

Smart Work for a Smarter Planet



Smarter Business Decisions through Rules and Optimization
Vivek Puri, ILOG, an IBM Company



ILOG Brings Four New Product Lines into IBM

Powerful Business Rule Management System

Automate complex, fine-grained decisions, while also enabling business users to maintain the decision logic used by systems

Innovative Suite of Optimization Tools

Produce the best possible action plans & schedules, enhancing abilities to explore alternatives, understand trade-offs, and respond to changes in business operations



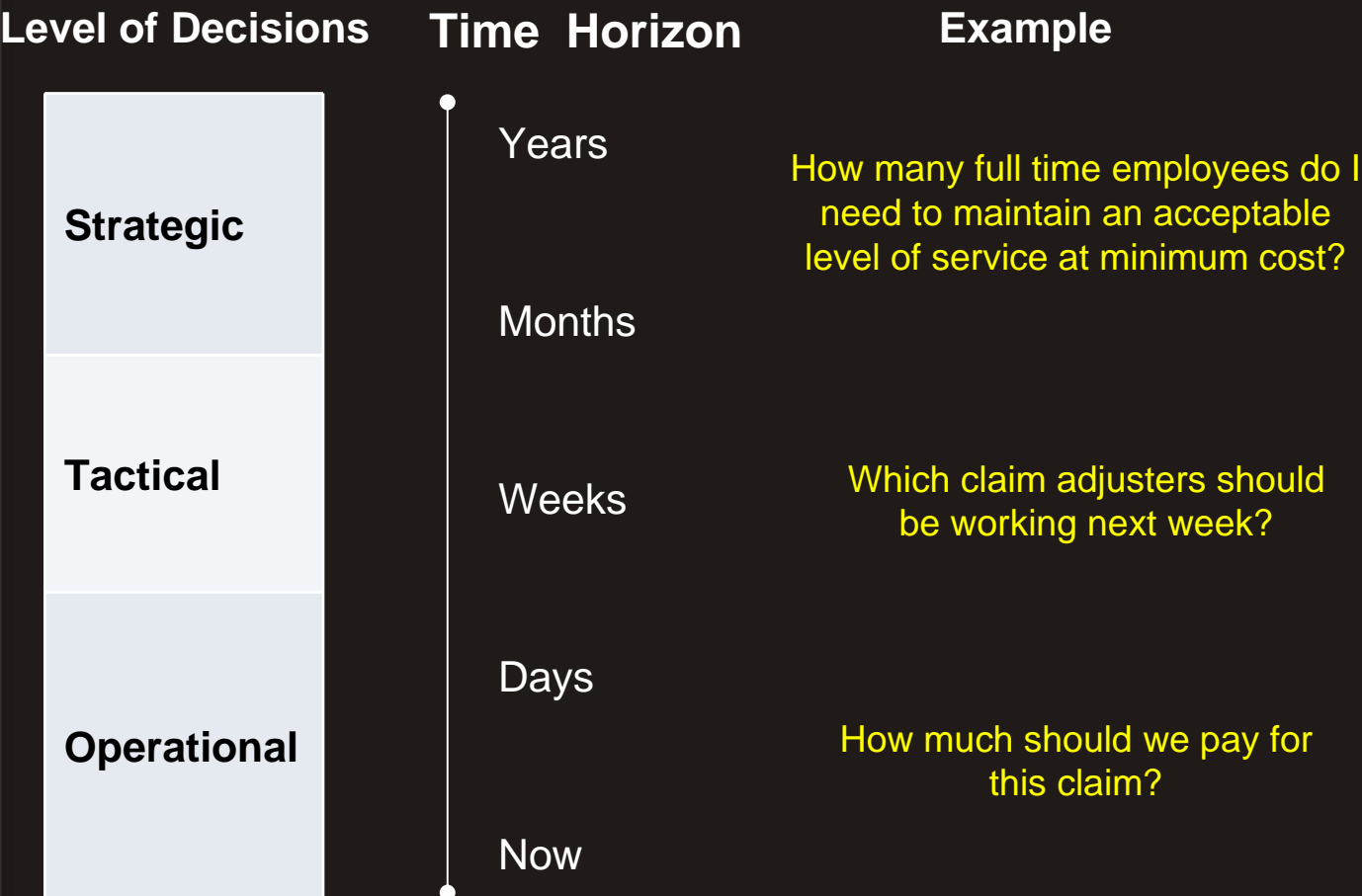
Supply Chain Management

Optimize supply chains, design & planning tools for improved efficiency and productivity

Visualization Tools

Transform insight into action, enhancing collaboration for smarter role-based business decisions

The Business Decision Continuum



How does ILOG extends IBM value proposition?

Level of Decisions

Source of value



Business Rules Management

Business Rules define the logic of operational decisions

The statements derived from business policies, regulations, and procedures that are embedded into an enterprise system to automate decisions

Rating

Underwriting

Risk Classification

Fraud assessment

Billing

Cross-selling

Configuration

Eligibility

Pricing

Benefit calculation

- *Each driver authorized to drive a car of group K must be over 21*
- *If the transaction is a cash-out refinance Then the loan-to-value ratio must be less than or equal to 85%*
- *If customer is member of night's plan and call time is after 5 p.m. Then the billing rate is .05 per minute.*
- *No security should be purchased from the Tobacco sector.*

The need for managing business rules

- Assigning a claim:
 - Privacy protection and dynamic security (HIPAA, Patriot Act)
 - Claim location, risk type, severity, staff availability and skills
 - ▶ **800 business rules**
 - Underwriting an insurance policy
 - Personal auto (800), commercial (200), homeowners (800)
 - ▶ **1800 business rules**
 - Cross-selling banking products
 - Offer targeting, program qualification, risk based pricing
 - ▶ **6000 business rules**
- ▶ Change more often than process flows
 - ▶ Changes expected to be implemented in day(s) not months

Business Rule Management System

Where Business Rules Typically Exist

```

#ifdef __WIN__
/*
Before performing any socket operation (like retrieving hostname
in init_common_variables we have to call WSASStartup
*/
WSADATA WsaData;
if (SOCKET_ERROR == WSASStartup (0x0101, &WsaData))
/* errors are not read yet, so we use english text here */
my_message(ER_WSAS_FAILED, "WSASStartup Failed", MYF(0));
unreg_abort(1);
}
#endif /* __WIN__ */

if (init_common_variables(MYSQL_CONFIG_NAME,
                        argc, argv, load_default_groups))
unreg_abort(1); // WTI1 do exit

init_signals();
if (T(opt_specialflag & SPECIAL_NO_PRIOR))
my_thread_setprio(pthread_self(), CONNECT_PRIOR);
    
```

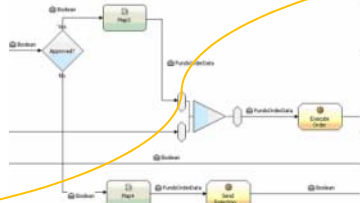
Applications



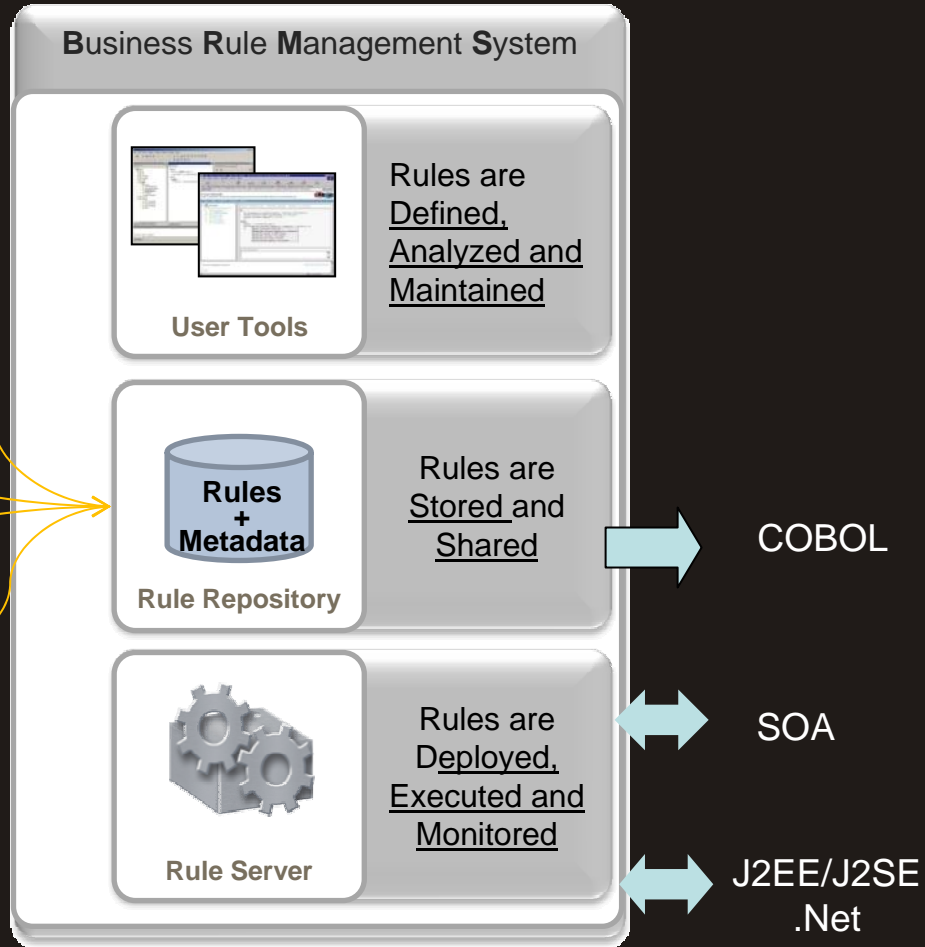
People



Documents



Processes



BRMS Usage Across Industries

Banking

- Loan Origination
- Credit Decisioning
- Sales Advisory
- Payments
- Accounting

Insurance

- Claims Processing
- Underwriting
- Quoting
- Rating
- Commissioning

Capital Markets

- Automated Trading
- Trade Order Management
- Accounting
- Compliance KYC / AML
- On Boarding

Public Sector

- Claims Processing
- Entitlement and Benefit calculation
- Fraud Detection and Management
- Screening and Targeting

Telecom

- Offer Configuration
- Order Management
- Fraud Detection and Management
- Loyalty Programs
- Network Monitoring

Transportation & Travel

- Promotions Management
- Loyalty Programs
- Customer Service
- Billing
- Contract Management

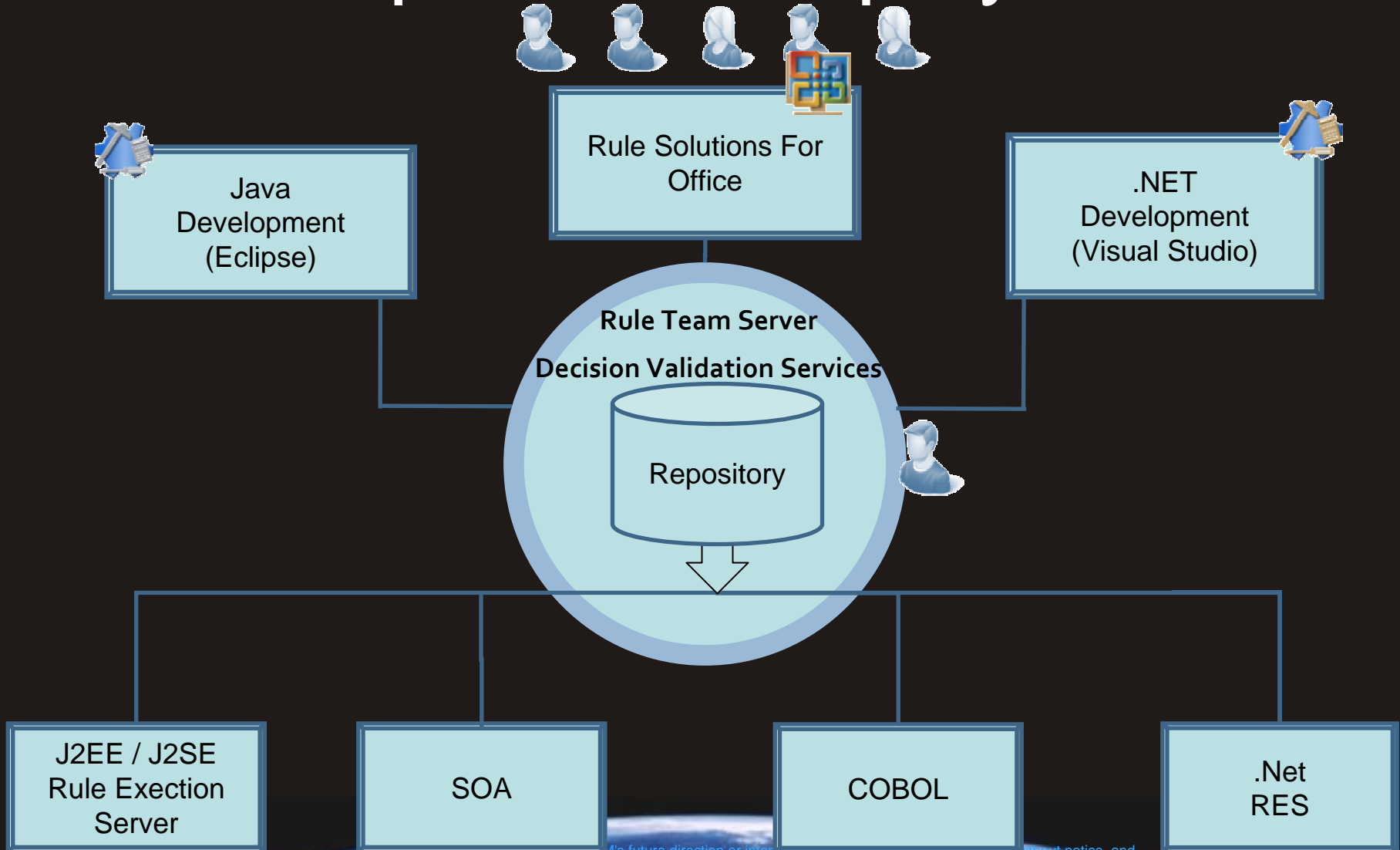
Retail

- Online recommendation
- Campaign Management
- Order Management
- Pricing

Manufacturing

- Production quality control
- Order Management
- Billing
- Contract Management

Multiplatform Deployment



WebSphere ILOG JRules 7.0

Business Rules: an Enterprise Asset

Business is in the
driver seat

Business Rules can
be deployed
everywhere

New change control
and governance
processes

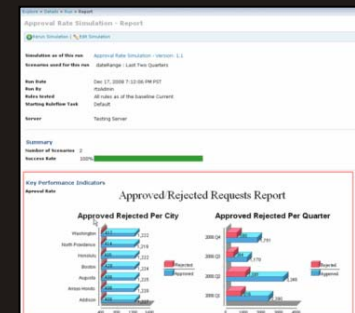
Business Experts Empowerment

New in Version 7.0

- Integrated rule testing and simulation (Decision Validation Services)
- Improved rule analysis and reporting for decision traceability and insights
- Integration with Microsoft Office Word and Excel for guided, offline rule editing and extended reach (Rule Solutions for Office)

Scenario Name	Expected	Actual
Scenario 1	TRUE	1590.45
Scenario 2	TRUE	1752.41
Scenario 3	TRUE	3190.01
Scenario 4	TRUE	1752.41
Scenario 5	FALSE	

Label	Run	Pass	Fail	Skipped	Failed	Not Run
Run Test Rule - Scenario 1	1	1	0	0	0	0
Run Test Rule - Scenario 2	1	1	0	0	0	0
Run Test Rule - Scenario 3	1	1	0	0	0	0
Run Test Rule - Scenario 4	1	1	0	0	0	0
Run Test Rule - Scenario 5	1	0	1	0	0	0



Rules Solutions for Office Business Rules in Excel + Word 2007

Excel Window: FishstoreDT 20070413.xlsx - Microsoft Excel

	A	B	C	D	E
1	Purchase Value	Category	Apply Discount	Display Message	
2	min	max			
3					
4	100	200	Silver 10	We've given you a 10% discount	
5			Gold 15	We've given you a 15% discount	
6			Platinum 20	We've given you a 20% discount	
7	200	300	Silver 15	We've given you a 15% discount	
8			Gold 20	We've given you a 20% discount	
9			Platinum 25	We've given you a 25% discount	
10			Silver 20	We've given you a 20% discount	
11			Gold 25	We've given you a 25% discount	
12			Platinum 30	We've given you a 30% discount	

Word Window: Word Tutorial - copied.docx - Microsoft Word

Pricing Policies Page 3

The following business rule defines the price of the Default Special Offer. The price is computed from the base price.

Define the Pricing of the Default Special Offer

Author: orti
Creation Date: 3/27/2007

Last Modification Author: ilog
Last Modification Date: 6/22/2007
DD: True

Definitions
Set 'the percentage' to 10;

if
The rental agreement qualifies for the "Default" offer

Then
Set the rental agreement "Default" discount to 'the percentage';
Set the rental agreement "Default" price to the rental agreement "Base" price * (1 - 'the percentage' / 100);
Display the message: "The Default special offer corresponds to a 10% rebate on the Base offer price.";

RuleDoc Outline

- Compute the Base Rate
- Check the Eligibility for the Defa...
- Define the Pricing of the Default...
- Check the Eligibility for the Long...
- Define the Pricing of the Long Te...

Rule Properties

Problem List

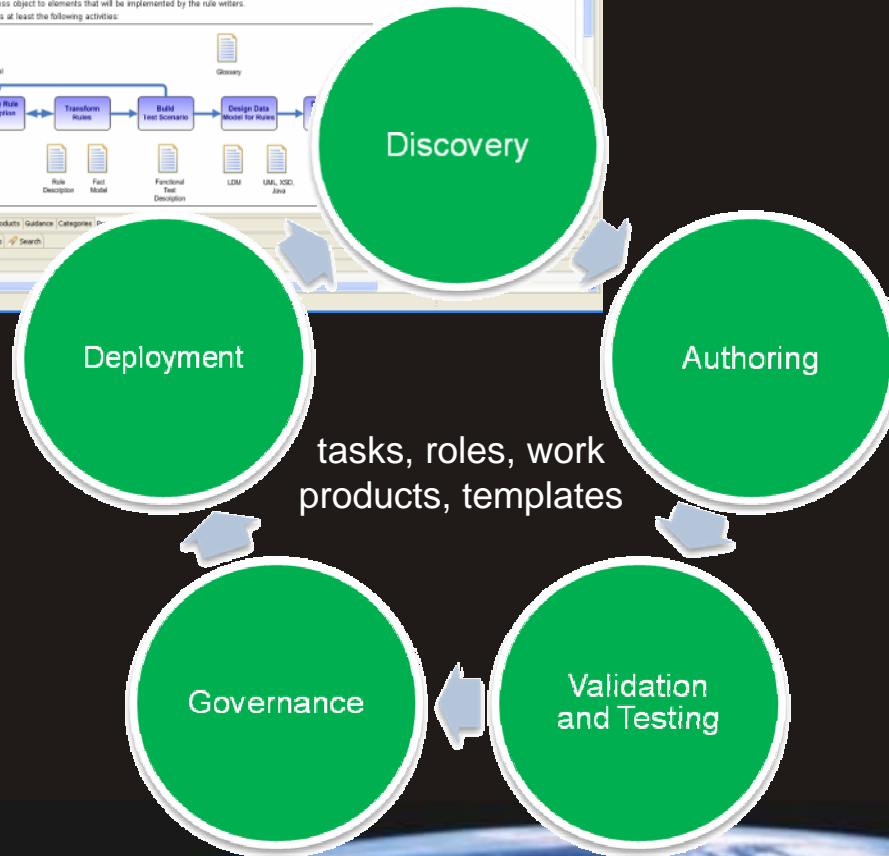
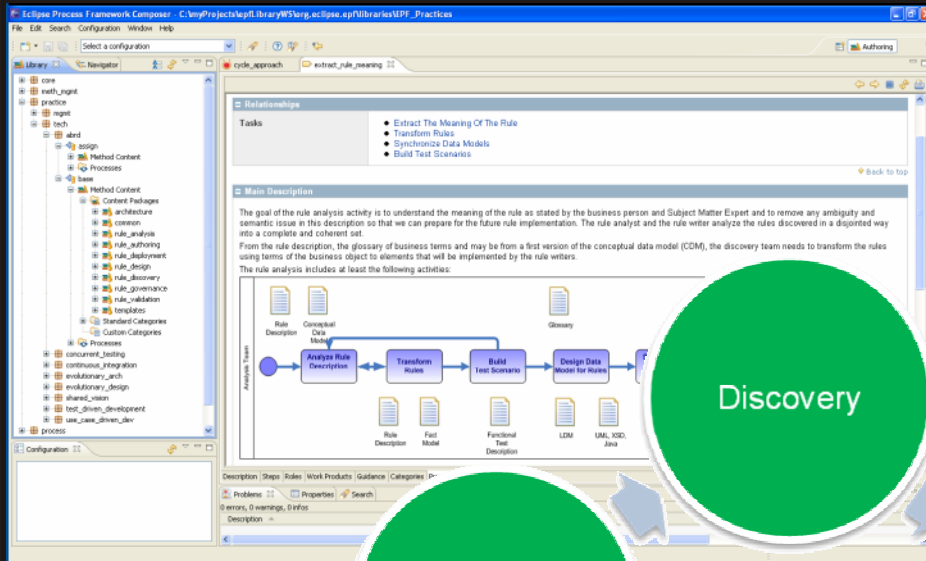
- The word "," is not required.
- The place holder '<a coverage n...
- The place holder '<a rental agre...
- The word "<a Boolean>" is missin...

WebSphere ILOG Rules for COBOL

- Rules managed in ILOG BRMS
 - Expressed in business terms
 - Version controlled
 - Able to change when the business needs it
 - Maintained with collaborative web tools
- Can be reused across applications, yet run natively in the COBOL code



Methodology for an agile infrastructure



- ABRD - First Open Source BR Methodology
- Best Practices based on 100's project
- Part of Eclipse Process Framework

www.eclipse.org/epf

Decision Services – where to start

1. Identify decision points in your architecture
 - Decisions that change frequently
 - Decision logic that the business wants to own
2. Refactor and externalize Business Rules
 - Business Terms, Facts, Policies, and Policy Enforcement Criteria (Rules) are the bedrock of successful BRMS applications.
3. Expose Business Rules as a Transparent Decision Service
4. Establish the rules governance process
 - What is the life cycle of decision logic from requirement to deployment?
 - What is the business context and motivation for changes?
 - What should be the governance process?
5. Involve the business at every stage
 - Business involvement ensures that Terms, Facts and business policies are clearly understood and properly represented.

Optimization

The science of Better Decisions



How to best allocate aircrafts and crews?



inventory cost vs. customer satisfaction?



What to build, where and when?

Optimization helps businesses:

- create the best possible plans
- explore alternatives and understand trade-off
- respond to changes in business operations

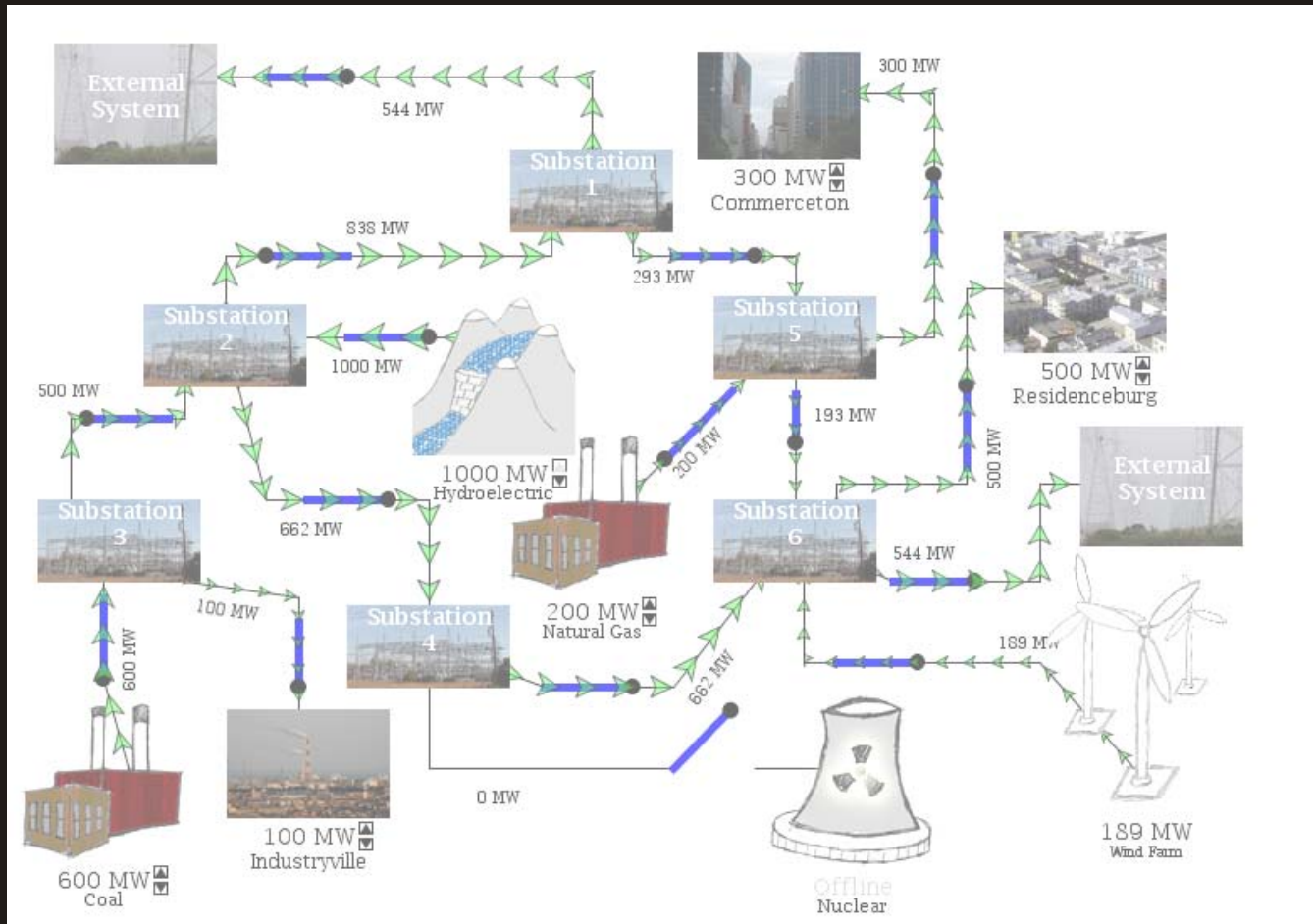


Risk vs. potential reward?

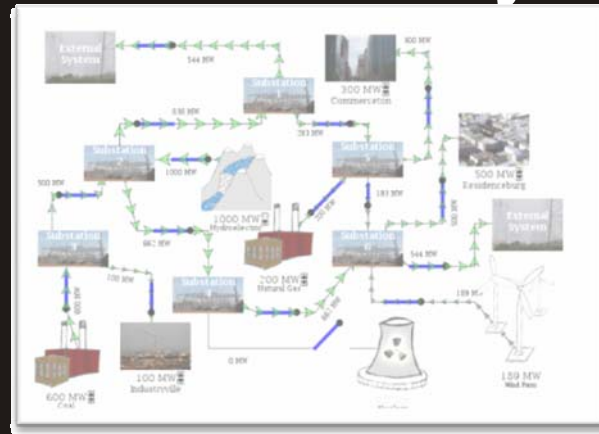


Cost vs. carbon emission?

Example: Optimizing the production of electricity



Optimizing the production of electricity



10 years ago

Could not be solved
using standard solvers

Today

- ✓ Solvable to optimality
- ✓ Re-optimized daily
- ✓ Clean energy enabled

Optimization is used across industries

Retail and Healthcare

- Product configuration
- Space management
- Pricing & promotions optimization
- Workforce scheduling
- Marketing campaign optimization

Financial Services

- Portfolio optimization and rebalancing
- Portfolio in-kinding
- Trade crossing
- Loan pooling
- Product/price recommendations

Transportation & Logistics

- Depot/warehouse location
- Fleet assignment
- Network design
- Vehicle routing & scheduling
- Vehicle & container loading
- Crew & driver scheduling
- Maintenance scheduling

Manufacturing

- Plant location
- Plant layout
- Supply chain management
- Production planning
- Detailed scheduling
- Combinatorial auctions for procurement

Utilities, Energy & Natural Resources

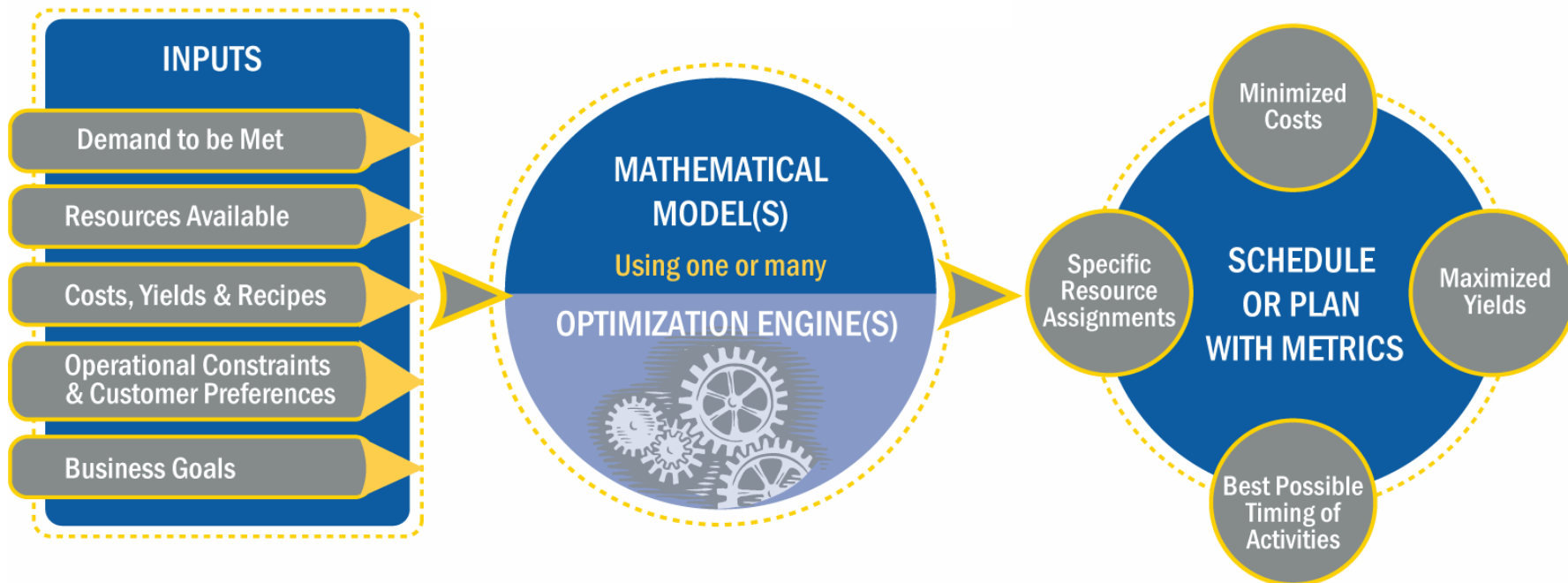
- Supply portfolio planning
- Power generator scheduling
- Distribution planning
- Water reservoir management
- Mine operations
- Timber harvesting

Telecom

- Network capacity planning
- Routing
- Adaptive network configuration
- Antenna and concentrator location
- Equipment and service configuration
- Field technician dispatching

From Strategic Planning to Real-Time Detailed Scheduling

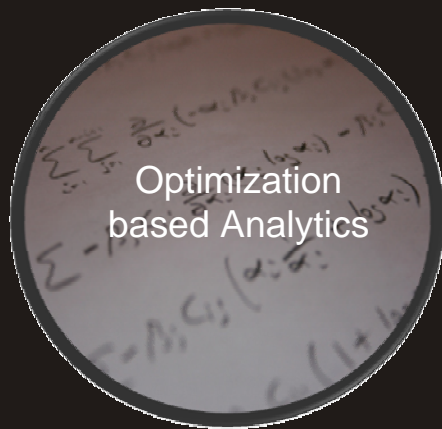
Structure of Optimization Models



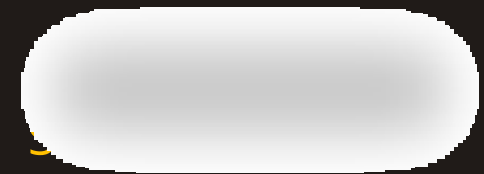
Two Core Engine Technologies

- Mathematical Programming (MP)
 - ILOG CPLEX delivers high-performance, robust, flexible optimizers for solving linear, mixed-integer and quadratic programming problems
 - For mission-critical resource allocation applications
- Constraint Programming (CP)
 - ILOG CP Optimizer delivers high performance for detailed scheduling problems over fine-grained time
 - Also for combinatorial problems with highly logical business constraints

Turning optimization based analytics into decision-making applications



CPLEX
CP Optimizer



Systems

IBM ILOG Optimization Decision Manager Enterprise



Optimization
based Analytics

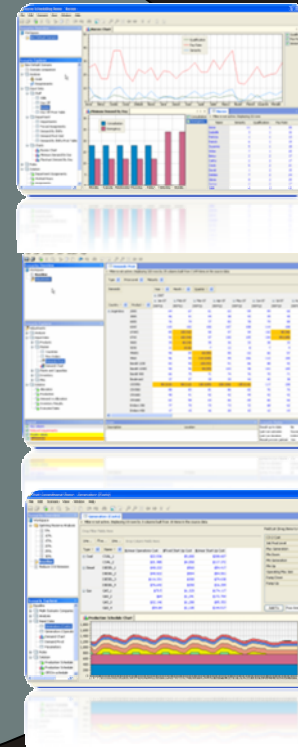
What-if Analysis

Data Analysis

Interactive
Visualization

Collaboration

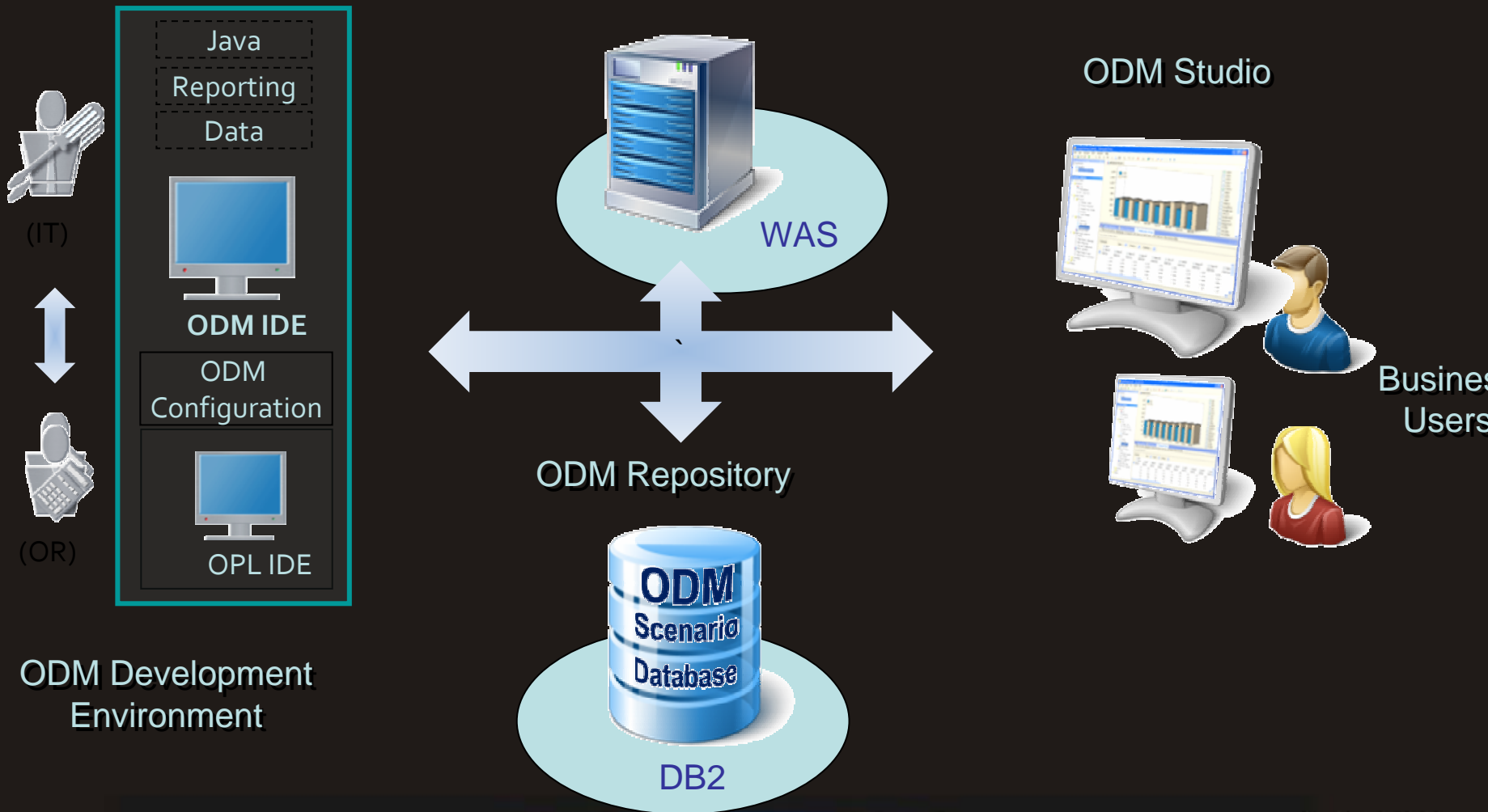
Enterprise
Deployment



IT and
LOB
Executives

IBM ILOG ODM Enterprise

ODM Optimization Server



ODM Development Environment

ODM Studio

Business Users

ODM Repository

ODM Scenario Database

DB2

WAS

1 – Traditional Power Generation

Unit Commitment Demo - Generators (Costs)

File Edit Scenario View Window Help

Scenarios Overview

- Workspace
 - Spinning Reserve Analysis
 - 5%
 - 10%
 - 15%
 - 20%
 - 25%
 - 30%
 - Baseline**
 - Reduce CO2 Emission

Generators (Costs)

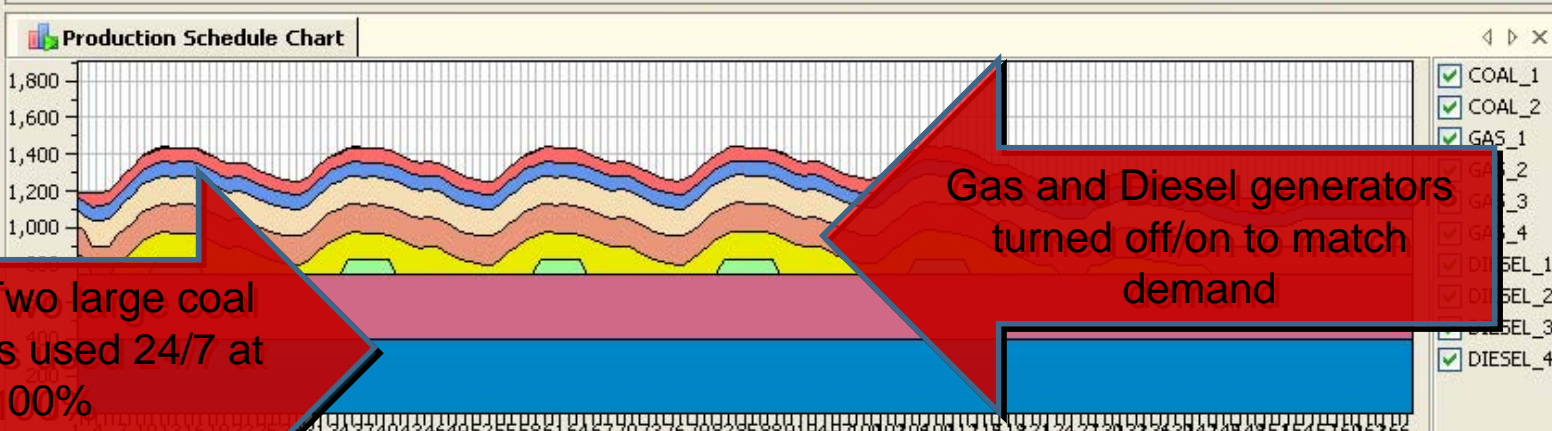
Filter is not active. Displaying 10 rows by 3 columns built from 10 items in the source data

Drop Filter Fields Here

Drop Column Fields Here

Type	Name	\$Linear Operations Cost	\$Fixed Start Up Cost	\$Linear Start Up Cost
Coal	COAL_1	\$22.536	\$5,000	\$208.607
	COAL_2	\$31.985	\$4,550	\$117.372
Diesel	DIESEL_1	\$40.222	\$560	\$54.417
	DIESEL_2	\$40.522	\$554	\$54.551
	DIESEL_3	\$116.331	\$300	\$79.638
	DIESEL_4	\$76.642	\$250	\$16.259
Gas	GAS_1	\$70.5	\$1,320	\$174.117
	GAS_2	\$69	\$1,291	\$172.754
	GAS_3	\$32.146	\$1,280	\$95.353
	GAS_4	\$54.84	\$1,105	\$144.517

Approach:
consider only operating costs



Result: Two large coal generators used 24/7 at 100%

- COAL_1
- COAL_2
- GAS_1
- GAS_2
- GAS_3
- GAS_4
- DIESEL_1
- DIESEL_2
- DIESEL_3
- DIESEL_4

2 – Considering CO2 costs

Unit Commitment Demo - Generators (Costs)

File Edit Scenario View Window Help

Drop Filter Fields Here

Drop Column Fields Here

Scenarios Overview

Workspace

- Spinning Reserve Analysis
 - 5%
 - 10%
 - 15%
 - 20%
 - 25%
 - 30%
 - Baseline**
 - Reduce CO2 Emission

Generators (Costs)

Filter is not active. Displaying 10 rows by 4 columns built from 10 items in the source data

Type	Name	\$Linear Operations Cost	\$Fixed Start Up Cost	\$Ramp Start Up Cost	\$CO 2 Cost
Coal	COAL_1	\$22.536	\$5,000	\$208.607	\$30
	COAL_2	\$21.885	\$4,500	\$117.372	\$30
Diesel	DIESEL_1	\$41.5	\$1,000	\$417	\$15
	DIESEL_2	\$41.5	\$1,000	\$417	\$15
	DIESEL_3	\$116.83	\$1,000	\$638	\$15
	DIESEL_4	\$76.64	\$1,000	\$16,259	\$15
Gas	GAS_1	\$70.5	\$1,320	\$174.117	\$5
	GAS_2	\$69	\$1,200	\$172,754	\$5
	GAS_3	\$32.146	\$1,200		
	GAS_4	\$54.84	\$1,200		

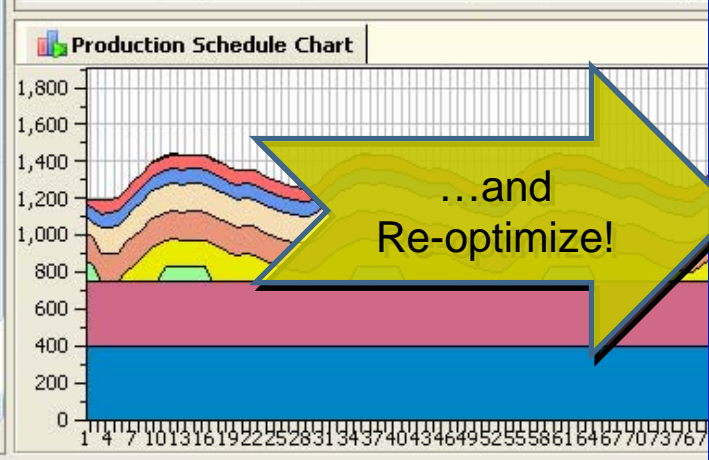
Field List (Drag Items to the Pivot Grid):

- Init Prod Level
- Max Generation
- Min Down
- Min Generation
- Min Up
- Operating Max Gen
- Ramp Down
- Ramp Up

**Green approach:
Add CO2 emission
cost & cap it**

Scenario Explorer

- Baseline
- Multi-Scenario Comparison
- Analysis
- Input Data
 - Generators (Costs)
 - Generators (Operati...)
 - Demand Chart
 - Demand Pivot
 - Parameters
- Rules
- Solution
 - Production Schedule
 - Production Schedule
 - Off/On schedule



Solve Progress

Detailed Solve Progress

Combined Objective

Fuel Cost

Best Solution Found: 8101517.53

Best Possible Optimal Solution: 8100805.22

Percent from Optimal: 0.01 %

Fuel Cost: \$8,089,735.526

Solution found

Relax more requirements | Accept relaxation level | 0:00:18

Close this dialog box when solve completes | Continue in background... | Close

3 – Review new “greener” schedule

Unit Commitment Demo - Goals

File Edit Scenario View Window Help

Scenarios Overview

Workspace

- Spinning Reserve Analysis
 - 5%
 - 10%
 - 15%
 - 20%
 - 25%
 - 30%
- Baseline
 - Reduce CO2 Emission

Goals

Goal Name	Value	Active	Importance Factor
Fuel Cost	\$8,845,765.132 (8,089,735.526)	<input checked="" type="checkbox"/>	
Start Up Cost	\$6,600 (11,782)	<input checked="" type="checkbox"/>	
Ecological Cost	\$4,000,000 (4,518,328)	<input checked="" type="checkbox"/>	

Constraints

Name	Value
Constrain max to	Ecological Cost
Constrain min to	4,000,000
With priority	Mandatory

Bound Searches

Name	Value
COAL_1	\$2,016,000
COAL_2	1,144,944 (1,764,000)
DIESEL_1	196,560 (196,299)
DIESEL_2	191,520 (190,455)
GAS_1	31,708 (13,417)

Production Schedule Chart

At limited cost: Increased operating costs mostly offset by CO2 savings!

New schedule: 2nd coal generator only used as necessary – replaced by cleaner gas

Scenario Explorer

- Reduce CO2 Emission
 - Multi-Scenario Comparison
 - Analysis
 - Goals
 - Requirements
 - Input Data
 - Rules
 - Solution
 - Production Schedule
 - Production Schedule Chart
 - Off/On schedule
 - Gantt (Requires JViews)
 - Units Schedules
 - KPI



With IBM ILOG Optimization Decision Manager and IBM ILOG CPLEX, Red Electrica is

- reducing CO2 emission by 2.5% (100,000 tons/year)
- incorporating wind power into the grid
- saving 50,000 - 100,000 euros/day

Supply Chain Applications

LogicNet Plus

Inventory Analyst

Plant Power Ops

Optimization

ODM Enterprise

ODM

OPL Studio

CPLEX

CP Optimizer

Visualization

JViews

ILOG Elixir
(Flex)

Diagram .Net
Gantt .Net

Views (C++)

Business Rules Management

JRules

Rules for .Net

Rules for
COBOL

Smart Work for a Smarter Planet



Thank You

