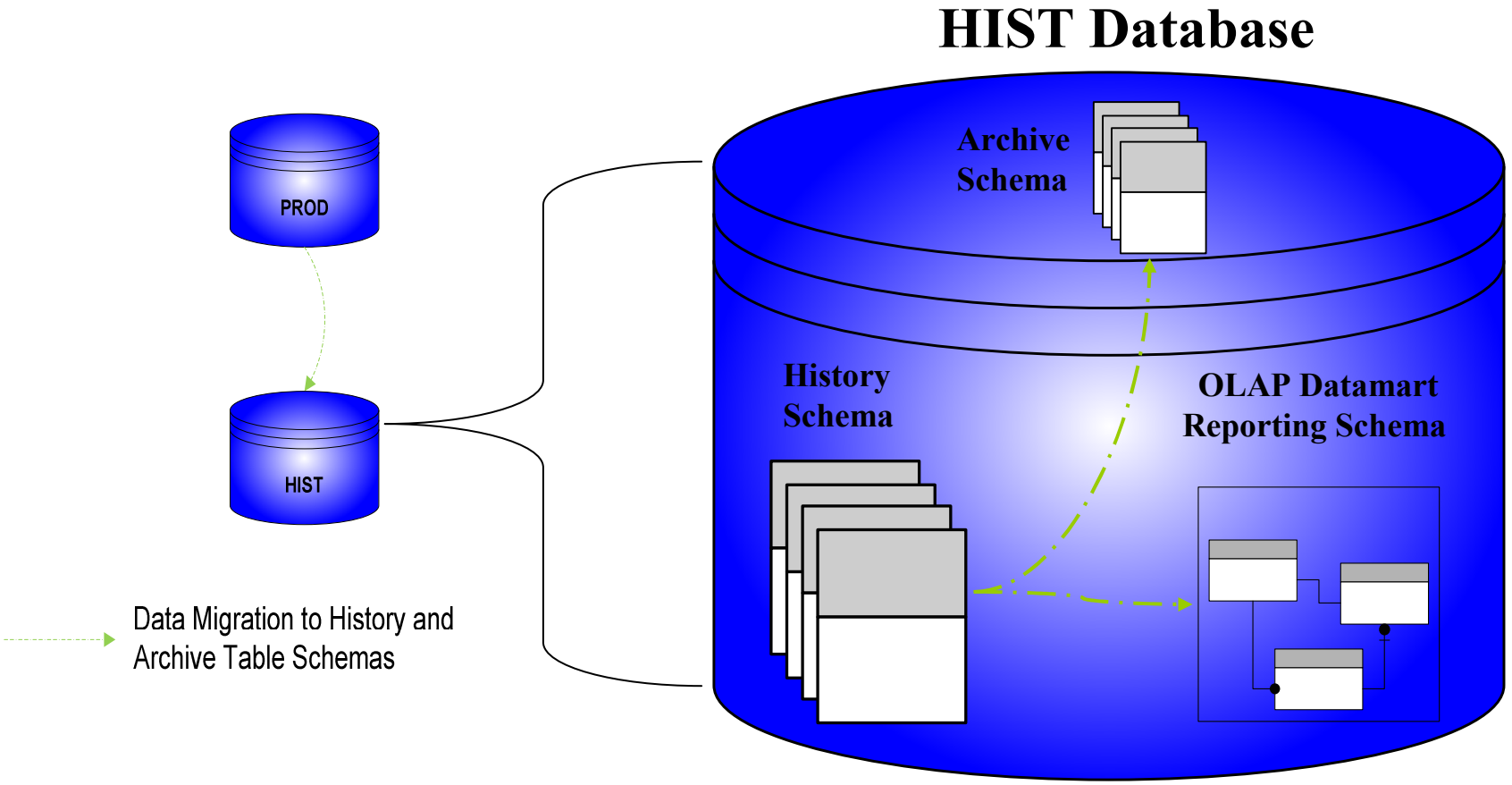
Extend Architecture for Additional Enterprise Uses

Future Goal 3:

Leverage Enterprise Data Warehouse Information for Strategic Decision Making

Analytic Reporting

A **Data Archive and Retention (DAR)** solution can create a single environment for data analysis and reporting. Business rules drive **data retention, ranging up to 10's of years if necessary**. With historical data stored centrally (HIST Database), a **robust reporting framework can be built** for internal management analysis, regulatory adherence, and operations support.



Analytic Reporting: User Groups

In order to understand the benefits of newly harvested data, it can prove useful to initiate a user group study. Interview representatives of all internal areas that could potentially benefit from improved data analysis, and gather their requirements. Translate those requirements into data models and solutions that facilitate data access.

Data access can take the form of pre-formatted reports, or more robust OLAP tools that allow users to supply criteria for data analysis, returning the most updated information at the point of request.

Analytic Reporting: Example of 9 Potential User Groups

Group Name	# Super Users	# End Users	Data Sources (Current State)	Data Sources (Future State)	Reports (Range)
Operations	4	100	Staging, Error, Core Data Warehouse, Analytic Data Store, and Outbound Vendor layers	Operations Datamart	30-60
G/L Reconciliation	4	75	Staging, Core Data Warehouse, GL Reconciliation Data Store	GL Reconciliation Datamart	100-400
VaR Reporting	2	10	Customer VaR Data Store, Core Data Warehouse	Customer VaR Datamart	30-60
Portfolio Credit Modeling	3	5	Portfolio Manager Access DB	Credit Modeling Datamart	6-11
Management Reporting	3	100	PRS, SQL Server, DB26, Revenue, Manual Input	Management Reporting Datamart	90-120
Pillar III/QOD	2	5	Core Data Warehouse, Manual Input	Pillar III/QOD Datamart	18-25
Loan Loss Reserve	1	15	Loan reserve output, PRS, Manual Input	Loan Reserve Datamart	33
Regulatory & Director's Information Group	2	100	Manual Input, SNIC DB2	Regulatory Datamart	25-30
Validation Adherence	2	25	Core Data Warehouse, Exposure model, Credit risk system, Portfolio Reports DB, Manual Input	Ratings Validation Datamart	16-30

Long Term Benefits: Goal 1 - Leverage Data Archive for Reporting and Data Mining

Data Mining: The HIST data framework creates opportunities for extracting business intelligence.

Area	Description	Business Benefit
Stress Testing	The availability of the full book of risk data enables **simulation of extreme downside risk events**. These stressed simulations can then be compared to realized loss data over long periods of time to **calibrate the simulation assumptions**.	Improves **accuracy in economic modeling**, enhances **portfolio risk strategies**, and **eases regulatory concerns** related to stress testing.
Regression Forecasting	Abundant historical data affords the opportunity to perform regression analysis, **building relationships to defined variables**. These relationships can then be parlayed into **predictive forecasts**, potentially simulating pro-forma financials.	Enhances **budgeting and risk trend modeling capabilities**
Scenario Analysis	a) *Product Portfolio*: Consolidation of current book of risk information allows for **modeling of shifts in product offerings**, including product retirement, innovation, and distribution changes, and the effects on pro-forma balance sheets and income statements. b) *Quantitative Impact Study on Demand (QOD)*: Scenarios can be created that alter regulatory capital treatment and **compare capital adequacy across regulatory regimes**.	a) Improved feedback to product management on **profitability changes related to product portfolio manipulation** b) Makes regulatory compliance more accurate, less time-consuming, and **more responsive to regulatory change scenarios**
Behavior Analysis	The granular level of most warehouse data and the frequency of refresh (most data re-loaded daily) can be combined with **data pattern analysis** to identify unusual or unexpected trends in **customer activity**, potentially leading to alterations in customer management and/or product innovation.	**Improved customer and product management**

Extend an analytic environment to an Enterprise Data Warehouse (EDW):

Business Benefits

1. **Eliminates duplicate cost** and effort of **data acquisition** (ETL) in point solutions.
2. **Centralizes repository** of **dimensions and hierarchies** (accounts, customers, products, organization, channels, geography, etc). Ownership and maintenance isn't strewn across wide range of systems.
3. **Eliminates** vigilant **processes** to keep data consistent, complete and synchronized across a multitude of systems and platforms.
4. **Enables** a '**single source of truth**' in data definitions, performance management, and risk calculations.
5. **Consolidates business rules** in one environment. Allows for the establishment of a common data framework as well as a shared set of configuration and rules management.

Rationale

Most analytic environment architectures include design attributes that lend well to expansion of the solution from risk and profitability-centric to enterprise-centric. In particular, the design of the **data model** and **processing architecture** are **extensible** for additional enterprise needs.

Extensibility of a Well Crafted Data Model

1. **Conforms data capture** using consistent representation of data from disparate input sources
2. Models robust **dimensional attributes** (Time, Customer, Product, Account, Department, etc.)
3. Includes **satellite** data model with **master tables** of common elements
4. Employs **scenario keys** to allow comparison of analytics under varying business assumptions
5. Defines **data layers** to identify data at various phases of transformation and enhancement (see diagram), as follows:

Data Layer	Description
i. Error	–Captures source system data input errors, e.g., duplicate rows, field format, referential integrity failures –Stores output of business validity checks, e.g., sums & tolerance thresholds –Retains reportable processing errors
ii. Staging	–Data model mirrors structure of providing source system. –Data elements comprehensive of downstream processing and reporting requirements. –Captures inputs from both legacy source systems and return feed analytics.
iii. Core Data Warehouse	–Central data model, representing every reportable data element from all source data providers –Normalized structure for data storage efficiency, conforms data from multiple sources into a consistent representation –Models complex time dimensions for robust time-series analysis
iv. Analytic Data Store and Return Feed	– Captures the output from analytic processing, as sourced from the Core Data Warehouse layer – Represents return-loop analytics as received from external calculation systems
v. Outbound Vendor and Publication Layer	– Modeled to represent the data elements required by external vendors or applications outside of the solution domain – Publishes data for use by technologies that “pull” data from warehouse
vi. Reporting Data Mart	– Structures necessary to extract into files feeding cube (MOLAP) style analysis – De-normalized star schema and snowflake data structures to facilitate ROLAP inquiry

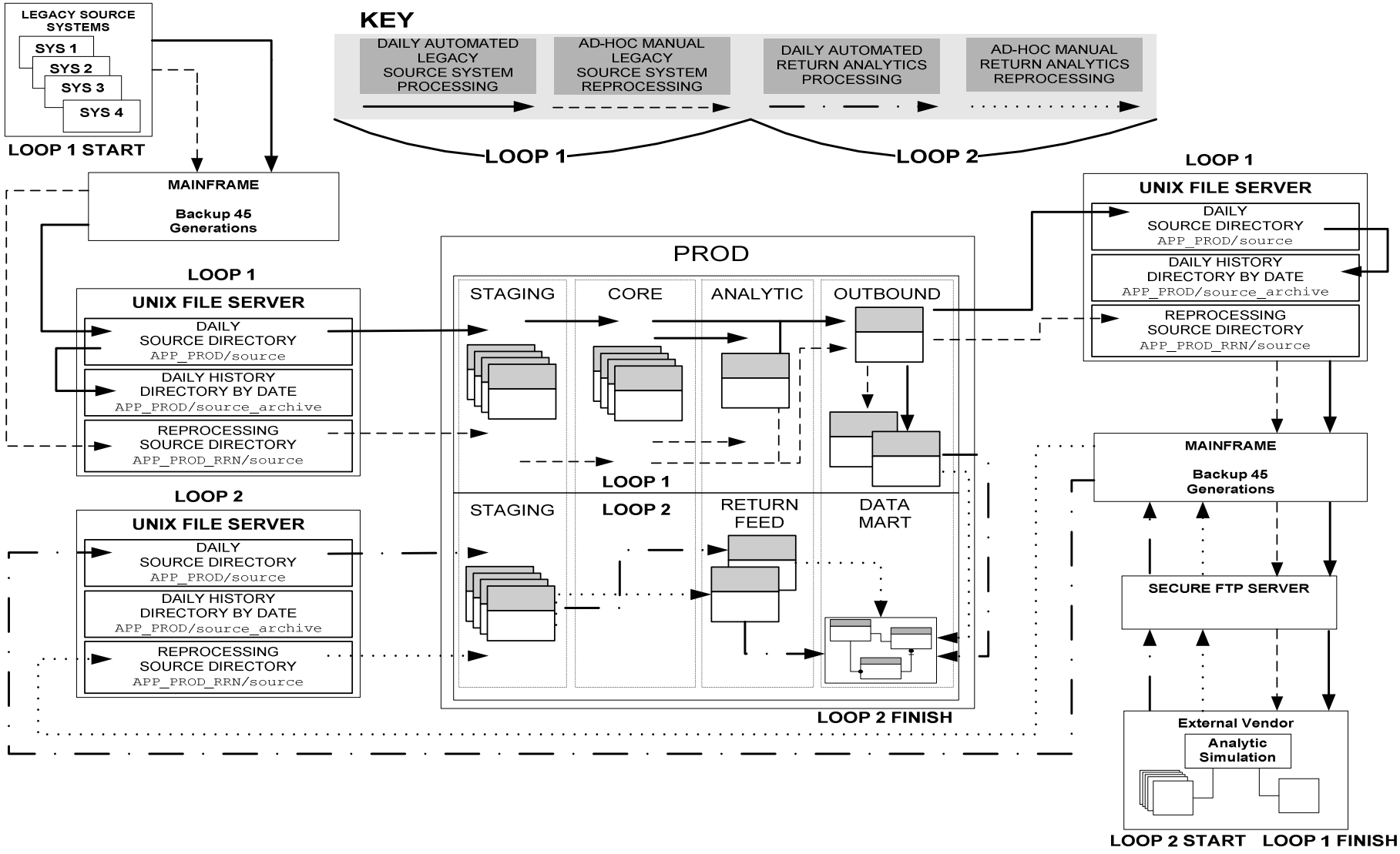
Extensibility of an Intelligent Processing Architecture

1. Translates to **multiple currency valuations** using rate server FX prices. Example:

Modeled Balance	Currency Code	FX Rate	Amount
Transaction Amount	EUR	N/A	105
Base Currency Equivalent	GBP	0.789 per EUR	82.85
Consolidation Amount	USD	1.556 per EUR	163.38

2. Employs **multiple technologies**, e.g., ETL, Analytics, OLAP, Unix scripts, database utilities, etc., depending on processing need
3. Uses reference and dimension tables for **data validation and referential integrity**
4. **Automates batch processing** using file-based triggers and pre-defined job dependencies across software platforms
5. Leverages inbound, outbound, return feed, and re-processing architecture to facilitate processing of **bi-directional data flows**

Bi-Directional Data Flows (file-based)



Additional Enterprise Uses

EDW Concept	Business Benefit
1. Liability and Trading Book Assets	Enhanced regulatory and profitability reporting. Migration toward **instrument level profitability**.
2. Non-credit instruments and revenue calculations	Visibility to fee based positions, e.g., Securities Clearing, Asset Management, etc. and related calculation of **instrument-level revenue components** to replace siloed calculations that miss some revenue views. Consistent revenue definition in RORAC.
3. Market and Operational Risk Capital	Comprehensive risk reporting from consistent data store and **integration with RORAC profitability model**.
4. Net Interest Margin for all Balance Sheet positions at the instrument level	**Consistent transfer pricing approach for both risk and profitability reporting**. Single input to RORAC model.
5. Dimension Definition	Export to other consuming applications dimensions that span the enterprise, including: **a) Time; b) Customer; c) Geography; d) Product; e) Security; f) Credit Exposure** All of which are either absent or defined at an aggregate level within the General Ledger chart of accounts
6. Employee Information	Visibility to **HR metrics** that can drive both **financial and non-financial performance evaluation**.
7. Regulatory Compliance Analysis	Consistent data store for **comprehensive regulatory and compliance analysis**: Sarbanes-Oxley, Patriot Act, Anti-Money Laundering, Know Your Customer, etc.

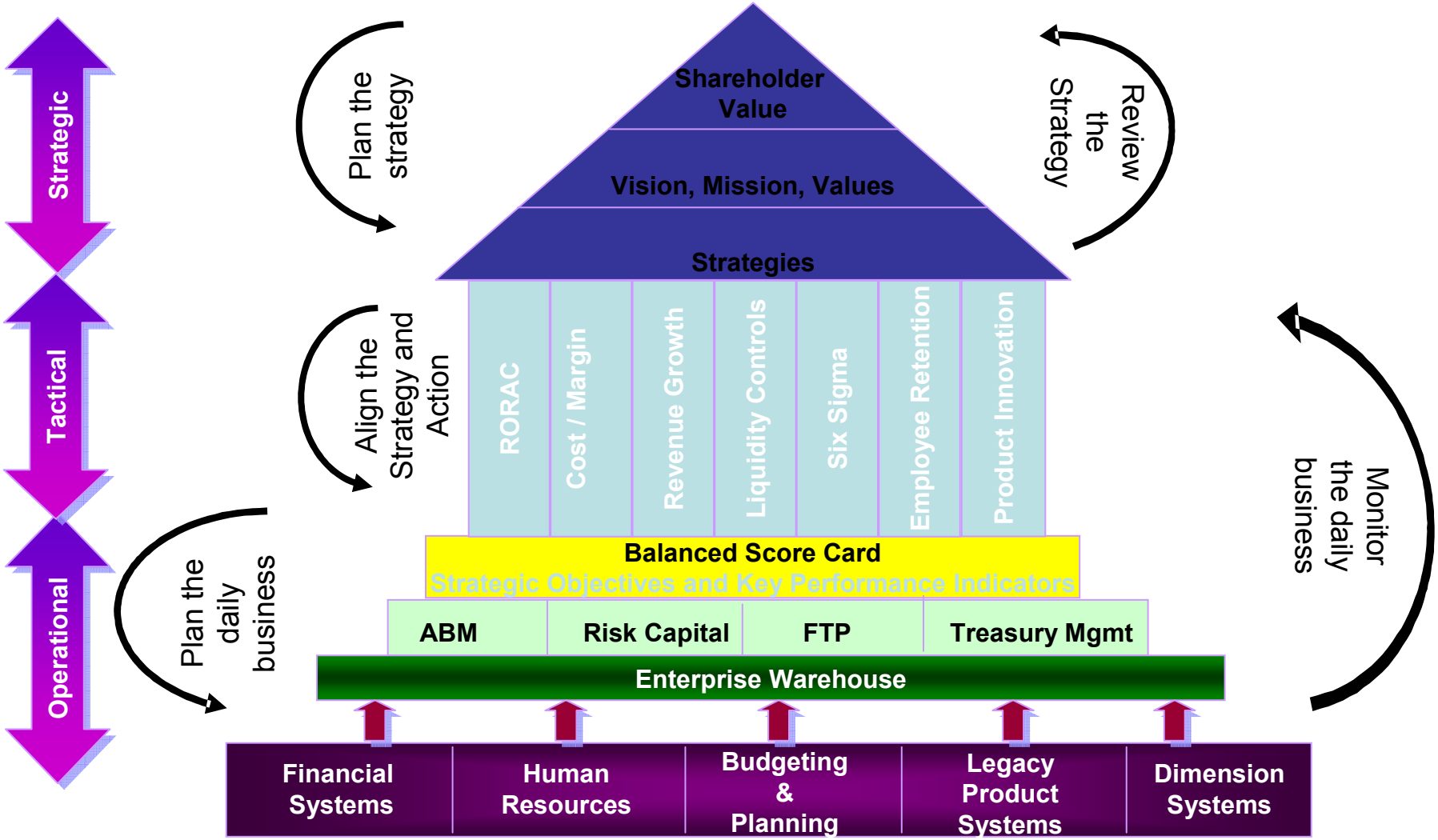
Ultimately Transform an analytic environment into a true Enterprise Data Warehouse (EDW)

Employ tools to unleash the analytic potential of consolidated enterprise data (EDW)

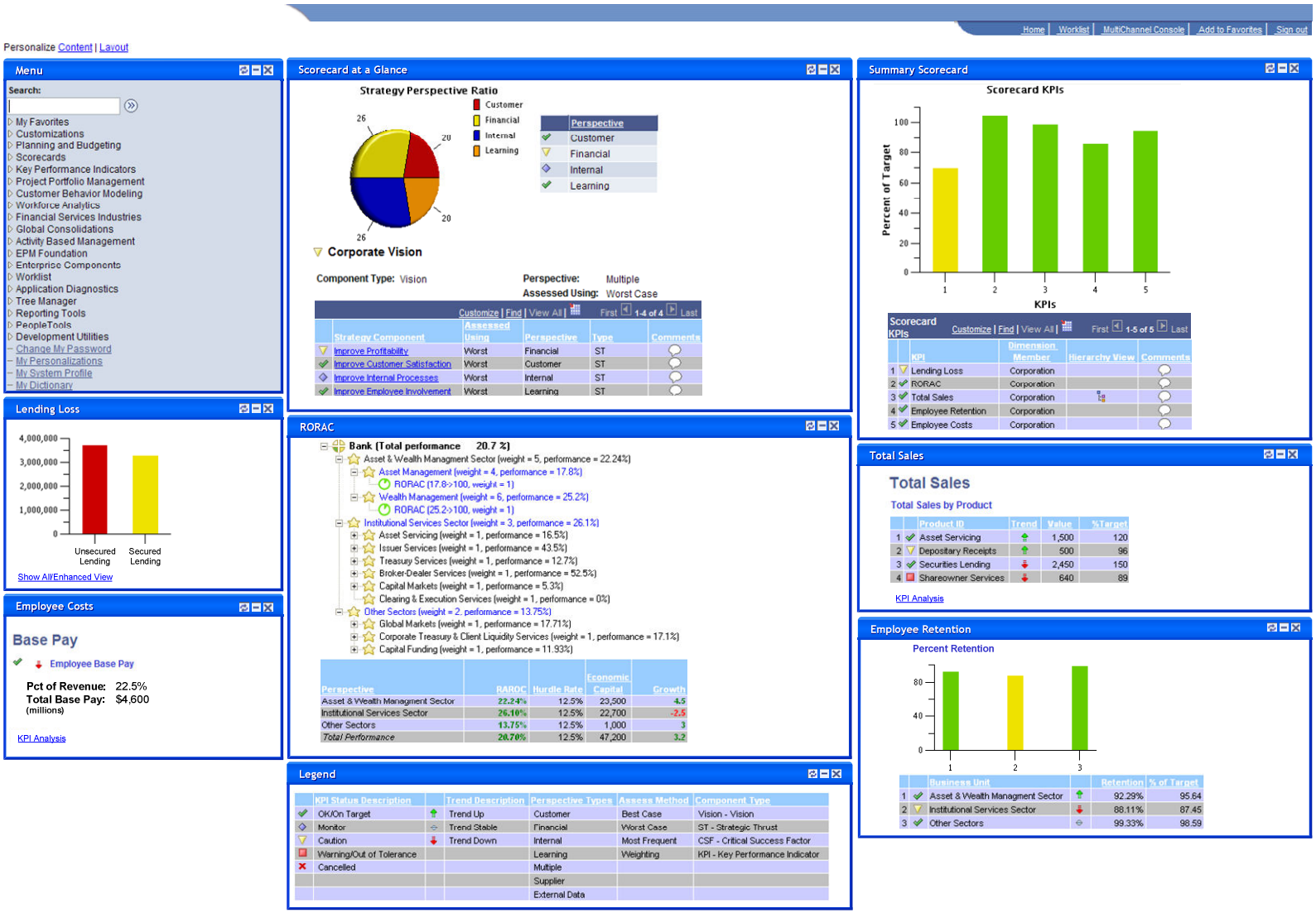
An EDW can act as an enabler for strategic decision making by upper management. With integration of additional enterprise data sources in an analytic model, a client can migrate to a **value-based management paradigm**, managed through **scorecards** compiled with **strategy metrics** and **Key Performance Indicators (KPIs),** with the following benefits:

- Corporate goals defined in both **financial and non-financial categories**
- Profitability analysis based on the **economic drivers** within the business
- Capital management using **risk-adjusted view of profitability**
- Operational decision making that **ties business structure to strategic vision** and goals in a **measureable way through KPIs**, e.g., market profitable products, cross-sell to profitable customers, retain key employees

Goal of a robust Enterprise Data Warehouse: Value-Based Management



Example Value-Based Management Scorecard Tool: Strategies Drive Data Analysis



Case Study: RORAC Model

Normal State	Future State with EDW Inputs
Profitability reporting structure is often **separated** from **risk reporting**. *Management Accounting Division* – Analyzes **Net Interest Margin, overhead allocations, and budget forecasts without** visibility to **risk-adjusted capital allocations** *Risk Sector* – Compiles a **RORAC** model which **omits the effect of overhead costs, employs a credit spread methodology that differs from Corporate Profitability's transfer pricing approach, and includes only credit capital effects, without considering market and operational risk** – **Operational risk** calculated at company level and **allocated to business lines 1x per year, outside of RORAC model** – **Market risk (Interest Rate, Trading)** calculated at company level and **allocated to business lines 1x per year, outside of RORAC model** – **Investment market risk** calculated at position level and **rolled-up to business lines 1x per year, outside of RORAC model**	**Integrate the risk and profitability functions to produce a consolidated, risk-adjusted profitability view.** *Profitability Division* – Manage **calculation of transfer pricing** rates – Manage **allocation of overhead costs** to revenue-generating products and customers – **Manage** consolidation and allocation of **all flavors of risk capital for RORAC calculation: Market, Credit and Operational**. – Compile RORAC report using an **economically-based hurdle rate: Weighted Average Cost of Capital**

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