Enterprise Decision Management

Why does the BRMS community care?

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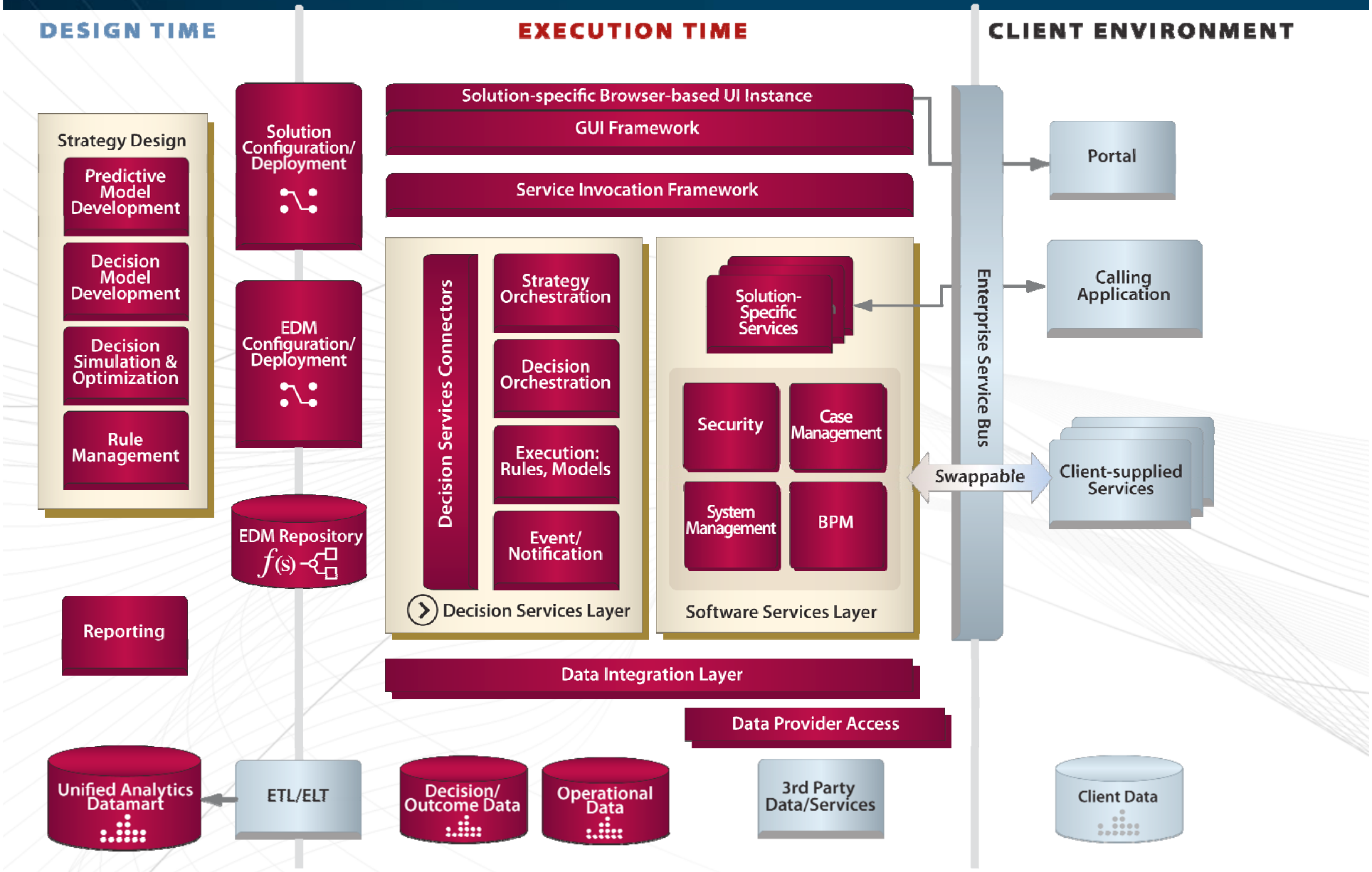
Enterprise Business Applications

- **“Let’s talk about Enterprise Business Applications”**
- **“Booooooriiiinnggggg!!!”**
- **Maybe**
  But they *do* give our Decision Management industry its biggest challenges
- **So… what do they want?**
  And how do we respond?

Here is one real EBA "architecture": Decisions are at the core



Enterprise Business Applications: What they expect in managing decisions?

<MBA TALK>

Days	Timeliness of Decisions	**Real-time / Point of Contact**
Local / Simple	Level of Objectives	**Corporate Objectives / Trade-Offs**
Static / Simple	Regulatory Constraints	**Dynamic / Complex**
Every 3-5 Years	Changes to Decision Strategy	**Frequent Adjustments**
Well-Defined	Decision-Making Boundaries	**Cross Channels / Geography / Departments**
Low / Manual	Operational Volume	**High / Automated**
Workforce Productivity	Value Creation	**Precision / Consistency / Agility / Cost / Speed**

Enterprise Business Applications:
What do they care about improving in their decisions?

"Decision Yield"

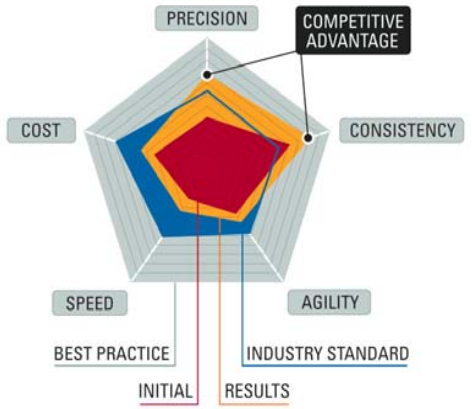
PRECISION — Make more profitable and targeted decisions

CONSISTENCY — Ensure coherence across channels, business units and geographies

AGILITY — Adapt dynamically to changing conditions

SPEED — Execute decisions and modify processes quickly

COST — Reduce expenses needed to make decisions



Harvard Business Review, June 2005

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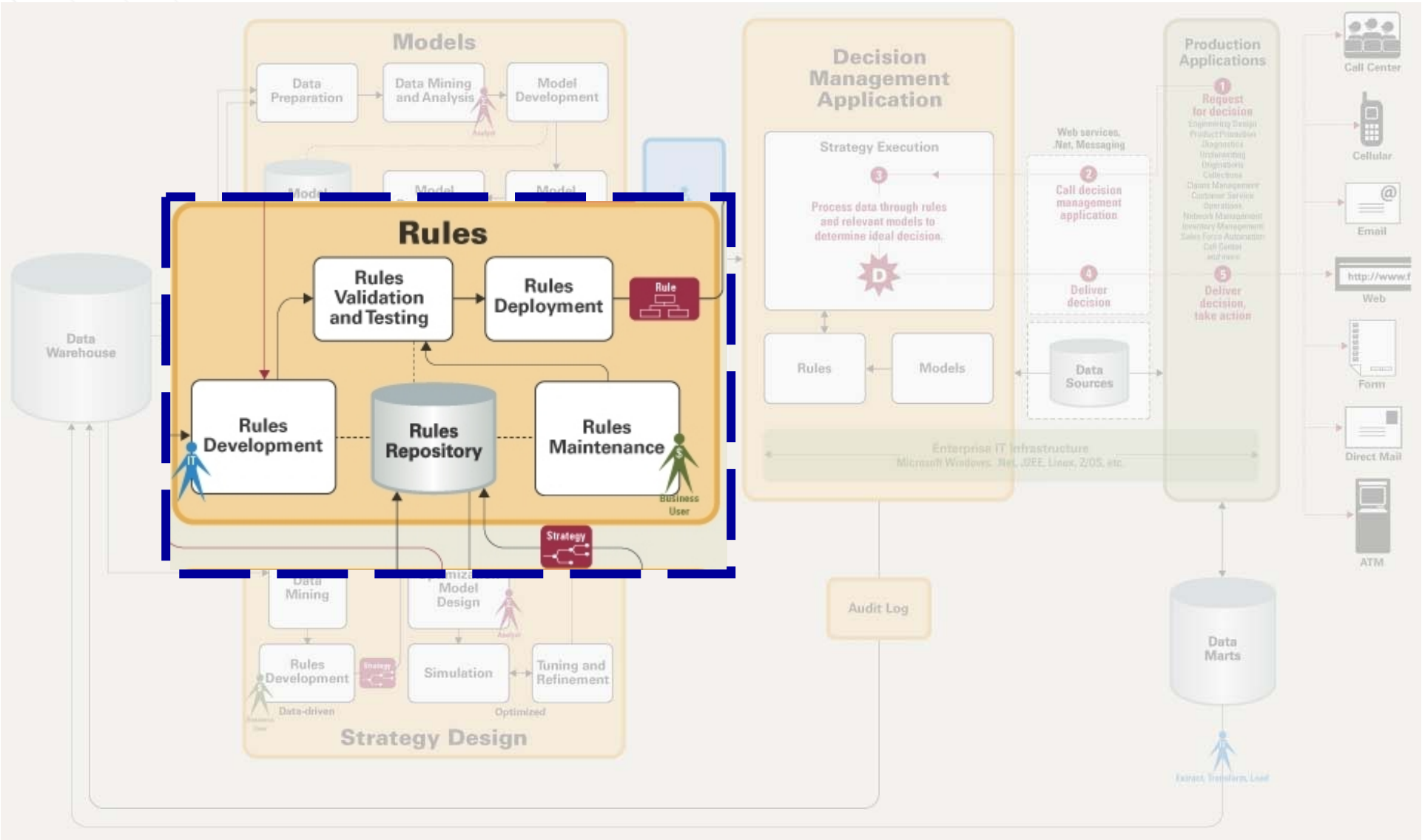
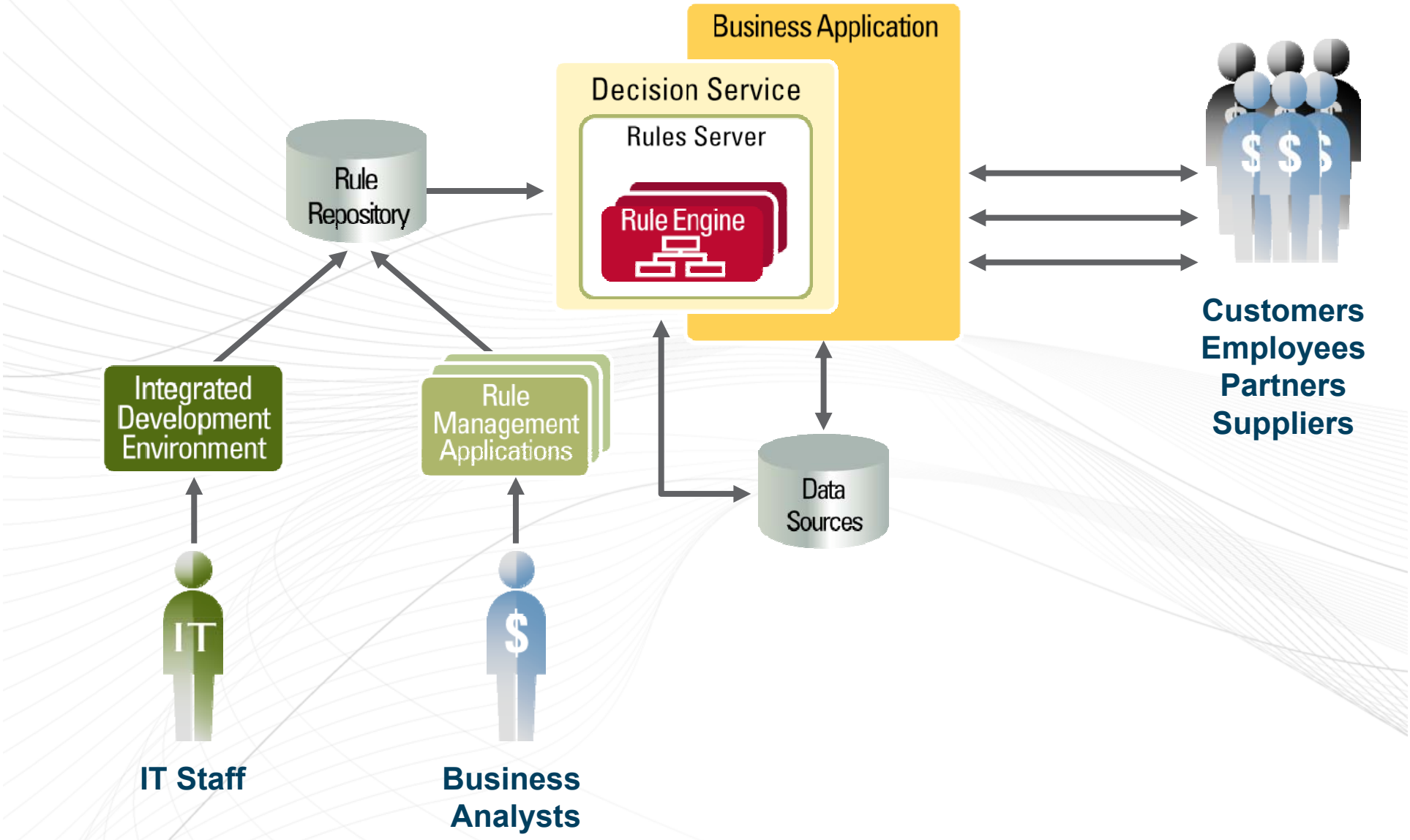
Consistency & Agility

Consistency, Agility



Goal: Consistency
Manage decision logic in a repository



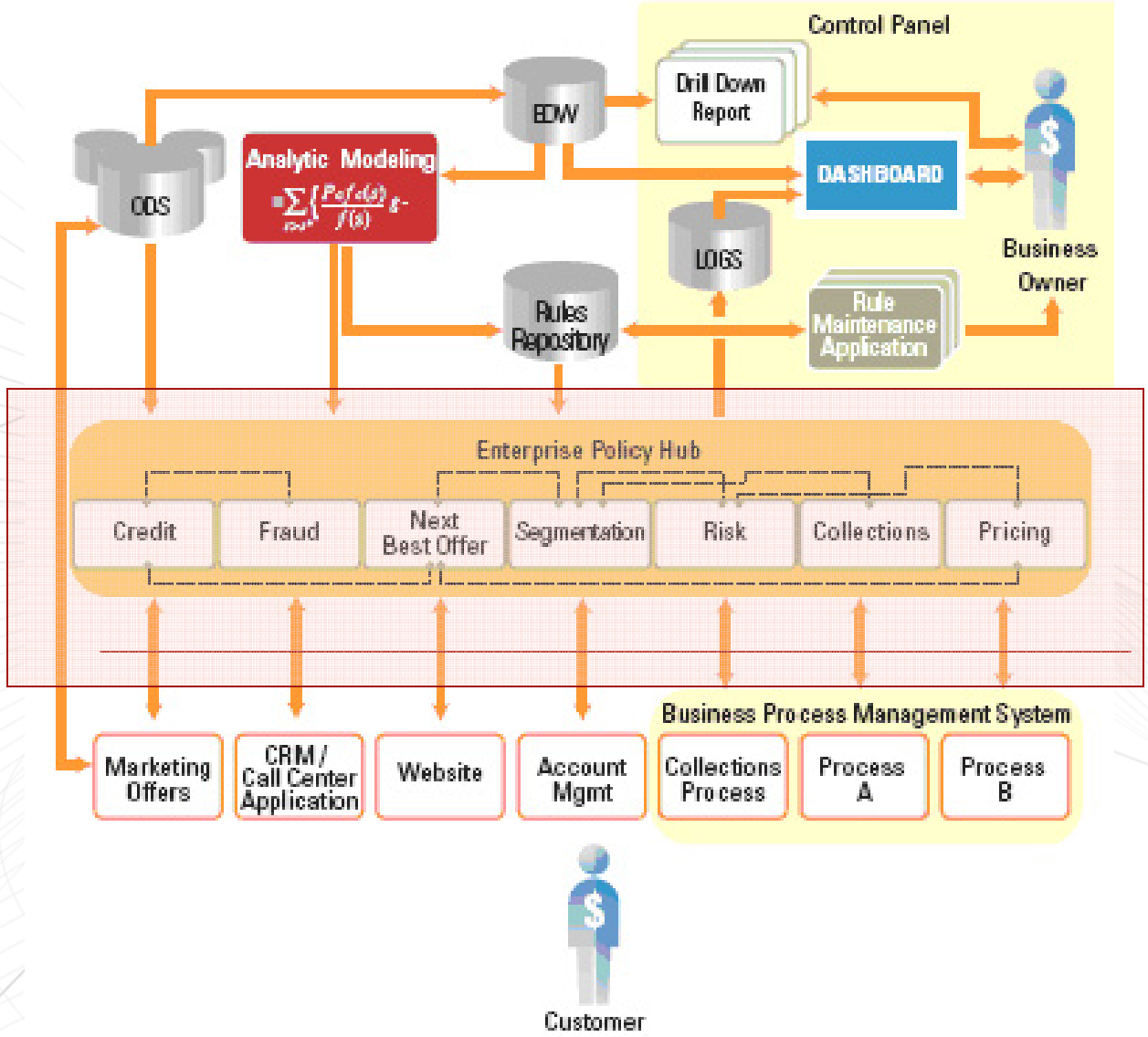
Goal: Consistency
Manage decision logic in a repository

- Start by establishing how the decision logic is managed through organization and time
  - Establish the corresponding repository organization
- Leveraging all management services a repository should provide
  - Versioning
    - Establish the right level of granularity corresponding to the management policies
  - Release and Publication Management
    - Establish the right grouping of entities corresponding to what needs to be delivered for each purpose
  - Extensible meta-information
    - Enrich the repository with your meta-information
  - Search and Queries
    - Enable re-use
    - Analyze, understand and control change / evolution impact
  - Query for changes
    - What has become different and how (presented in the right form)?

Goal: Consistency
Manage decision logic in a repository

- Even though managed differently, consider your decision logic to be part of the critical software assets you manage
  - Use CMS
  - Leverage the repository capabilities to coordinate with the lifecycle of the rest of the related critical software assets
- Minimize the amount of duplication of the same decision logic, establish a single source managed in a repository
- Take into account the authentication / authorization / security needs of a centralized repository in which critical software assets are managed
  - Approaches similar to that of the management of critical business data
  - Leverage similar infrastructure
- Minimize the number of management points
  - Users, roles, etc… defined centrally
  - Security managed centrally

Goal: Consistency
Deploy decision logic as a service

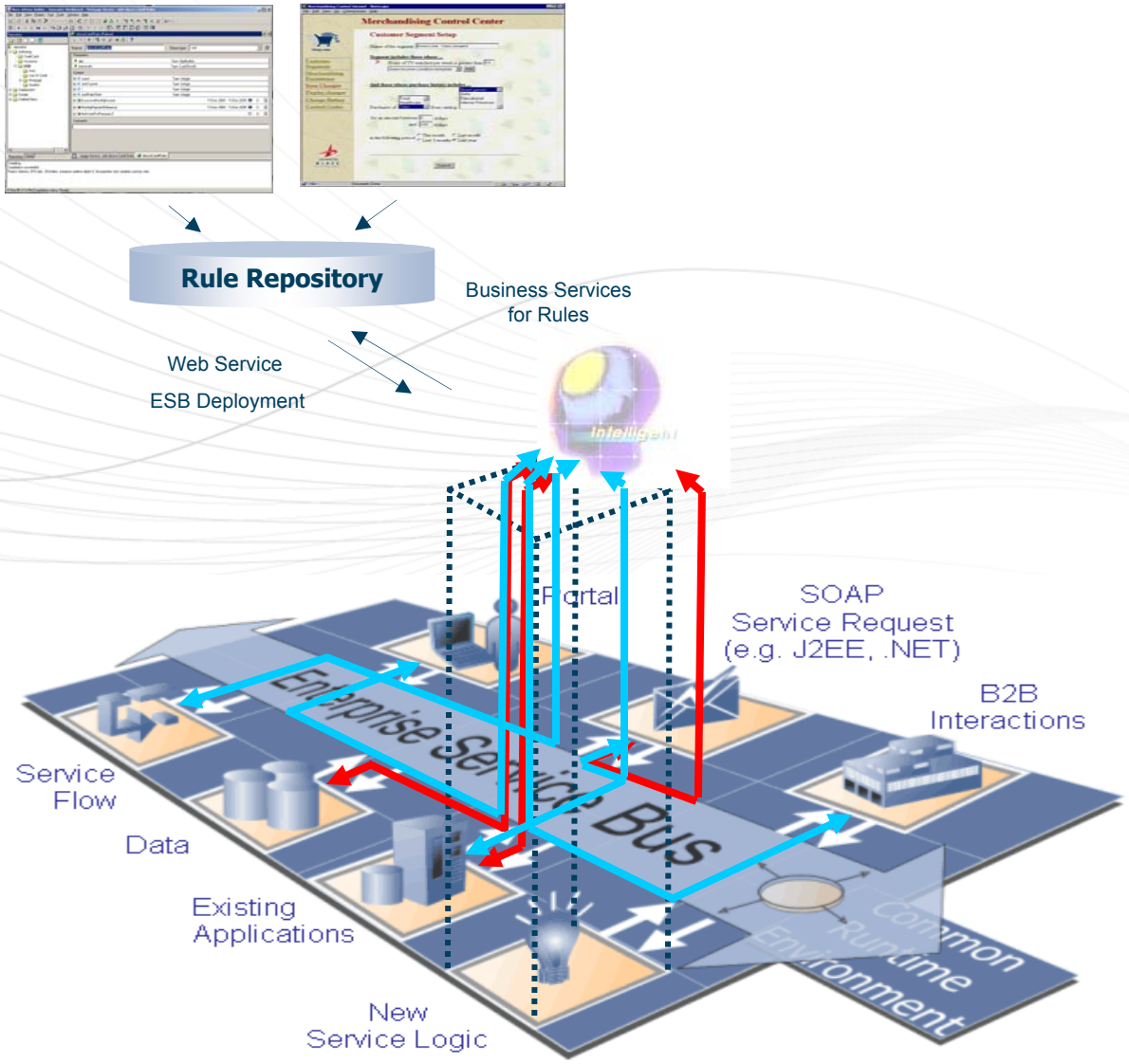


Standard Service Management

Standard Service Container

Standard Service Invocation Interfaces

Goal: Consistency
Deploy decision logic as a service

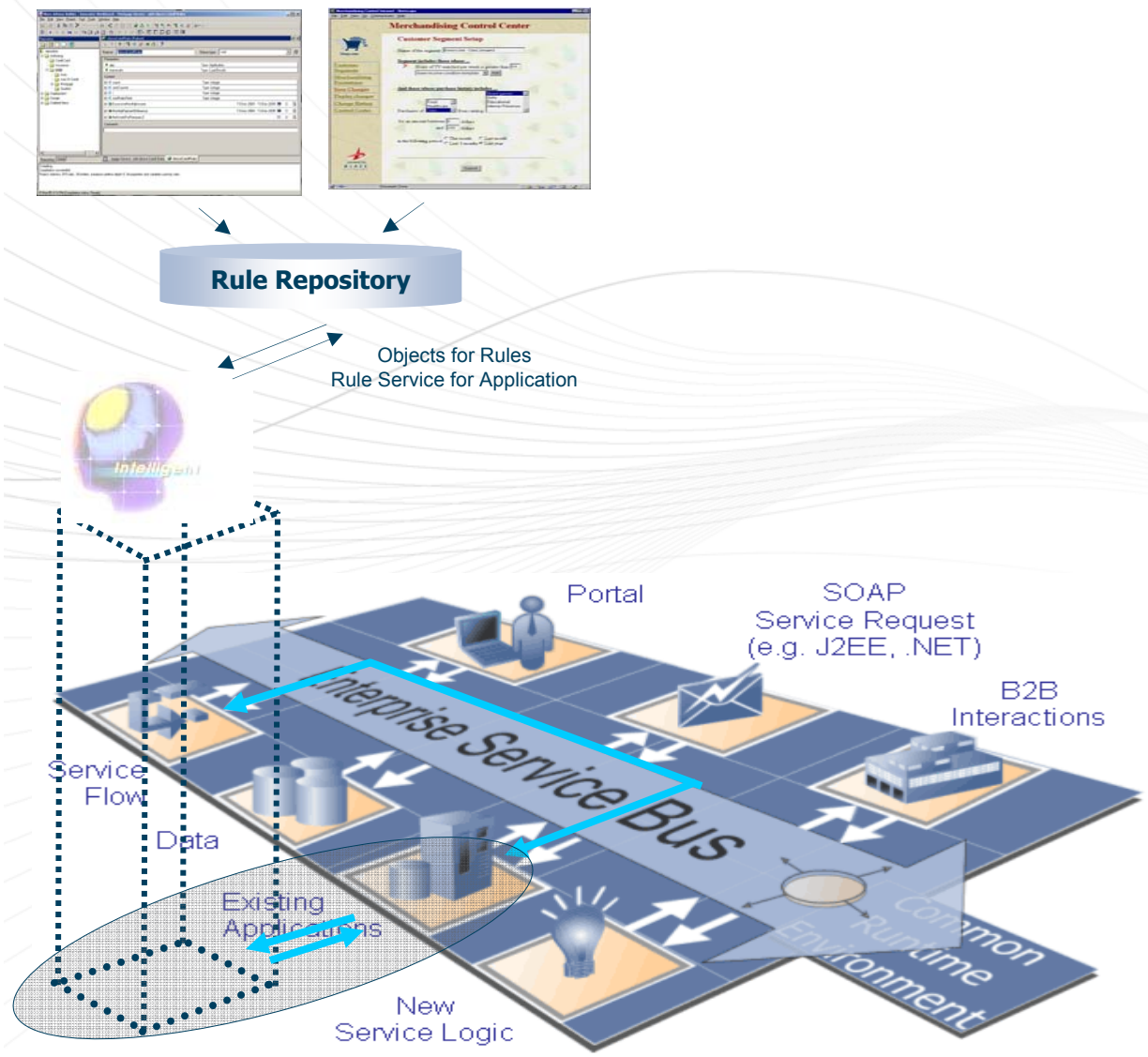


- Implement the business rule service
  - Accessing enterprise resources
  - Possibly accessing other business services through SOA
- Expose business interfaces to it
- Generate Service, Web Service or ESB deployment

Business-controlled SOA-managed business service

"The Policy Hub"

Goal: Consistency
Deploy decision logic as a part of a service



- Implement a Rule Service
  - Accessing resources and services
  - Use it in the context of a Business Service implementation
- Delegate the business rules sections of the Business Service to Rule Service

Business-controlled SOA-managed business service

Goal: Consistency
Deploy decision logic as a part of a service

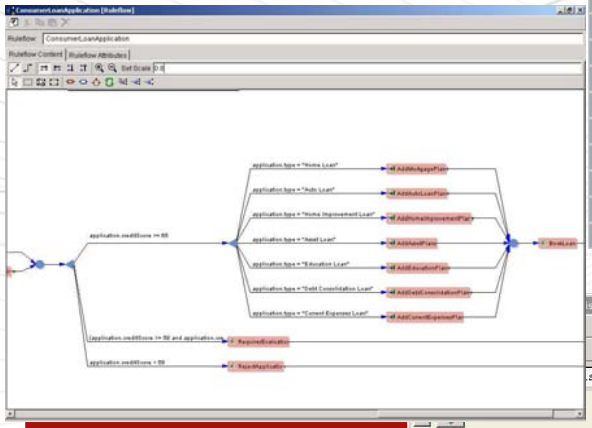
- Use a standard service approach
  - Leave the run time management of the decision service to the service container
    - Rolling your own does not work
  - Respect the 'service' contract regardless of the actual implementation

- But careful on business objects integration
  - Provide fast access to decision-relevant object information
  - Pay particular attention to the issues relative to the marshalling of data
  - Pay particular attention to the issues related to schema evolution

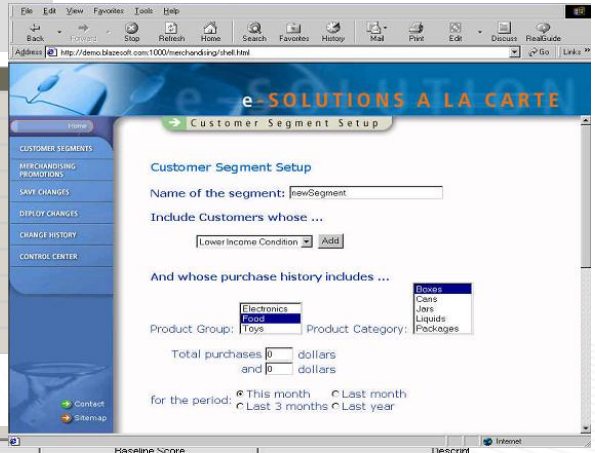
- Take into account the decision logic update requirements
  - Policies & governance
  - Hot swap capabilities
  - Co-existence of multiple versions
  - Time-based interactions
  - Leverage container capabilities, and decision services 'effective dating' capabilities

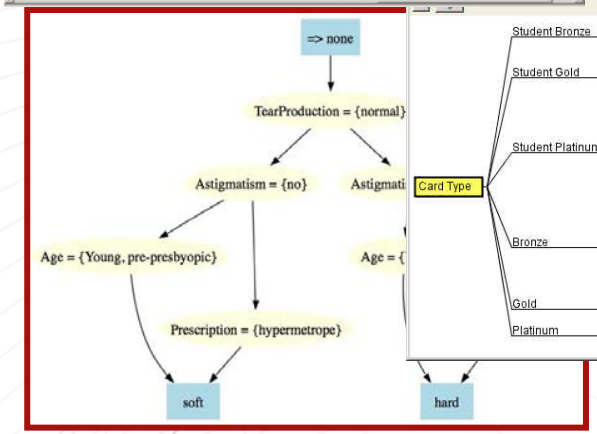
Goal: Agility
Express decision logic effectively

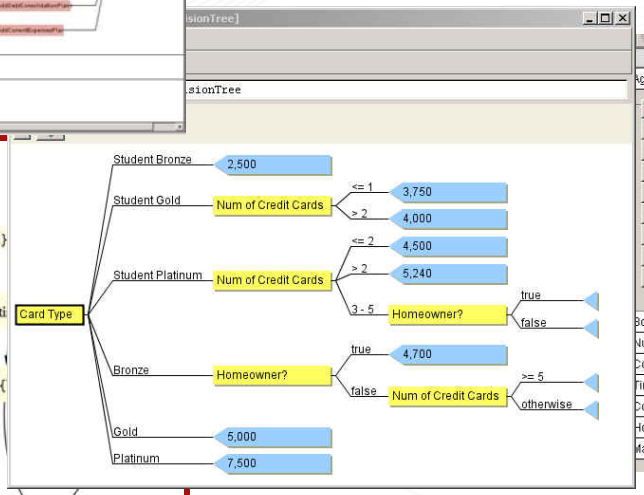
if the age of policy's applicant's vehicle does not exceed 4 years and
the age of policy's applicant is between 21 and 60 and
the incidents of policy do not exceed 2
then
set policy's rate to standard



Plan	Claim Type	In Network	Medical Charges	Pay this Amount	To this Entity
HMO	OfficeVisit	true	$0 -$100	100%	physician
HMO	OfficeVisit	true	> $100	100% of $100	physician
HMO	OfficeVisit	false	$0	0%	not applicable
PPO	OfficeVisit	true	$0 -$150	90%	physician
PPO	OfficeVisit	true	> $150	90% of $150	physician
PPO	OfficeVisit	false	$0 -$150	70%	patient
PPO	OfficeVisit	false	> $150	70% of $150	patient
HMO	UrgentCare	true	$0 -$400	100%	urgent care facility
HMO	UrgentCare	true	> $400	100% of $400	urgent care facility
HMO	UrgentCare	false	$0	0%	not applicable



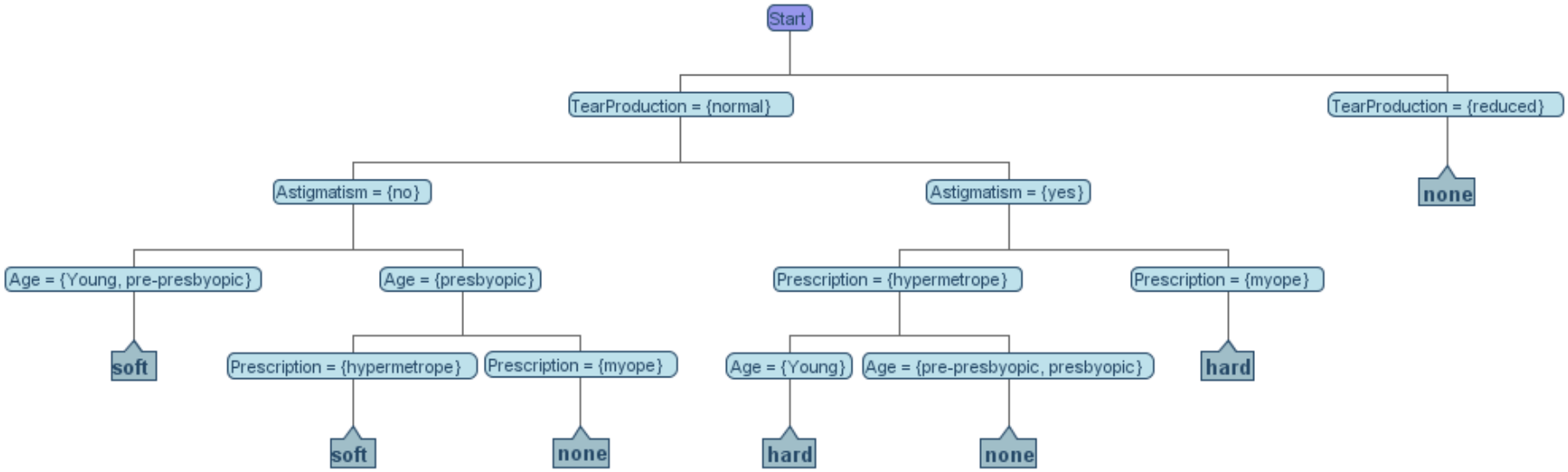




Characteristic	Baseline Score
AgeYoungestDriver	0.0
BodilyInjuryLimits	0.0
NumSigClaims	0.0
ComprehensiveDeductible	0.0
TimeSinceLastAccVio	0.0
CostNew	0.0
HomeownerIndicator	0.0
MaritalStatusCd	0.0

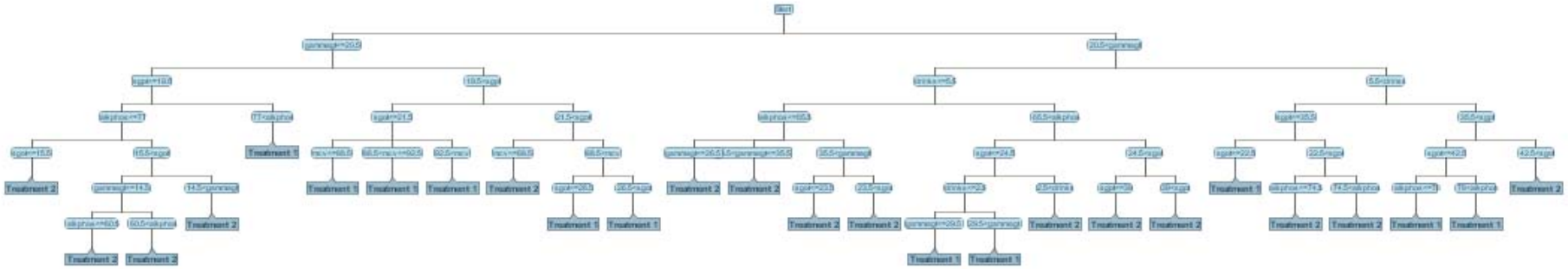
Bins	Range	Description	Score	Unexpected	Reason Code	Reason Message
14-17	14 - 17		0.0		A0NL00100...	Age of Youngest Driver is 14 to 17
18-20	18 - 20		6		A0NL00100...	Age of Youngest Driver is 18 to 20
21-29	21 - 29		18		A0NL00100...	Age of Youngest Driver is 21 to 29
30-34	30 - 34		32		A0NL00100...	Age of Youngest Driver is 30 to 34
35-39	35 - 39		44		A0NL00100...	Age of Youngest Driver is 35 to 39
40-54	40 - 54		50		A0NL00100...	Age of Youngest Driver is 40 to 54
55 or more	>= 55					...ungest Driver is 55 or g...
All Other						...ungest Driver is No Inf...

Goal: Agility
Not so simple: Trees Can Be A Nice Way to View Strategies



Goal: Agility
Not so simple: Do trees scale?

Disease Diagnosis Decision Tree: 75 nodes

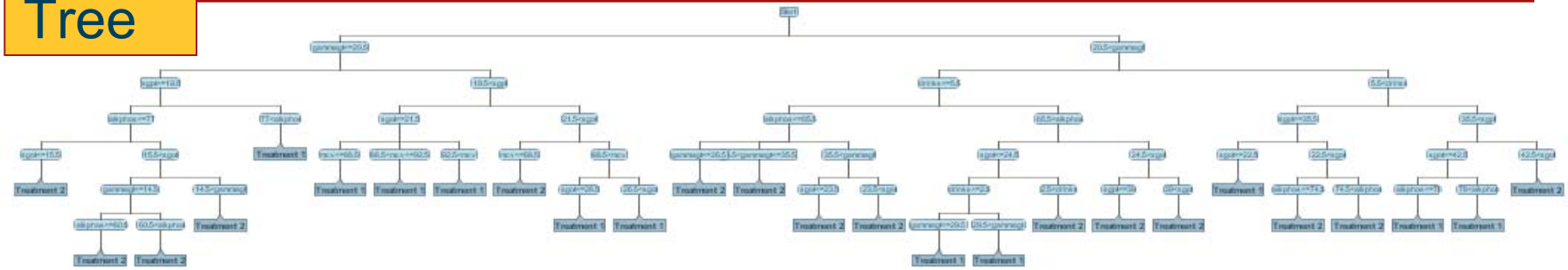


Initial Credit Line Decision Tree: 1750 nodes

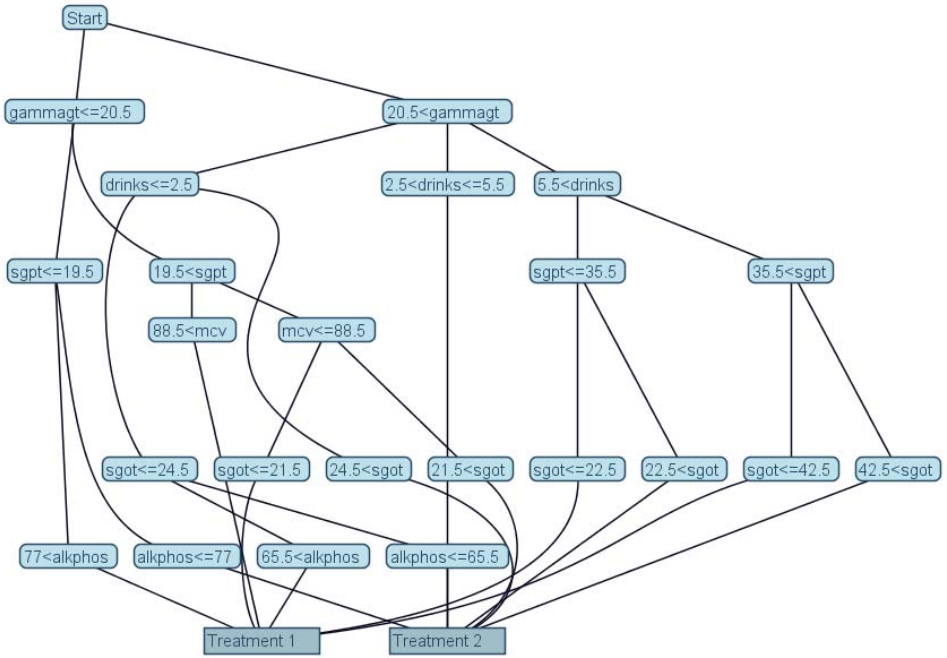
Goal: Agility
Not so simple: The result

Goal: Agility
Not so simple: Better fit the way specialists think

Tree

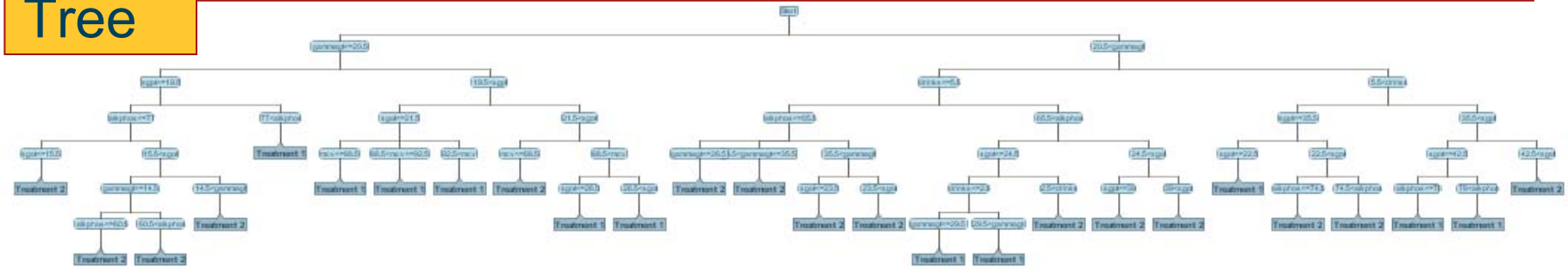


Graph

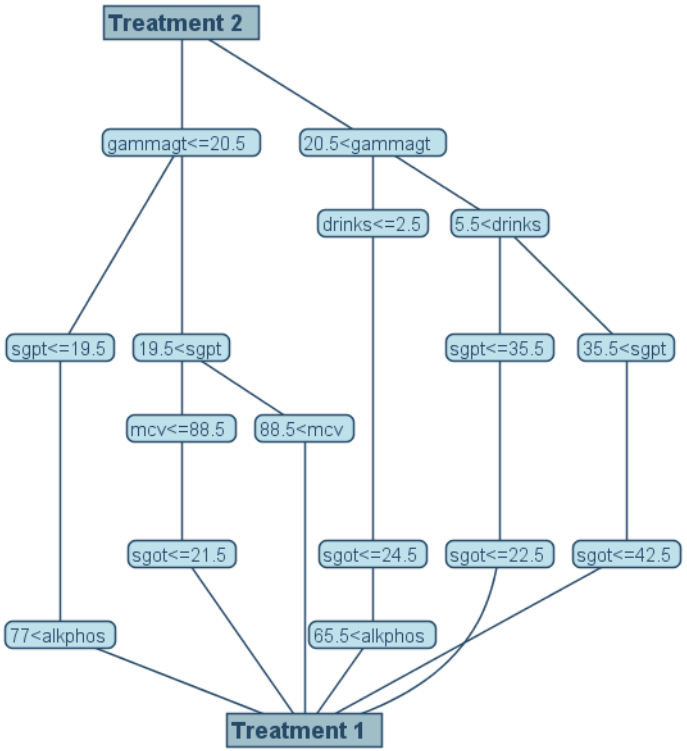


Goal: Agility
Not so simple: And even better with exceptions

Tree



EDAG



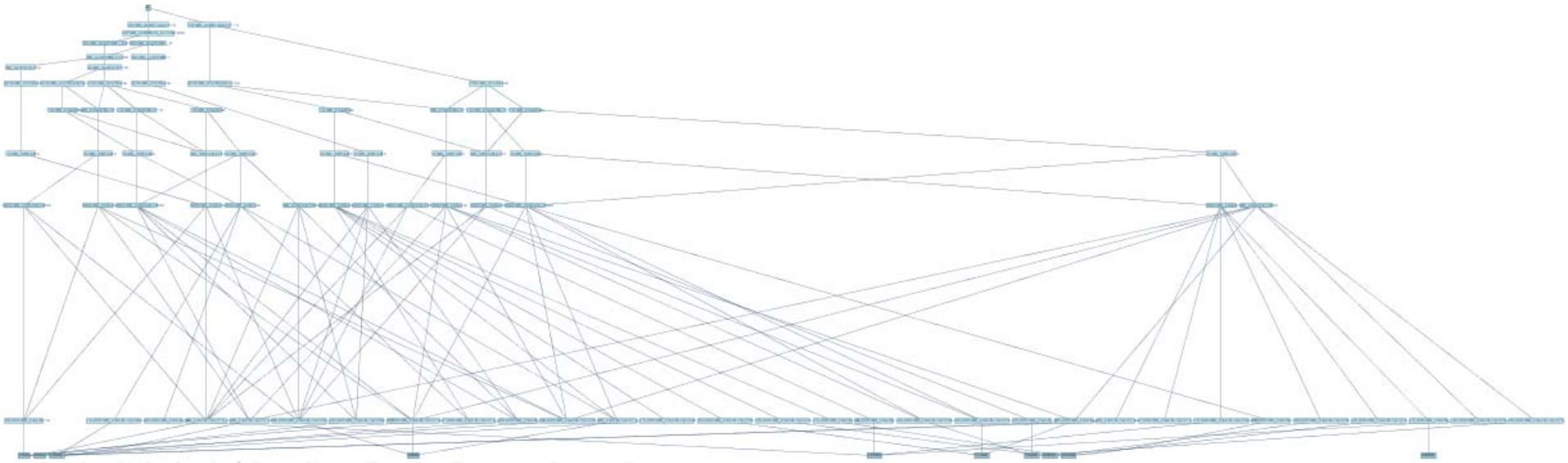
Goal: Agility
Not so simple: And even better with exceptions

Tree

Authorization Decision Tree: 492 nodes

EDAG

Authorization EDAG: 89 nodes



Goal: Agility
Express decision logic effectively

- Start by establishing how the actual decision owners want or need to see the decision logic

- Adopt the most appropriate representation
  - Ease of understanding
  - Ease of explanation
  - Legal compliance
  - One size does not fit all

- Choose approaches that minimize the translation risk
  - If possible, no translation
  - What the decision owner modifies is what is deployed and executed
  - But provide an efficient implementation

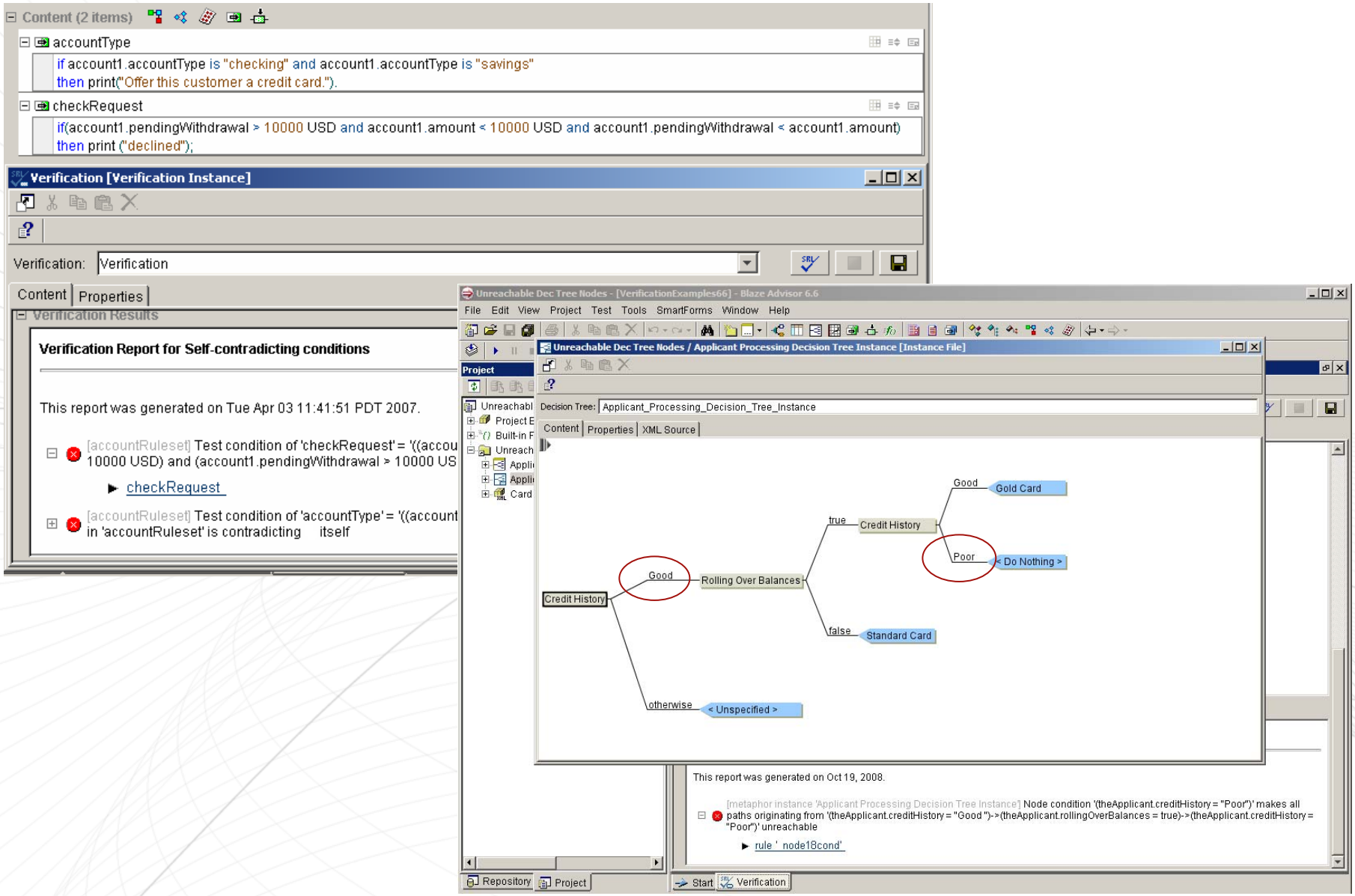
Goal: Agility under control

- Enable agility … but agility under control
  - Preservation of the systems integrity of automated systems is not enough
  - Preserve the integrity of the decisions
- Why is it not enough to decompose and keep interface contracts?
  - Seems clear: keep the interface contract, update the service
  - But that actual contract with the decision service is complex and contextual
    - Events, sequencing, time-dependency, …
- What to do then?
  - Ensure that what you write is what you want, always
    - Verification
    - Unit and Regression Testing
  - Establish practices, governance, etc…, that enable the manage of those services as high agility assets
    - Implement consistent life cycle management policies

Goal: Agility under control
Verification

- Leverage repository-level verification service for the logical integrity of the decision logic
  - High level
    - Overlapping tests, missing tests, self-contradicting tests, sub-sumption, unreachable conclusions….
  - Lower level
    - Possible firing cycles, …
  - Performance oriented
    - Potential for inefficiency, …
- Ensure the verification is independent of the representation of the decision logic
  - Independent on graphical representation
  - Independent of syntax
  - Independent of the way the syntax is used
- Based on all possible execution paths

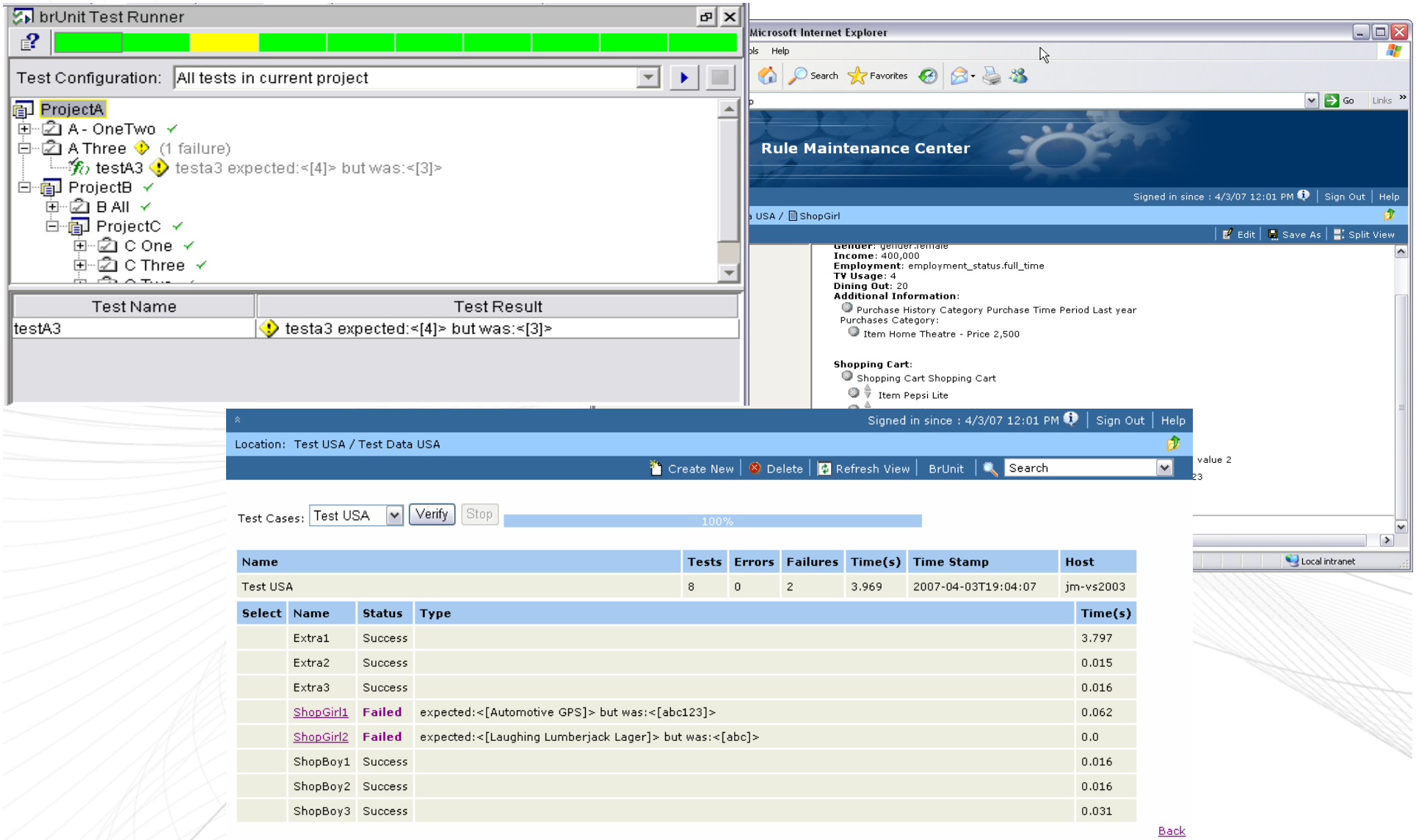
Goal: Agility under control
Verification



Goal: Agility under control
Unit and Regression Testing

- Include decision logic unit and regression tests as part of the development, maintenance and deployment of decision logic
  - High level
    - Expected results versus actual results
    - ‘Assertions’
    - ‘Deviations’
    - Etc.
- Include them as part of the overall tests made on the rest of the critical software assets leveraged by your application
  - JUnit / NUnit integrations
- Make the unit and regression tests accessible to business analysts

Goal: Agility under control
Unit and Regression Testing



Goal: Agility under control
Lifecycle Management

- Think through your approach to decision logic management in the context of their complete lifecycle
- Take into account all roles involved through the lifecycle and their activities
- Analyze early on the governance imperatives and the associated processes
  - Who owns what?
  - Who may modify which entities?
  - At what stage in the process?
  - How are changes rolled into Production?
  - Who needs to approve those changes?
  - What needs to be documented for audit purposes?
  - ../..
- Consider technical and business testing and validation part of the overall management from the beginning

Goal: Agility under control
Lifecycle Management – BRMS typical

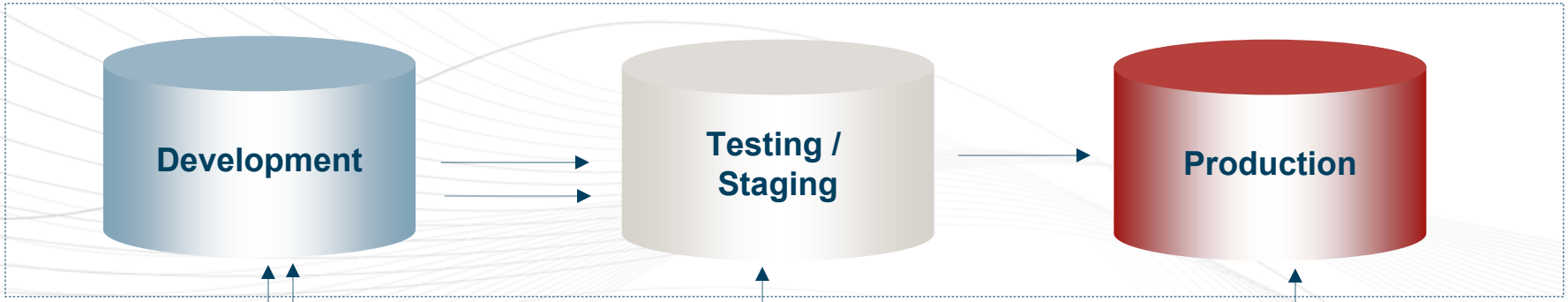
Business Rules Discovery

Business Rules Development

Business Rules Improvement

Business Rules Validation

Business Rules Service Deployment

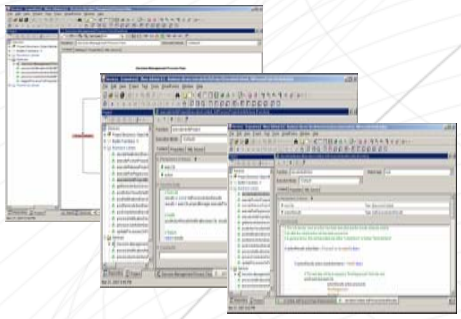


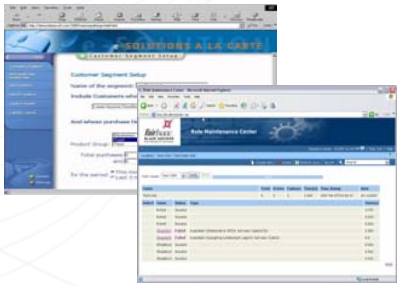
Rules Architect

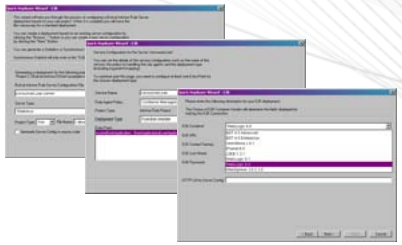
Business Owner

Business Analyst

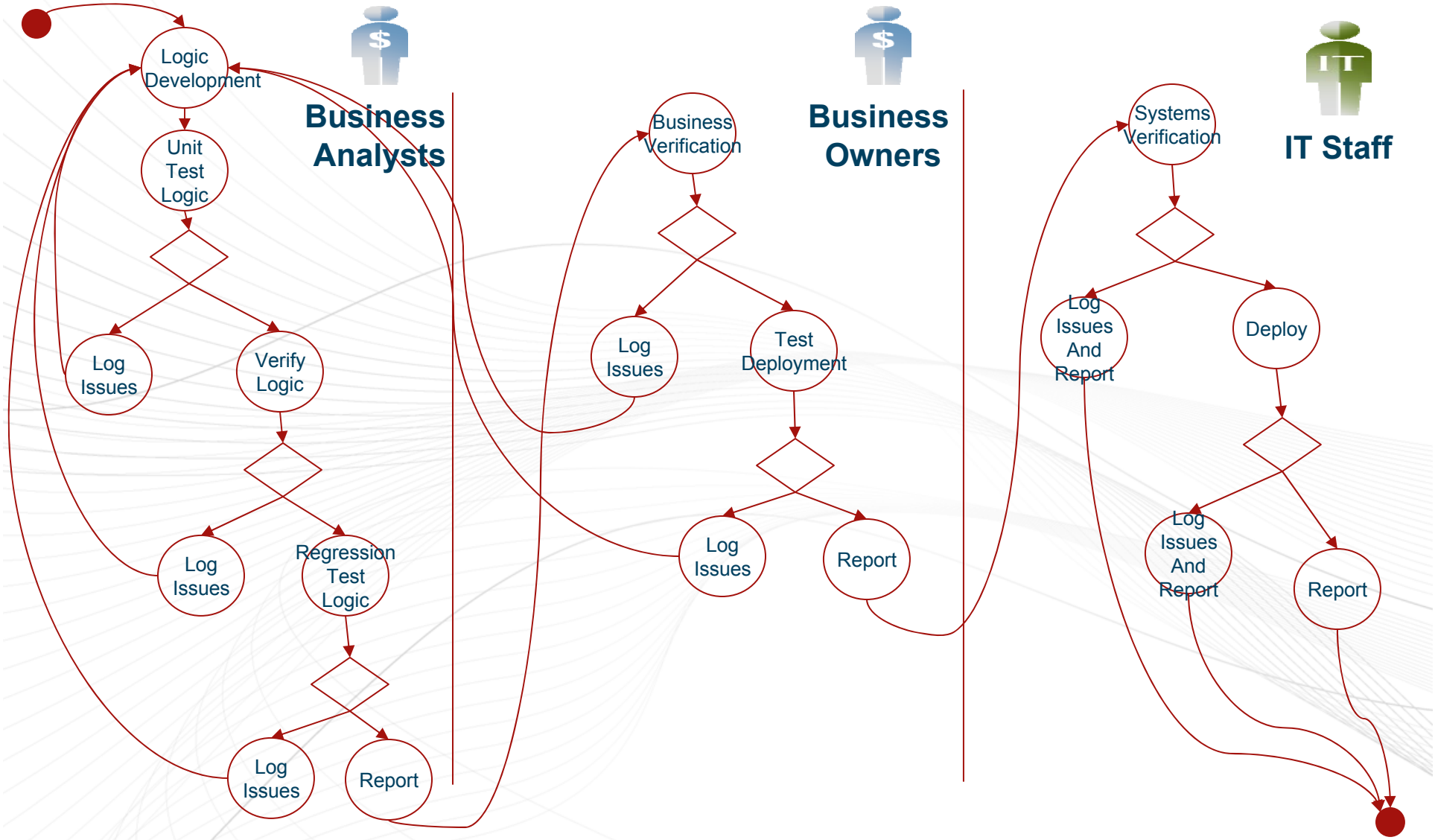
Systems Engineer







Goal: Agility under control
Lifecycle Management – BRMS Typical

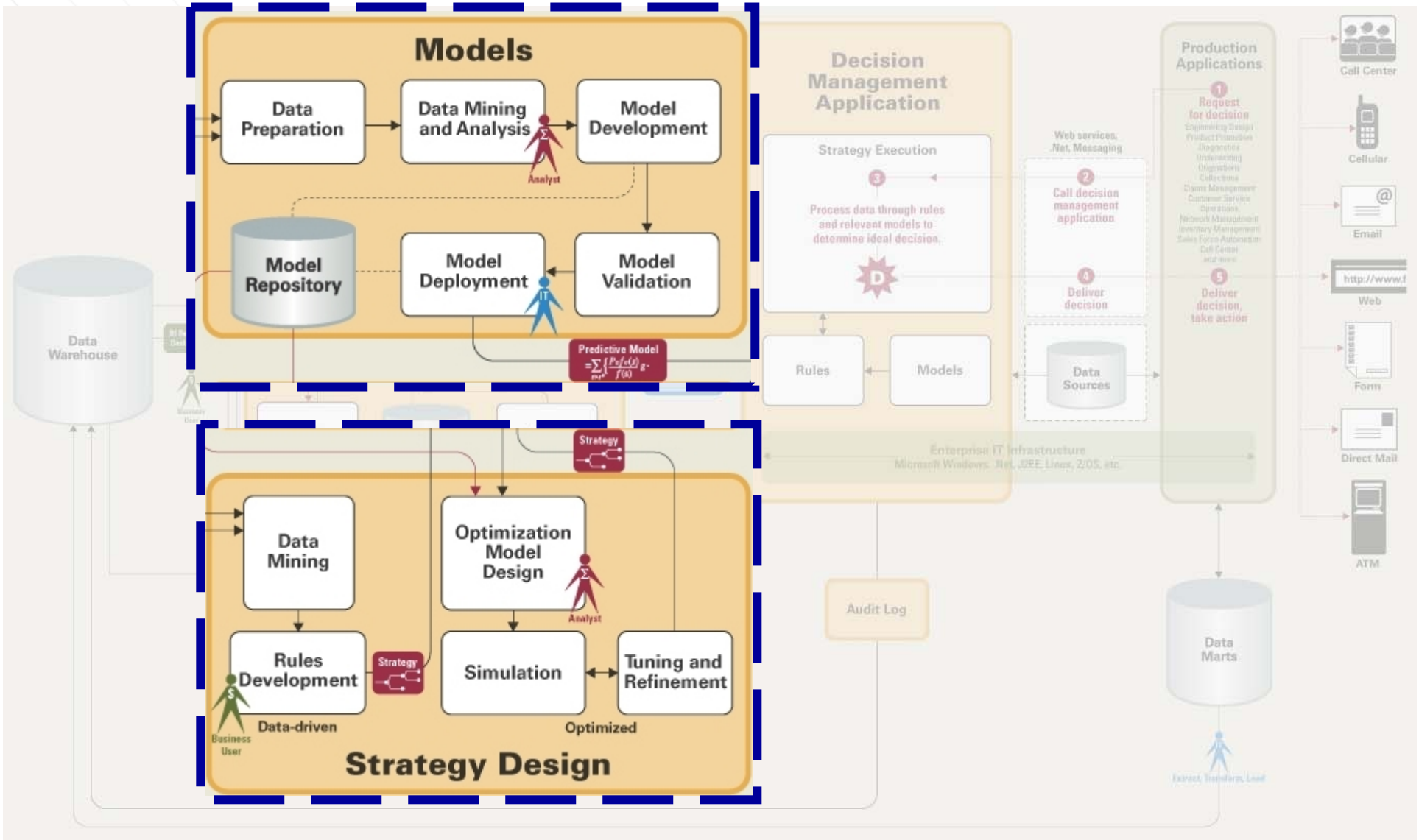


Enable decision agility : Architectural consequences

- Take into account the need to consider multiple evolving decision management roles in the systems
  - Business Analyst
  - Business Owner
  - Technical
- Take into account the need for rich interfaces for business-driven decision management
  - Web-based rich interfaces
  - Directly interfacing the decision logic
- Take complete lifecycle management into account in the way the repository is structured and managed
  - Roles, Organization, decision logic releases and publications
  - Leverage the management assets in your organization
  - Consider whether the same or different repositories are required
- Implement the lifecycle management business process that make sense for the decision logic assets
  - Leverage business process capabilities provided by the infrastructure
    - And if none is available, leverage collaboration / communication tools with database
  - Consider lifecycle management another decision process within the agile applications
  - Manage the lifecycle management business processes through their own lifecycles

Precision

Precision



Goal: Precision
Decision-centric Enterprise Applications

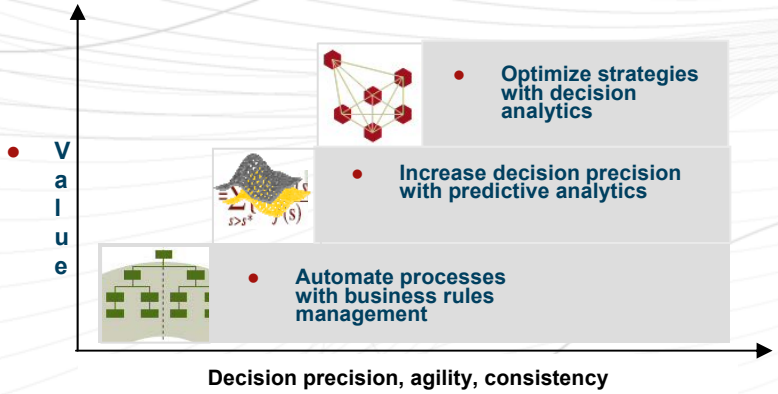
- Core value comes from the performance of the decisions
  - Lots of transactions, measurable value/risk per transaction
  - Few transactions, significant value/risk per transaction
  - Direct or differed value/risk

- Tend to be complex
  - Mix of automatic / straight-through-processing and human interactions
  - Decisions are connected directly or indirectly

- Automation is agile through BPM and BRM
  - But decisions are made in a context that is increasingly complex, interconnected and in constant evolution
  - Opportunity: how to leverage this wealth of data and events to increase the precision of decisions without giving up on agility?
  - Challenge: how to best improve the performance of the decisions?

Goal: Precision
Decision-centric Enterprise Applications

- **The EDM approach: increase precision and consistency while keeping business control and agility by leveraging the application, the business data and events through:**
  - **Champion-challenger**
  - **Predictive Analytics**
  - **Decision Analytics**



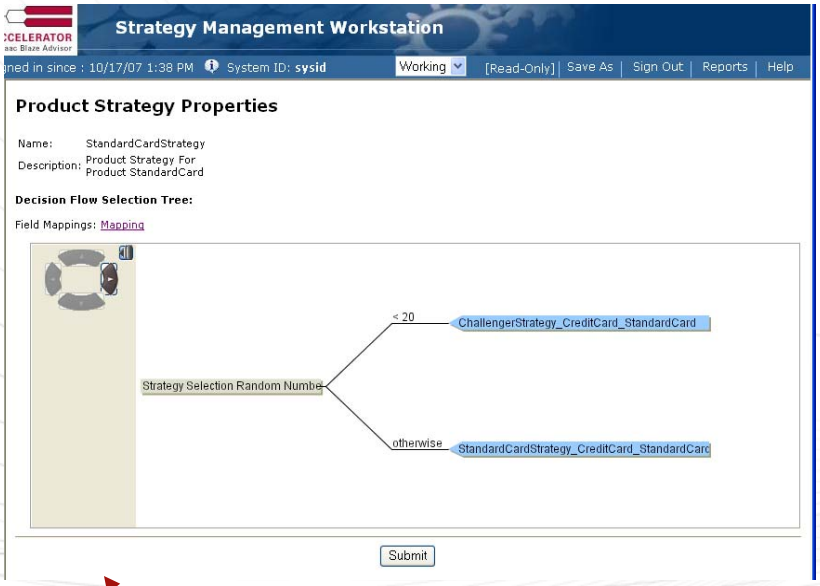
EDM technology	Advantages	ROI*
Business rules management	**Automated decision processes with business experts controlling policies:** ▪ Reduced development costs for decisioning applications and accelerated deployments ▪ More efficient decisioning processes, saving time and money ▪ Improved market agility, since business users can quickly change policies and other decision logic ▪ Better decisioning consistency across channels & operating environments	25-80% cost savings in application development and maintenance
Predictive analytics	**Clear forecasts of customer behavior:** ▪ More accurate and relevant decisions ▪ More precise targeting of treatments and offers ▪ Improved ability to make complex decisions at high volumes and speeds	Up to 15% profit gain; additional 5-15% gain by combining 2-3 predictive models Model deployment time compressed
Decision analytics (strategy optimization)	**Optimized decision strategies:** ▪ Rapid identification of the single best strategy for achieving the performance outcome ▪ Reconciliation of competing objectives ▪ Improved control over business drivers and tradeoffs	5-20% profit gain

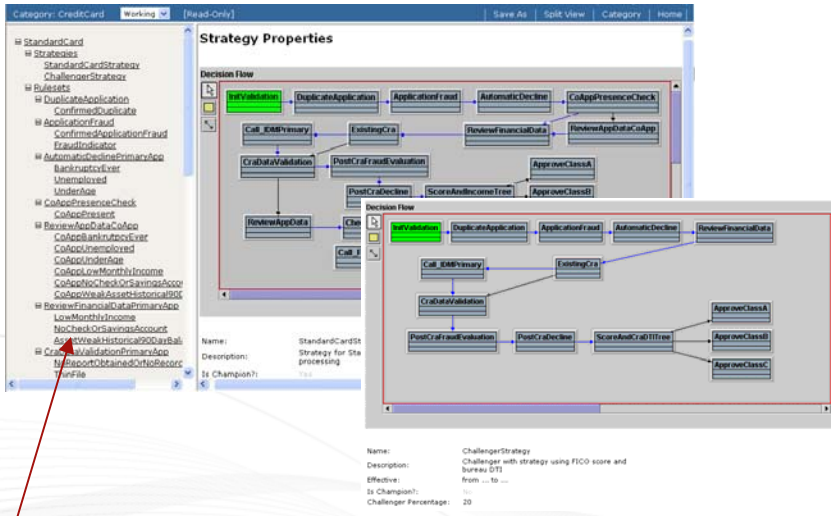
Goal: Precision Champion-Challenger deployments

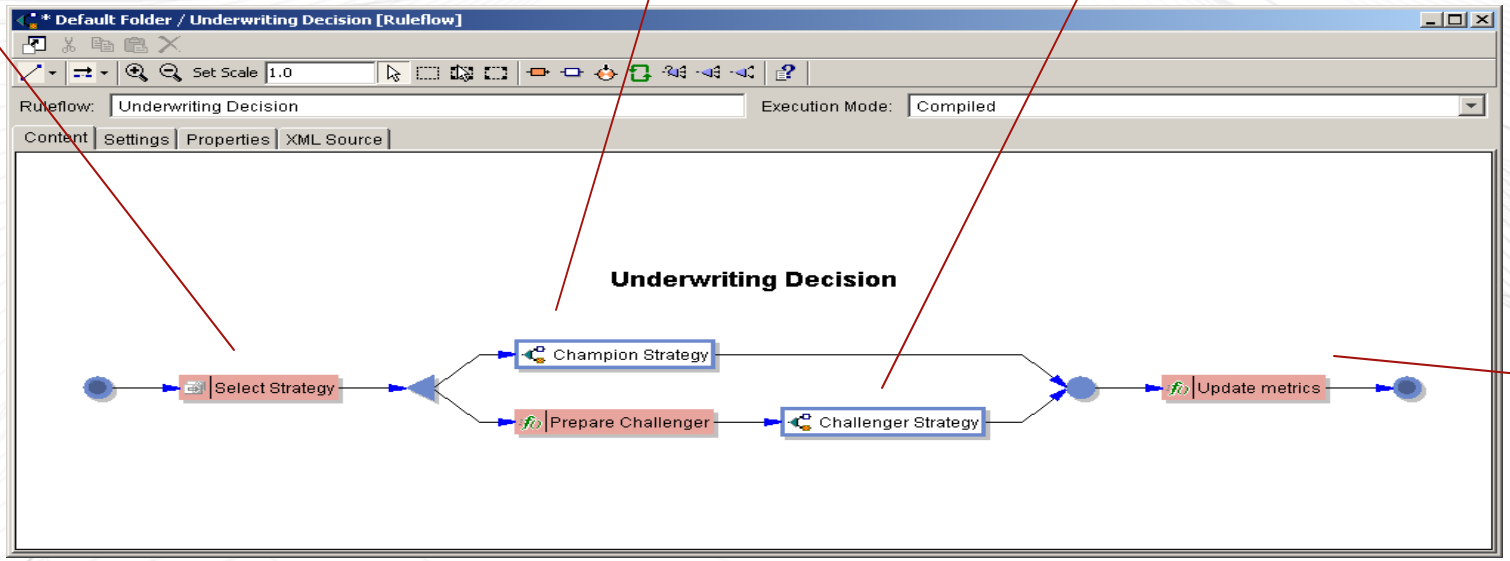
- Key preoccupation:
  - How can we control that decision service updates bring the expected improvements when deployed in the enterprise application?

- Approach
  - In application testing by deploying both the current approach and challenger approaches
  - "Controlled" routing to challenger approaches of decisions
    - Statistically relevant
    - Business constraints aware
  - Tracking outcomes and analyzing performance
  - Promoting well-performing Challengers to Champions

Goal: Precision
Champion-Challenger deployments

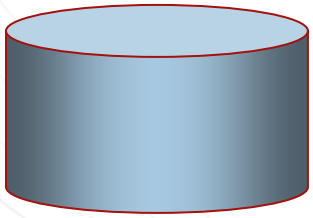






Performance Metrics

Goal: Precision Champion-Challenger analysis



Performance Metrics

Business Value

Action Mix Data For Portfolio Segment

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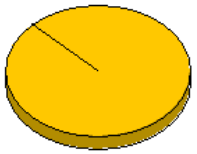
Action Mix Data For Portfolio Segment

Selected scenario/solution(s) - For actions : Balance Transfer APR Channel (mail or tel) Purchase APR



Action Mix
- Manual Review
- Auto Reject
- Auto Renew

Scenario / Solution	Action Mix		
	Manual Review	Auto Reject	Auto Renew
Current Version	100%	0%	0%
New Version	10%	30%	60%

Swap Table Report for Balance Transfer APR

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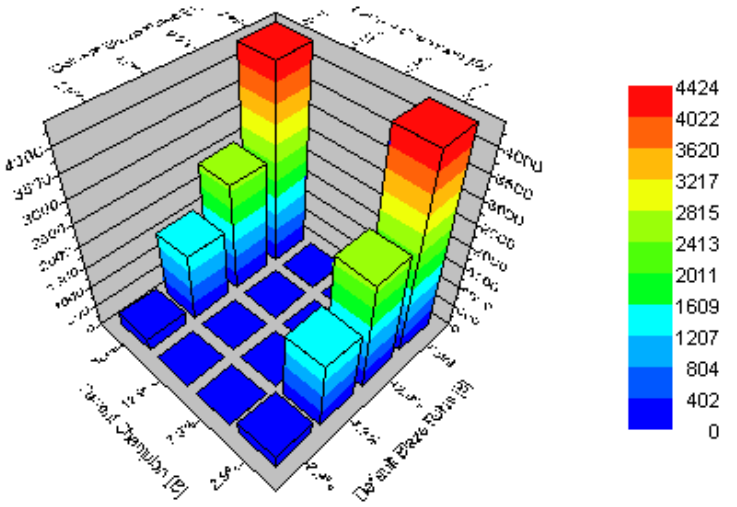
Swap Table Report for Balance Transfer APR

Current Champion [B] vs Default Blaze Rules [B]



Current Champion [B]	New Version			
	2.9%	7.9%	12.9%	Total
2.9%	306	1578	2540	4424
7.9%	0	0	0	0
12.9%	0	0	0	0
Total	306	1578	2540	4424

Goal: Precision Champion-Challenger

- Requires the architecture to capture all the relevant information for comparison of performance
  - Real time performance metrics storage
  - Operational reporting to assess performance at any point
- Strategy decides how the decision is rendered
  - Information captured for analysis includes the strategy information
  - Segment & random based
  - Keeping into account business constraints
- Performance analysis can sometimes be automated achieving closed-loop learning
  - Monitoring required
- Strategies must be managed through time exactly like decisions

Goal: Precision
Enrich decision logic using predictive analytics

- Key preoccupation
  - How to take advantage of the available business and performance data to improve / optimize the performance of the automated decisions?
  - How to do it in a way that remains manageable and controlled?

- Approach
  - Leverage powerful predictive analytics combined with business rules
  - Deployed and managed through the same decision management services

- Adding predictive analytics to decision enables the automation of a further section of the business transactions
  - For example, from 75% to 90% automation in Insurance Underwriting
  - Provides significant competitive edge to the corresponding applications

Goal: Precision
Enrich decision logic using predictive analytics

- Leverage sophisticated statistical analysis of the data to create predictive models
  - Mathematical objects which synthesize & evaluate relevant customer facts to estimate likelihoods and quantities of future events

    "customers between the ages 45 and 54 with a net worth over $500k are will not default in 96% of the cases"

- In general used to assess risk or likelihood levels
  - An input into actual decision logic

    "if customer's potential_default_rate is lower than 0.04 and customer's request's amount is less than $100,000 then set customer's request's approved_state to true"

  - Managed in the context of larger business decision logic
  - Best if explainable / legally challengeable: scorecards, decision trees

Goal: Precision
Enrich decision logic using predictive analytics

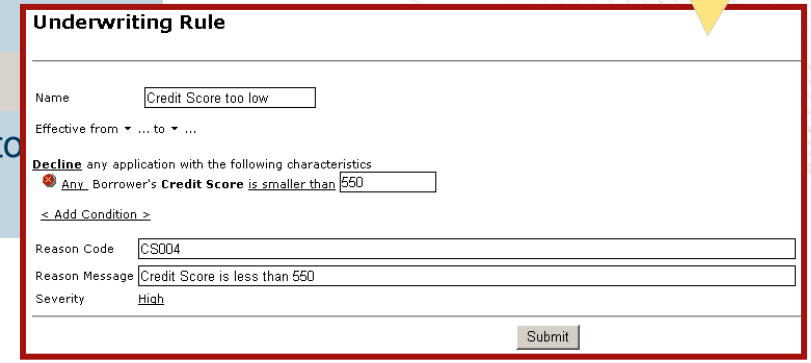
Variable	Weight	Reason
creditLineUtilization %		
0—30	64	
31—82	55	
83—100	48	Over-Extended
monthsSinceDelinquent		
0—3	45	Late Payments
4—8	55	
9—NeverLate	74	
No Information	60	
applicantAge		
19—25	50	Too Young
26—High	55	
monthsAsACustomer		
0—36	51	New Custo
37—Maximum	75	

Model Formula

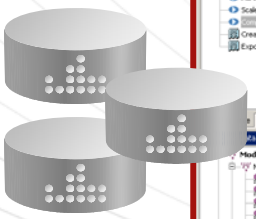
Model Score

194

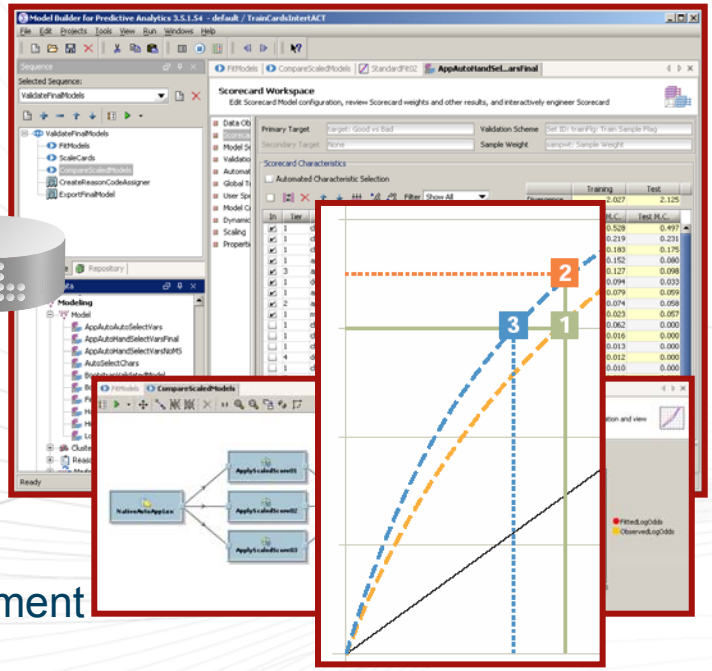
Simple Cut-off Rule



Goal: Precision
Enrich decision logic using predictive analytics



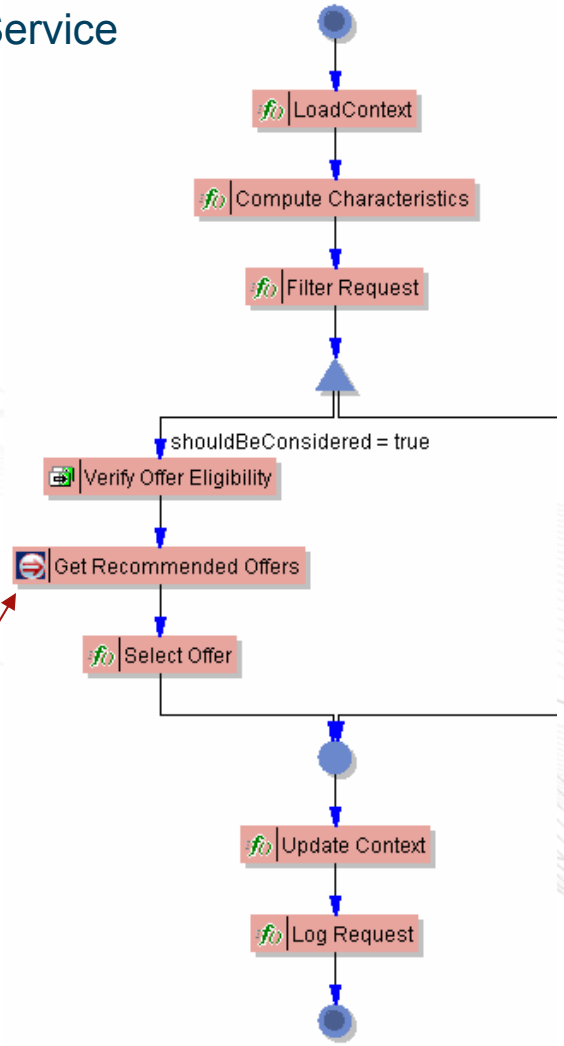
Historical Data

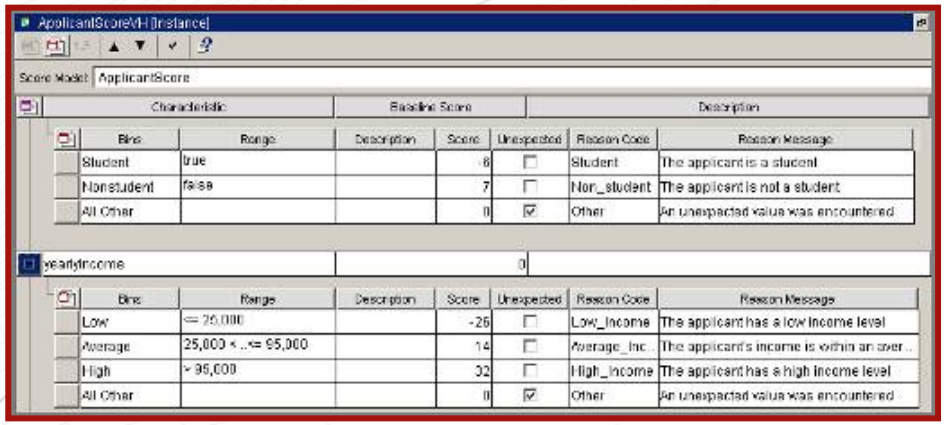


Model Development

PMML

Decision Service



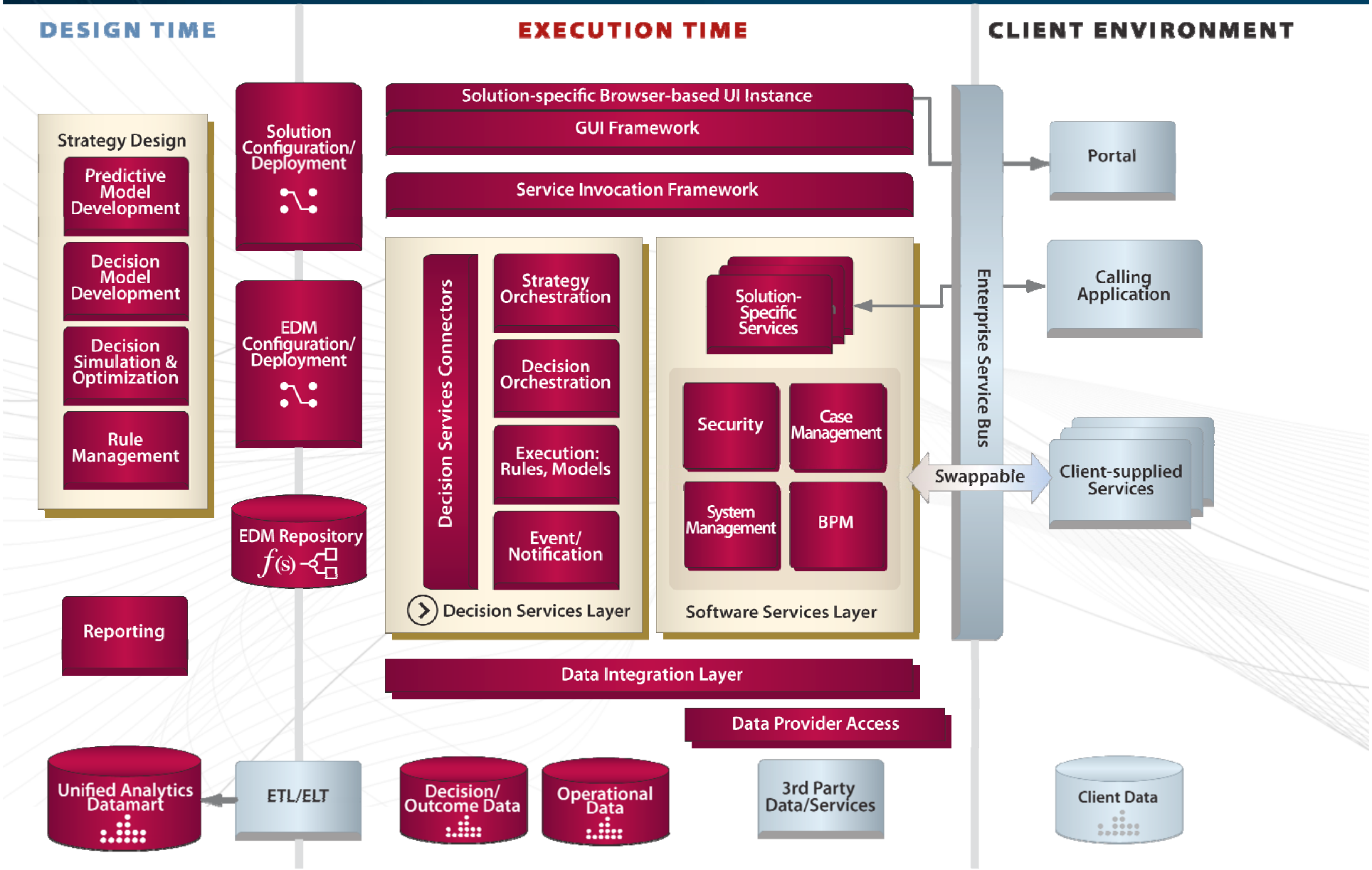


Goal: Precision
Enrich decision logic using predictive analytics

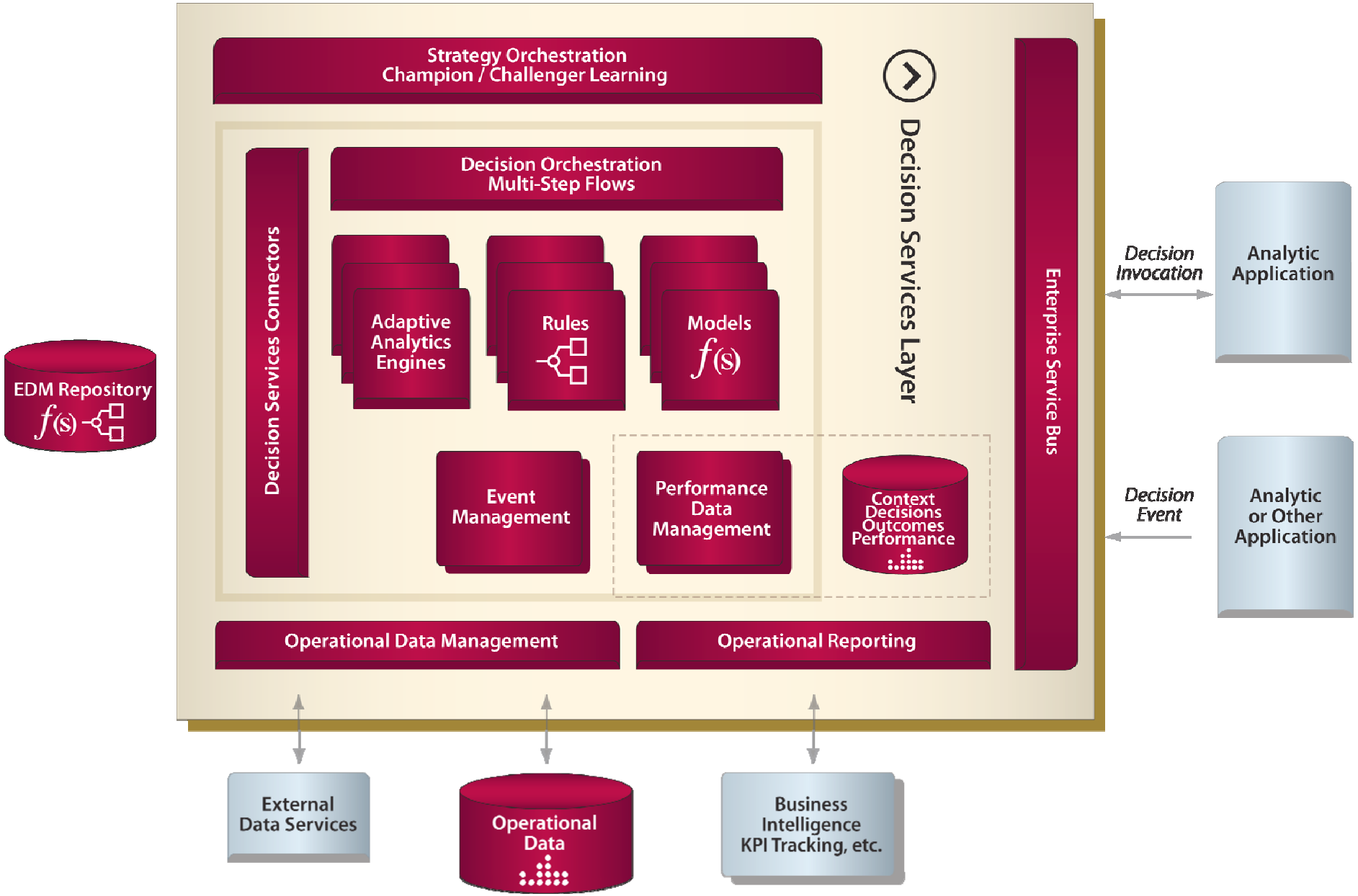
- Business data, decision data and business events need to be captured and managed
  - Real time logging of business and decision data
  - Real time event capture and processing
  - Extraction of relevant features into data warehouses
- Predictive models need to be deployed in the context of the overall decision logic
  - Minimize the amount of transcoding
  - Leverage the services provided by the decision logic management
    - Predictive variable computation through decision logic
    - Decision Services implement decision logic that leverages the risk or likelihood assessment specified by models
- Data provided to predictive model should be monitored for expected qualities

Decision Management in Action

Real EBA "architecture"



Real EBA "architecture": Decision Service Layer



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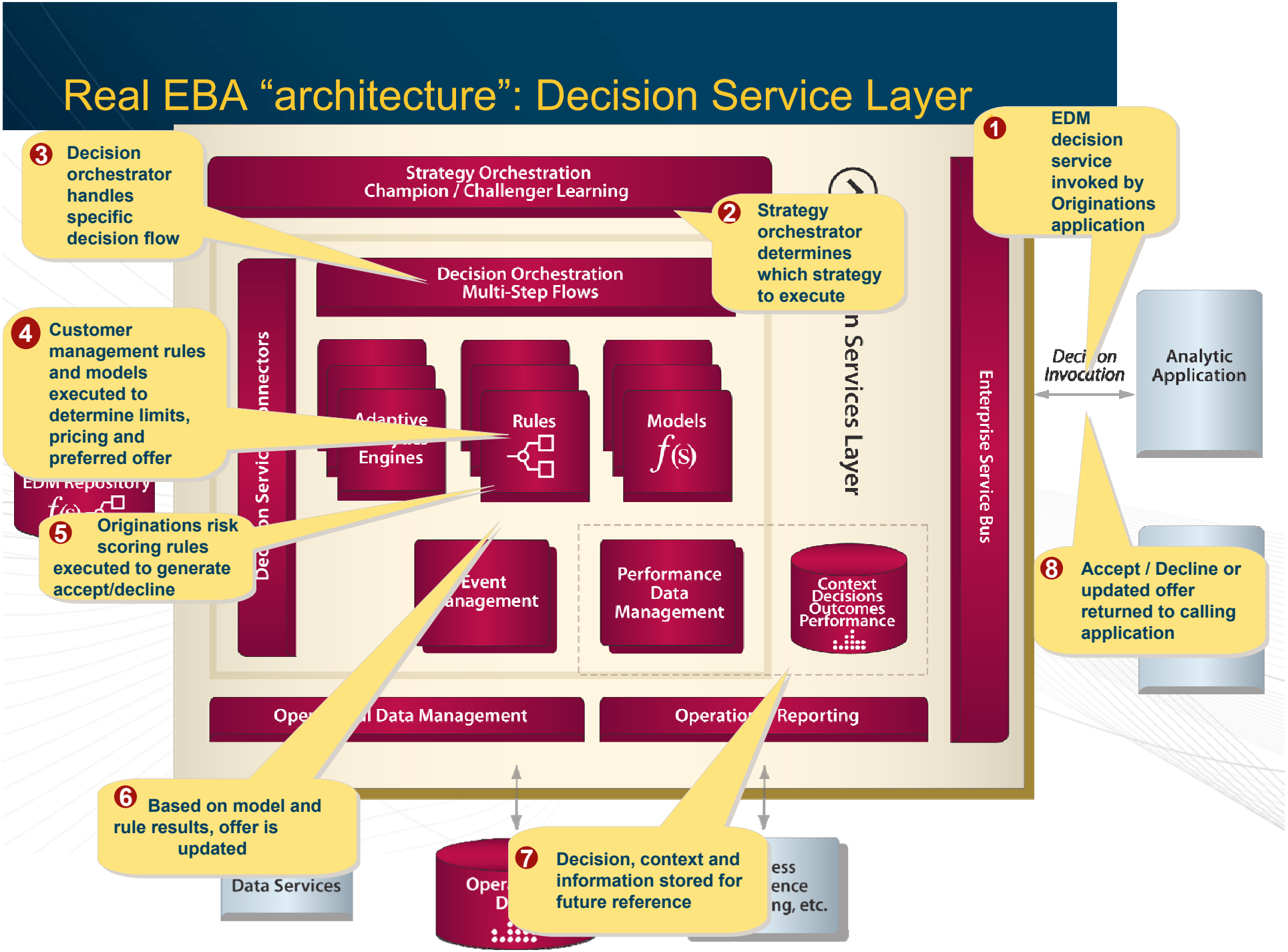
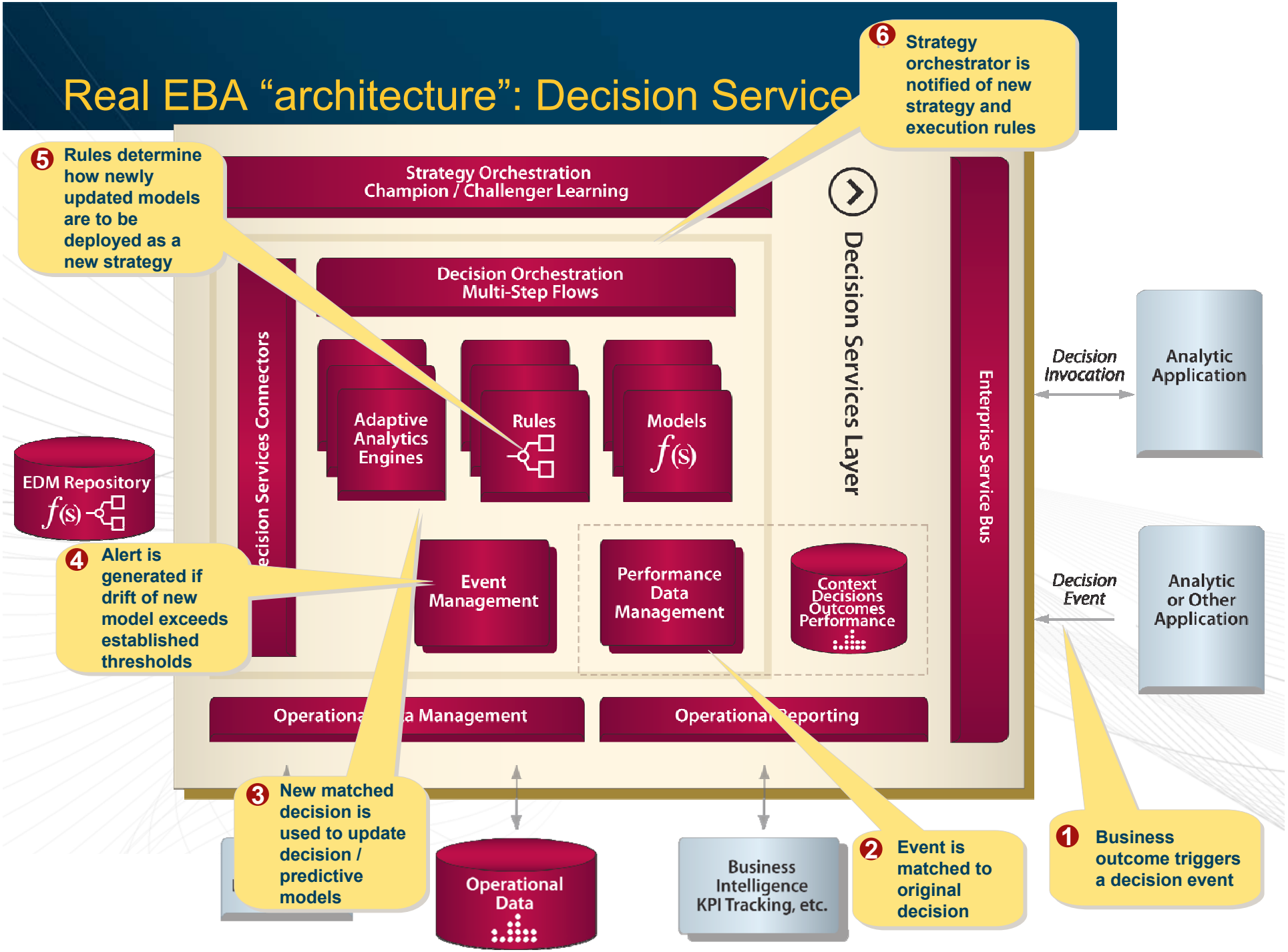


Real EBA “architecture”: Decision Service



Is that all?

- There is much more
  - Decision Improvement
  - Decision Optimization
  - Etc

- The challenges are huge, the opportunities as big

Thank you!

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