
RCADT
DIPLOMADOS VIRTUALES PERMANENTES
DECISIONWARE
MACHINE LEARNING & OPTIMIZATION
USING
MATHEMATICAL PROGRAMMING TECHNOLOGIES
GLPK
GMPL
COIN-OR
GLOP
python
C++
PYOMO
LINGO
LINDO
TOMLAB
OPTIMIZATION
GUROBI
OPTIMIZATION
KNITRO
julia
IBM
OPL /
CPLEX
GAMS
AMPL
AIMMS
PRESCRIPTIVE
ANALYTICS
PLATFORM
IBM
DECISION
OPTIMIZATION
CENTER
FICO
XPRESS
OPTIMIZATION
SUITE
sas
OPTIMIZATION

DIPLOMADOS VIRTUALES PERMANENTES

MACHINE LEARNING & OPTIMIZATION USING MATHEMATICAL PROGRAMMING TECHNOLOGIES

CURSOS DISPONIBLES:

- C++
- GAMS
- AMPL
- AIMMS
- PYTHON-PYOMO
- XPRESS-MOSEL
- IBM-CPLEX OPTIMIZATION STUDIO (OPL)

STRUCTURED MATHEMATICAL MODELING

GLPK GMPL · COIN-OR · GLOP · python · C++ · PYOMO · LINGO LINDO · GUROBI OPTIMIZATION · KNITRO · TOMLAB OPTIMIZATION · julia · IBM OPL / CPLEX · GAMS · AMPL · AIMMS PRESCRIPTIVE ANALYTICS PLATFORM · IBM DECISION OPTIMIZATION CENTER · FICO XPRESS OPTIMIZATION SUITE · sas OPTIMIZATION

DESCUENTO TEMPORAL

HASTA EL 30 DE JUNIO DE 2021

DECISIONWARE
MAKING YOUR WORLD SMARTER

DIPLOMADO

MACHINE LEARNING & OPTIMIZATION USING MATHEMATICAL PROGRAMMING TECHNOLOGIES

MARCO DE REFERENCIA

GO BACK

MATHEMATICAL PROGRAMMING

Son múltiples los tipos de modelos basados en Programación Matemática (**MP**) que pueden ser requeridos por una organización, cada uno de ellos con fines específicos y complementarios; se pueden nombrar:

- Optimización
- Equilibrio General Computable
- Modelos Estadísticos y/o Econométricos
- Dinámica de Sistemas
- Generadores Sintéticos de Variables Aleatorias
- Modelamiento de Procesos Estocásticos

A pesar de su diversidad, los diferentes tipos de modelos cumplen con una característica común: se pueden formular por medio de expresiones algebraicas propias de la programación matemática, o sea que todos pueden ser resueltos utilizando:

- Un solver fundamentado en las leyes matemáticas de la optimización
- Un lenguaje de programación de bajo nivel en el que se programen la interfaz entre la formulación algebraica y el solver de programación matemática
- Un lenguaje de programación de alto nivel orientado a manejar formulaciones algebraicas y la interfaz con el solver

SOLVER PROGRAMACIÓN MATEMÁTICA

LENGUAJE DE PROGRAMACIÓN DE BAJO NIVEL

LENGUAJE ALGEBRAICO DE ALTO NIVEL

OPTIMIZATION TECHNOLOGIES

OPTIMIZATION INFORMATIC PLATFORM

IBM DECISION OPTIMIZATION CENTER

FICO XPRESS OPTIMIZATION SUITE

AIMMS PRESCRIPTIVE ANALYTICS PLATFORM

SAS OPTIMIZATION

OPTIMIZATION INFORMATIC PLATFORM.
They correspond to it platforms that integrate all the problems of implementing decision support systems. They are products similar to OPTEX but to date do not include tools for handling the problems associated with mathematical programming 4.0

LOW-LEVEL PROGRAMMING LANGUAGE

julia, R, python, Java, C++

HIGH-LEVEL ALGEBRAIC LANGUAGE

AMPL, GAMS, GMPL, IBM OPL, FICO Mosel, AIMMS, SAS OPTIMIZATION, LINGO, TOMLAB OPTIMIZATION

PROGRAMMING LANGUAGE.
They are products oriented to the development of optimization models and focus on providing the mathematical modeler with a means to implement integrated optimization models and (some of them) allow implementation of large-scale methodologies. They are not oriented to the integration of mathematical models as OPTEX does, and do not stimulate the standardization of the mathematical modeling process. OPTEX generates source programs for most of the referenced products and therefore, more than competition, OPTEX is a user of these methodologies.

OPTIMIZATION SOLVERS

GLPK, COIN-OR, LPS, GLOP, KNITRO, LINDO, IBM CPLEX, FICO Xpress, GUROBI OPTIMIZATION

OPTIMIZATION SOLVERS.
They are highly specialized products based on the mathematical laws of optimization. They are the basis of all high-complexity mathematical optimization.

TECNOLOGÍAS DE PROGRAMACIÓN MATEMÁTICA

Cursos disponibles:

- C++
- GAMS
- AMPL
- AIMMS
- PYTHON-PYOMO
- XPRESS-MOSEL
- IBM-CPLEX Optimization Studio (OPL)

Cada diplomado esta compuesto por dos módulos:

- **Módulo Básico**
- **Módulo Avanzado**

Se estudia el manejo de múltiples solvers

GLPK COIN-OR LPS GLOP KNITRO LINDO IBM CPLEX FICO Xpress GUROBI OPTIMIZATION

CURSOS EN OTRAS TECNOLOGÍAS PUEDEN DESARROLLARSE A PETICIÓN DEL INTERESADO.

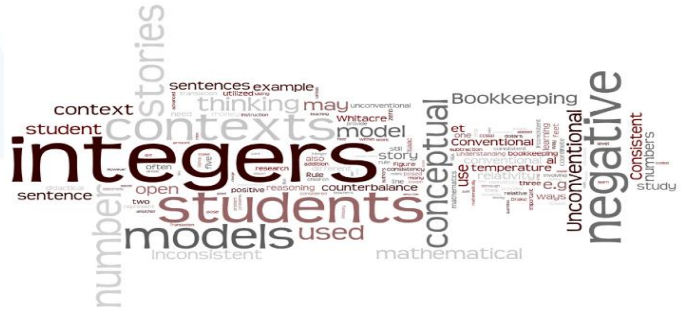
TECNOLOGÍAS DE PROGRAMACIÓN MATEMÁTICA

ESTRUCTURA:

El diplomado avanzado **ADVANCED ANALYTICS & OPTIMIZATION USING OPTIMIZATION TECNOLOGIES**, hace parte del programa de educación continuada **MATHEMATICAL PROGRAMING ANALYST**, está orientado a capacitar al participante en los principales problemas que se deben resolver en la planificación de largo y de mediano, y en la programación de corto plazo de sistemas reales. Para cualquier tecnología se imparten dos módulos:

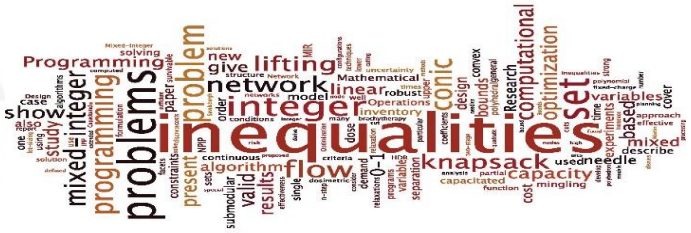
- **BASIC OPTIMIZATION:** capacitación en la solución de problemas integrados utilizando una tecnología de optimización especifica. La mayoría de ejemplos están relacionados con problemas reales cuya solución se puede realizar con modelos de optimización.

- **ADVANCED OPTIMIZATION:** capacitación en la solución de problemas avanzados utilizando GAMS. El carácter avanzado radica en la solución de los múltiples problemas en los que se puede descomponer un problema complejo. Se enseña el uso de modelos basados en metodologías de optimización de gran escala, como Benders y Relajación Lagrangeana.



DIRIGIDO A:

Profesionales (ingenieros, matemáticos, físicos, consultores, economistas, "data analyst", desarrolladores de software, …) que requieran o desean conocer las nuevas tecnologías de optimización vigentes de acuerdo con el estado del arte de la computación, los algoritmos de optimización y las tecnologías de gran escala.



Source: http://ieor.berkeley.edu/~atamturk/bcol/

ALL MATHEMATICAL MODELS DEVELOPED BY DECISIONWARE USE OPTEX

- **OPTEX – Optimization Expert System**
  https://www.linkedin.com/pulse/optex-optimization-expert-system-new-approah-make-models-velasquez/

TECNOLOGÍAS DE PROGRAMACIÓN MATEMÁTICA

FUNDAMENTOS:

DW ha desarrollado OPTEX, el primer robot capaz de generar modelos matemáticos de optimización haciendo uso de metodologías para la solución de problemas de gran tamaño (Teoría de Benders, Relajación Lagrangeana, Danbtzig-Wolfe, …) utilizando múltiples tecnologías de optimización (GAMS, AMPL, IBM-OPL, PYTHON-PYOMO, C, …) para construir hipotálamos artificiales para las empresas. Las metodologías que soportan a OPTEX se denominan Modelamiento Matemático Estructurado (MME).

METODOLOGÍA:

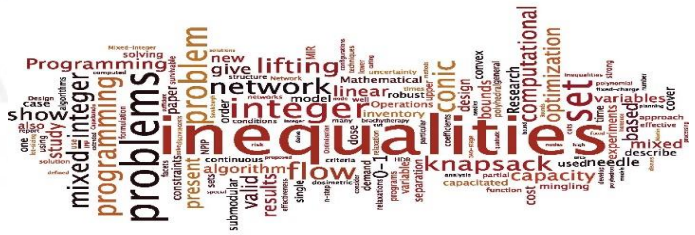
Considerando que el MME. Genera una ventaja competitiva para los modeladores, todos los diplomados aplicados para las diferentes tecnologías de optimización están soportados en estos conceptos.

Por lo anterior los cursos se componen de dos partes:

i) Conceptos de MME., y
ii) Implementación de MME en las diferentes tecnologías.

Para facilitar la comprensión de los conceptos, como material de los cursos se entregan modelos matemáticos desarrollados con los conceptos de MME. En las diferentes tecnologías, de tal modo que el estudiante pueda utilizarlos para el aprendizaje de los conceptos MME y su implementación en las tecnologías de interés.

Los conceptos MME. Se dividen en dos niveles: básicos y avanzados. Los básicos están orientados a la implementación de modelos integrados, en tanto que los avanzados están orientados a la implementación de modelos de gran tamaño haciendo uso de la partición y la descomposición de los problemas matemáticos.



TARIFA REDUCIDA PARA ESTUDIANTES

Programación Flexible: Los participantes podrán ir pagando en la medida que toman los módulos.

Source: http://ieor.berkeley.edu/~atamturk/bcol/

THE MODERN OPTIMIZATION REQUIREMENTS

1. **Structured Mathematical Modeling**

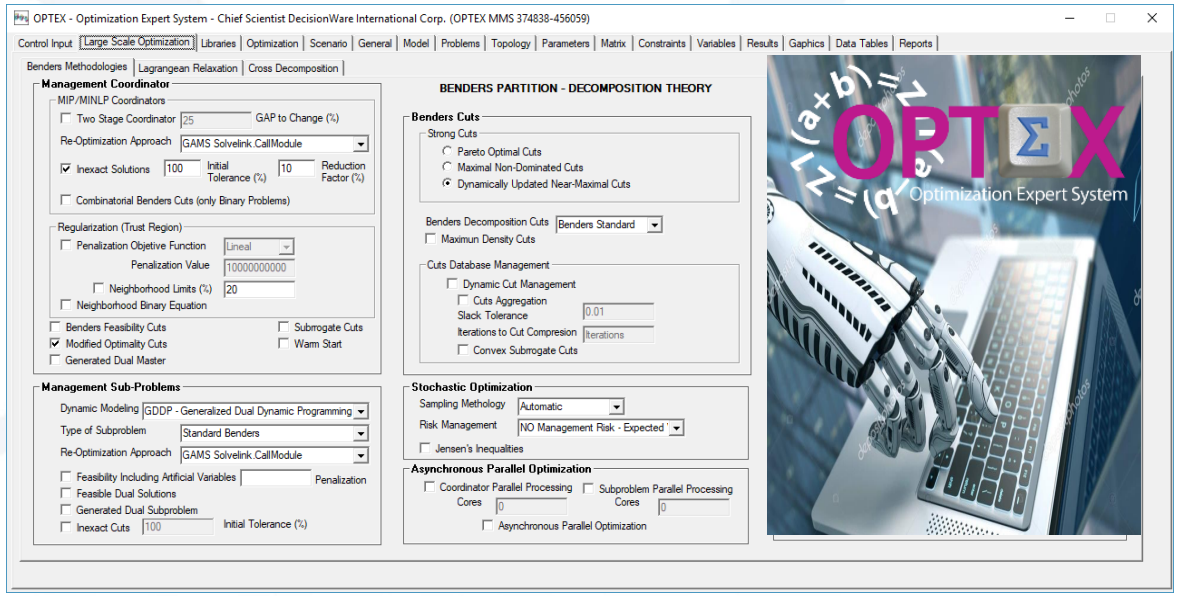
2. **Expert Optimization Systems**
   (Capitalization of the knowledge in optimization)

3. **Standardization & Normalization**
   (Easy connection of multiple mathematical models).
   Making easy the implementation of complex mathematical models

4. **Socialization of large-scale technologies to the community of mathematical modelers.**

5. **The large-scale methodologies must be connected in a similar way that actually we connect the basic solvers.**

6. **Real-Time Distributed Optimization.**
   A new look of optimization according to the real-world technologies:
   - **Internet of Things (IoT)**
   - **Industrial Internet of Things (IIoT)**
   - **Smart Metering**
   - **Big Data**



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DIPLOMADO

MACHINE LEARNING & OPTIMIZATION USING MATHEMATICAL PROGRAMMING TECHNOLOGIES

TECNOLOGÍAS DE OPTIMIZACIÓN
ROADMAP

GO BACK

OPTIMIZATION TECHNOLOGIES

OPTIMIZATION TECHNOLOGIES

COIN-OR · LPS · GLPK · LINDO · KNITRO · GUROBI OPTIMIZATION · FICO Xpress · IBM CPLEX

OPTIMIZATION LIBRARY

OPTIMIZATION TECHNOLOGIES

TIEMPO DE SOLUCIÓN DE LOS PROBLEMAS MATEMÁTICOS – COSTO DE LA OPERACIÓN

OPTIMIZATION LIBRARY

OPTIMIZATION TECHNOLOGIES

DB2 - ORACLE
EXCEL - DBF
SQL SERVER - MySQL

COMPUTER LANGUAGE

R, python, Java, C++

ALGEBRAIC LANGUAGE

GMPL, AMPL, GAMS, LINGO, AIMMS, FICO Mosel, IBM OPL

OPTIMIZATION LIBRARY

COIN-OR, LPS, GLPK, LINDO, KNITRO, GUROBI OPTIMIZATION, FICO Xpress, IBM CPLEX

OPTIMIZATION TECHNOLOGIES

DB2 - ORACLE

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COMPUTER LANGUAGE

ALGEBRAIC LANGUAGE

TIEMPO/COSTO DE IMPLEMENTACIÓN MODELOS MATEMÁTICOS

TIEMPO DE SOLUCIÓN DE LOS PROBLEMAS MATEMÁTICOS – COSTO DE LA OPERACIÓN

OPTIMIZATION LIBRARY

OPTIMIZATION TECHNOLOGIES

DB2 - ORACLE
EXCEL - DBF
SQL SERVER - MySQL

SYSTEM FOR DSS SYSTEMS

AIMMS
FICO
IBM ODME

COMPUTER LANGUAGE

R
python
Java
C++

ALGEBRAIC LANGUAGE

GMPL
AMPL
GAMS
LINGO
AIMMS
FICO Mosel
IBM OPL

COIN-OR
LPS
LINDO
KNITRO
GUROBI OPTIMIZATION
FICO Xpress
IBM CPLEX

OPTIMIZATION LIBRARY

OPTIMIZATION TECHNOLOGIES

DB2 - ORACLE
EXCEL - DBF
SQL SERVER - MySQL

SYSTEM FOR DSS SYSTEMS

TIEMPO/COSTO "DEPLOYMENT"

ODME

COMPUTER LANGUAGE

ALGEBRAIC LANGUAGE

TIEMPO/COSTO DE IMPLEMENTACIÓN MODELOS MATEMÁTICOS

GMPL AMPL LINGO AIMMS FICO Mosel IBM OPL

TIEMPO DE SOLUCIÓN DE LOS PROBLEMAS MATEMÁTICOS
COSTO DE LA OPERACIÓN

COIN-OR LPS GUROBI OPTIMIZATION FICO Xpress IBM CPLEX

OPTIMIZATION LIBRARY

MATHEMATICAL MODELING PROCESS

REAL WORLD

ALGEBRAIC MODEL

$$Min \quad \Psi = \sum_{t=1}^{T} \sum_{i=1}^{N_T} \psi_{(i,t)}$$

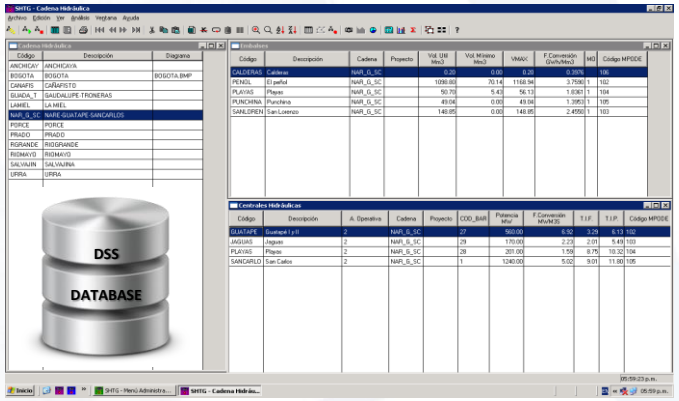
s.a.

$$\psi_{(i,t)} = \frac{c_{(i,t)}}{2} \cdot P_{(i,t)}{}^2 + e_{(i,t)} \cdot P_{(i,t)}$$

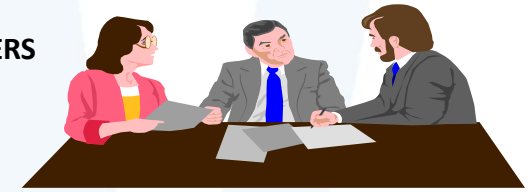
$$V_{(j,t+1)} = V_{(j,t)} + \tau \cdot \left(A_{(j,t)} - Q_{(j,t)} - S_{(j,t)} \right)$$

$$P_{(j,t)} = \rho_{(j)} \cdot Q_{(j,t)}$$

DATA MODEL

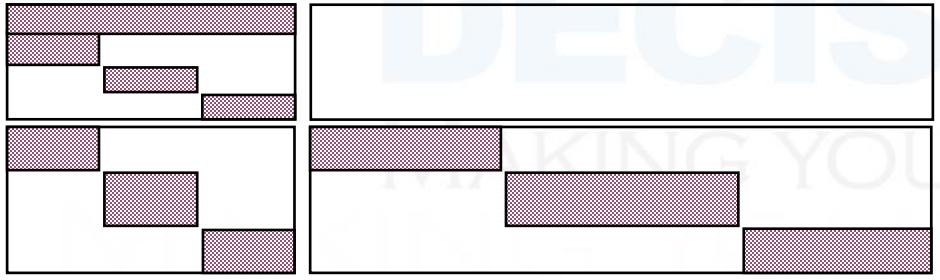


MODELERS

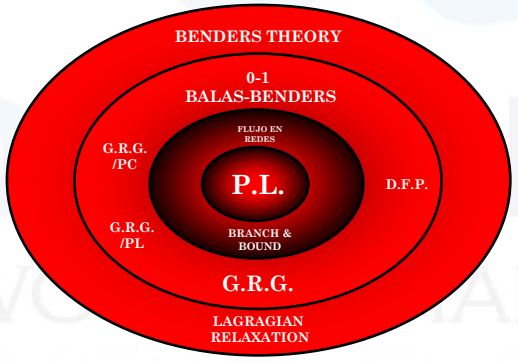


DECISION MAKERS

MATRIX GENERATION



NUMERICAL MODEL



MATHEMATICAL ALGORITHM

x, π

MATHEMATICAL MODELING PROCESS

REAL WORLD

ALGEBRAIC MODEL

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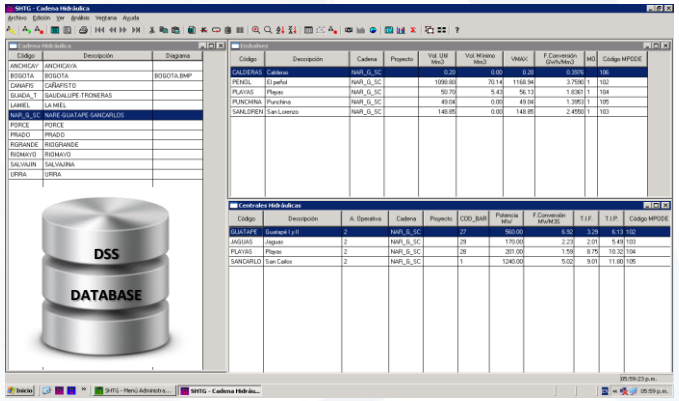
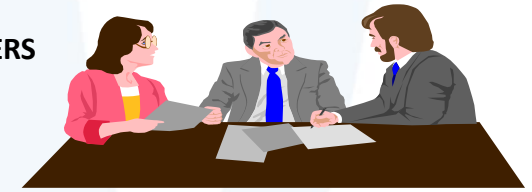
DATA MODEL

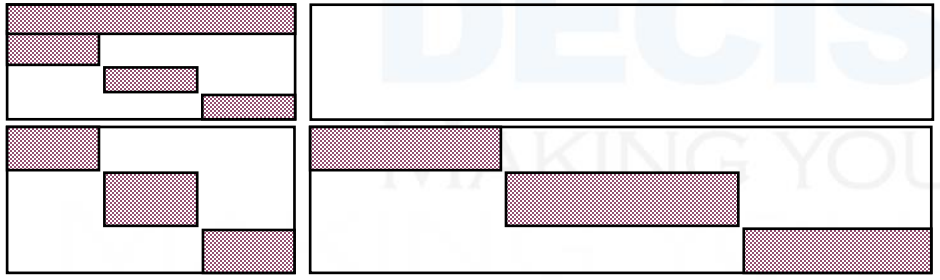


MODELERS



DECISION MAKERS

MATRIX GENERATION



NUMERICAL MODEL

GUROBI OPTIMIZATION · FICO Xpress · IBM CPLEX · KNITRO · LINDO · COIN-OR · LPS

MATHEMATICAL ALGORITHM

x, π

OPTIMIZATION DATABASE

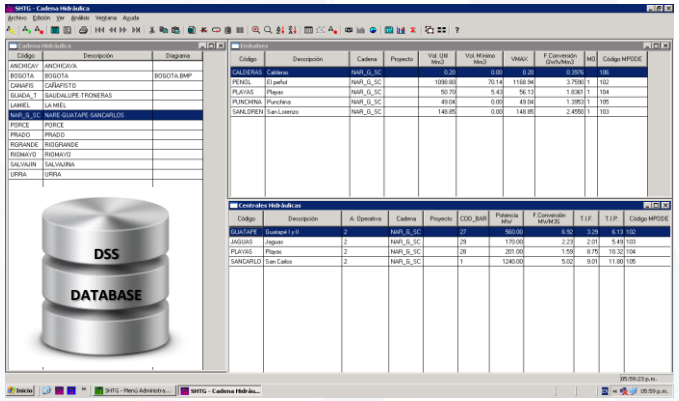
MATHEMATICAL MODELING PROCESS

REAL WORLD

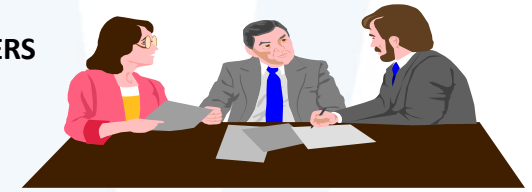
ALGEBRAIC MODEL

Fortran

DATA MODEL



MODELERS



DECISION MAKERS

MATRIX GENERATION

Fortran

OPTIMIZATION SUBROUTINES

NUMERICAL MODEL

GUROBI OPTIMIZATION
FICO Xpress
IBM CPLEX
KNITRO
LINDO
COIN-OR
LPS

MATHEMATICAL ALGORITHM

x, π

OPTIMIZATION DATABASE

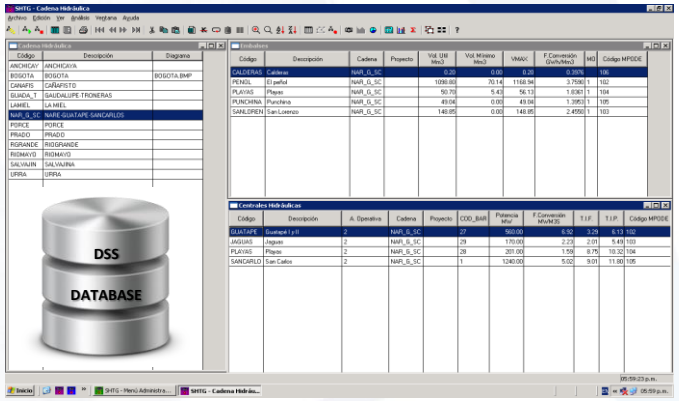
MATHEMATICAL MODELING PROCESS

REAL WORLD

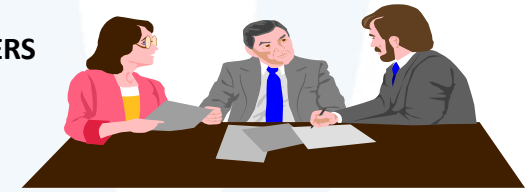
ALGEBRAIC MODEL

julia R python Java C++

DATA MODEL



MODELERS



DECISION MAKERS

MATRIX GENERATION

julia R python Java C++

LIBRARY OPTIMIZATION OBJECTS

NUMERICAL MODEL

GUROBI OPTIMIZATION FICO Xpress IBM CPLEX KNITRO LINDO COIN-OR LPS

MATHEMATICAL ALGORITHM

x, π

OPTIMIZATION DATABASE

MATHEMATICAL MODELING PROCESS

REAL WORLD

ALGEBRAIC MODEL

GAMS

IBM OPL

AMPL

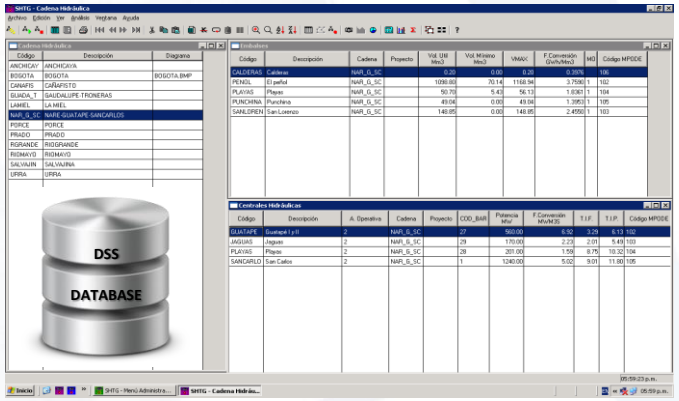
GMPL

FICO Mosel

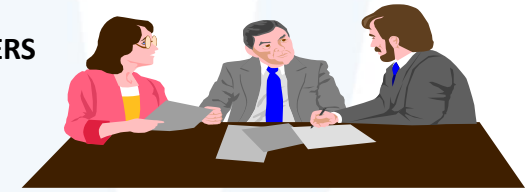
LINGO

AIMMS

DATA MODEL



MODELERS



DECISION MAKERS

MATRIX GENERATION

NUMERICAL MODEL

GUROBI OPTIMIZATION

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COIN-OR

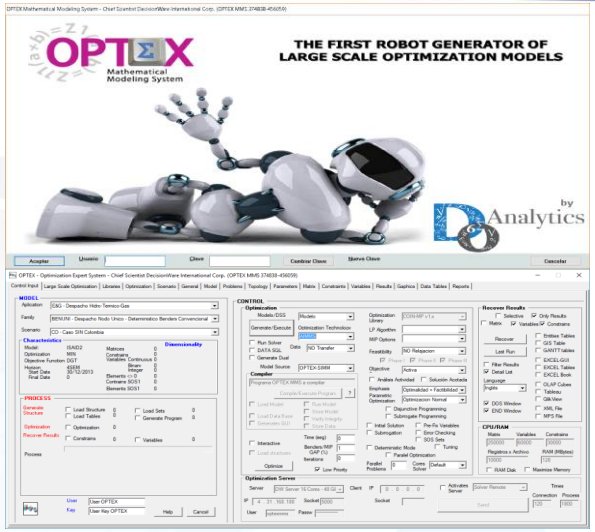
LPS

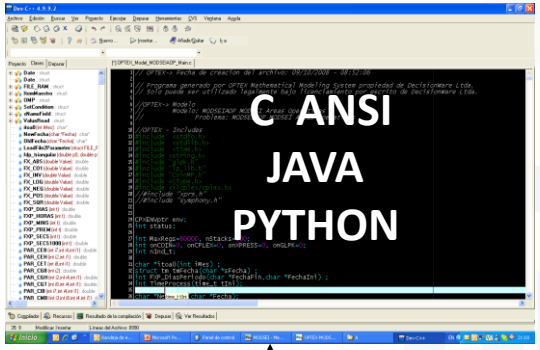
MATHEMATICAL ALGORITHM

x, π

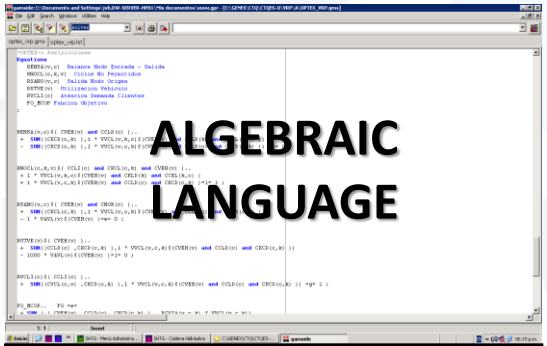
OPTIMIZATION DATABASE

DEVELOPING MATHEMATICAL MODELS





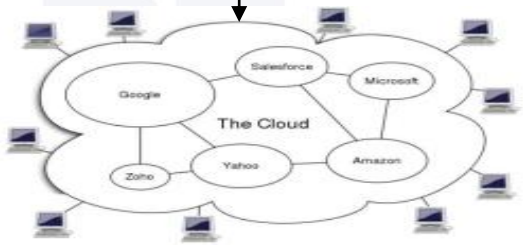
SOLVER



SOLVER

OPTEX
Mathematical Modeling System

CLOUD LINK



CLOUD SERVER

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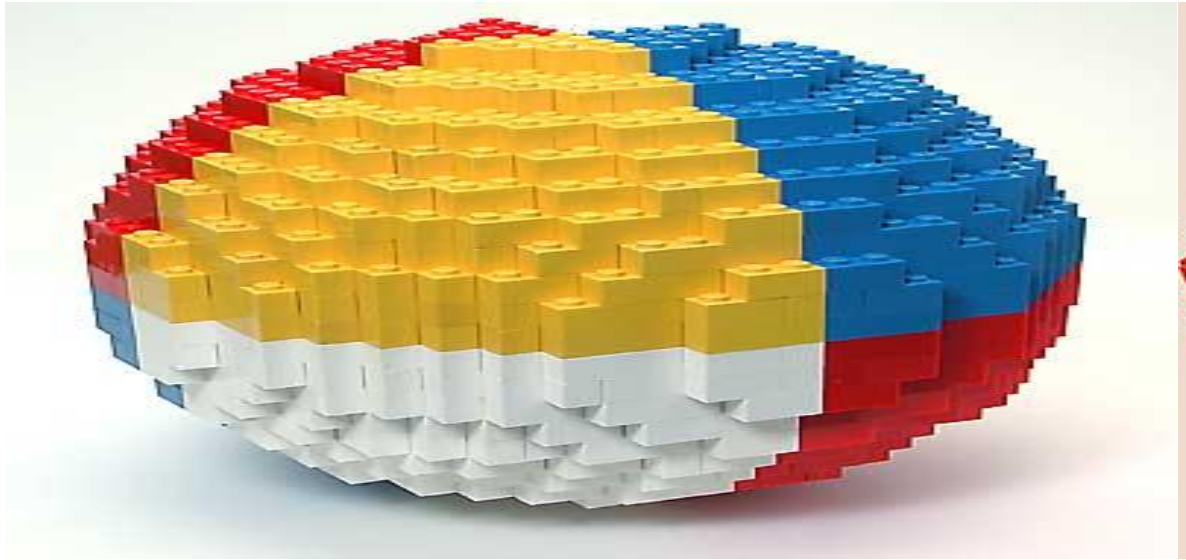
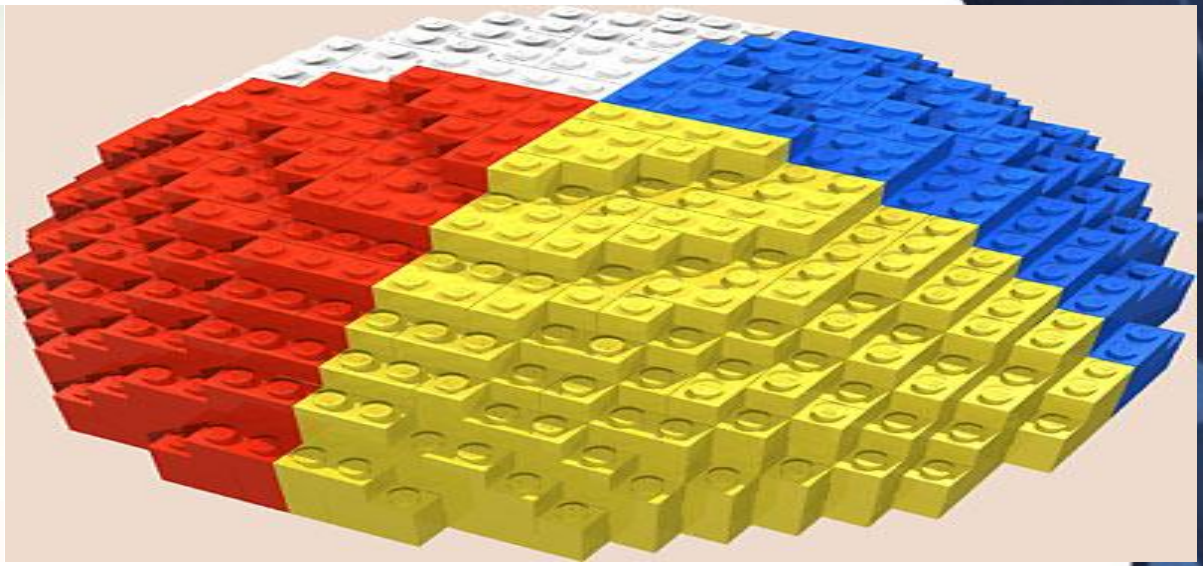
MACHINE LEARNING & OPTIMIZATION USING MATHEMATICAL PROGRAMMING TECHNOLOGIES

MODELAMIENTO MATEMÁTICO ESTRUCTURADO BÁSICO



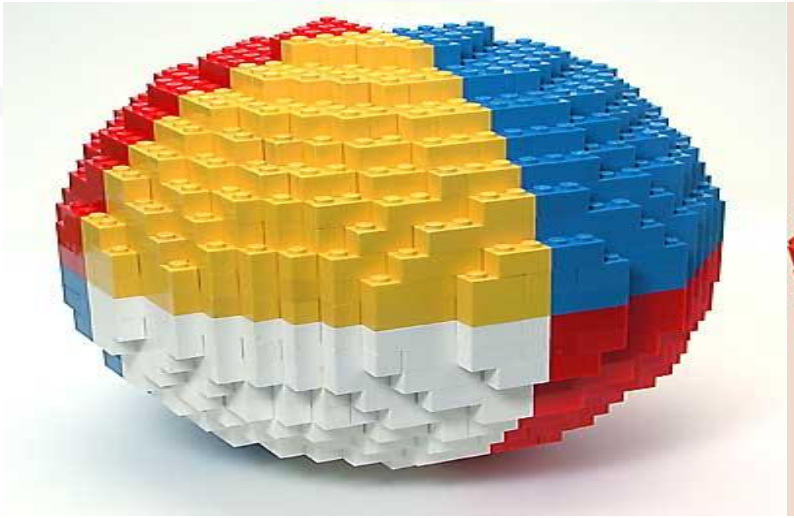


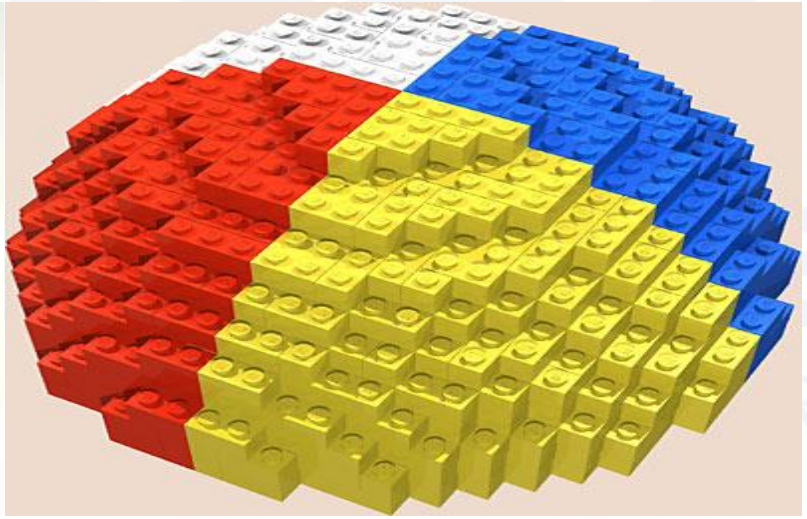
GO BACK

UN MODELO MATEMÁTICO SE PUEDE CONCEBIR COMO

LA UNIÓN DE COMPONENTES MATEMÁTICAS

ARMÓNICAMENTE INTEGRADAS





HAVING IN THE MIND THAT A MATHEMATICAL PROGRAMING (MP) STORED IN AN INFORMATION SYSTEM IS AN STANDARD; THEN IT IS POSSIBLE TO JOIN TWO MP PROBLEMS TO OBTAIN A NEW MODEL.

$$Min \ \Psi = \sum_{t=1}^{T} \sum_{i=1}^{N_T} \Psi_{(i,t)}$$

s.a.

$$\Psi_{(i,t)} = \frac{\alpha_{(i,t)}}{2} \cdot P_{(i,t)} + e_{(i,t)} \cdot P_{(i,t)}$$

$$V_{(j,t+1)} = V_{(j,t)} + \tau \cdot \left(A_{(j,t)} - Q_{(j,t)} - S_{(j,t)} \right)$$

$$P_{(j,t)} = \rho_{(j)} \cdot Q_{(j,t)}$$

MATHEMATICAL PROGRAMMING

$$Min \ \Psi = \sum_{t=1}^{T} \sum_{i=1}^{N_T} \Psi_{(i,t)}$$

s.a.

$$\Psi_{(i,t)} = \frac{\alpha_{(i,t)}}{2} \cdot P_{(i,t)} + e_{(i,t)} \cdot P_{(i,t)}$$

$$V_{(j,t+1)} = V_{(j,t)} + \tau \cdot \left(A_{(j,t)} - Q_{(j,t)} - S_{(j,t)} \right)$$

$$P_{(j,t)} = \rho_{(j)} \cdot Q_{(j,t)}$$

MATHEMATICAL PROGRAMMING

THE UNION OF MATHEMATICAL PROGRAMMING PROBLEMS GENERATE A NEW MODEL OR A VARIATION OF AN ALREADY EXISTING MODEL

$$Min\ \Psi = \sum_{t=1}^{T}\sum_{i=1}^{N_T}\psi_{(i,t)}$$

s.a.

$$\psi_{(i,t)} = \frac{c_{(i,t)}}{2}\cdot P_{(i,t)}^{\ 2} + e_{(i,t)}\cdot P_{(i,t)}$$

ELECTRICITY

$$V_{(j,t+1)} = V_{(j,t)} + \tau\cdot\left(A_{(j,t)} - Q_{(j,t)} - S_{(j,t)}\right)$$

$$P_{(j,t)} = \rho_{(j)}\cdot Q_{(j,t)}$$

+

$$Min\ \Psi = \sum_{t=1}^{T}\sum_{i=1}^{N_T}\psi_{(i,t)}$$

s.a.

$$\psi_{(i,t)} = \frac{c_{(i,t)}}{2}\cdot P_{(i,t)}^{\ 2} + e_{(i,t)}\cdot P_{(i,t)}$$

GAS

$$V_{(j,t+1)} = V_{(j,t)} + \tau\cdot\left(A_{(j,t)} - Q_{(j,t)} - S_{(j,t)}\right)$$

$$P_{(j,t)} = \rho_{(j)}\cdot Q_{(j,t)}$$

=

$$Min\ \Psi = \sum_{t=1}^{T}\sum_{i=1}^{N_T}\psi_{(i,t)}$$

s.a. **ELECTRICITY**

$$\psi_{(i,t)} = \frac{c_{(i,t)}}{2}\cdot P_{(i,t)}^{\ 2} + e_{(i,t)}\cdot P_{(i,t)}$$

&

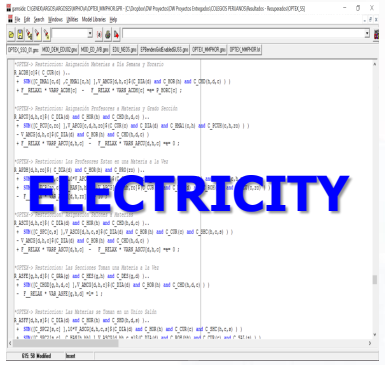
$$V_{(j,t+1)} = V_{(j,t)} + \tau\cdot\left(A_{(j,t)} - Q_{(j,t)} - S_{(j,t)}\right)$$

GAS

$$P_{(j,t)} = \rho_{(j)}\cdot Q_{(j,t)}$$

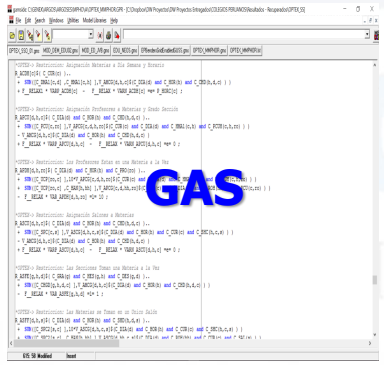
MATHEMATICAL PROGRAMMING AS AN STANDARD

THE UNION OF COMPUTER PROGRAMS
DOESN'T GENERATE A NEW CORRECT COMPUTER PROGRAM



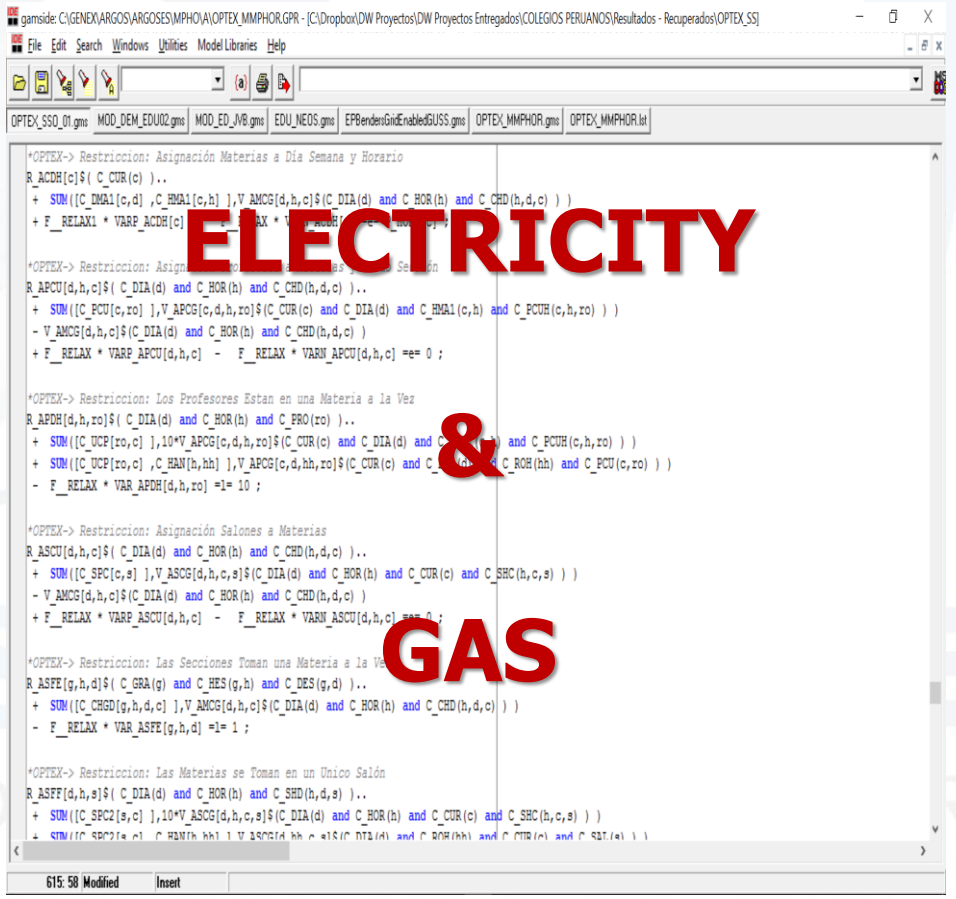
ELECTRICITY

+



GAS

=

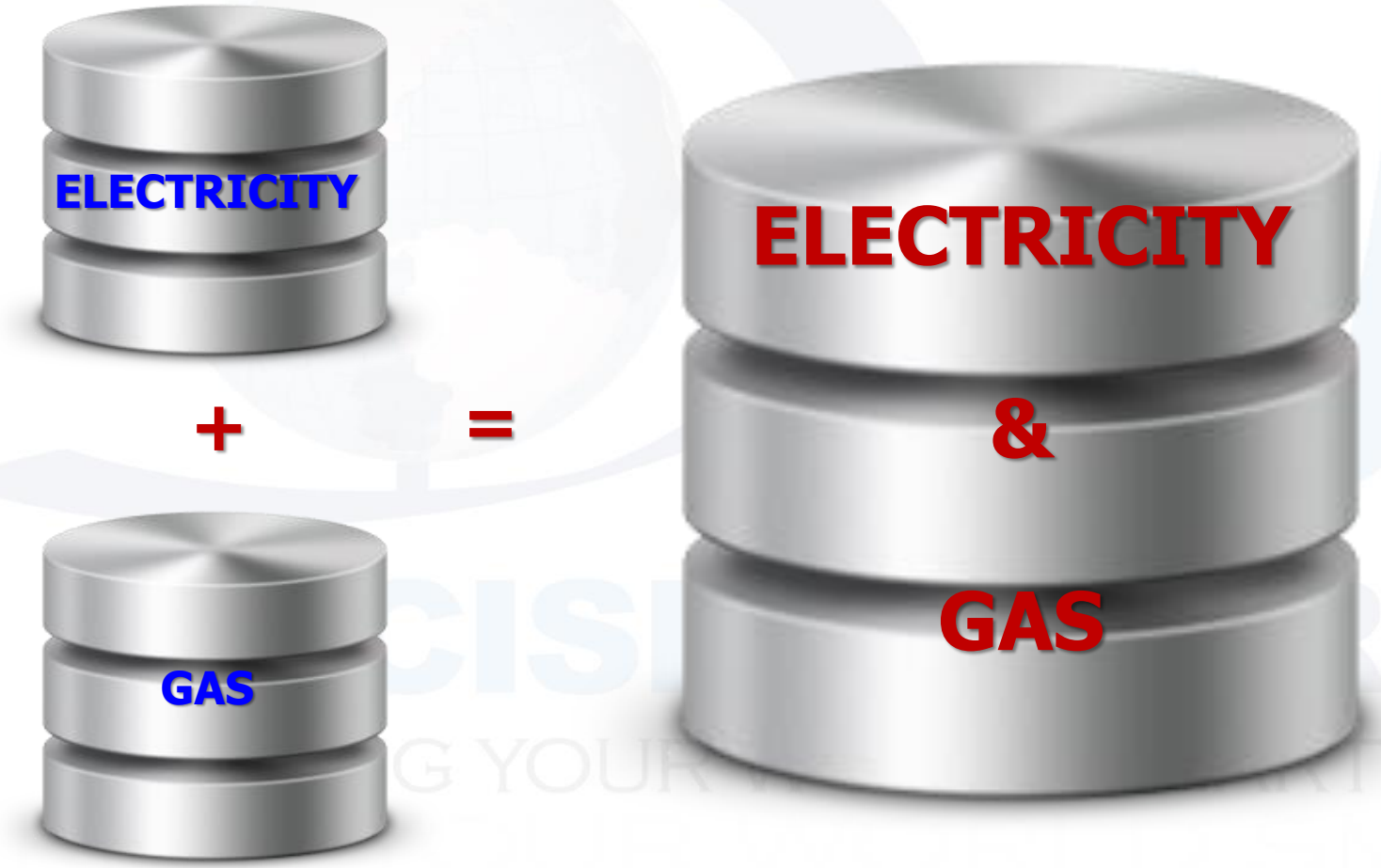


ELECTRICITY

&

GAS

THE UNION OF COMPONENTS OF AN INFORMATION SYSTEM GENERATES A NEW CORRECT INFORMATION SYSTEM

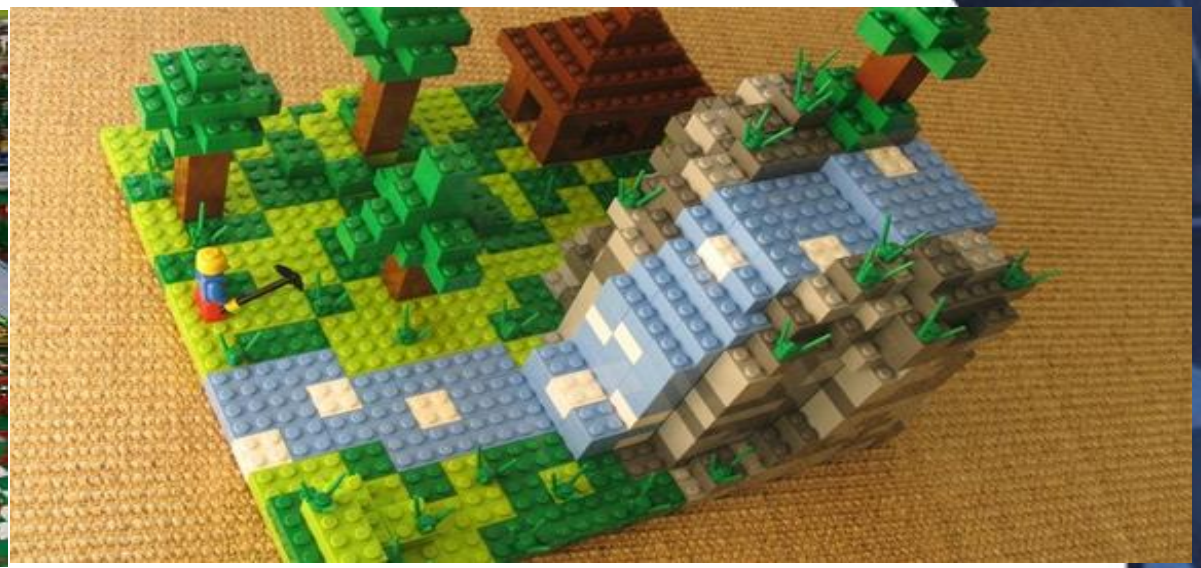


DECISIONWARE
MAKING YOUR WORLD SMARTER

DIPLOMADO

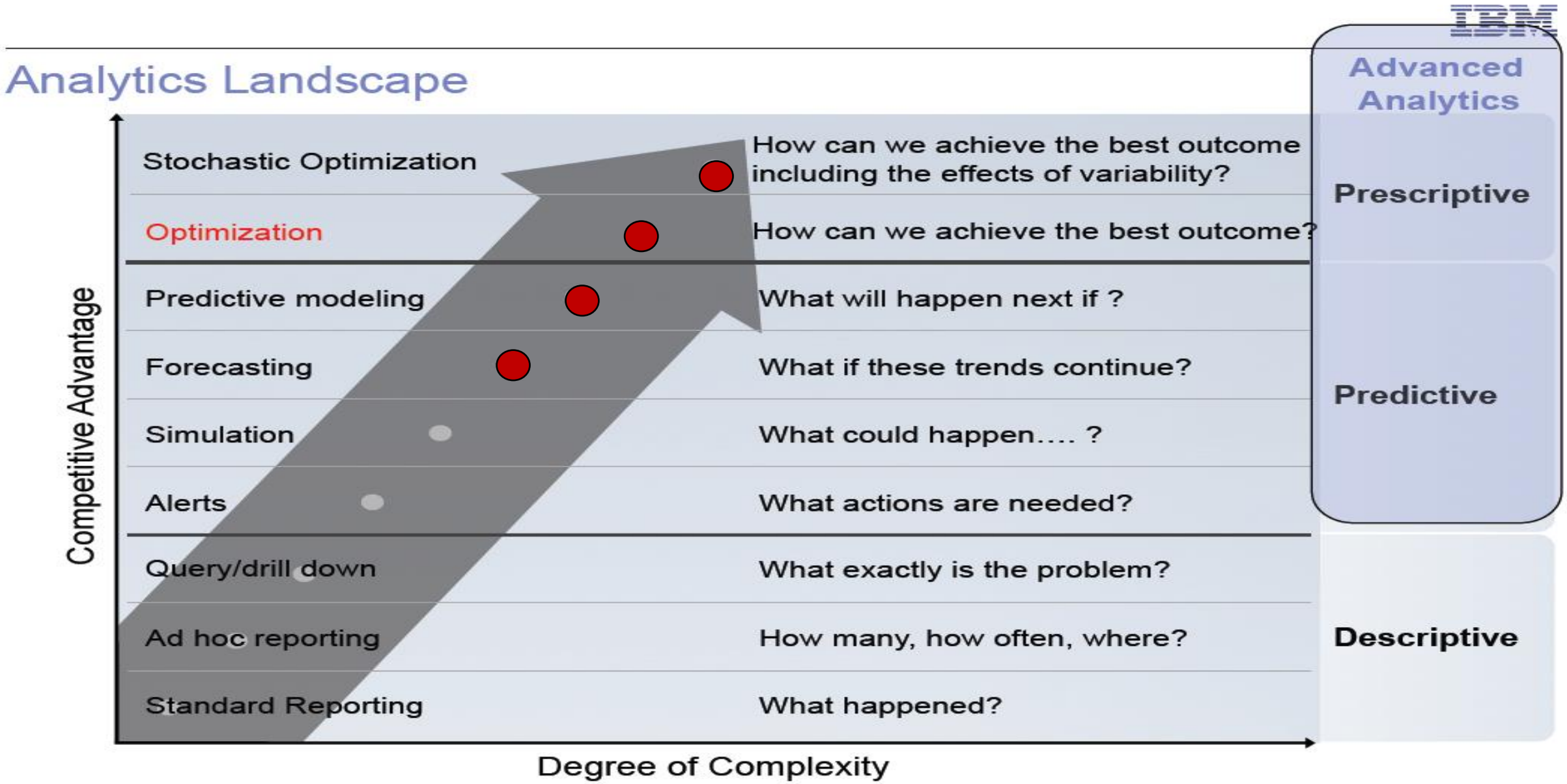
MACHINE LEARNING & OPTIMIZATION USING MATHEMATICAL PROGRAMMING TECHNOLOGIES

MODELAMIENTO MATEMÁTICO ESTRUCTURADO AVANZADO



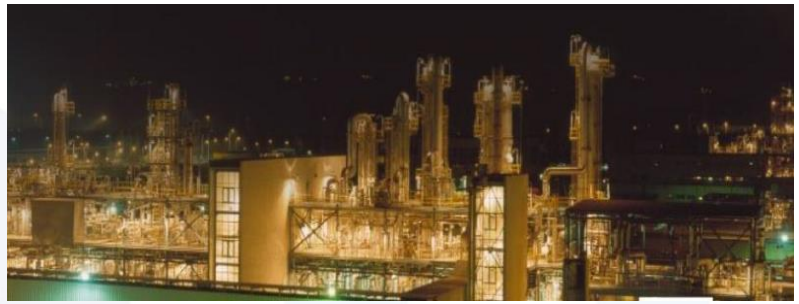
GO BACK

BUSINESS VALUE ADDED BY MATHEMATICAL METHODOLOGIES

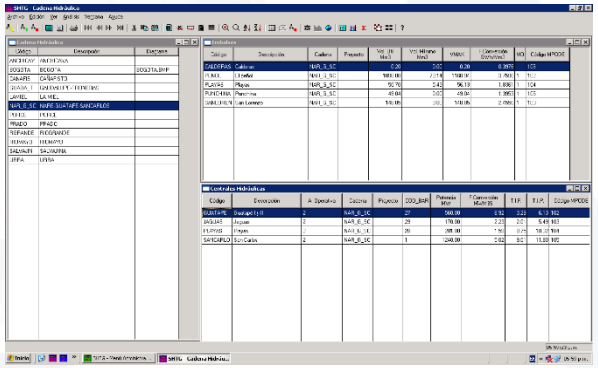


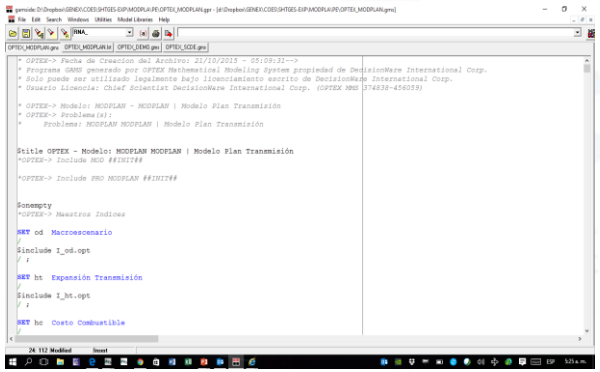
MATHEMATICAL MODELING PROCESS

REAL WORLD



DATA MODEL





PROGRAM MODEL

x,

π

MODELERS
DECISION MAKERS

ESTÁNDAR IMPLEMENTACIÓN

PRE-PROCESSING

$$GD_{zth} - \Sigma_{u \in TN(z)} LD_{uzth} = 0$$

$$GD_{zth} + GHA_{zth} + DEF_{zth} = DEM_{zth}$$

$$EN_{uth} - \Sigma_{j \in L1(u)} GTE_{juth} - \Sigma_{v \in L2(u)} LL_{vuth} = 0$$

Sets & Parameters Read & Pre-Calculated

Sets & Parameters Read

OPTIMIZATION

$$\text{Min} \quad \Sigma_t \Sigma_j \Sigma_h \, CT_t(GT_{jth})$$

sujeto a:

$$GD_{zth} - \Sigma_{u \in TN(z)} LD_{uzth} = 0$$

$$GD_{zth} + GHA_{zth} + DEF_{zth} = DEM_{zth}$$

$$EN_{uth} - \Sigma_{j \in L1(u)} GTE_{juth} - \Sigma_{v \in L2(u)} LL_{vuth} = 0$$

Primal & Dual Variables

Sets & Parameters Read & Pre-Calculated

$$GD_{zth} - \Sigma_{u \in TN(z)} LD_{uzth} = 0$$

$$GD_{zth} + GHA_{zth} + DEF_{zth} = DEM_{zth}$$

$$EN_{uth} - \Sigma_{j \in L1(u)} GTE_{juth} - \Sigma_{v \in L2(u)} LL_{vuth} = 0$$

Primal & Dual Variables

Sets & Parameters Pre & Post Calculated

POST-PROCESSING

ESTÁNDAR IMPLEMENTACIÓN

PRE-PROCESSING

$$GD_{zth} - \Sigma_{u \in TN(z)} LD_{uzth} = 0$$

$$GD_{zth} + GHA_{zth} + DEF_{zth} = DEM_{zth}$$

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Sets & Parameters
Read & Pre-Calculated

Sets & Parameters
Read

INPUTS

OPTIMIZATION

$$\text{Min} \quad \Sigma_t \Sigma_j \Sigma_h \, CT_t(GT_{jth})$$

sujeto a:

$$GD_{zth} - \Sigma_{u \in TN(z)} LD_{uzth} = 0$$

$$GD_{zth} + GHA_{zth} + DEF_{zth} = DEM_{zth}$$

$$EN_{uth} - \Sigma_{j \in L1(u)} GTE_{juth} - \Sigma_{v \in L2(u)} LL_{vuth} = 0$$

Primal & Dual
Variables

Primal & Dual
Variables

OUTPUTS

Sets & Parameters
Read & Pre-Calculated

Sets & Parameters
Pre & Post
Calculated

POST-PROCESSING

$$GD_{zth} - \Sigma_{u \in TN(z)} LD_{uzth} = 0$$

$$GD_{zth} + GHA_{zth} + DEF_{zth} = DEM_{zth}$$

$$EN_{uth} - \Sigma_{j \in L1(u)} GTE_{juth} - \Sigma_{v \in L2(u)} LL_{vuth} = 0$$

PRE-PROCESSING

$$GD_{zth} - \Sigma_{u\varepsilon TN(z)} LD_{uzth} = 0$$

$$GD_{zth} + GHA_{zth} + DEF_{zth} = DEM_{zth}$$

$$EN_{uth} - \Sigma_{j\varepsilon L1(u)} GTE_{juth} - \Sigma_{v\varepsilon L2(u)} LL_{vuth} = 0$$

PARAMETERS MODEL

Sets & Parameters Read & Pre-Calculated

Sets & Parameters Read

OPTIMIZATION

$$\text{Min} \quad \Sigma_t \Sigma_j \Sigma_h \; CT_t(GT_{jth})$$

sujeto a:

$$GD_{zth} - \Sigma_{u\varepsilon TN(z)} LD_{uzth} = 0$$

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Primal & Dual Variables

Sets & Parameters Read & Pre-Calculated

$$GD_{zth} - \Sigma_{u\varepsilon TN(z)} LD_{uzth} = 0$$

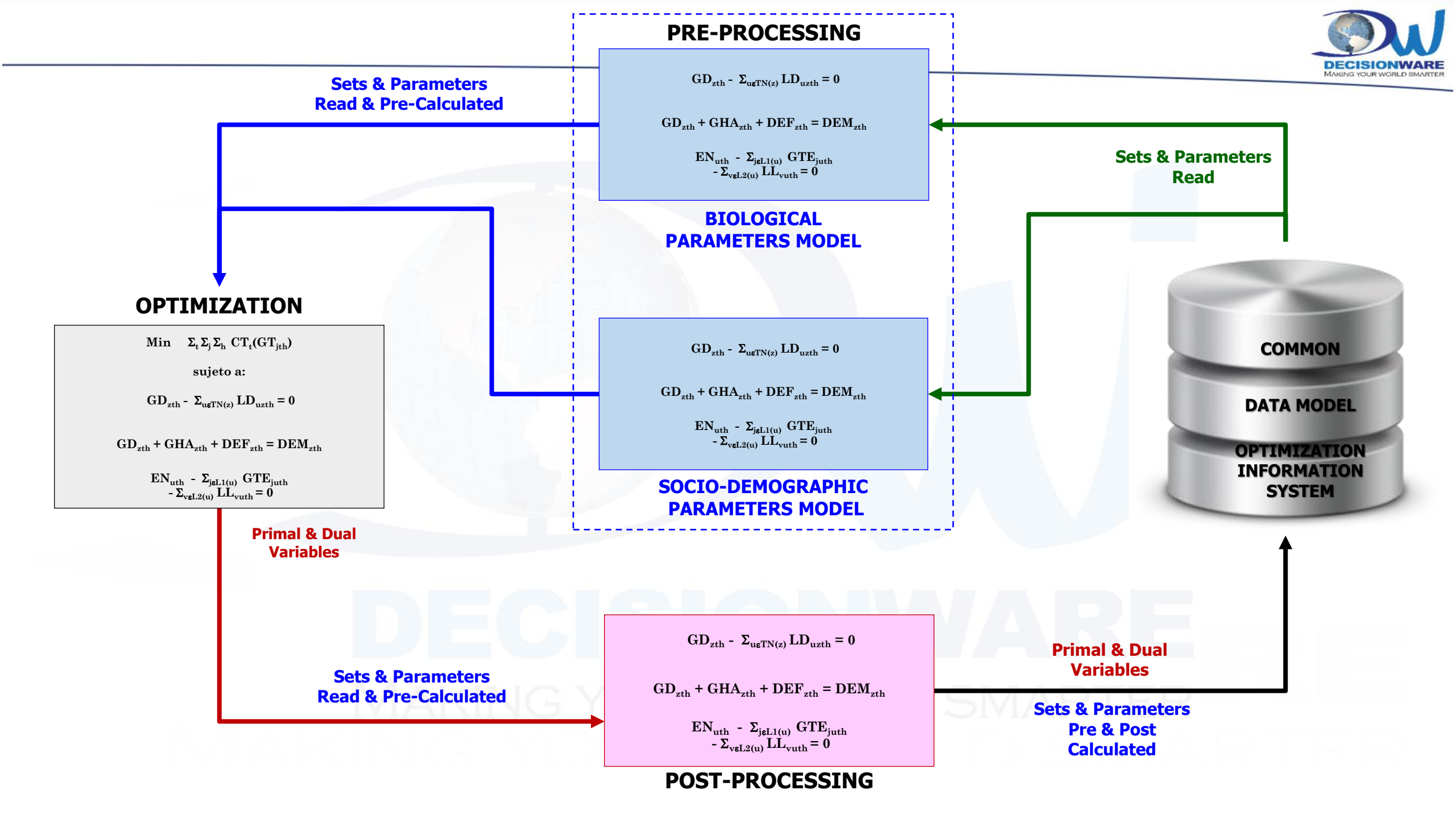
$$GD_{zth} + GHA_{zth} + DEF_{zth} = DEM_{zth}$$

$$EN_{uth} - \Sigma_{j\varepsilon L1(u)} GTE_{juth} - \Sigma_{v\varepsilon L2(u)} LL_{vuth} = 0$$

POST-PROCESSING

Primal & Dual Variables

Sets & Parameters Pre & Post Calculated


PRE-PROCESSING
$GD_{zth} - \Sigma_{u\varepsilon TN(z)} LD_{uzth} = 0$
$GD_{zth} + GHA_{zth} + DEF_{zth} = DEM_{zth}$
$EN_{uth} - \Sigma_{j\varepsilon L1(u)} GTE_{juth} - \Sigma_{v\varepsilon L2(u)} LL_{vuth} = 0$
BIOLOGICAL PARAMETERS MODEL
SOCIO-DEMOGRAPHIC PARAMETERS MODEL
Sets & Parameters Read & Pre-Calculated
Sets & Parameters Read
OPTIMIZATION
Min $\Sigma_t \Sigma_j \Sigma_h CT_t(GT_{jth})$
sujeto a:
$GD_{zth} - \Sigma_{u\varepsilon TN(z)} LD_{uzth} = 0$
$GD_{zth} + GHA_{zth} + DEF_{zth} = DEM_{zth}$
$EN_{uth} - \Sigma_{j\varepsilon L1(u)} GTE_{juth} - \Sigma_{v\varepsilon L2(u)} LL_{vuth} = 0$
Primal & Dual Variables
COMMON
DATA MODEL
OPTIMIZATION INFORMATION SYSTEM
Sets & Parameters Read & Pre-Calculated
$GD_{zth} - \Sigma_{u\varepsilon TN(z)} LD_{uzth} = 0$
$GD_{zth} + GHA_{zth} + DEF_{zth} = DEM_{zth}$
$EN_{uth} - \Sigma_{j\varepsilon L1(u)} GTE_{juth} - \Sigma_{v\varepsilon L2(u)} LL_{vuth} = 0$
POST-PROCESSING
Primal & Dual Variables
Sets & Parameters Pre & Post Calculated

COORDINATION OF MULTIPLES PROBLEMS

DECISIONWARE
MAKING YOUR WORLD SMARTER

TWO STAGE OPTIMIZATION

PRE-PROCESSING

$$GD_{zth} - \Sigma_{u \varepsilon TN(z)} LD_{uzth} = 0$$

$$GD_{zth} + GHA_{zth} + DEF_{zth} = DEM_{zth}$$

$$EN_{uth} - \Sigma_{j \varepsilon L1(u)} GTE_{juth} - \Sigma_{v \varepsilon L2(u)} LL_{vuth} = 0$$

Sets & Parameters
Read & Pre-Calculated

Sets & Parameters
Read

OPTIMIZATION HARD CONSTRAINTS

$$\text{Min} \quad \Sigma_t \Sigma_j \Sigma_h \; CT_t(GT_{jth})$$

sujeto a:

$$GD_{zth} - \Sigma_{u \varepsilon TN(z)} LD_{uzth} = 0$$

$$GD_{zth} + GHA_{zth} + DEF_{zth} = DEM_{zth}$$

$$EN_{uth} - \Sigma_{j \varepsilon L1(u)} GTE_{juth} - \Sigma_{v \varepsilon L2(u)} LL_{vuth} = 0$$

YES

FEASIBLE ?

NO

OPTIMIZATION SOFT CONSTRAINTS

$$\text{Min} \quad \Sigma_t \Sigma_j \Sigma_h \; CT_t(GT_{jth})$$

sujeto a:

$$GD_{zth} - \Sigma_{u \varepsilon TN(z)} LD_{uzth} = 0$$

$$GD_{zth} + GHA_{zth} + DEF_{zth} = DEM_{zth}$$

$$EN_{uth} - \Sigma_{j \varepsilon L1(u)} GTE_{juth} - \Sigma_{v \varepsilon L2(u)} LL_{vuth} = 0$$

Primal & Dual Variables

Sets & Parameters
Read & Pre-Calculated

$$GD_{zth} - \Sigma_{u \varepsilon TN(z)} LD_{uzth} = 0$$

$$GD_{zth} + GHA_{zth} + DEF_{zth} = DEM_{zth}$$

$$EN_{uth} - \Sigma_{j \varepsilon L1(u)} GTE_{juth} - \Sigma_{v \varepsilon L2(u)} LL_{vuth} = 0$$

Primal & Dual Variables

Sets & Parameters
Pre & Post
Calculated

POST-PROCESSING

COORDINATION OF MULTIPLES PROBLEMS

DECISIONWARE
MAKING YOUR WORLD SMARTER

TWO STAGE OPTIMIZATION

PRE-PROCESSING

$$GD_{zth} - \Sigma_{u \varepsilon TN(z)} LD_{uzth} = 0$$

$$GD_{zth} + GHA_{zth} + DEF_{zth} = DEM_{zth}$$

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Sets & Parameters
Read & Pre-Calculated

Sets & Parameters
Read

OPTIMIZATION HARD CONSTRAINTS

$$\text{Min} \quad \Sigma_t \Sigma_j \Sigma_h \; CT_t(GT_{jth})$$

sujeto a:

$$GD_{zth} - \Sigma_{u \varepsilon TN(z)} LD_{uzth} = 0$$

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$$EN_{uth} - \Sigma_{j \varepsilon L1(u)} GTE_{juth} - \Sigma_{v \varepsilon L2(u)} LL_{vuth} = 0$$

YES

FEASIBLE ?

NO

OPTIMIZATION SOFT CONSTRAINTS

$$\text{Min} \quad \Sigma_t \Sigma_j \Sigma_h \; CT_t(GT_{jth})$$

sujeto a:

$$GD_{zth} - \Sigma_{u \varepsilon TN(z)} LD_{uzth} = 0$$

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Primal & Dual Variables

Sets & Parameters
Read & Pre-Calculated

$$GD_{zth} - \Sigma_{u \varepsilon TN(z)} LD_{uzth} = 0$$

$$GD_{zth} + GHA_{zth} + DEF_{zth} = DEM_{zth}$$

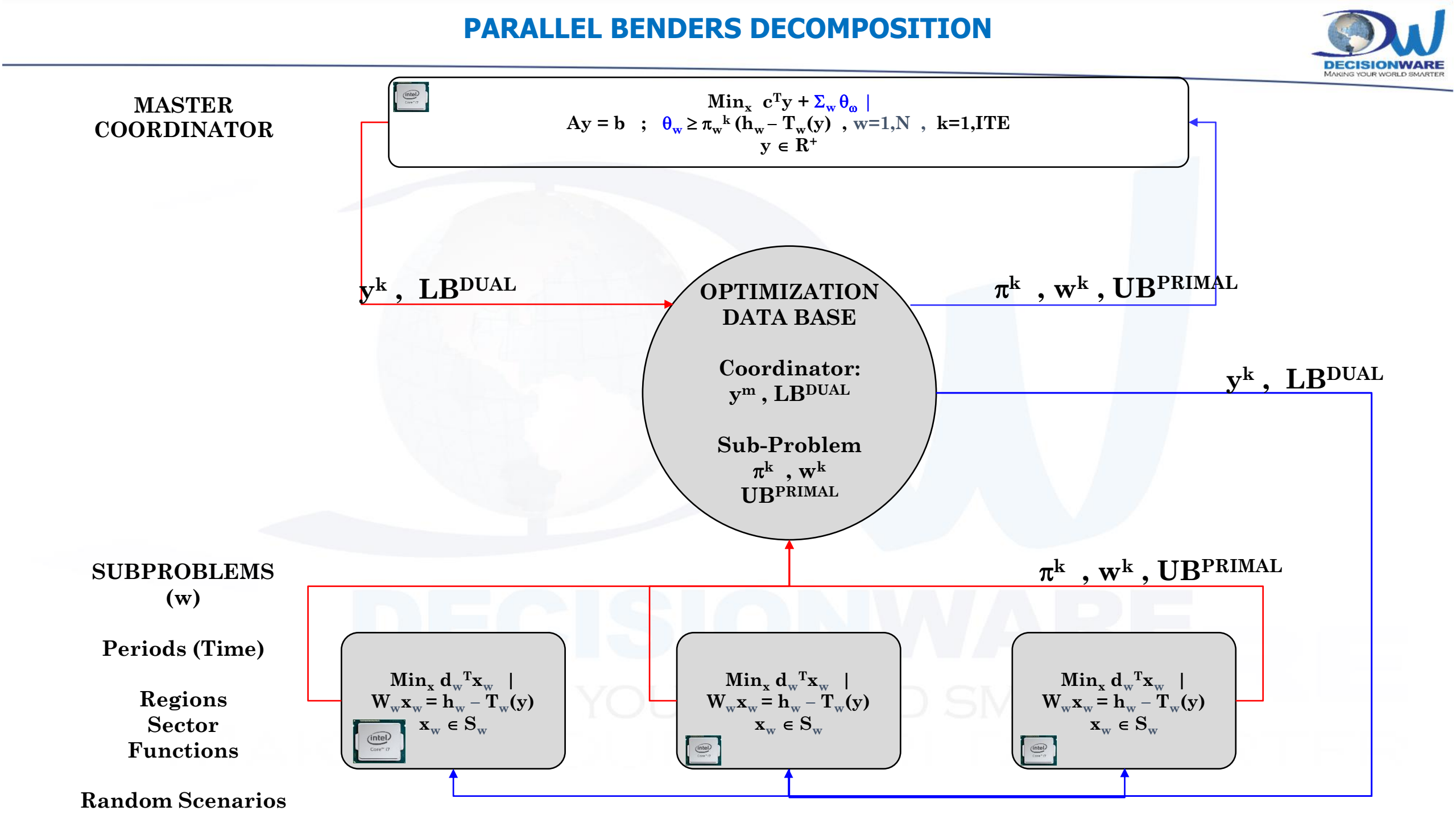
$$EN_{uth} - \Sigma_{j \varepsilon L1(u)} GTE_{juth} - \Sigma_{v \varepsilon L2(u)} LL_{vuth} = 0$$

Primal & Dual Variables

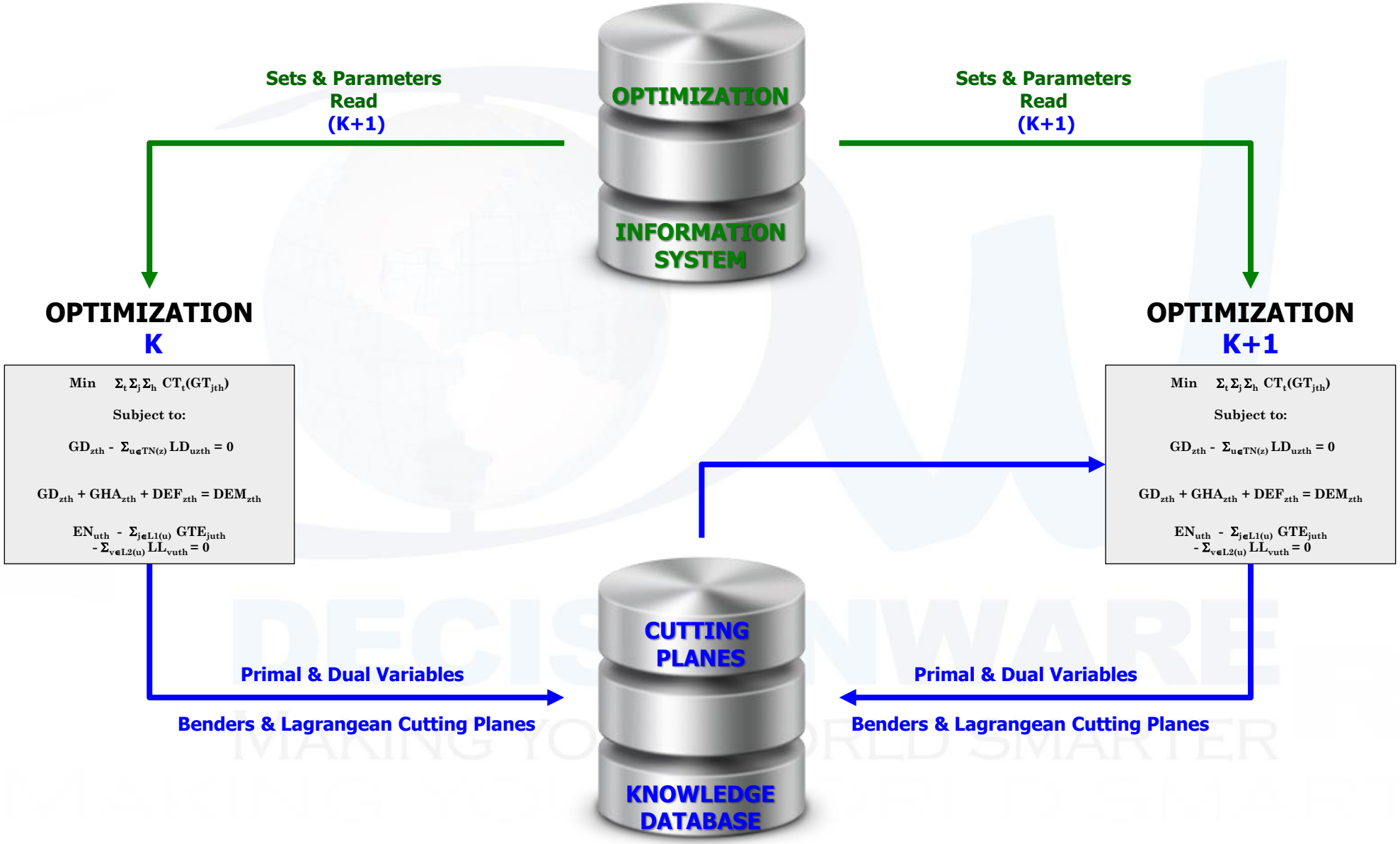
Sets & Parameters
Pre & Post
Calculated

POST-PROCESSING

PARALLEL BENDERS DECOMPOSITION



OPTIMIZATION KNOWLEDGE EXPERT SYSTEM
CUTTING PLANES DATABASE



MATHEMATICAL PROGRAMMING 4.0:
CONNECTING MODELS DYNAMICALLY – CONVEX HULLS

DECISIONWARE
MAKING YOUR WORLD SMARTER

Sets & Parameters Read (K)

Sets & Parameters Read (K+1)

OPTIMIZATION K

$$\text{Min} \quad \Sigma_t \Sigma_j \Sigma_h \; CT_t(GT_{jth})$$

Subject to:

$$GD_{zth} - \Sigma_{u \in TN(z)} LD_{uzth} = 0$$

$$GD_{zth} + GHA_{zth} + DEF_{zth} = DEM_{zth}$$

$$EN_{uth} - \Sigma_{j \in L1(u)} GTE_{juth} - \Sigma_{v \in L2(u)} LL_{vuth} = 0$$

CONVEX HULL EQUATIONS

OPTIMIZATION K+1

$$\text{Min} \quad \Sigma_t \Sigma_j \Sigma_h \; CT_t(GT_{jth})$$

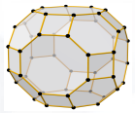
Subject to:

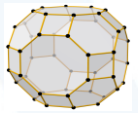
$$GD_{zth} - \Sigma_{u \in TN(z)} LD_{uzth} = 0$$

$$GD_{zth} + GHA_{zth} + DEF_{zth} = DEM_{zth}$$

$$EN_{uth} - \Sigma_{j \in L1(u)} GTE_{juth} - \Sigma_{v \in L2(u)} LL_{vuth} = 0$$

CONVEX HULL EQUATIONS





CONVEX HULL MODEL

$$\text{Min} \quad \Sigma_j \Sigma_h \; CT_t(GT_{jth})$$

$$GD_{zth} - \Sigma_{u \in TN(z)} LD_{uzth} = 0$$

$$GD_{zth} + GHA_{zth} + DEF_{zth} = DEM_{zth}$$

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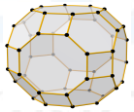


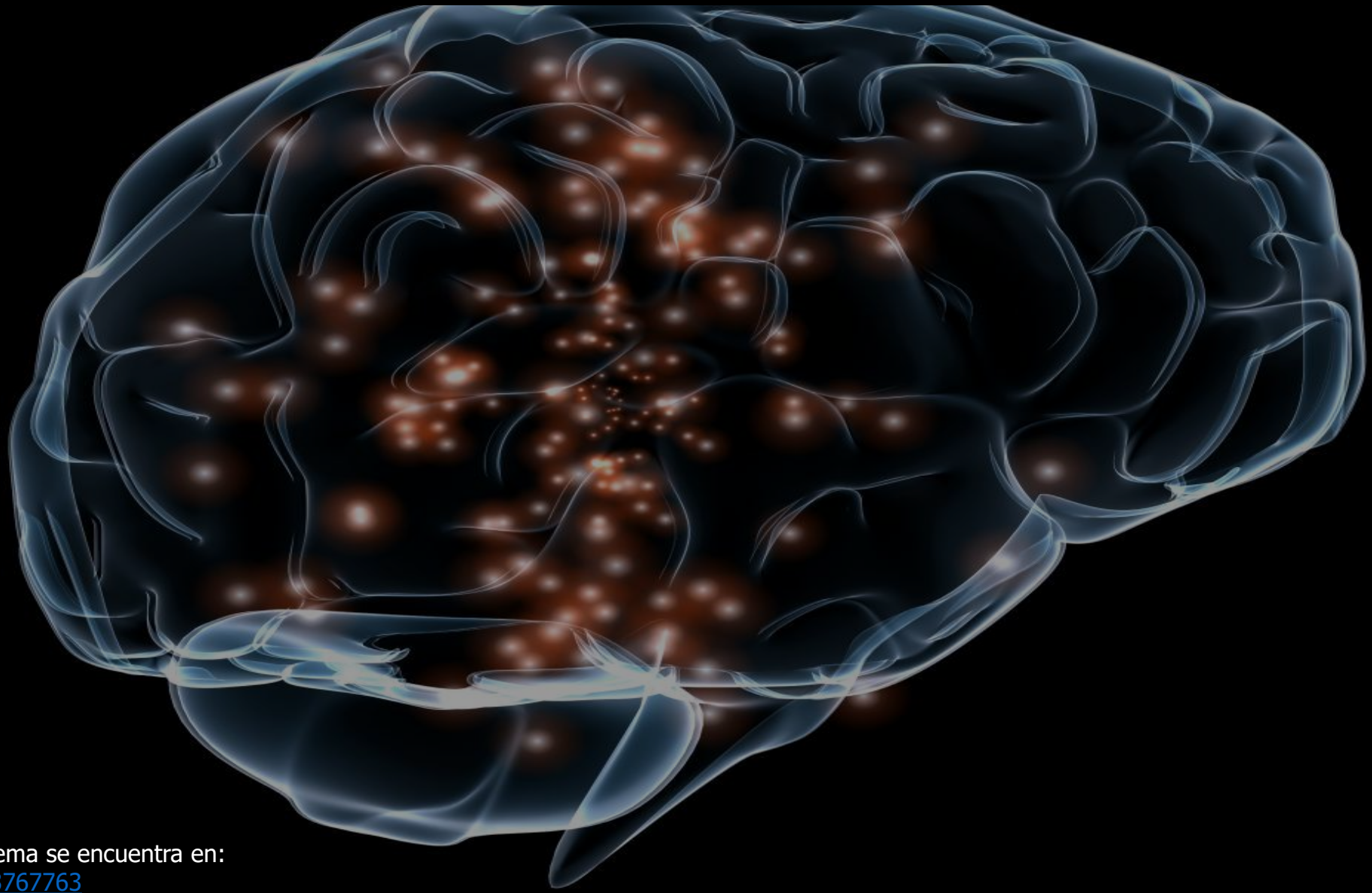
HUMAN HYPOTHALAMUS

The hypothalamus is a portion of the brain that contains several small nuclei with a variety of functions. One of the most important functions of the hypothalamus is to link the nervous system to the endocrine system via the pituitary gland. It is not a separate system, but a collection of structures from the cerebrum, diencephalon, and midbrain. It supports many different functions, including emotion, behavior, motivation, long-term memory, and olfaction.

All vertebrate brains contain a hypothalamus it is responsible for the regulation of certain metabolic processes and other activities of the autonomic nervous system and controls body temperature, hunger, important aspects of parenting and attachment behaviors, thirst, fatigue, sleep, and circadian rhythms.

The hypothalamus is highly interconnected with other parts of the central nervous system, in particular the brainstem and its reticular formation. The hypothalamus receives many inputs from the brainstem, the most notable from the nucleus of the solitary tract, the locus coeruleus, and the ventrolateral medulla. It is the central regulator of several autonomous and endocrine visceral functions and acts as a relay point in the information that starts from the brain reaching the spinal cord. Each of the target systems influenced by the hypothalamus return feedback controls onto the hypothalamus completing a circuit and so establishing a homeostasis system. The role of the hypothalamus in regulation of homeostasis is essential for survival and reproduction of the species. The hypothalamus is one of those organs that we can't live without.

Artificial Hypothalamus: Artificial Intelligence and Mathematical Programming Integration



La información sobre este tema se encuentra en:
https://ssrn.com/abstract=3767763

THE HYPOTHALAMUS OF THE ORGANIZATION

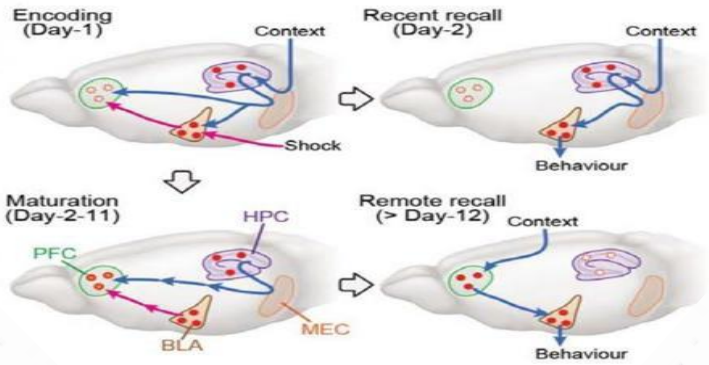
FUNCTION 1

FUNCTION 2

FUNCTION N

FUNCTION 3

FUNCTION N-1



THE HYPOTHALAMUS OF THE ORGANIZATION

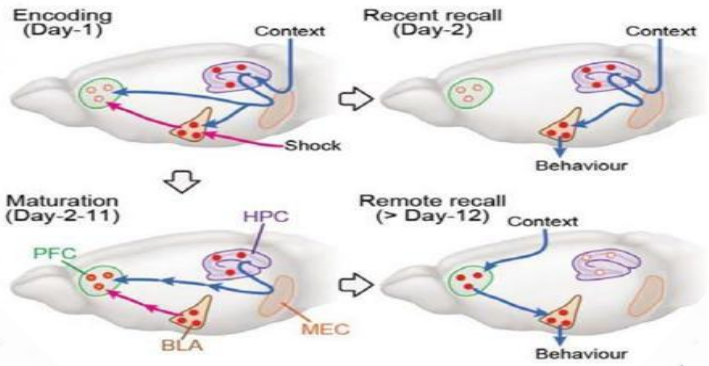
REGION 1

REGION 2

REGION N

REGION 3

REGION N-1



THE HYPOTHALAMUS OF THE ORGANIZATION

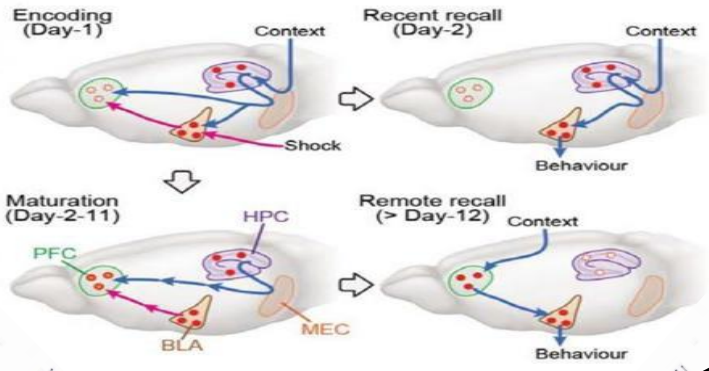
BUSINESS 1

BUSINESS 2

BUSINESS N

BUSINESS 3

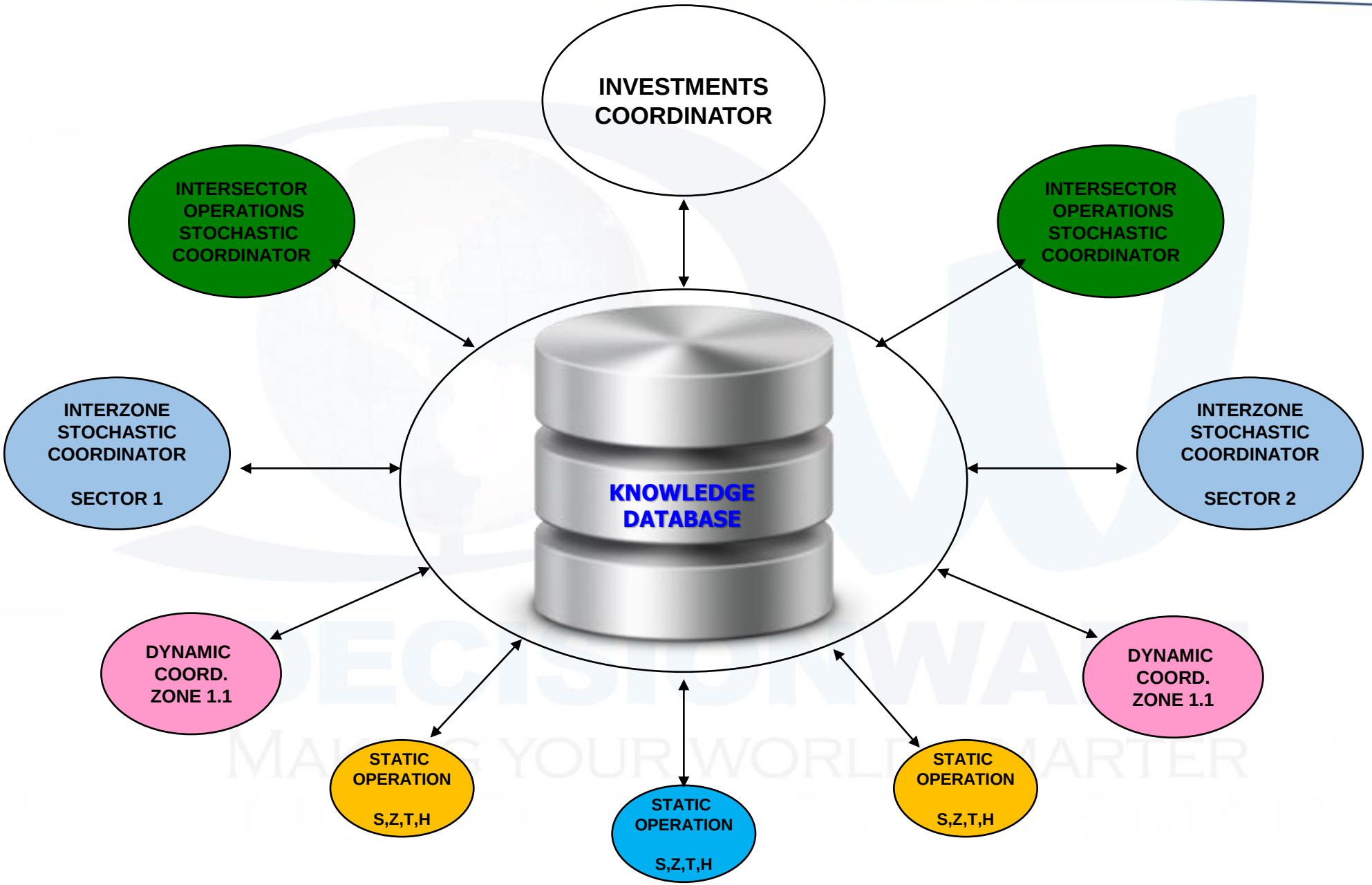
BUSINESS N-1



THE HYPOTHALAMUS OF AN OIL ORGANIZATION

KNOWLEDGE DATABASE

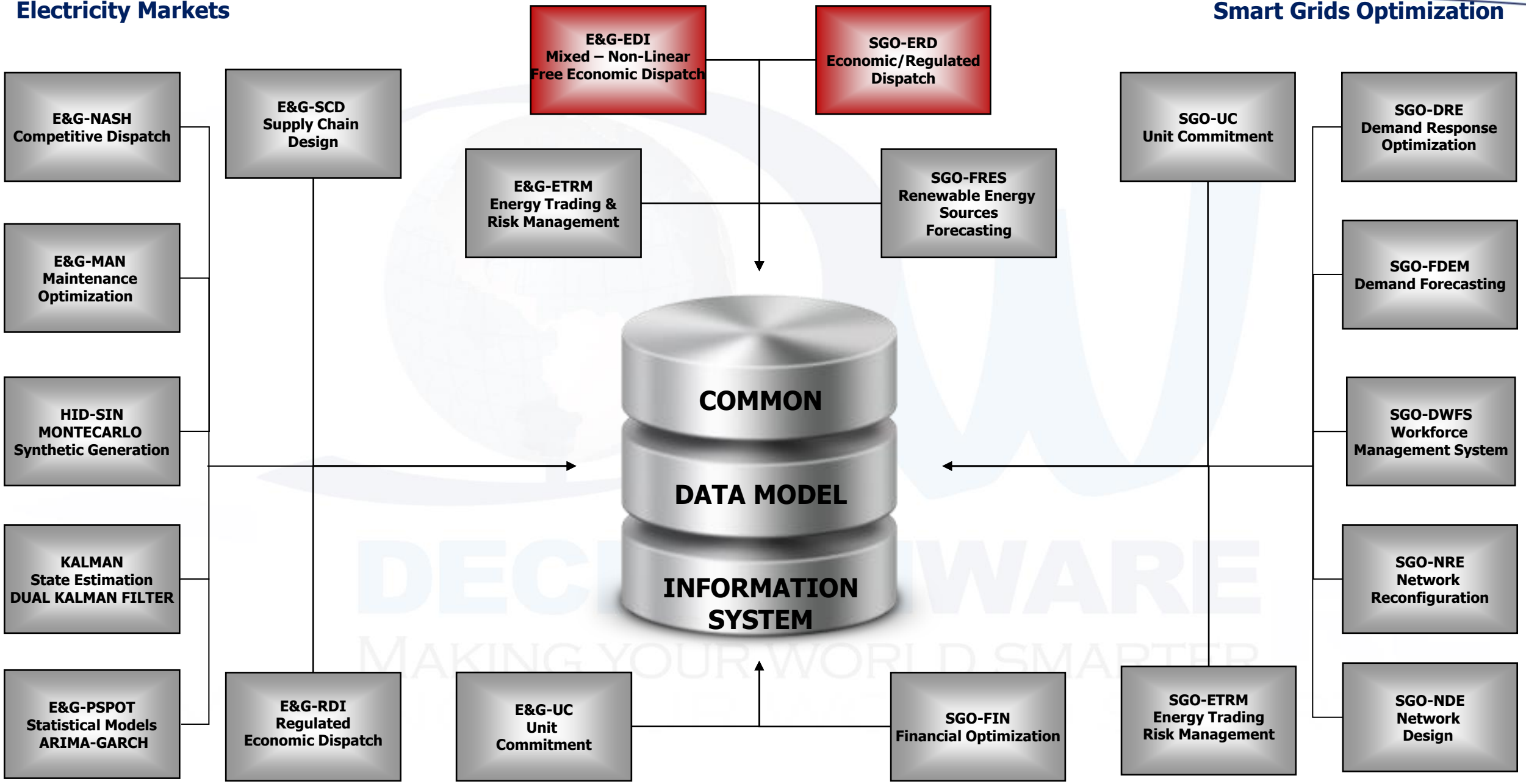
LARGE-SCALE OPTIMIZATION
COORDINATION BASED ON AN OPTIMIZATION DATABASE



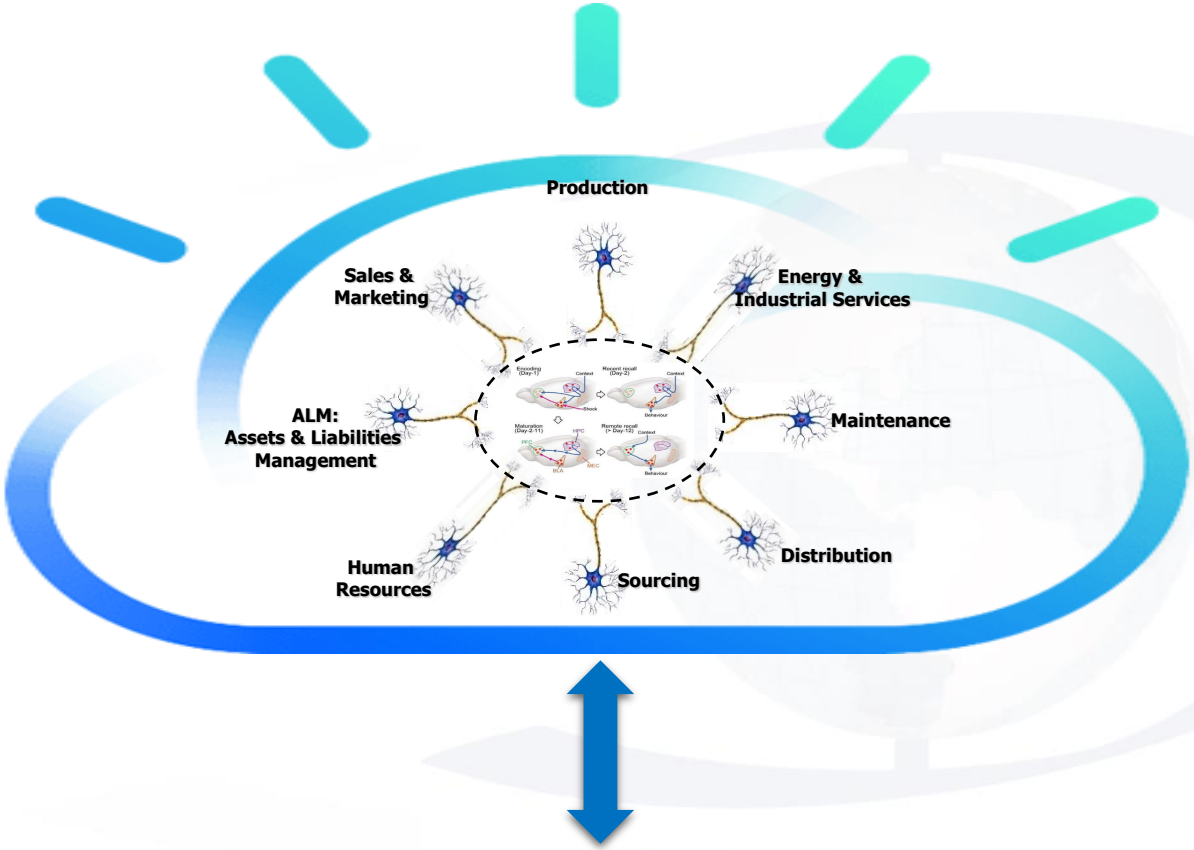
HYPOTHALAMUS MODELS IN THE ELECTRIC SECTOR

Electricity Markets

Smart Grids Optimization



ATHENEA PROJECT
CLOUD INDUSTRIAL ENTERPRISE HYPOTHALAMUS



END USERS

The mathematical models individually are associated with different administrative divisions/functions that the organization must attend, for the General Industrial Hypothalamus the models are:

- Supply Chain
  - Resilient Supply Chain Design
  - Integrated Sales & Operations Planning (S&OP)
  - Optimal Inventory Policy Planning
  - Sourcing Optimization
  - Production Scheduling
  - Product Delivery Program Planning (ATP)
  - Product Distribution Scheduling
  - Predictive Maintenance Programming
  - Human Resources Planning & Scheduling

- Demand Chain
  - Demand Management & Forecasting
  - Marketing Mix Policy Optimization
  - Price Optimization (Revenue Management)
  - Suggested Order Optimization

There are other advanced mathematical models that may be integrated into the ATHENEA INDUSTRIAL HYPOTHALAMUS, but they are not considered in this initial stage.

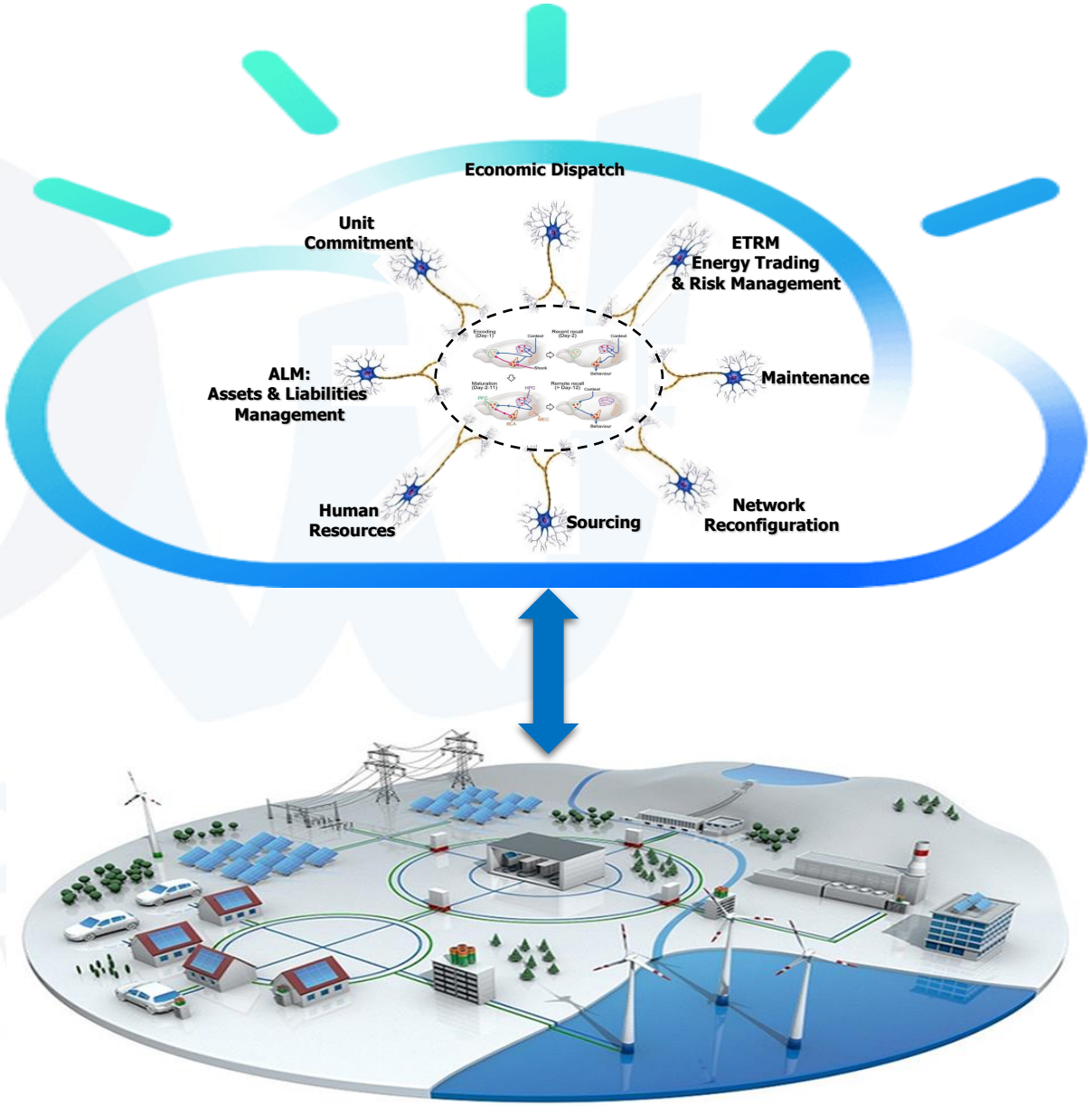
ATHENEA PROJECT
CLOUD ELECTRIC ENTERPRISE HYPOTHALAMUS

The mathematical models individually are associated with different administrative divisions/functions that the organization must attend, for the Electric Sector Hypothalamus the models are:

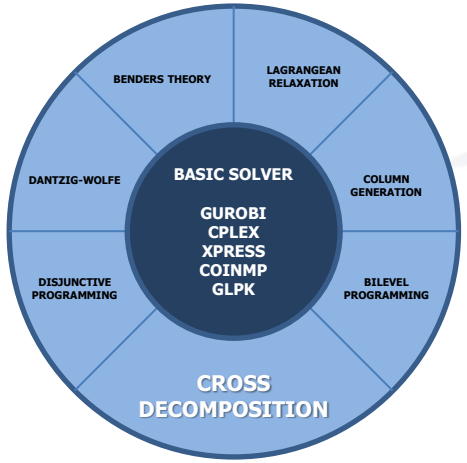
- Prescriptive Models
  - Optimal Economic Dispatch
  - Unit Commitment
  - Optimal Design of Smart Networks
  - Real-Time Reconfiguration of Smart Networks
  - ETRM: Energy Trading & Risk Management
  - ALM: Assets & Liabilities Management

- Predictive Models
  - Demand forecasting
  - Hydroclimatic forecasting

There are other advanced mathematical models that may be integrated into the ATHENEA ELECTRIC HYPOTHALAMUS, but they are not considered in this initial stage.



MATHEMATICAL MODEL vs. ORGANIZATION MATHEMATICAL HYPOTHALAMUS



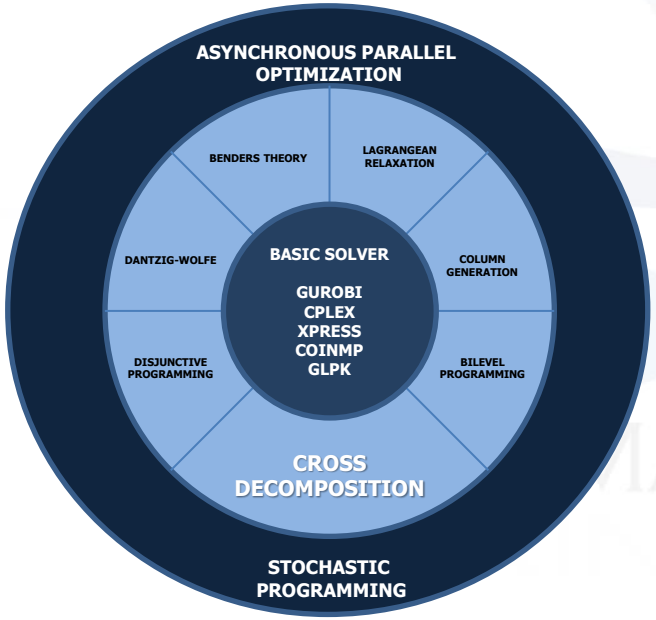
$$Min \quad \Psi = \sum_{t=1}^{T} \sum_{i=1}^{N_T} \Psi_{(i,t)}$$

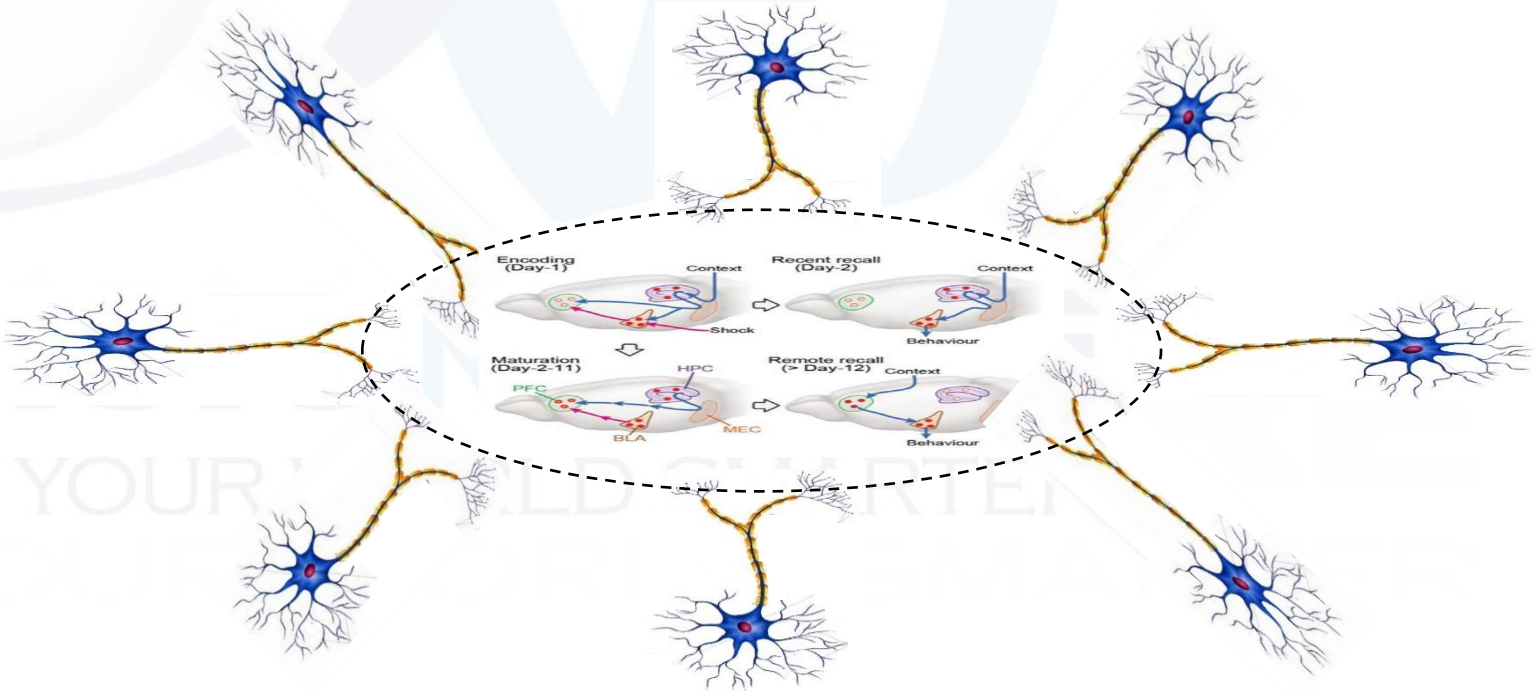
s.a.

$$\Psi_{(i,t)} = \frac{c_{(i,t)}}{2} \cdot P_{(i,t)}{}^2 + e_{(i,t)} \cdot P_{(i,t)}$$

$$V_{(j,t+1)} = V_{(j,t)} + \tau \cdot \left(A_{(j,t)} - Q_{(j,t)} - S_{(j,t)} \right)$$

$$P_{(j,t)} = \rho_{(j)} \cdot Q_{(j,t)}$$





Chapter IV-1 Enterprise Wide Optimization. The Hypothalamus of the Enterprise

Jesus Velásquez-Bermúdez

Abstract

At the end of the last century SCM was a relatively new term that brought together the concepts of integrated business planning that have been used for many years by logistics experts, strategists and experts in Operations Research. Today, integrated planning based on mathematical models of optimization is the standard possible due to advances in information technology (high and low-level parallel computing, optimization algorithms, data transmission capabilities, platforms for the development of mathematical models).

There are four dimensions of the optimal synchronization of a supply chain, namely:

- Functional associated with the purchase, manufacture, transport and storage of industrial supplies and products
- Space associated with activities through industrial facilities and the different forms of markets.
- Internal associated with the hierarchy of decisions: strategic, tactical and operational.
- Business that responds to the purposes of strategic and tactical planning within the organization. Business integration makes SCM one of the components of a broader vision of integrated planning.

This improves the competitive advantage, reduce costs and increase profits, then managers seek to integrate planning activities of its value chain, which, originally, was understood as the sum of the Supply Chain Management (SCM) and Demand Chain Management (DCM). Today, this concept has expanded and covers all the functional areas of the organization including financial and human resources chains.

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1.1.2. Enterprise Hypothalamus
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1.3. Enterprise Wide Optimization

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2.1. Decision Support Environment
2.1.1. Hierarchical Decisions
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2.1.1.4. Real-Time Optimization
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3.1.1. Multi-Business Supply Chains
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3.2. S&OP Multifunction Modeling
3.2.1. Production and Demand
3.2.2. Production and Financial
3.2.3. Production and Energy
3.2.4. Production and Maintenance
3.2.5. Production and Human Resources

4. COMPUTATIONAL IMPLEMENTATION

DOCUMENTOS TÉCNICOS
METODOLOGÍAS GRAN ESCALA - TECNOLOGÍAS DE OPTIMIZACIÓN

Mathematical Programming 4.0: Real Time Distributed Optimization in Cyber-Physical Systems
https://www.linkedin.com/pulse/future-mathematical-programming-jesus-velasquez/

OPTEX – Optimization Expert System
https://www.linkedin.com/pulse/optex-optimization-expert-system-new-approah-make-models-velasquez/

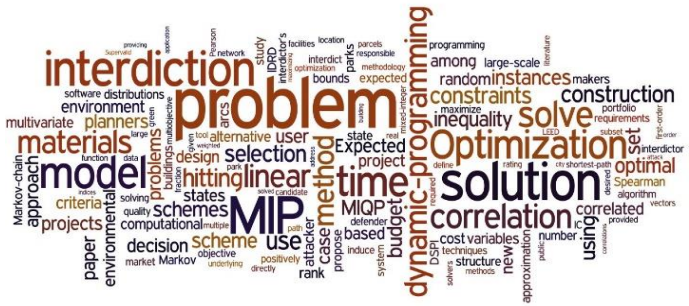
Making COMPLEX MATH Models as LEGO Models
https://www.linkedin.com/pulse/standardization-base-mathematical-programming-40-making-velasquez/

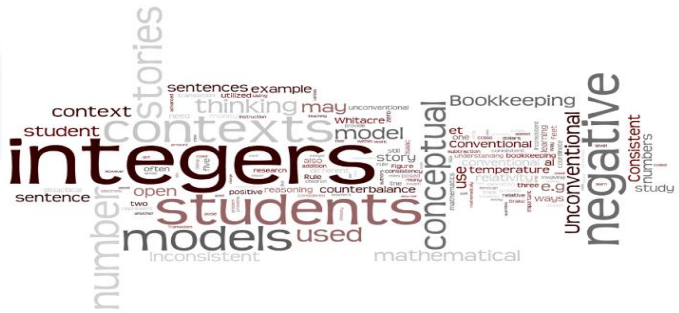
Stochastic Programming & Risk Management: Fundamentals
https://www.linkedin.com/pulse/stochastic-programming-fundamentals-jesus-velasquez/

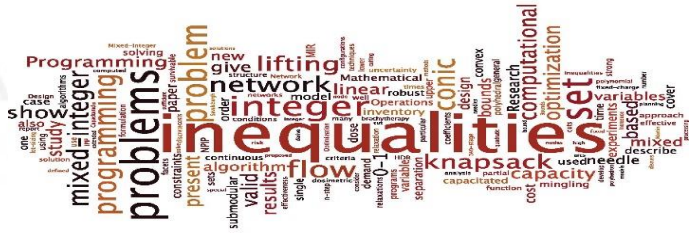
Making Stochastic Programing Models Filling the Blanks in MS-EXCEL …
https://www.linkedin.com/pulse/making-stochastic-programing-models-filling-blanks-jesus-velasquez/

Stochastic Advanced Analytics Modeling - OPCHAIN-SAAM
https://www.linkedin.com/pulse/stochastic-advanced-analytics-modeling-opchain-saam-jesus-velasquez/

Catalogue of Advanced Analytics & Optimization Mathematical Models
https://www.linkedin.com/pulse/advanced-analytical-optimization-models-machine-neural-velasquez/







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DIPLOMADO

MACHINE LEARNING & OPTIMIZATION USING MATHEMATICAL PROGRAMMING TECHNOLOGIES

PLAN DE TEMAS

TECNOLOGÍAS DE PROGRAMACIÓN MATEMÁTICA

Cursos disponibles:

- C++
- GAMS
- AMPL
- AIMMS
- PYTHON-PYOMO
- XPRESS-MOSEL
- IBM-CPLEX Optimization Studio (OPL)

Por haga clic en la opción que le interese.

Cada diplomado esta compuesto por dos módulos:

- **Módulo Básico**
- **Módulo Avanzado**

Se estudia el manejo de múltiples solvers

GLPK GLOP

CURSOS EN OTRAS TECNOLOGÍAS PUEDEN DESARROLLARSE A PETICIÓN DEL INTERESADO.

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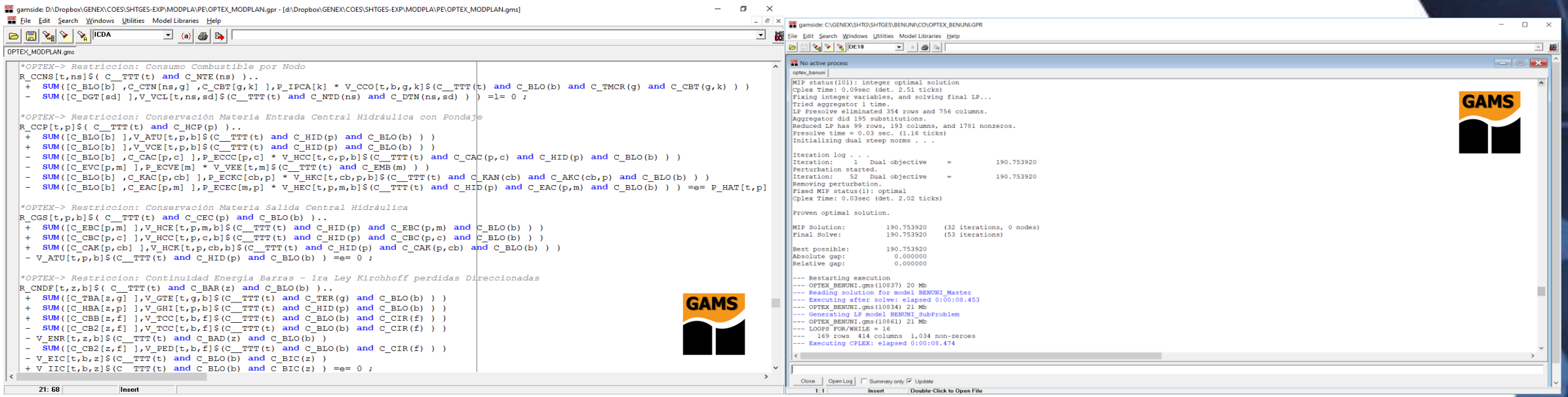
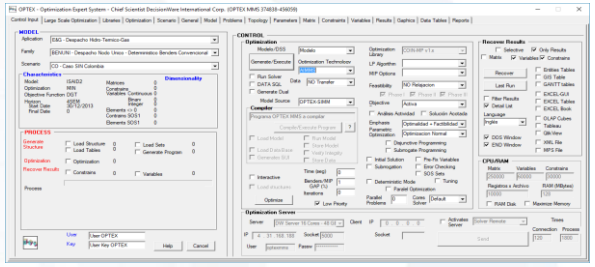
DIPLOMADO EN PLAN DE TEMAS



GO BACK

OPTEX-GAMS



ODBC

Remote Access Server Connectivity

GLPK

GLOP

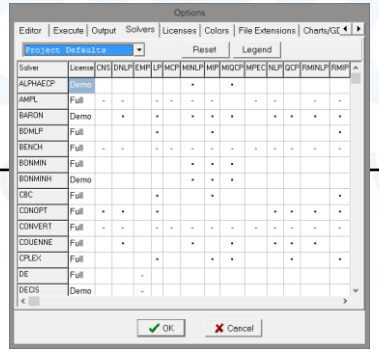
KNITRO

LINDO

IBM CPLEX

FICO Xpress

GUROBI OPTIMIZATION

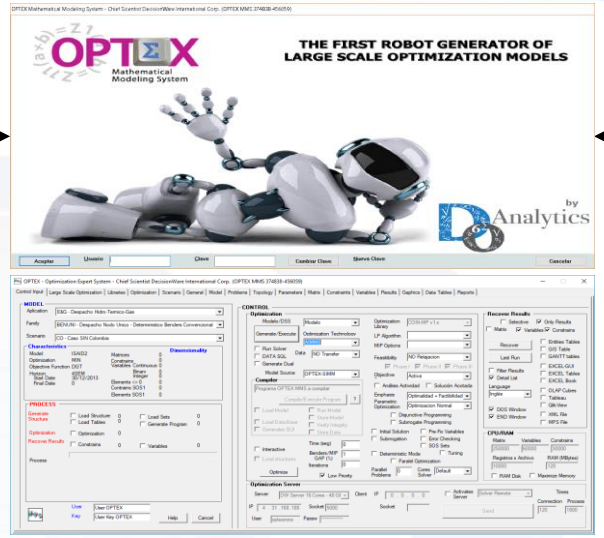


GAMS

GAMS

OPTIMIZATION SERVER

OPTEX-GAMS



ODBC

Remote Access Server Connectivity

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GAMS

New solution concepts

- Extended Nonlinear Programs
- Embedded Complementarity Systems
- Bilevel Programs
- Disjunctive Programs
- …

  - Breakouts of traditional MP classes
  - No conventional syntax
  - Limited support with common model representation
  - Incomplete/experimental solution approaches
  - Lack of reliable/any software

MACHINE LEARNING & OPTIMIZATION USING MATHEMATICAL PROGRAMMING TECHNOLOGIES
UTILIZANDO GAMS (BÁSICO)

ANALÍTICA AVANZADA & OPTIMIZACIÓN UTILIZANDO GAMS BÁSICO		
SESIÓN	**PROFESOR**	**TEMA**
		Valor Económico Agregado por las Matemáticas Estado del Arte de la Optimización (Advanced Analytics)
		Mathematical Programming 4.0 Fundamentos de Optimización
1	**JVB**	Introducción Cursos GAMS Fundamentos de GAMS
2	**JVB**	Modelamiento Matemático Estructurado - I Formulación Algebraica - Implementación en GAMS del Modelo de Despacho Económico E&G
3	**JVB**	Modelamiento Matemático Estructurado - II Formulación Algebraica - Implementación en GAMS del Modelo S&OP Industria Bebidas
4	**JVB**	Modelamiento Tiempo Continuo Casos: Programación de Actividades - Ruteo de Vehículos – Procesos Industriales
5	**JVB**	Metodologías de Gran Escala – Descomposición de Sistemas -Optimización Paralela - Sistemas Expertos para programación Matemática – Real-Time Distributed Optimization
6	**JVB**	GDX (GAMS Data eXchange)
7	**JVB**	GAMS: Solvers Utilidades para Calibración de Parámetros
8	**JVB**	Superstructures Optimization
9	**JVB**	Disjunctive Programing Caso: Optimización de Procesos
10A	**JVB**	Diseño de Time-Tables Casos: Colegios - Puertos
10B	**JVB**	Solución Secuencial de Problemas – GUSS Data Envelopment Analisys
	JVB	OPTEX – BÁSICO Modelamiento Matemático Estructurado
	JVB	OPTEX – GAMS Modelamiento Básico - Análisis de Factibilidad – Programación Disyuntiva

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ICDA

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```
*OPTEX-> Restriccion: Consumo Combustible por Nodo
R_CCNS[t,ns]$( C__TTT(t) and C_NTE(ns) )..
 +  SUM([C_BLO[b] ,C_CTN[ns,g] ,C_CBT[g,k] ],P_IPCA[k] * V_CCO[t,b,g,k]$(C__TTT(t) and C_BLO(b) and C_TMCR(g) and C_CBT(g,k) ) )
 -  SUM([C_DGT[sd] ],V_VCL[t,ns,sd]$(C__TTT(t) and C_NTD(ns) and C_DTN(ns,sd) ) ) =l= 0 ;

*OPTEX-> Restriccion: Conservación Materia Entrada Central Hidráulica con Pondaje
R_CCP[t,p]$( C__TTT(t) and C_HCP(p) )..
 +  SUM([C_BLO[b] ],V_ATU[t,p,b]$(C__TTT(t) and C_HID(p) and C_BLO(b) ) )
 +  SUM([C_BLO[b] ],V_VCE[t,p,b]$(C__TTT(t) and C_HID(p) and C_BLO(b) ) )
 -  SUM([C_BLO[b] ,C_CAC[p,c] ],P_ECCC[p,c] * V_HCC[t,c,p,b]$(C__TTT(t) and C_CAC(p,c) and C_HID(p) and C_BLO(b) ) )
 -  SUM([C_EVC[p,m] ],P_ECVE[m] * V_VEE[t,m]$(C__TTT(t) and C_EMB(m) ) )
 -  SUM([C_BLO[b] ,C_KAC[p,cb] ],P_ECKC[cb,p] * V_HKC[t,cb,p,b]$(C__TTT(t) and C_KAN(cb) and C_AKC(cb,p) and C_BLO(b) ) )
 -  SUM([C_BLO[b] ,C_EAC[p,m] ],P_ECEC[m,p] * V_HEC[t,p,m,b]$(C__TTT(t) and C_HID(p) and C_EAC(p,m) and C_BLO(b) ) ) =e= P_HAT[t,p]

*OPTEX-> Restriccion: Conservación Materia Salida Central Hidráulica
R_CGS[t,p,b]$( C__TTT(t) and C_CEC(p) and C_BLO(b) )..
 +  SUM([C_EBC[p,m] ],V_HCE[t,p,m,b]$(C__TTT(t) and C_HID(p) and C_EBC(p,m) and C_BLO(b) ) )
 +  SUM([C_CBC[p,c] ],V_HCC[t,p,c,b]$(C__TTT(t) and C_HID(p) and C_CBC(p,c) and C_BLO(b) ) )
 +  SUM([C_CAK[p,cb] ],V_HCK[t,p,cb,b]$(C__TTT(t) and C_HID(p) and C_CAK(p,cb) and C_BLO(b) ) )
 - V_ATU[t,p,b]$(C__TTT(t) and C_HID(p) and C_BLO(b) ) =e= 0 ;

*OPTEX-> Restriccion: Continuidad Energía Barras - 1ra Ley Kirchhoff perdidas Direccionadas
R_CNDF[t,z,b]$( C__TTT(t) and C_BAR(z) and C_BLO(b) )..
 +  SUM([C_TBA[z,g] ],V_GTE[t,g,b]$(C__TTT(t) and C_TER(g) and C_BLO(b) ) )
 +  SUM([C_HBA[z,p] ],V_GHI[t,p,b]$(C__TTT(t) and C_HID(p) and C_BLO(b) ) )
 +  SUM([C_CBB[z,f] ],V_TCC[t,b,f]$(C__TTT(t) and C_BLO(b) and C_CIR(f) ) )
 -  SUM([C_CB2[z,f] ],V_TCC[t,b,f]$(C__TTT(t) and C_BLO(b) and C_CIR(f) ) )
 - V_ENR[t,z,b]$(C__TTT(t) and C_BAD(z) and C_BLO(b) )
 -  SUM([C_CB2[z,f] ],V_PED[t,b,f]$(C__TTT(t) and C_BLO(b) and C_CIR(f) ) )
 - V_EIC[t,b,z]$(C__TTT(t) and C_BLO(b) and C_BIC(z) )
 + V_IIC[t,b,z]$(C__TTT(t) and C_BLO(b) and C_BIC(z) ) =e= 0 ;
```

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```
* OPTEX-> Conjuntos Leidos
Q12="SELECT COD_VEH FROM VEHICULO WHERE COD_VEH IN (SELECT COD_VEH FROM ESC_VEH)
s12=C_VEH
Q13="SELECT COD_CVE FROM CICLOS WHERE COD_CVE IN (SELECT COD_CVE FROM ESC_CVE)
s13=C_CIC
Q14="SELECT COD_CVE,COD_CVE1 FROM CICLOS3 WHERE COD_CVE IN (SELECT COD_CVE FROM ESC_CVE) AND COD_CVE1 IN (SELECT COD_CVE1 FROM ESC_CVE)
s14=C_CPO
Q15="SELECT COD_VEH,COD_MUE FROM MUE_VEH WHERE COD_VEH IN (SELECT COD_VEH FROM ESC_VEH) AND COD_MUE IN (SELECT COD_MUE FROM ESC_MUE)
s15=C_MUV
Q16="SELECT COD_EVE FROM EVENTOS WHERE COD_EVE IN (SELECT COD_EVE FROM ESC_EVE)
s16=C_EVE
Q17="SELECT COD_MUE FROM MUELLES WHERE COD_MUE IN (SELECT COD_MUE FROM ESC_MUE)
s17=C_MUE
Q18="SELECT COD_EVE,COD_EVE1 FROM EVENTOS3 WHERE COD_EVE IN (SELECT COD_EVE FROM ESC_EVE) AND COD_EVE1 IN (SELECT COD_EVE1 FROM ESC_EVE)
s18=C_EPO
Q19="SELECT COD_MUE,COD_VEH FROM MUE_VEH WHERE COD_MUE IN (SELECT COD_MUE FROM ESC_MUE) AND COD_VEH IN (SELECT COD_VEH FROM ESC_VEH)
s19=C_VMU
Q20="SELECT COD_NOD FROM NODOS WHERE COD_NOD IN (SELECT COD_NOD FROM ESC_NOD)
s20=C_CLI
Q21="SELECT COD_NOD,COD_PED FROM PEDIDOS WHERE COD_NOD IN (SELECT COD_NOD FROM ESC_NOD) AND COD_PED IN (SELECT COD_PED FROM ESC_PED)
s21=C_PDE
Q22="SELECT COD_CVE1 FROM ESC_CVE WHERE COD_CVE1 IN (SELECT COD_CVE1 FROM ESC_CVE)
s22=C_CIA
Q23="SELECT COD_MUE FROM MUE_VEH WHERE COD_MUE IN (SELECT COD_MUE FROM ESC_MUE)
s23=C_MVE
Q24="SELECT COD_EVE1 FROM EVENTOS WHERE COD_EVE1 IN (SELECT COD_EVE1 FROM ESC_EVE)
s24=C_EVA
Q25="SELECT COD_PED,COD_PRO FROM PED_PRO WHERE COD_PED IN (SELECT COD_PED FROM ESC_PED) AND COD_PRO IN (SELECT COD_PRO FROM ESC_PRO)
s25=C_PRP
Q26="SELECT COD_PRO FROM ESC_PRO WHERE COD_PRO IN (SELECT COD_PRO FROM ESC_PRO)
s26=C_PRO

* OPTEX-> Parametros Leidos
Q27="SELECT COD_NOD,TVIN FROM NODOS WHERE COD_NOD IN (SELECT COD_NOD FROM ESC_NOD)"
 a27=P_TVIS
```

1: 1 Insert

GAMS

SESIÓN	PROFESOR	TEMA
1-2-3	**JVB**	Teoría de Partición de Benders – Variaciones – Mejoras Ejemplos GAMS
4A, 4B	**JVB**	Programación Estocástica & Manejo del Riesgo
5	**JVB**	Dynamic Programming - Dynamic Benders SDDP (Stochastic Dual Dynamic Programming) - G-SDDP (Generalized Stochastic Dual Dynamic Programming) Case: Aplicaciones en el Sector Eléctrico
6	**JVB**	Relajación Lagrangeana – Surrogate Programming
7	**JVB**	Dantzig–Wolfe Decomposition Aplicación en el Sector Petrolero - Ejemplos GAMS
8	**JVB**	Descomposición Cruzada Ejemplos: Sector Eléctrico , Cadena de Abastecimiento – Ejemplos GAMS
9	**JVB**	Extended Mathematical Programming Rapid Prototyping
10	**JVB**	Optimizacion Paralela Asincrónica en GAMS Optimizacion Distribuida en Tiempo Real
	JVB	OPTEX – GAMS Large-Scale Optimization – Optimización Paralela – Sistemas Expertos

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DE18

OPTEX_BENUNI.gms | OPTEX_BENUNI.lst | RR_D04.csv | RR_FBE.csv

```
* OPTEX-> File creation date: 11/06/2019 - 06:10:00-->
* GAMS Program Code generated by OPTEX Mathematical Modeling System copyright  DO ANALYTICS LLC.
* This code can be legally used only with write or digital license of DO ANALYTICS LLC.
* User License ID: Chief Scientist DecisionWare International Corp. (OPTEX MMS 374838-456059)

* OPTEX-> Modelo: BENUNI - Standard Benders Nodo Unico

* OPTEX-> Problema(s):
*      Problem: BENUNICO Despacho Ideal Nodo Unico - Coordinador Benders
*      Problem: BENUNISP Despacho Ideal Nodo Unico - SubProblema Benders


*Tipo Modelo: Normal

$title OPTEX - Model: BENUNI Standard Benders Nodo Unico

*OPTEX-> Benders' Theory Parameters:
*OPTEX-> Coordinator Management:
*        Master Re-Optimization Approach: GAMS CALL
*        Subrrogate Cuts: False
*        Generated Dual Master: False
*        Warm Start: False
*        Modified Optimality Cuts: True
*OPTEX-> MIP/MINLP Coordinator:
*        Two Stage Coordinator: False
*        GAP to Change: 25.00000000
*        Inexact Solutions: True
*        Initial Tolerance GAP Coordinator: 100.00000000
*        Initial Tolerance GAP Coordinator: 10.00000000
*OPTEX-> Trust Region - Regularization: False
*        Penalization Objetive Function: False
*        Type Penalization: Lineal
*        Penalization Value: 10000000000.00000000
*        Neighborhood Limits (%): False
*        Neighborhood Limits (%): 20.00000000
*        Neighborhood Binary Equation: False
*OPTEX-> Sub-Problem(s) Management:
*        Dynamic Modeling: GDDP - Generalized Dual Dynamic Programming
*        Type of Benders Subproblem: Standard Benders
*        Sub-Problem(s) Re-Optimization Approach: GAMS CALL
*        Convex Subrrogate Cuts: False
*        Generated Dual Subproblem: False
*        Feasibility Including Artificial Variables: False
```

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```
*OPTEX-> Include MOD MODPLAN ##PRESOL##
*OPTEX-> Include MOD MODPLAN ##NEWSOL##
C__DIM_od(od) = no ;
Loop ( C__SOD(od) ,
if (on_SUB_Loop > 0 ,
     C__DIM_od(od) = yes ;
    P_DBME[t,z,b]$(C__TTT(t)) = (  +  SUM([C_SBA[z,si] ,C_SOP[od,hp] ,C_SODD[od,hd] ],P_PBDE[t,z,b,hd,hp] * P_DMAE[t,si,hd,hp])  )
    P_HT_CRE2[v] =  + 1 * P_R_HT_CRE2[v,od] ;
    P_HT_CHI[p] =  + 1 * P_R_HT_CHI[p,od] ;
    P_HT_CTE[g] =  + 1 * P_R_HT_CTE[g,od] ;
    P_HT_EMB[m] =  + 1 * P_R_HT_EMB[m,od] ;
    P_ON_CHI[p] =  + P_HT_CHI[p] * 100000000 ;
    P_ON_CTE[g] =  + P_HT_CTE[g] * 100000000 ;
    P_ON_EMB[m] =  + P_HT_EMB[m] * 100000000 ;
    P_VFFE[t,m]$(C__TTT(t)) = (  + P_HT_EMB[m] * P_VFEM[t,m] ) * 1 ;
    P_DSGHE[t,b,z]$(C__TTT(t)) = (  +  SUM([C_HBA[z,p] ,C_SODD[od,hd] ,C_SOP[od,hp] ],P_FB[t,z,b]$(C__TTT(t)) * P_DSMH[t,p]$(C__TTT
    P_DBBE[t,z,b]$(C__TTT(t)) = ( ( ( + 1 * P_DBME[t,z,b]$(C__TTT(t)) ) * 1 + 1 * P_DSGHE[t,b,z]$(C__TTT(t)) ) * 1 +  SUM([C_DIZ[z
    P_TCDE[t,z,b,d]$(C__TTT(t)) = (  + P_CTDE[d] * P_DBBE[t,z,b]$(C__TTT(t)) ) * 1 ;
    V_DEF.up[t,z,d,b] = P_TCDE[t,z,b,d]$(C__TTT(t)) ;

    Display  P_DBME, P_HT_CRE2, P_HT_CHI, P_HT_CTE, P_HT_EMB, P_ON_CHI, P_ON_CTE, P_ON_EMB, P_VFFE, P_DSGHE, P_DBBE, P_TCDE ;
     C__DIM_ht(ht) = no ;
Loop ( C__SHT(ht) ,
if (on_SUB_Loop > 0 ,
          C__DIM_ht(ht) = yes ;
    P_HT_CRE1[v,hp] =  + 1 * P_R_HT_CRE1[v,hp,ht] ;
    P_HT_CRE[v] = (  +  SUM([C_SOP[od,hp] ],1 * P_HT_CRE1[v,hp])  ) * 1 ;
    P_SPCTB[t,b,v]$(C__TTT(t)) = ( (  + P_HT_CRE[v] * P_SPCB[t,b,v]$(C__TTT(t)) ) * 1 + P_HT_CRE2[v] * P_SPCB[t,b,v]$(C__T

    Display  P_HT_CRE1, P_HT_CRE, P_SPCTB ;
          C  DIM hc(hc) = no ;
```

GAMS

2452: 45 Modified Insert

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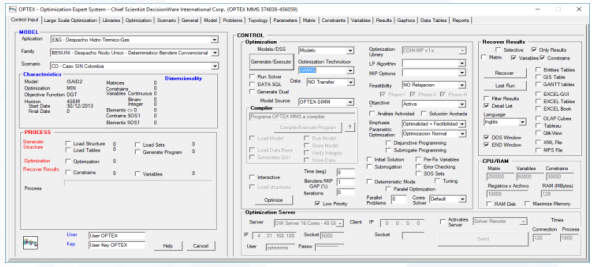
DIPLOMADO EN AMPL

PLAN DE TEMAS

GO BACK

OPTEX-AMPL



ODBC

Remote Access Server Connectivity

OPTIMIZATION SERVER

KNITRO

FICO Xpress

Gurobi Optimization

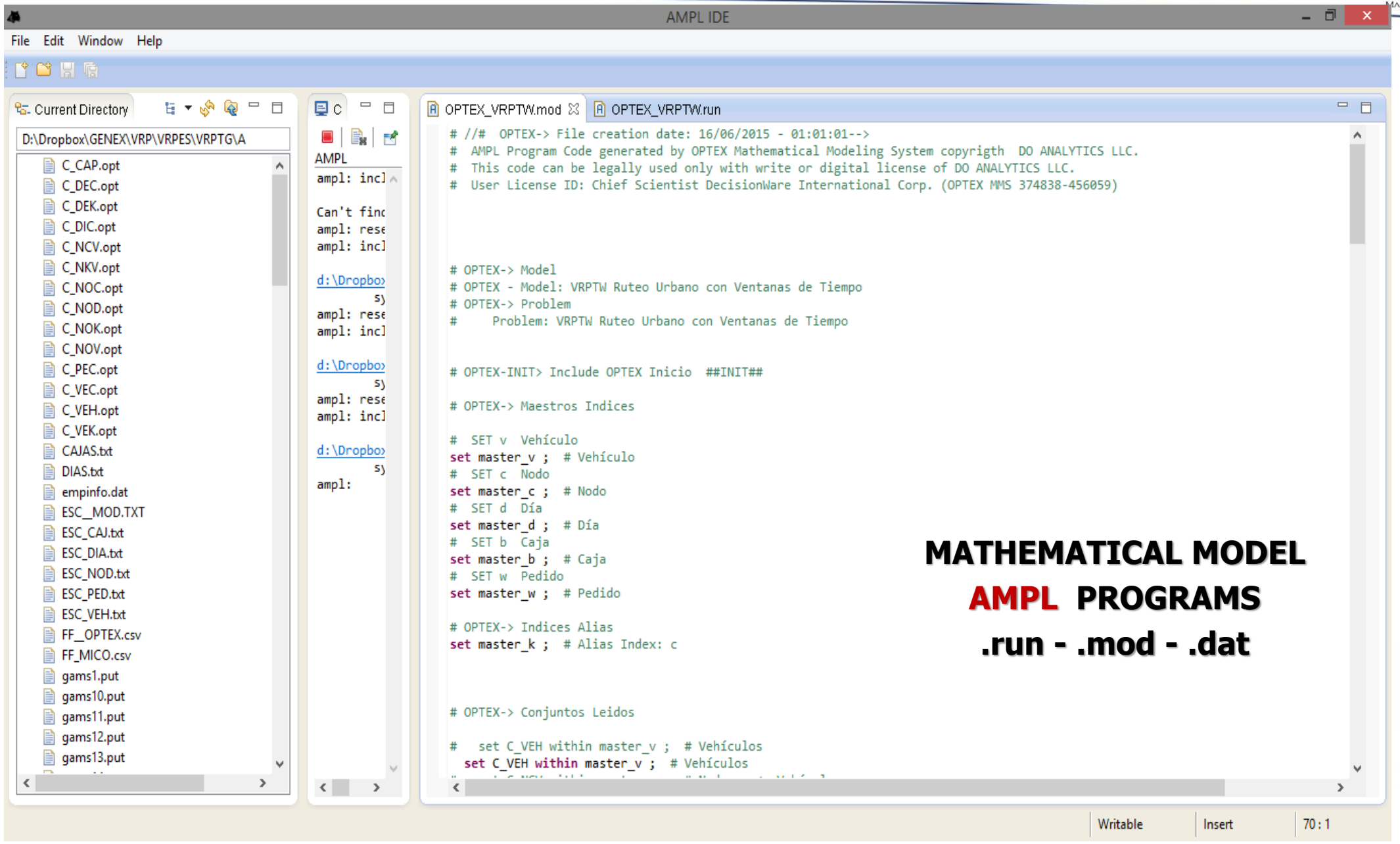
IBM CPLEX

AMPL

AMPL

WORK IN PROGRESS

OPTEX-AMPL-MMS

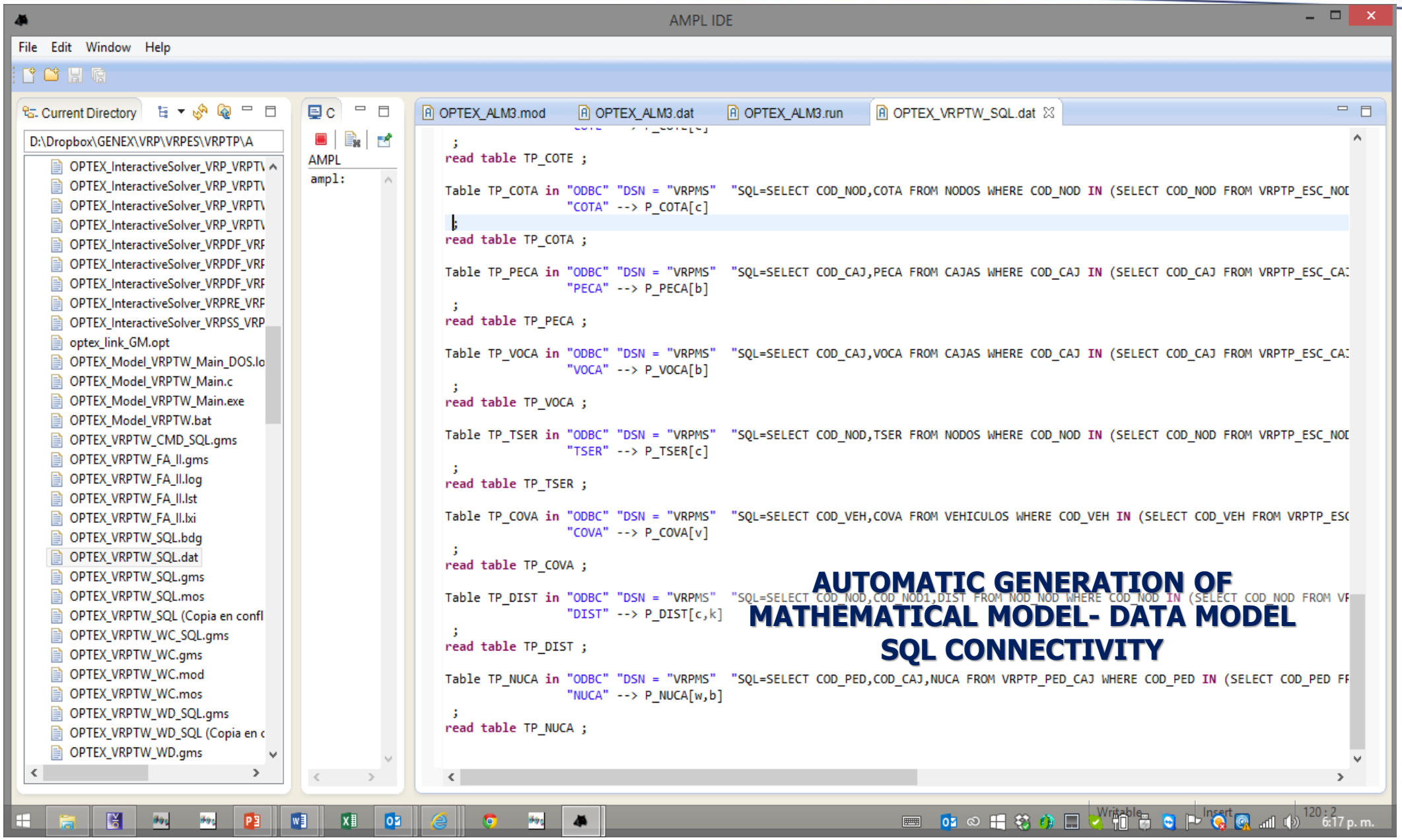


MATHEMATICAL MODEL

AMPL PROGRAMS

.run - .mod - .dat

OPTEX-AMPL-MMS




WORK
IN PROGRESS

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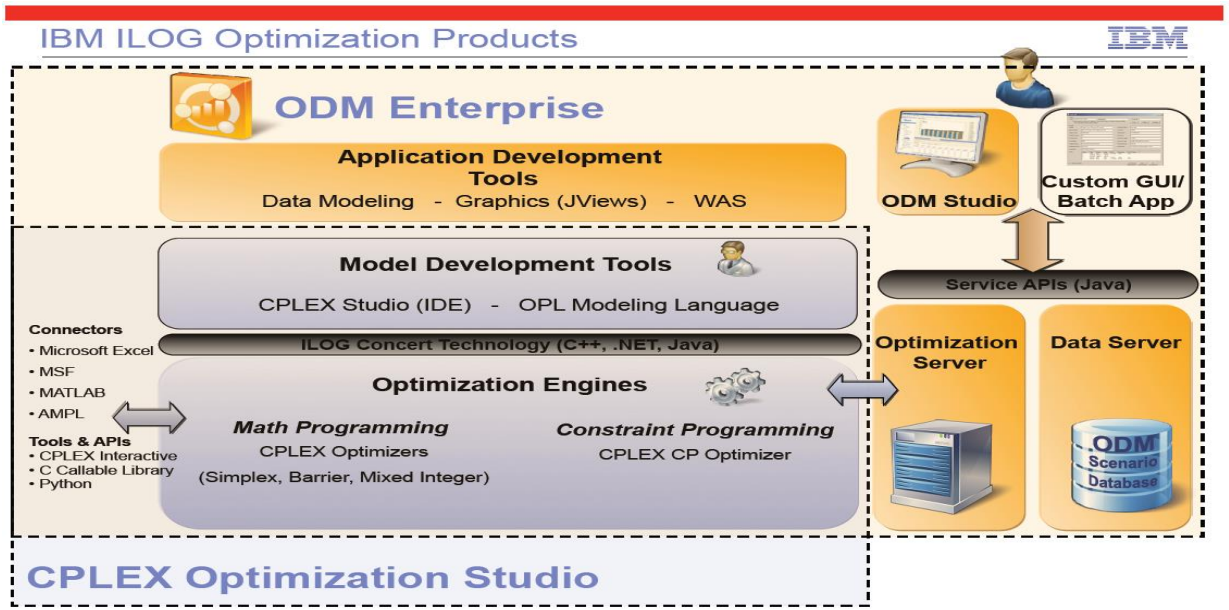
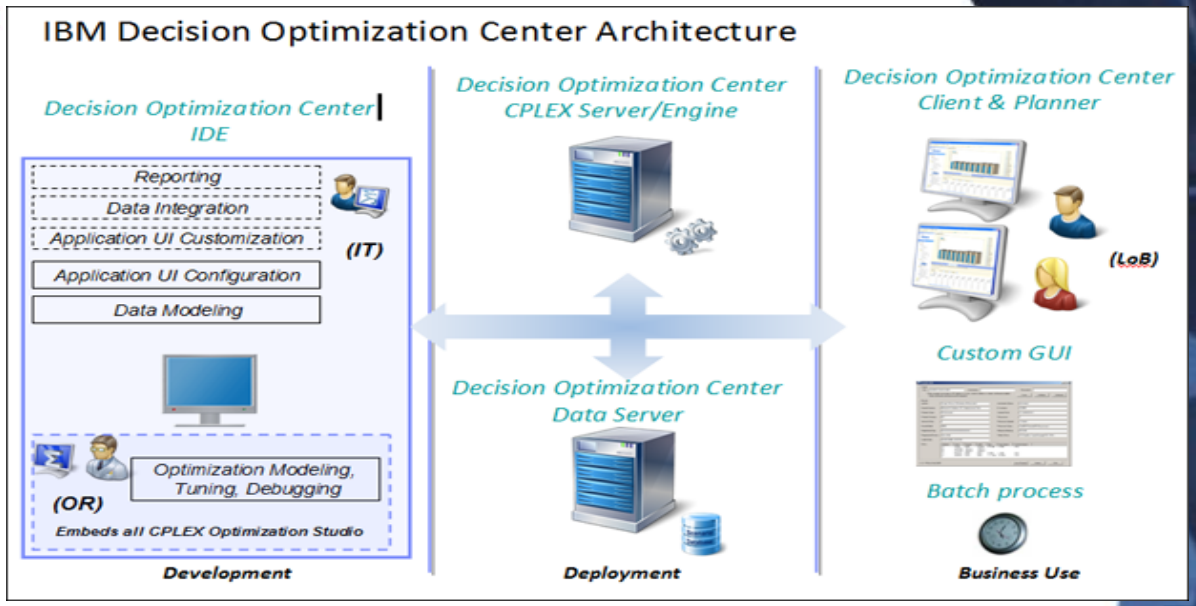
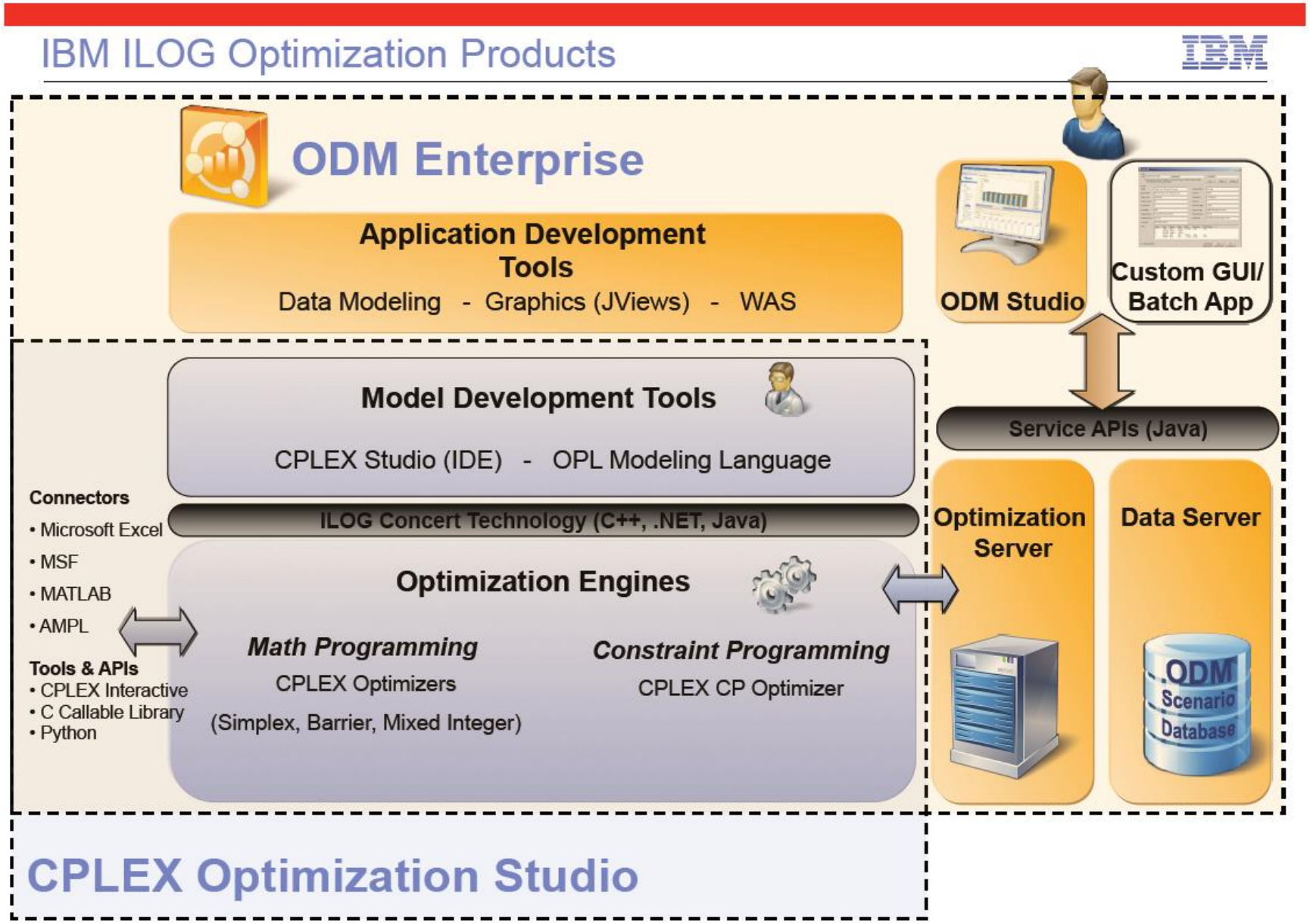
DIPLOMADO EN IBM OPL / CPLEX -
PLAN DE TEMAS



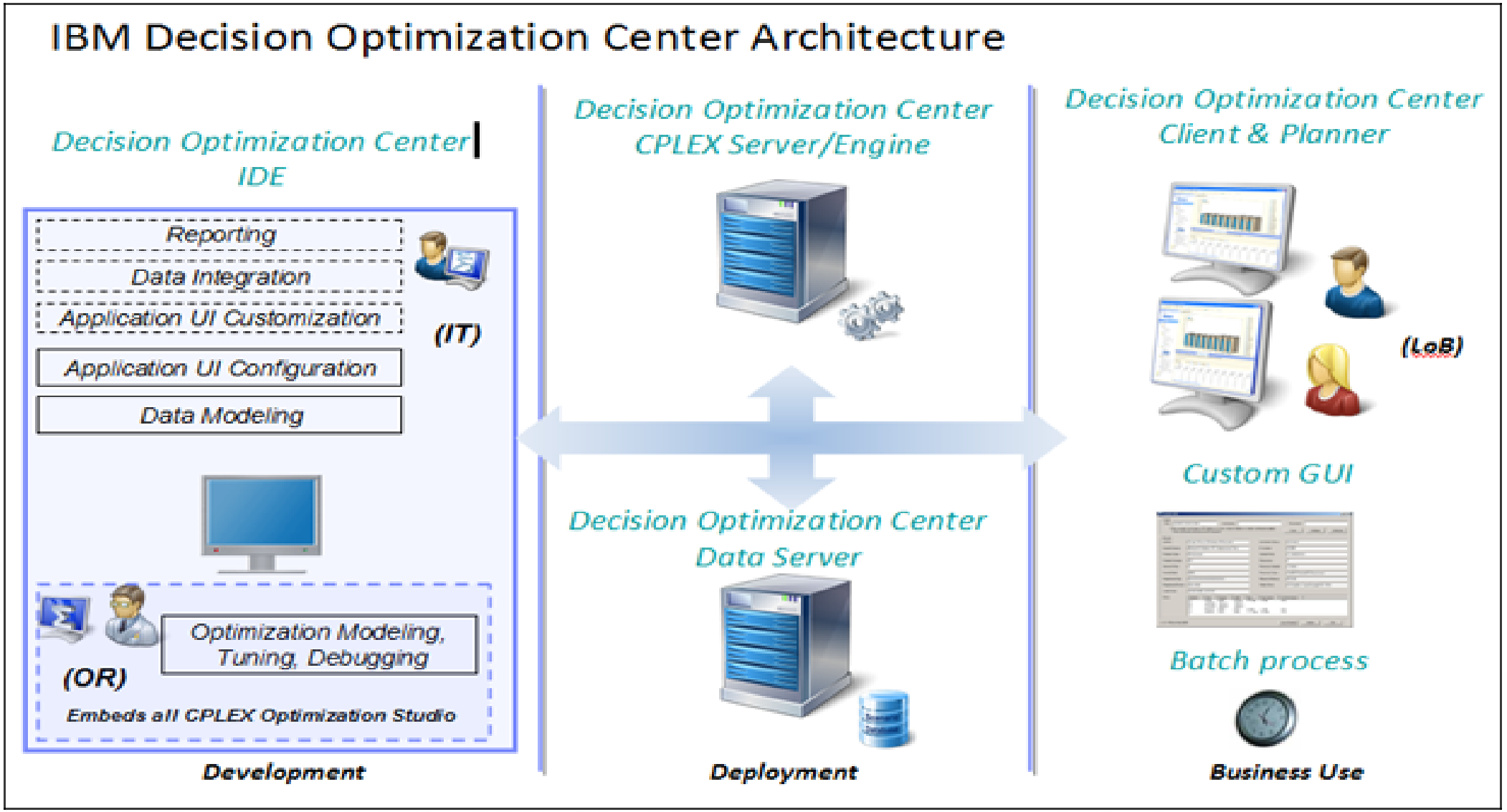


GO BACK

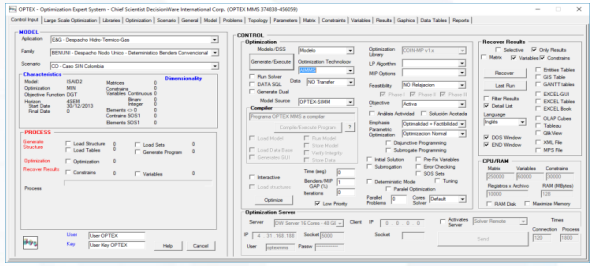
IBM-CPLEX OPTIMIZATION STUDIO



IBM DECISION OPTIMIZATION CENTER



OPTEX-CPLEX-OPL



ODBC

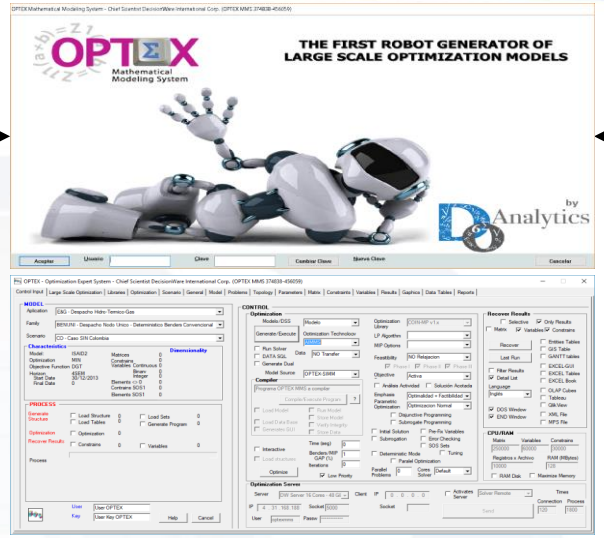
Remote Access Server Connectivity

OPTIMIZATION SERVER

IBM CPLEX

IBM OPL

OPTEX-CPLEX-OPL



ODBC

Remote Access Server Connectivity

OPTIMIZATION SERVER

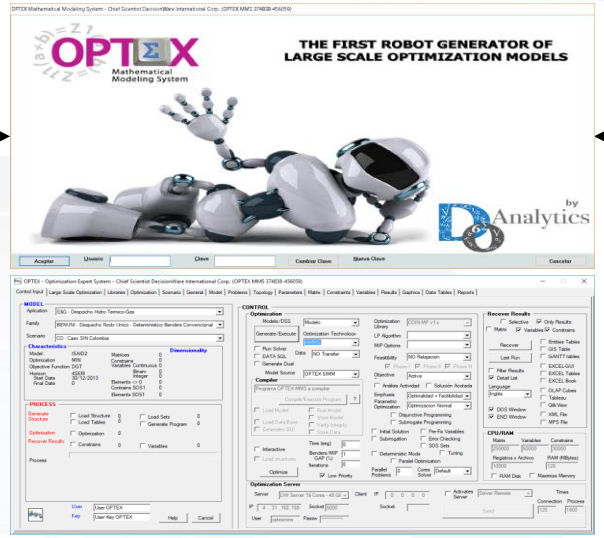
USUARIOS ILIMITADOS

IBM CPLEX

R python Java C++

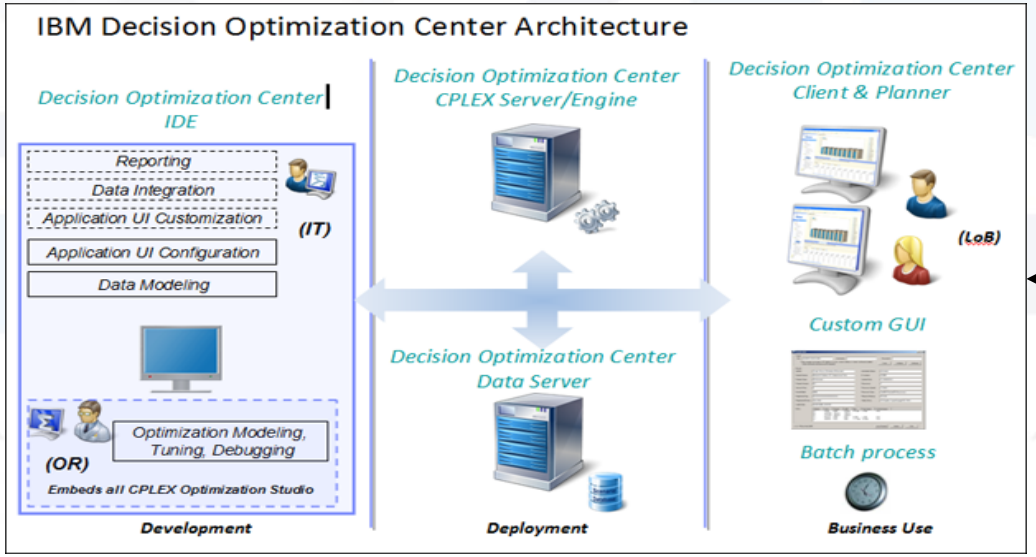
IBM ILOG CONCERT TECHNOLOGIES

OPTEX-IBM-DOC



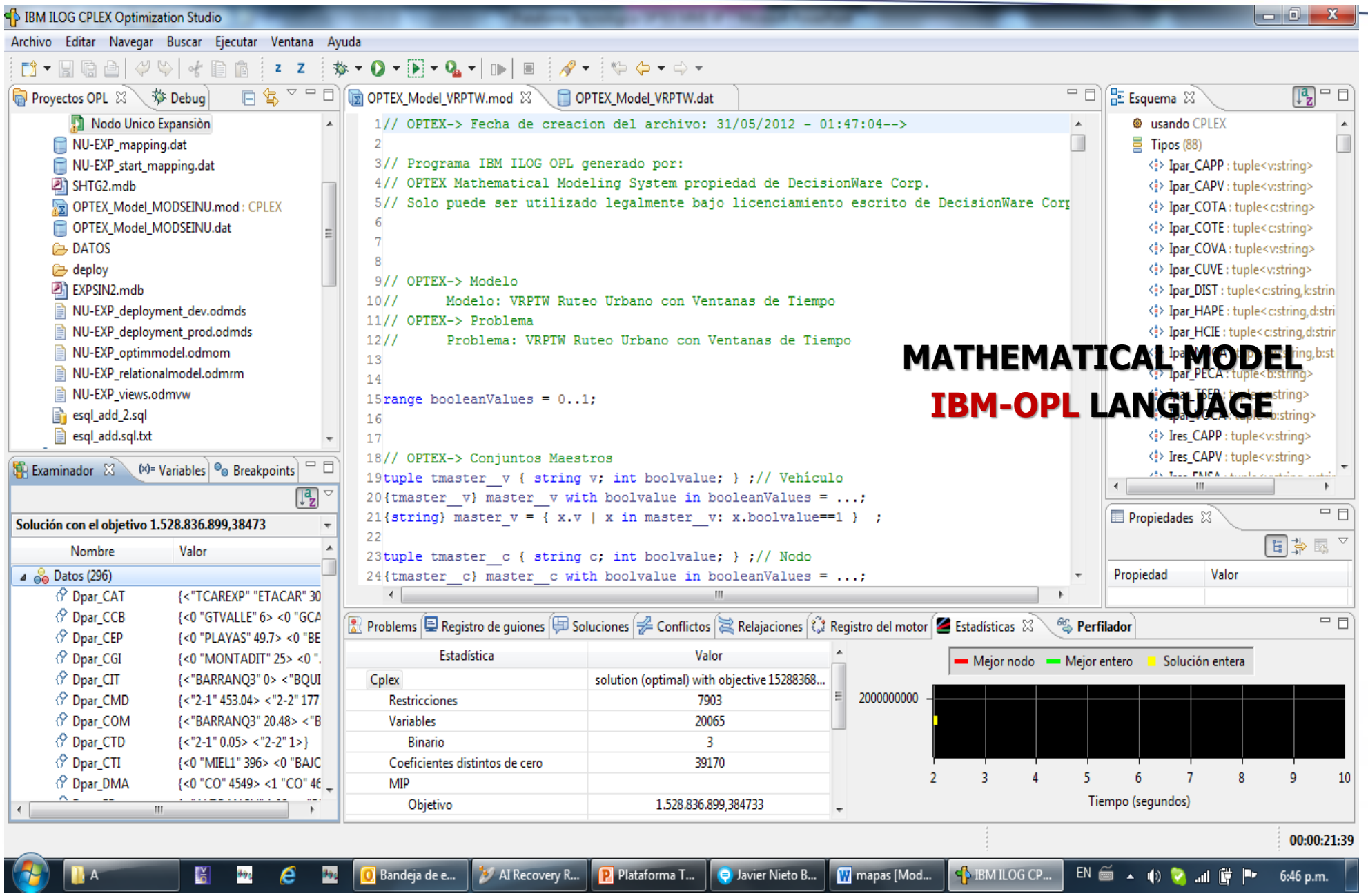
ODBC

Remote Access Server Connectivity



OPTIMIZATION SERVER

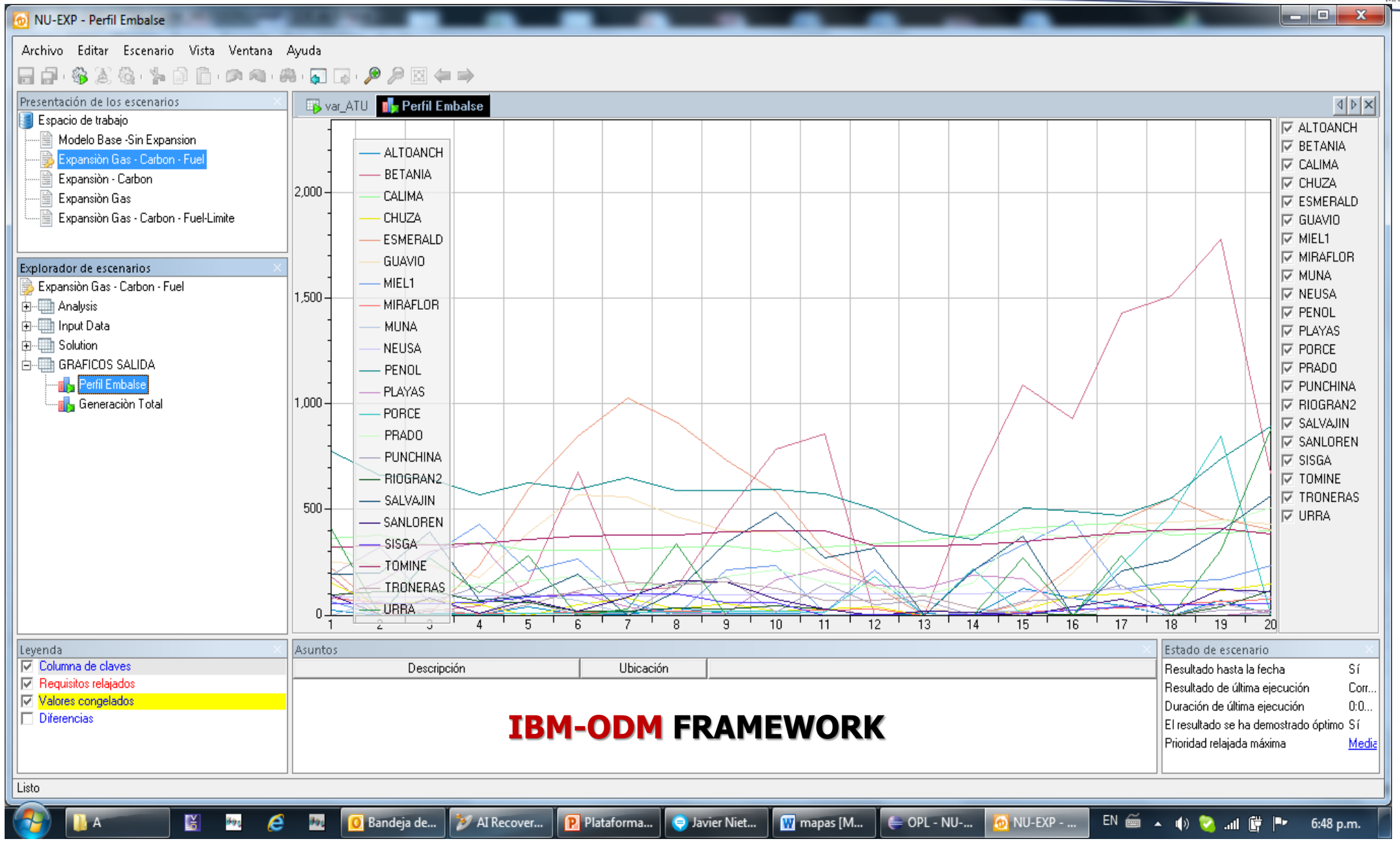
OPTEX-IBM-ILOG OPL



MATHEMATICAL MODEL

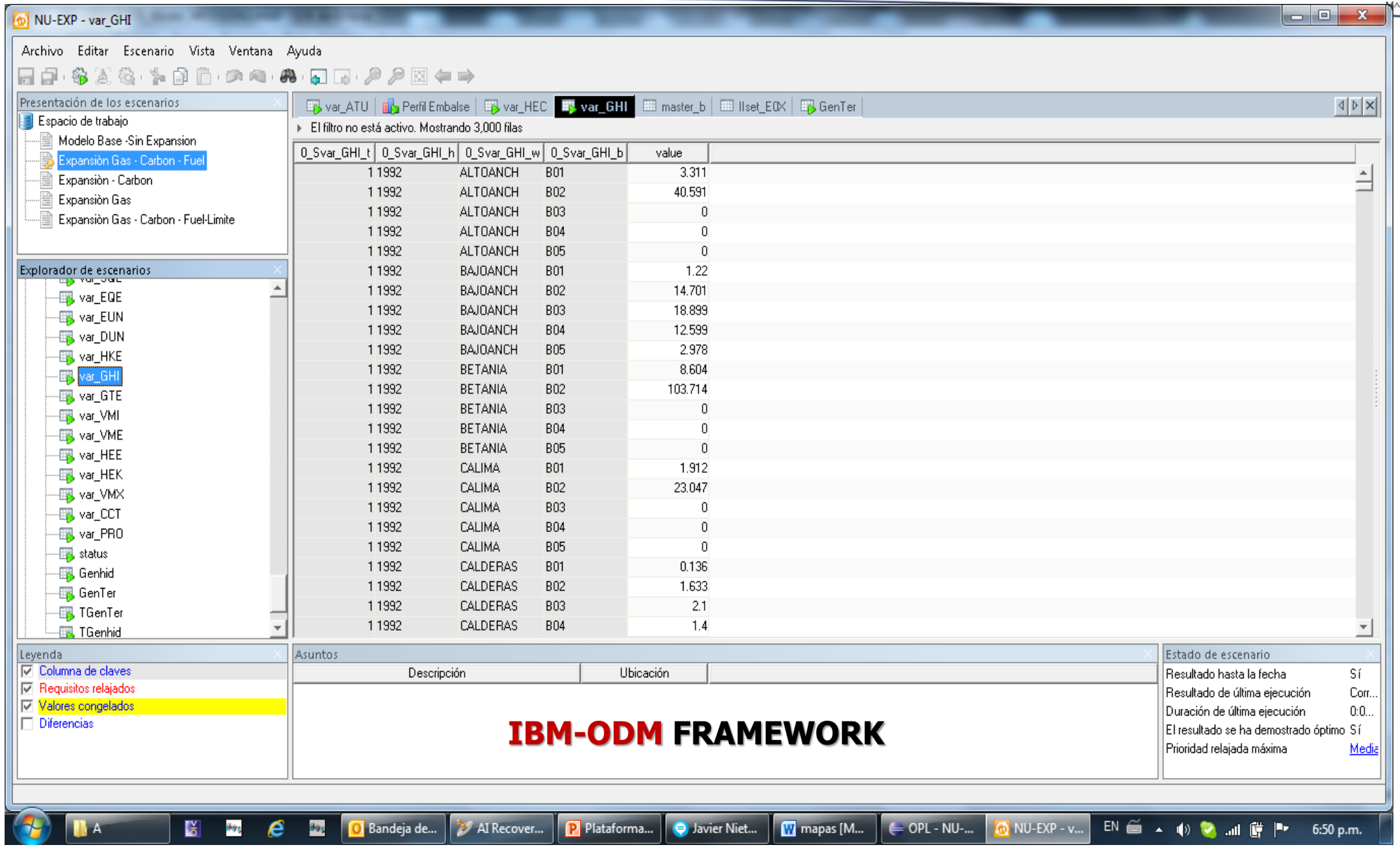
IBM-OPL LANGUAGE

OPTEX-IBM-ILOG ODME



IBM-ODM FRAMEWORK

OPTEX-IBM-ILOG-ODME



http://www.doanalytics.net/Documents/OPTEX-IBM-ILOG-MMS.pdf

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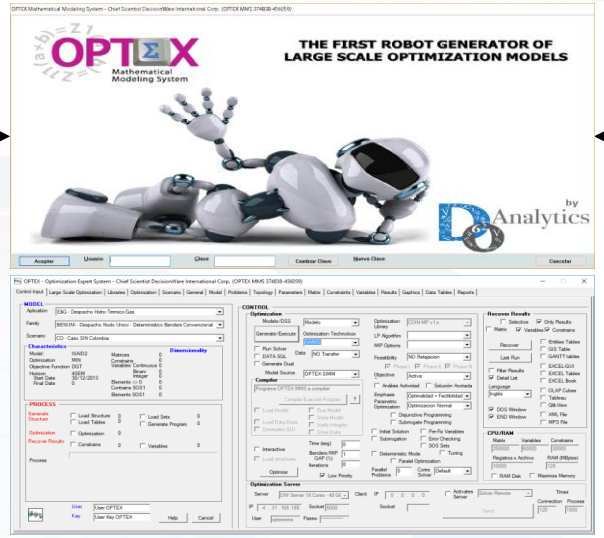
DIPLOMADO EN
PLAN DE TEMAS

OPTEX-C



ODBC

Remote Access Server Connectivity

OPTEX

DATABASE

LPS

COIN-OR

FICO™ XPRESS

GUROBI OPTIMIZATION

ILOG An IBM Company

CPLEX

OPTIMIZATION SERVER

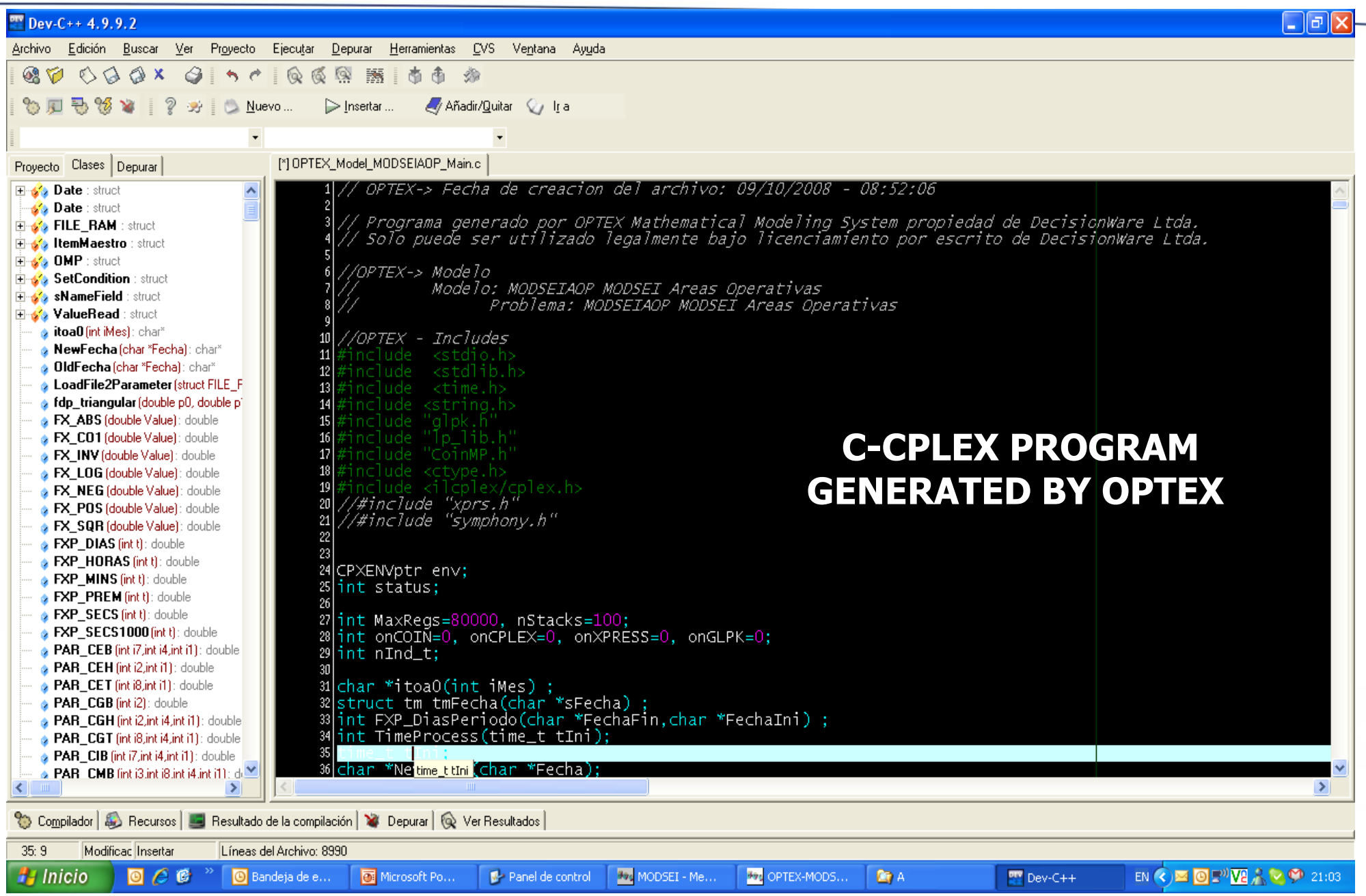
Dev C++

Microsoft Visual C#

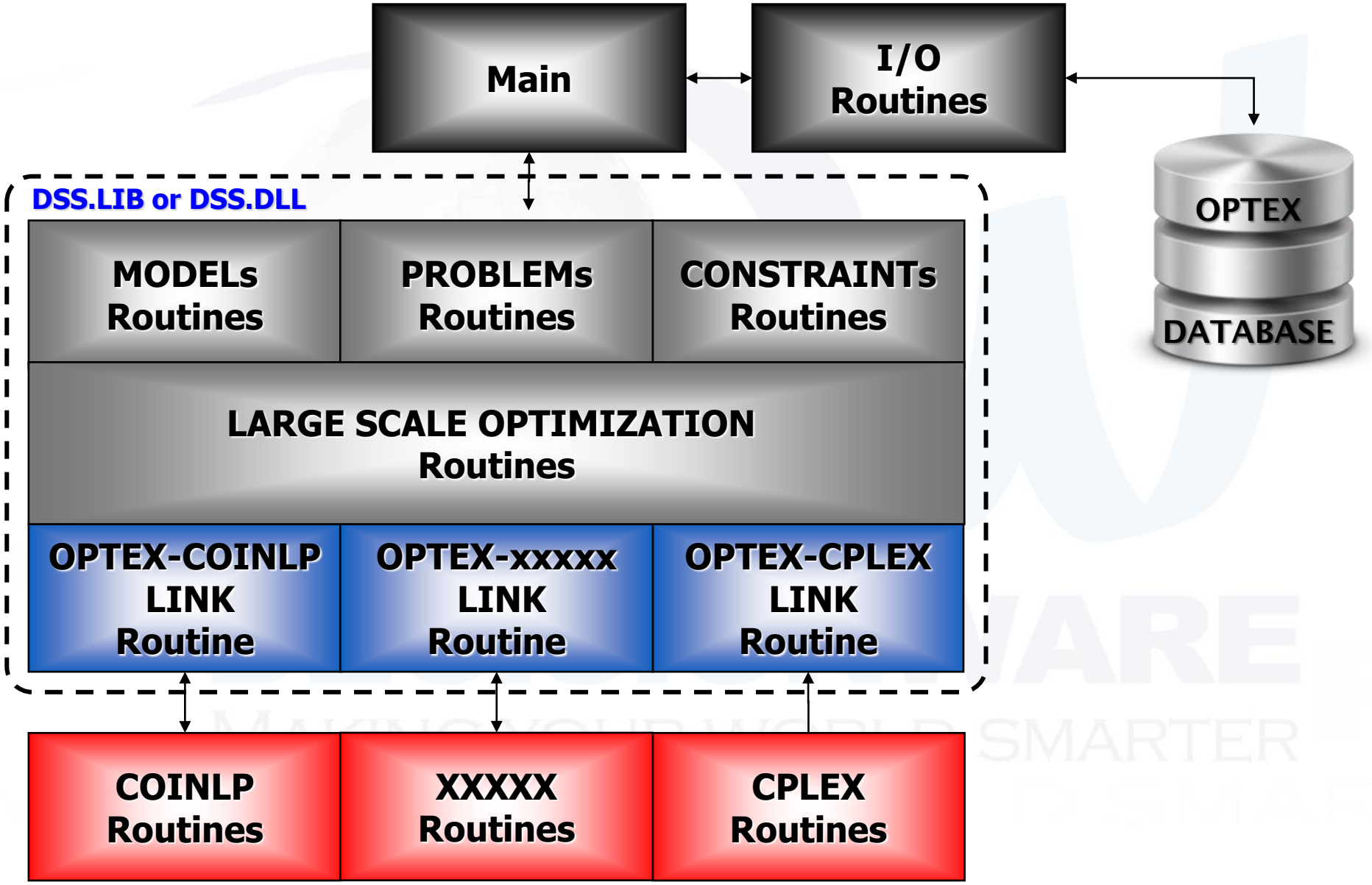
Dev C++

OPTIMIZATION LIBRARY

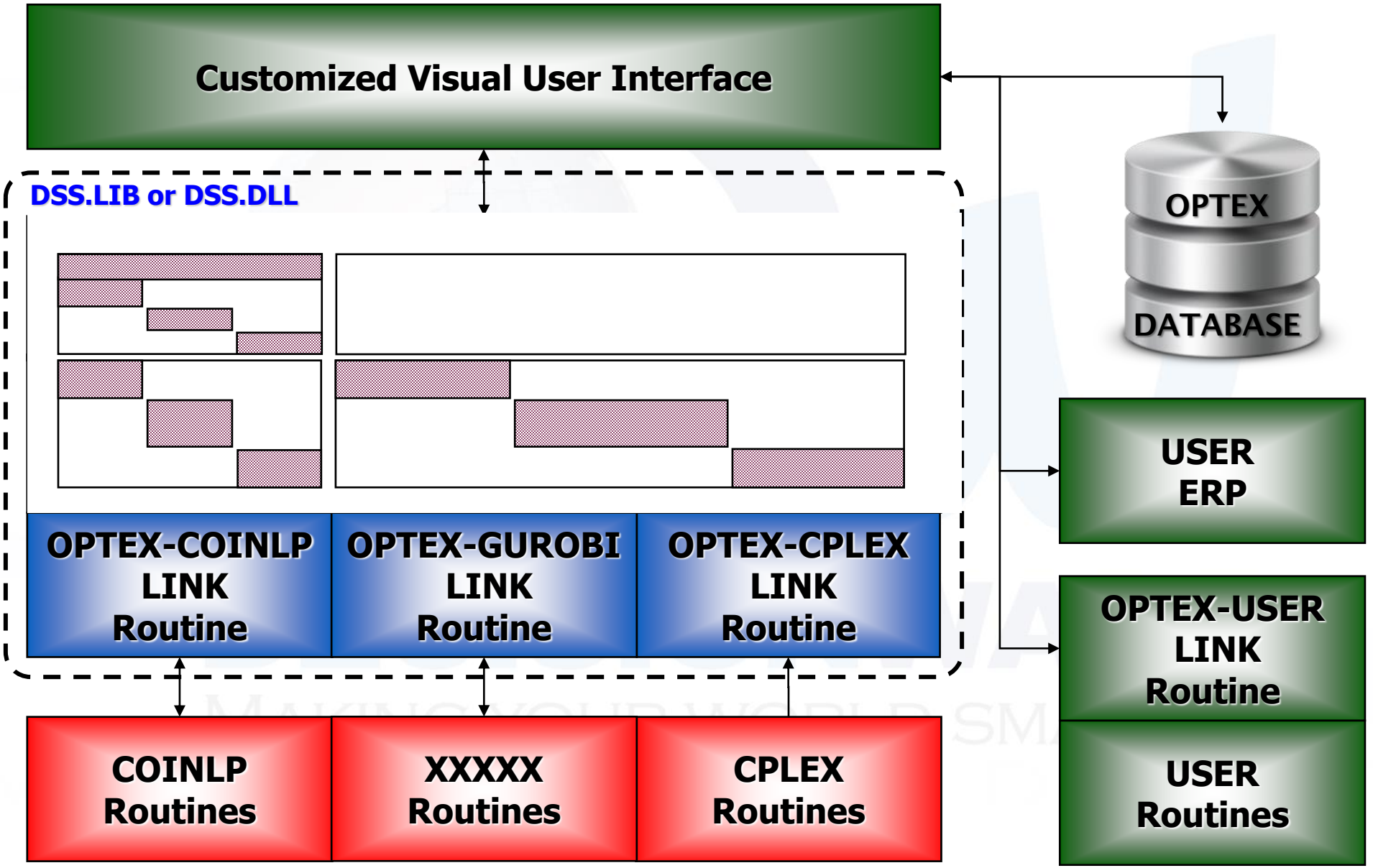
OPTEX-C


Dev-C++ 4.9.9.2
Archivo Edición Buscar Ver Proyecto Ejecutar Depurar Herramientas CVS Ventana Ayuda
Nuevo ... Insertar ... Añadir/Quitar Ir a
Proyecto Clases Depurar
[*] OPTEX_Model_MODSEIAOP_Main.c
// OPTEX-> Fecha de creacion del archivo: 09/10/2008 - 08:52:06
// Programa generado por OPTEX Mathematical Modeling System propiedad de DecisionWare Ltda.
// Solo puede ser utilizado legalmente bajo licenciamiento por escrito de DecisionWare Ltda.
//OPTEX-> Modelo
// Modelo: MODSEIAOP MODSEI Areas Operativas
// Problema: MODSEIAOP MODSEI Areas Operativas
//OPTEX - Includes
#include <stdio.h>
#include <stdlib.h>
#include <time.h>
#include <string.h>
#include "glpk.h"
#include "lp_lib.h"
#include "CoinMP.h"
#include <ctype.h>
#include <ilcplex/cplex.h>
//#include "xprs.h"
//#include "symphony.h"
CPXENVptr env;
int status;
int MaxRegs=80000, nStacks=100;
int onCOIN=0, onCPLEX=0, onXPRESS=0, onGLPK=0;
int nInd_t;
char *itoaO(int iMes) ;
struct tm tmFecha(char *sFecha) ;
int FXP_DiasPeriodo(char *FechaFin,char *FechaIni) ;
int TimeProcess(time_t tIni);
time_t tIni;
char *Ne time_t tIni (char *Fecha);
C-CPLEX PROGRAM
GENERATED BY OPTEX
Compilador Recursos Resultado de la compilación Depurar Ver Resultados
35: 9 Modificac Insertar Líneas del Archivo: 8990
Inicio
Bandeja de e...
Microsoft Po...
Panel de control
MODSEI - Me...
OPTEX-MODS...
A
Dev-C++
EN
21:03

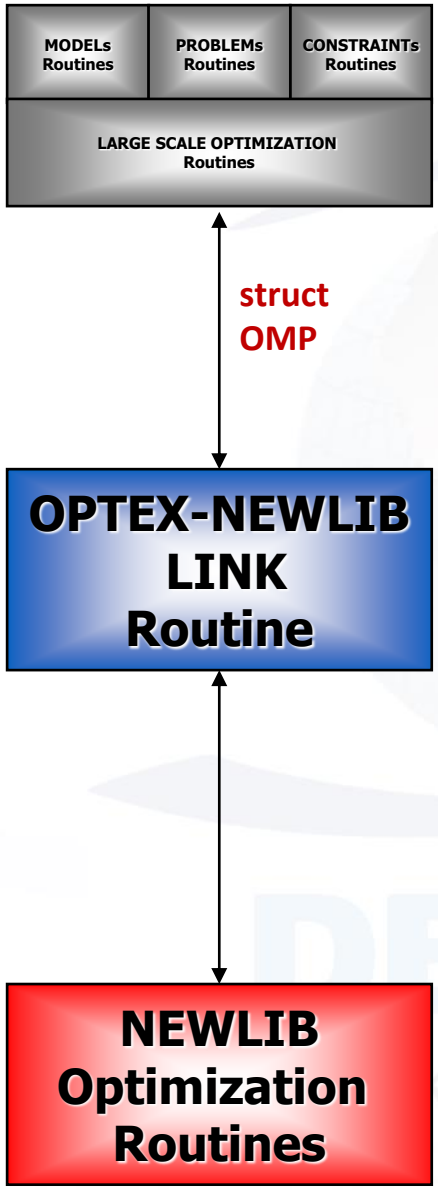
OPTEX-C PROGRAM STRUCTURE



OPTEX-C PROGRAM STRUCTURE



OPTEX-C PROGRAM STRUCTURE

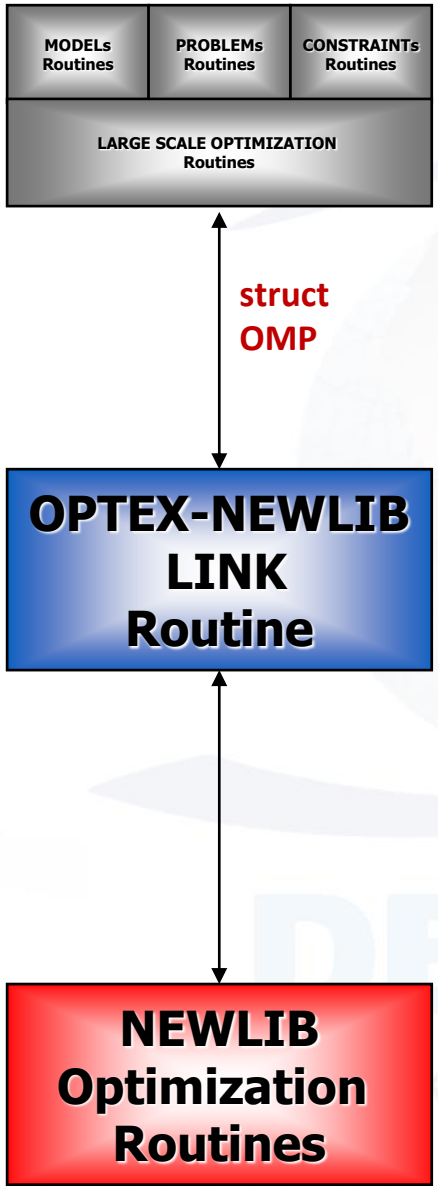


OPTEX-C

CONNECTING

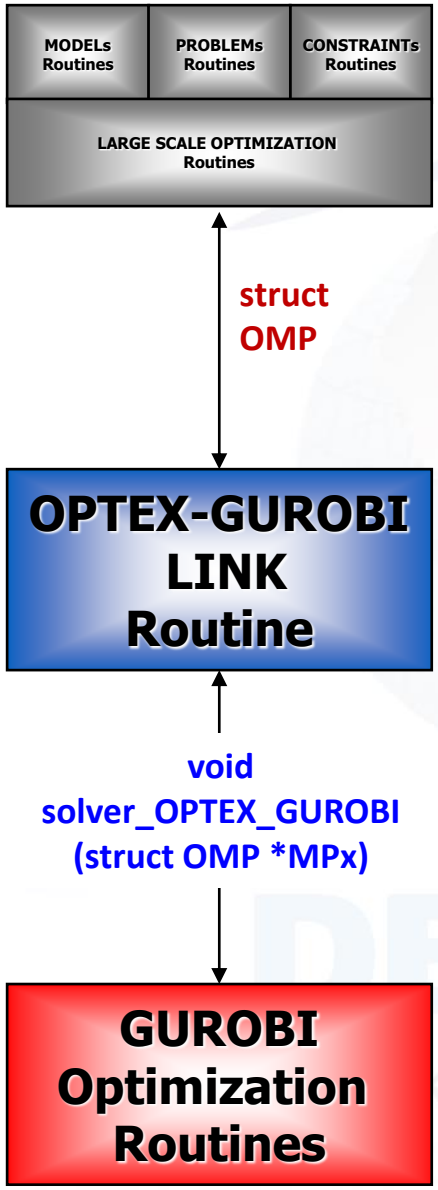
NEW OPTIMIZATION LIBRARIES

OPTEX-C PROGRAM STRUCTURE



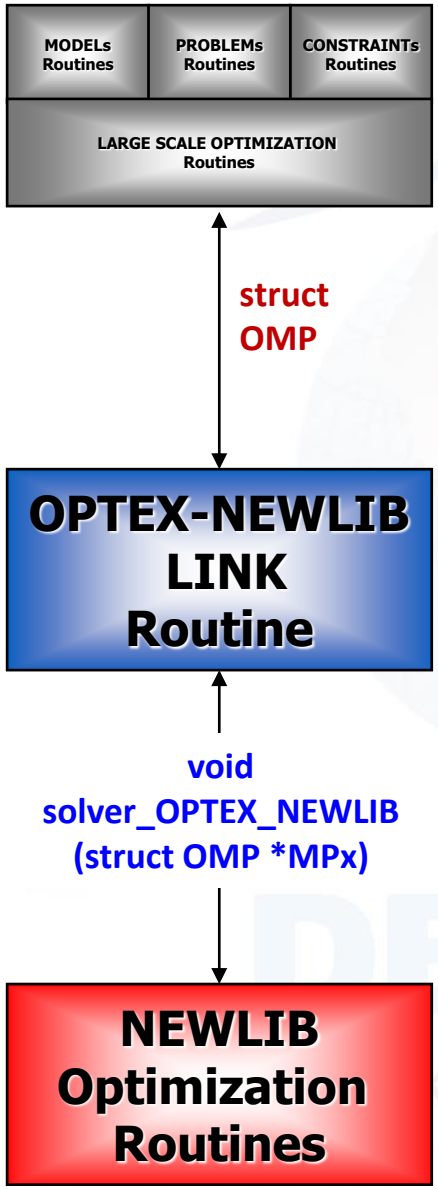

```
struct OMP  // Structure OPTEX Mathematical Problem
{
// Input
   char *sModelo, *sProblema ;
   int cMP ; // Format Problem {LP,MIP,QP,MQP,QPC,MQPC}
   int PD ; // Type of Formulation: 0 Clasica, 1 Disyuntiva
   int FO ; // Optimization Type: {MAX,MIN}
   int nLibrary, nAlgoritmo ;  // Optimization Library - Algorithm
   int numMAT, numRES, numVAR, numSOS1, numMAT_FQP;  // Vectorial Element Dimensions
   int *VarELE, *ResELE ; // Matrix Elements
   int *VARindRES ; // Logics Variables Logics Disjunctives Constraints
   int *VarSOS1, *nVarSOS1 , nResSOS1 ;
   int *VarOrder, *VarPriority, nPriority ; // Priorities B&B
   double *MatELE, *RHS, *LHS, *CostoVAR, *UppVAR, *LowVAR ;
   int *typeRES ; // {"=","<",">",":"}
   int *typeVAR ; // {"C","B","E","SC","SI"}
   int *V1qpELE, *V2qpELE ; // Elements - Matrix Function Objective QP
   double *MqpELE ; // Values - Matrix Function Objective QP
   double Limit_Time ; // Limit Time (seconds)
   double Limit_mipGAP ; // Limit Relative GAP (%)
   int Limit_Iter ; // Limit Iterations
   double INFINITO ; // INFINITE Value
   double RAM ; // Value RAM Solver (CPLEX)
   int DiskRAM ; // Value Disk-RAM Solver (CPLEX)
// Output
   int status ; // {"OPTIMO","FACTIBLE","NO-FACTIBLE","NO-ACOTADO"}
   double vFO ; // Objective Function Value
   double relGAP ; // Relative GAP (%)
   double *primalVAR, *dualVAR, *primalRES, *dualRES ; // Primal and Dual Solutions
   int unboundedVaR ;
} ;
```

OPTEX-C PROGRAM STRUCTURE



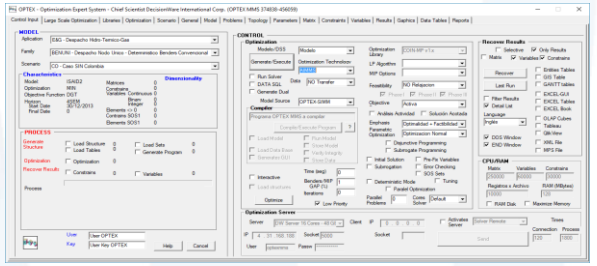

```
//OPTEX-SOLVER INCLUDES

#include "gurobi_c.h"

//OPTEX-SOLVER DECLARATIONS

void solver_OPTEX_GUROBI(struct OMP *MPx); // Solver OPTEX via GUROBI  v6.x

//OPTEX-SOLVER FUNCTIONS

void solver_OPTEX_GUROBI(struct OMP *MPx) // Solver OPTEX via GUROBI v6.x
{
int v, r, m, status, statusSOL, statuspv=0, statusdv=0, statuspr=0, statusdr=0 ;
//char     *probname = NULL;
int objsen, method, solnmethod, solntype;
char *sense = NULL, *ctype = NULL;
int *matbeg = NULL, *matcnt = NULL;
double *rngval ;
double objval;

GRBenv   *env   = NULL;
GRBmodel *model = NULL;
int      error = 0;

ctype = (char *) malloc ((unsigned) (MPx->numVAR) *sizeof(char) ) ;
//matbeg = (int *) malloc ((unsigned) (MPx->numVAR+1) *sizeof(int) ) ;

fprintf(logFile,"\n\nLibreria GUROBI\n") ;
fprintf(linkFile,"Libreria GUROBI\n") ;
printf("\n\nLibreria GUROBI\n") ;

//OrderMatrixByColumn(MPx->VarELE,MPx->ResELE,MPx->MatELE,1,MPx->numMAT) ;
ChangeReferece_0(MPx) ;
```

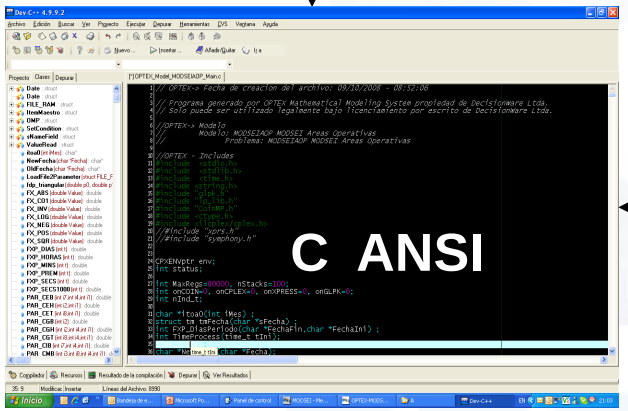
OPTEX-C PROGRAM STRUCTURE




```
//OPTEX-SOLVER INCLUDES

#include “NEWLIB_c.h"

//OPTEX-SOLVER DECLARATIONS

void solver_OPTEX_NEWLIB(struct OMP *MPx); // Solver OPTEX via NEWLIB

//OPTEX-SOLVER FUNCTIONS

void solver_OPTEX_NEWLIB(struct OMP *MPx) // Solver OPTEX via NEWLIB
{

NEWLIB User Code


…

};
```

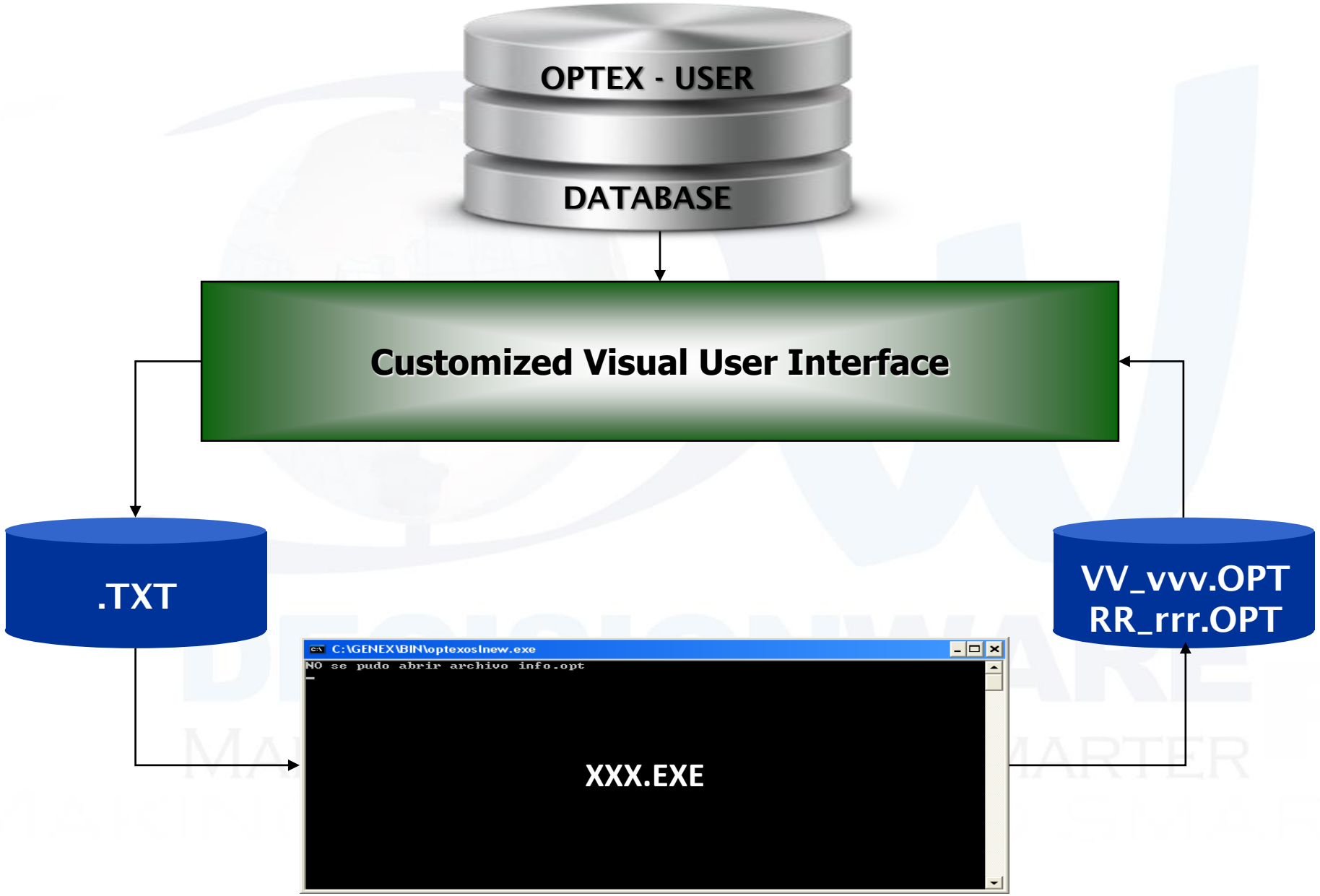
OPTEX-C PROGRAM CONNECTED DIRECTLY WITH A REMOTE SOLVER



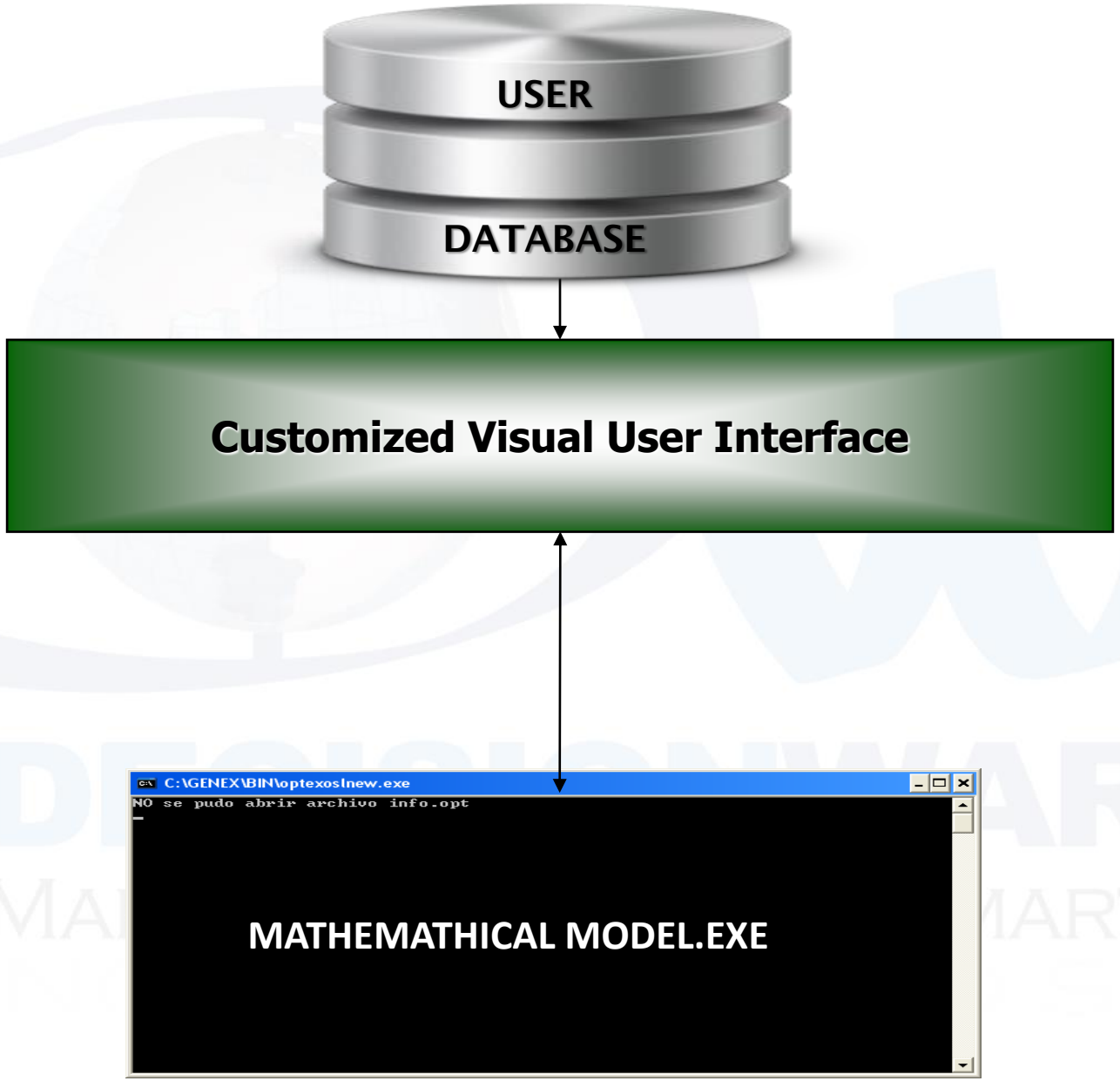


GUROBI REMOTE SOLVER

DEVELOPMENT PHASE



PRODUCTION PHASE

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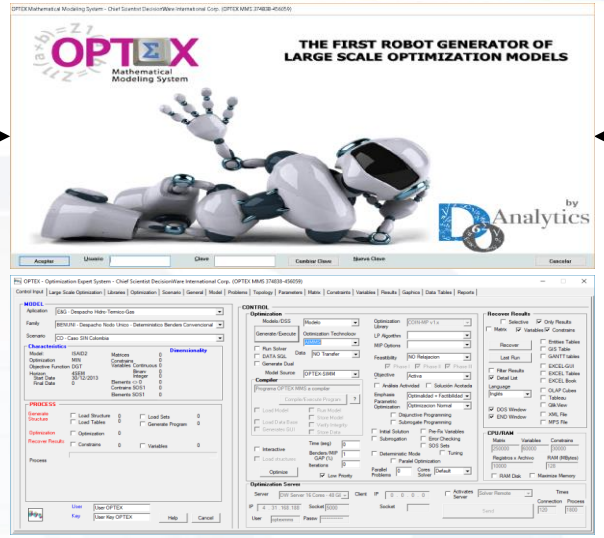
DIPLOMADO EN AIMMS
PLAN DE TEMAS

GO BACK

OPTEX-AIMMS



ODBC

Remote Access Server Connectivity

OPTIMIZATION SERVER

Gurobi Optimization

ILOG An IBM Company

CPLEX

AIMMS

OPTEX-AIMMS

OPTEX_VRPTW.aim: Bloc de notas

Archivo Edición Formato Ver Ayuda

```
! //!  OPTEX-> File creation date: 26/06/2015 - 12:40:11-->
!  AIMMS Program Code generated by OPTEX Mathematical Modeling System copyrigth  DO ANALYTICS LLC.
!  This code can be legally used only with write or digital license of DO ANALYTICS LLC.
!  User License ID: Chief Scientist DecisionWare International Corp. (OPTEX MMS 374838-456059)



! OPTEX-> Model
! OPTEX - Model: VRPTW Ruteo Urbano con Ventanas de Tiempo
! OPTEX-> Problem
!     Problem: VRPTW Ruteo Urbano con Ventanas de Tiempo


MAIN MODEL OPTEX_VRPTW

! OPTEX - Generacion Lectura Bases de Datos

! OPTEX - Areas de Datos

SECTION Definiciones_Matematicas

! OPTEX-INIT> Include OPTEX Inicio  ##INIT##

! OPTEX-> Maestros Indices

DECLARATION SECTION Conjuntos_Maestros

SET:
   identifier : master_v
   text : "Vehículo" ;

SET:
   identifier : master_c
   text : "Nodo" ;

SET:
   identifier : master_d
   text : "Día" ;

SET:
   identifier : master_b
   text : "Caja" ;
```

MATHEMATICAL MODEL

AIMMS PROGRAM

.aim

OPTEX_VRPTW.aim: Bloc de notas

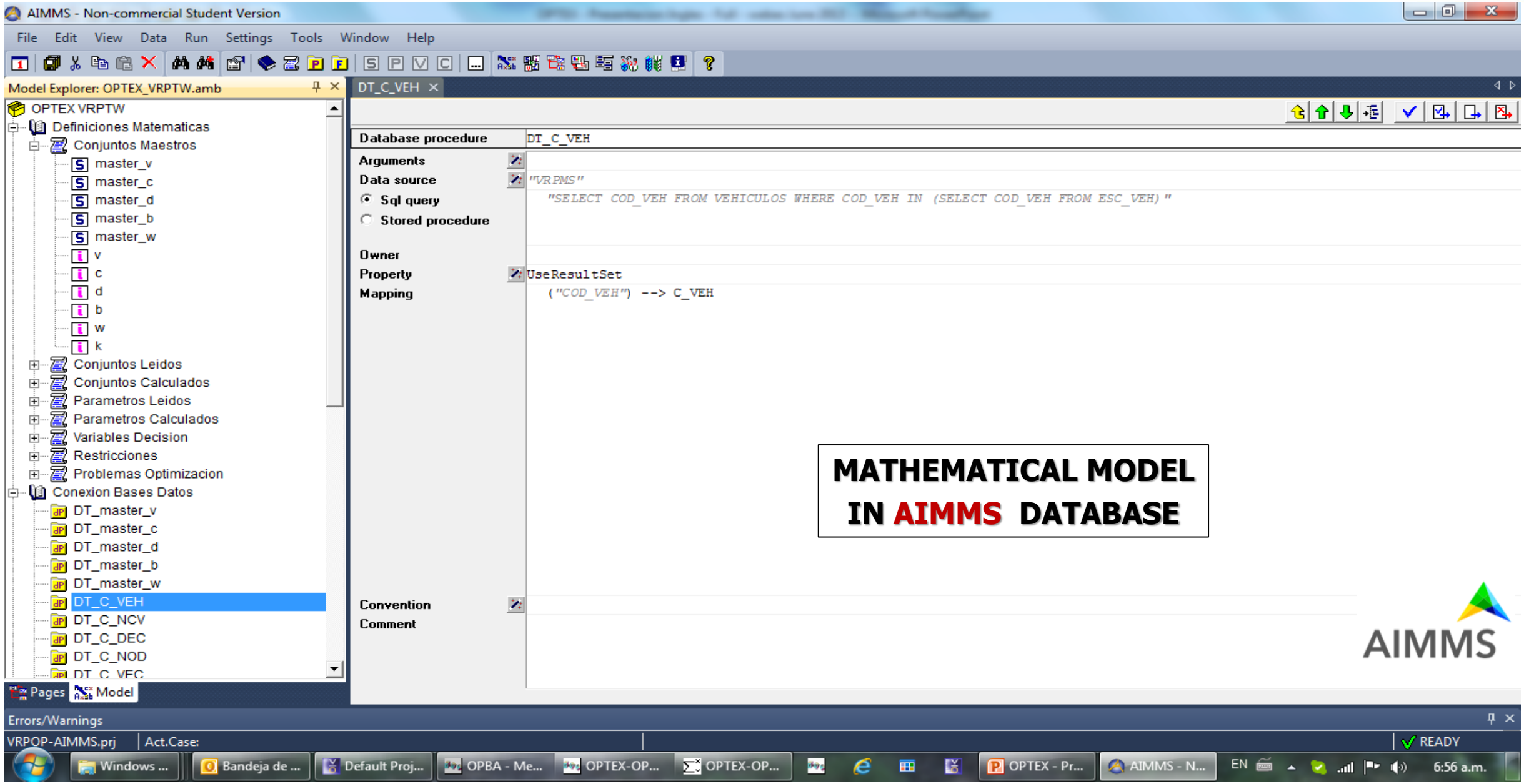
Archivo Edición Formato Ver Ayuda

```
! OPTEX-> Parametros Leidos
DATABASE PROCEDURE
        identifier : DT_P_CAPP
        data source : "VRPMS"
        sql query : "SELECT COD_VEH,CAPP FROM VEHICULOS"
                    + "  WHERE COD_VEH IN (SELECT COD_VEH FROM VRPTP_ESC_VEH)"
        property :  UseResultSet
        mapping : "COD_VEH" --> v,
                  "CAPP" --> P_CAPP[v]
ENDPROCEDURE ;

DATABASE PROCEDURE
        identifier : DT_P_CAPV
        data source : "VRPMS"
        sql query : "SELECT COD_VEH,CAPV FROM VEHICULOS"
                    + "  WHERE COD_VEH IN (SELECT COD_VEH FROM VRPTP_ESC_VEH)"
        property :  UseResultSet
        mapping : "COD_VEH" --> v,
                  "CAPV" --> P_CAPV[v]
ENDPROCEDURE ;

DATABASE PROCEDURE
        identifier : DT_P_HCIE
        data source : "VRPMS"
        sql query : "SELECT COD_NOD,COD_DIA,HCIE FROM HORARIO"
                    + "  WHERE COD_NOD IN (SELECT COD_NOD FROM VRPTP_ESC_NOD)"
                    + "  AND COD_DIA IN (SELECT COD_DIA FROM VRPTP_ESC_DIA)"
        property :  UseResultSet
        mapping : "COD_NOD" --> c,"COD_DIA" --> d,
                  "HCIE" --> P_HCIE[c,d]
ENDPROCEDURE ;

DATABASE PROCEDURE
        identifier : DT_P_HAPE
        data source : "VRPMS"
        sql query : "SELECT COD_NOD,COD_DIA,HAPE FROM HORARIO"
                    + "  WHERE COD_NOD IN (SELECT COD_NOD FROM VRPTP_ESC_NOD)"
```

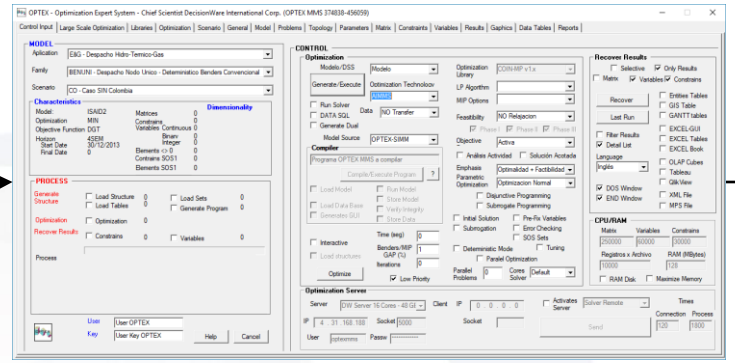
AUTOMATIC GENERATION OF MATHEMATICAL MODEL- DATA MODEL SQL CONNECTIVITY

AIMMS

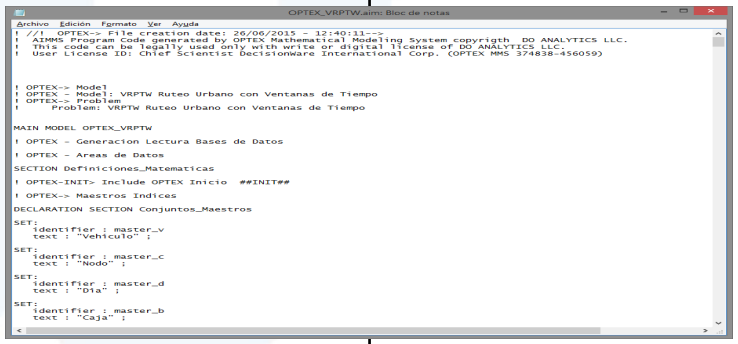
OPTEX-AIMMS

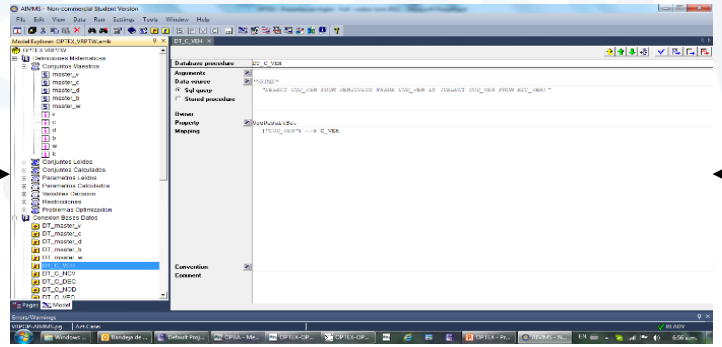

AIMMS - Non-commercial Student Version
File Edit View Data Run Settings Tools Window Help
Model Explorer: OPTEX_VRPTW.amb
OPTEX VRPTW
Definiciones Matematicas
Conjuntos Maestros
master_v
master_c
master_d
master_b
master_w
v
c
d
b
w
k
Conjuntos Leidos
Conjuntos Calculados
Parametros Leidos
Parametros Calculados
Variables Decision
Restricciones
Problemas Optimizacion
Conexion Bases Datos
DT_master_v
DT_master_c
DT_master_d
DT_master_b
DT_master_w
DT_C_VEH
DT_C_NCV
DT_C_DEC
DT_C_NOD
DT_C_VEC
Pages
Model
DT_C_VEH
Database procedure DT_C_VEH
Arguments
Data source "VRPMS"
Sql query
"SELECT COD_VEH FROM VEHICULOS WHERE COD_VEH IN (SELECT COD_VEH FROM ESC_VEH)"
Stored procedure
Owner
Property UseResultSet
Mapping ("COD_VEH") --> C_VEH
Convention
Comment
MATHEMATICAL MODEL
IN AIMMS DATABASE
AIMMS
Errors/Warnings
VRPOP-AIMMS.prj
Act.Case:
READY
Windows ...
Bandeja de ...
Default Proj...
OPBA - Me...
OPTEX-OP...
OPTEX-OP...
OPTEX - Pr...
AIMMS - N...
EN
6:56 a.m.

OPTEX-AIMMS



MODEL.AIM

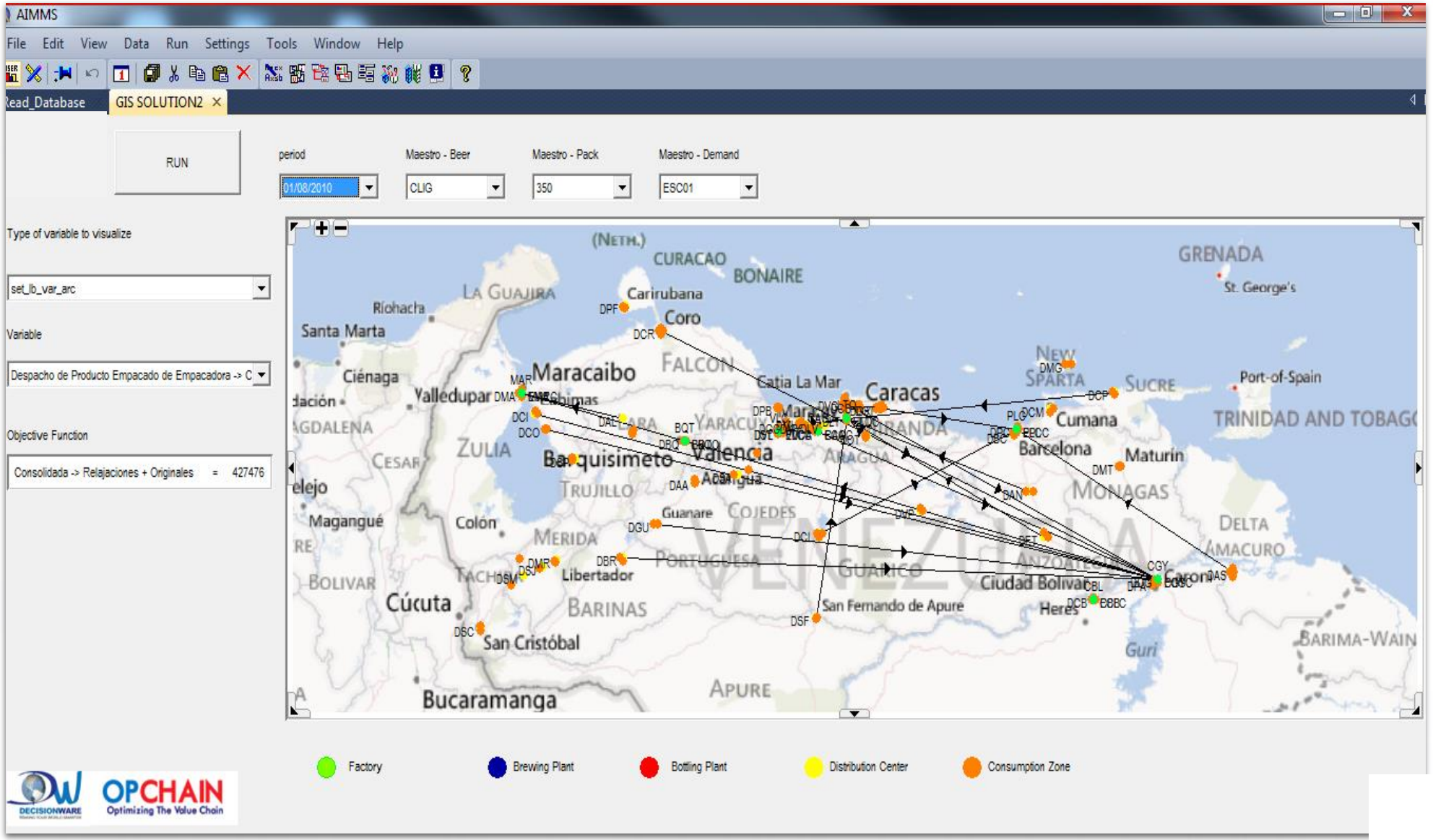




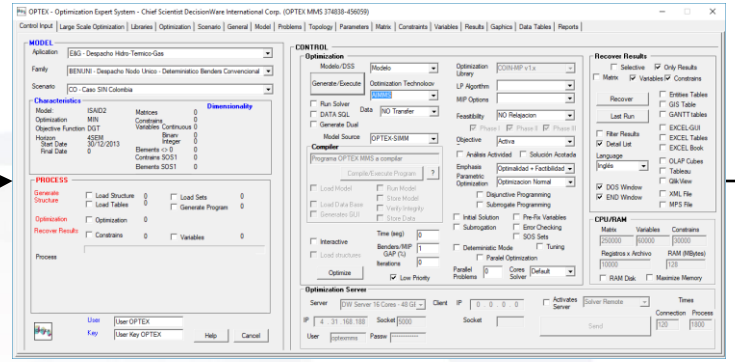
ODBC

AIMMS

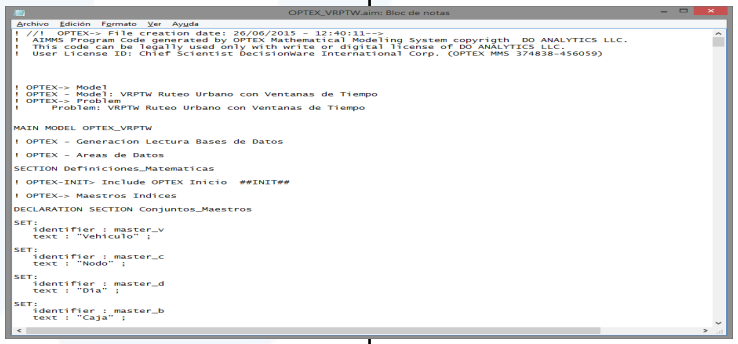
OPTEX-AIMMS

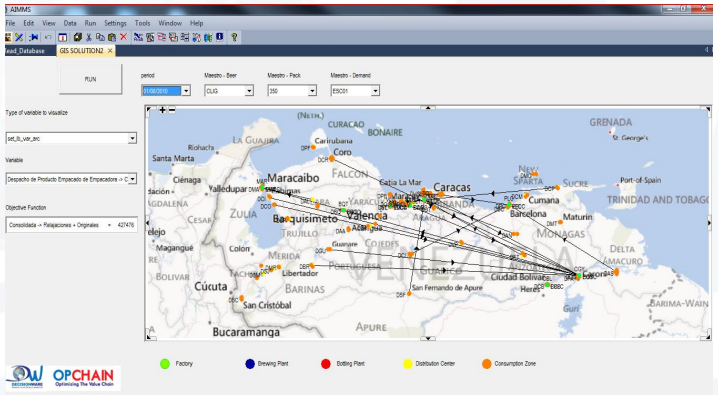

AIMMS
File Edit View Data Run Settings Tools Window Help
Read_Database
GIS SOLUTION2
RUN
period
01/08/2010
Maestro - Beer
CLIG
Maestro - Pack
350
Maestro - Demand
ESC01
Type of variable to visualize
set_lb_var_arc
Variable
Despacho de Producto Empacado de Empacadora -> C
Objective Function
Consolidada -> Relajaciones + Originales = 427476
(Neth.)
CURACAO
BONAIRE
GRENADA
St. George's
LA GUAJIRA
Riohacha
Carirubana
Coro
Santa Marta
Ciénaga
Maracaibo
FALCON
Valledupar
Catia La Mar
Caracas
NEW SPARTA
SUCRE
Port-of-Spain
TRINIDAD AND TOBAGO
Cumana
Barcelona
Maturín
Barquisimeto
Valencia
ZULIA
CESAR
TRUJILLO
COJEDES
MONAGAS
DELTA AMACURO
Magangué
Colón
MERIDA
Guanare
PORTUGUESA
GUARICO
ANZOATEGUI
BOLIVAR
Libertador
Ciudad Bolivar
Caron
Cúcuta
BARINAS
San Fernando de Apure
Heres
San Cristóbal
Guri
BARIMA-WAIN
APURE
Bucaramanga
VENEZUELA
Factory
Brewing Plant
Bottling Plant
Distribution Center
Consumption Zone
OPCHAIN
Optimizing The Value Chain

OPTEX-AIMMS



MODEL.AIM





AIMMS

ODBC


WORK
IN PROGRESS

DECISIONWARE
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DIPLOMADO

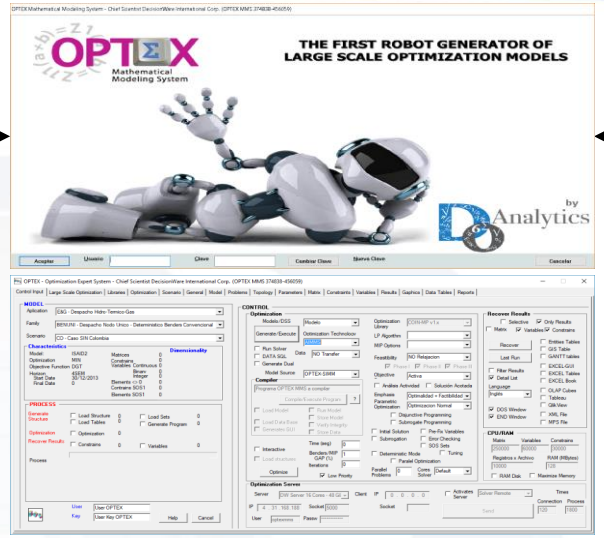
MACHINE LEARNING & OPTIMIZATION USING MATHEMATICAL PROGRAMMING TECHNOLOGIES

DIPLOMADO EN PLAN DE TEMAS

FICO Mosel

GO BACK

OPTEX-XPRESS-MMS



ODBC

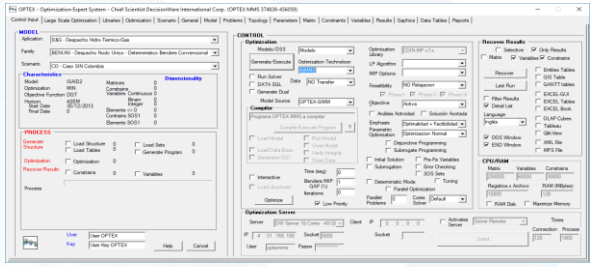
Remote Access Server Connectivity

OPTIMIZATION SERVER

FICO Xpress

FICO Mosel

OPTEX-XPRESS-MMS



ODBC

Remote Access Server Connectivity

OPTIMIZATION SERVER

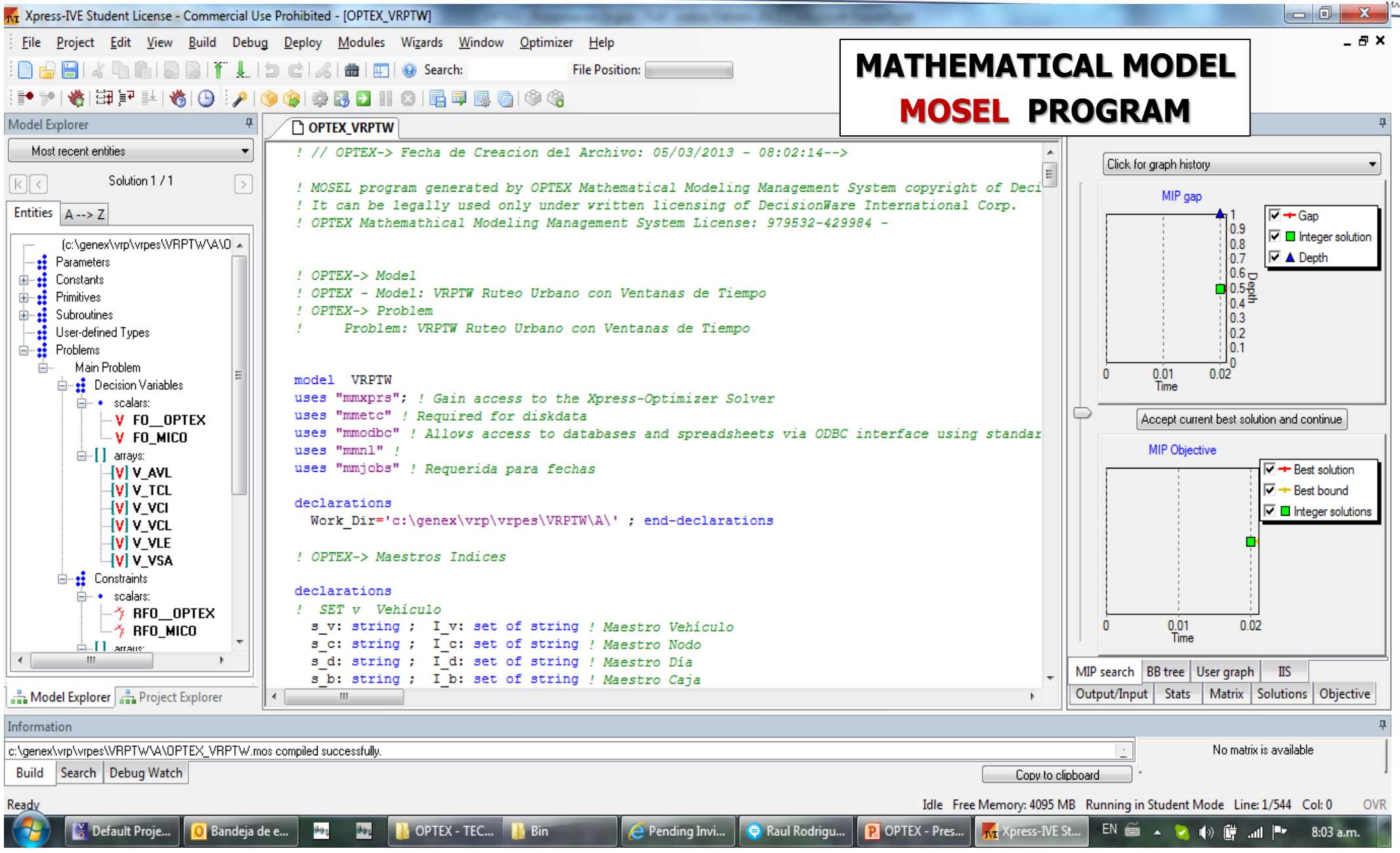
FICO Xpress

DEV C++

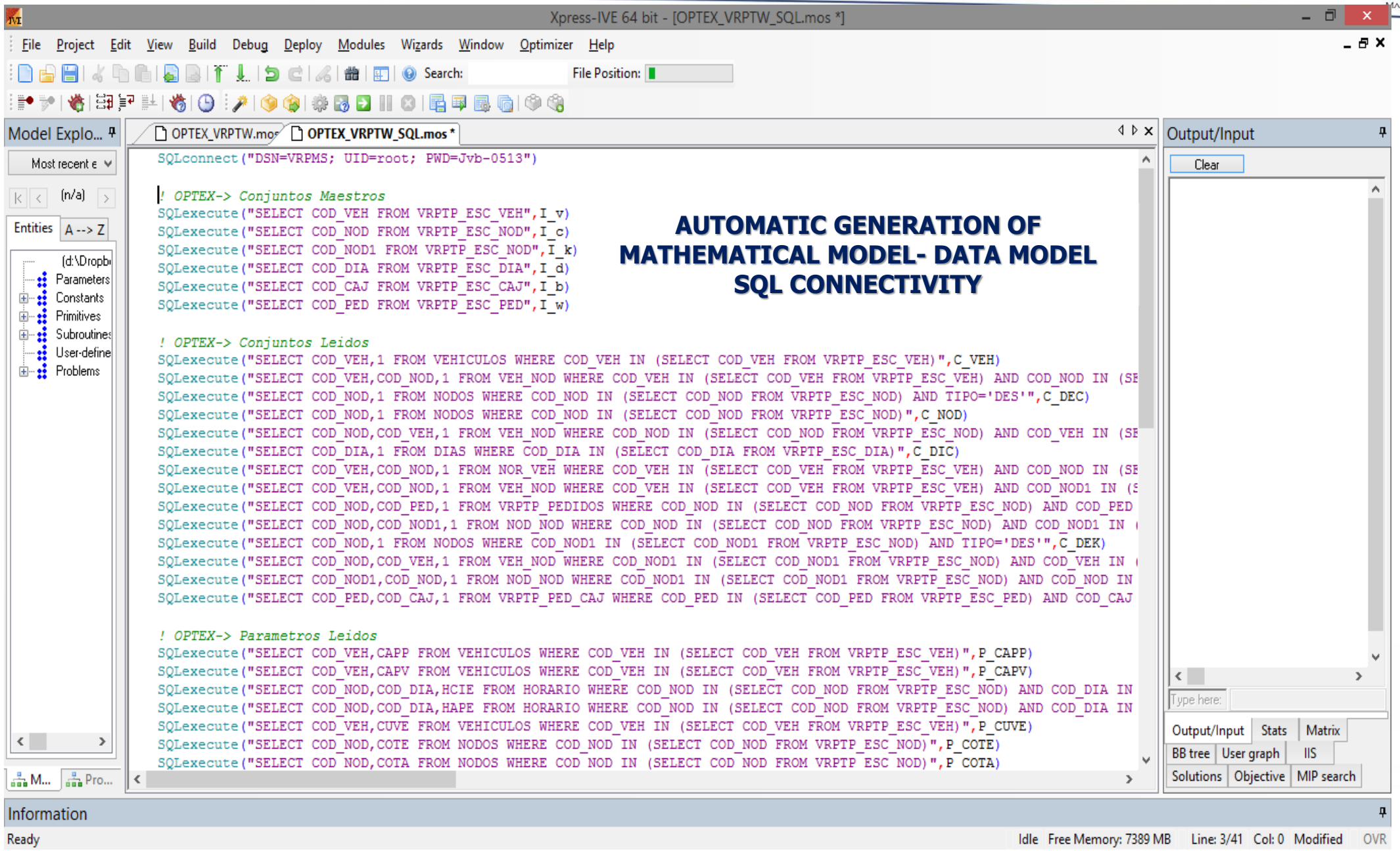
FICO

OPTEX-XPRESS-MMS

MATHEMATICAL MODEL
MOSEL PROGRAM



OPTEX-XPRESS-MMS




WORK
IN PROGRESS

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DIPLOMADO

MACHINE LEARNING & OPTIMIZATION USING MATHEMATICAL PROGRAMMING TECHNOLOGIES

CONDICIONES GENERALES

CONDICIONES GENERALES

1. Valor Inversión:
   - Clase individual: CINCUENTA DÓLARES AMERICANOS (USD/clase 50,oo)
   - Modulo individual (10 clases): CUATROCIENTOS DÓLARES AMERICANOS (USD/módulo 400,oo). Descuento 25% respecto a la clase
   - Diplomado (4 cuatro módulos o más): UN MIL CUATROCIENTOS CUARENTA DÓLARES AMERICANOS (USD/curso 1.440,oo). Descuento del 10% respecto costo de los cuatro módulos UN MIL SEISCIENTOS DÓLARES AMERICANOS (USD/curso 1.600,oo).

   Los anteriores valores NO incluyen retención de impuestos sobre el valor de la factura; en caso de existir, estas retenciones deberán cargarse al valor del curso de forma tal que el depósito neto sea igual a la tarifa establecida.

2. Descuentos:
   - Descuento especial temporada: **Dependiente de la oferta de temporada**
   - Estudiantes de Pregrado: 60%. Menores de 26 años cumplidos
   - Estudiantes de Maestría: 40%. Menores de 30 años cumplidos
   - Estudiantes de Doctorado: 20%. Menores de 34 años cumplidos
   - Profesores Universitarios Tiempo Completo: 20%. No aplica para inscripción como estudiante.
   - Volumen Alumnos: 20% por grupos de seis alumnos o más. (Inscripción empresarial)
   - Aliados de Negocios de DW: 40% (No aplican otros descuentos)
   - Grupos de Estudiantes y Asociaciones Gremiales/Profesionales: Descuentos según convenio.
   - Acuerdos Personales: Descuentos según convenio.
   - Múltiples descuentos se multiplican, no se suman. Aplican condiciones.

3. Forma de Pago:
   - Los honorarios por dictar el curso deberán pagarse directamente al instructor, Ing. Jesús Velásquez-Bermúdez, mediante transferencia bancaria.
   - Pagos por medio de Pay-Pal o similar tendrán un incremento del 5%

   Nota: A partir de febrero de 2021 todos los cursos serán dictados y cobrados por el RCADT (Research Center for Advanced Decisión Technologies Inc.) compañía norteamericana con sede en West Palm Beach, Florida, USA. Los pagos deberán realizar mediante pago en cuenta corriente en USA.

4. Plan de Flexible (solo aplica a inscripciones personales):
   - Pago Flexible: Los participantes podrán ir pagando en la medida que toman los módulos. En dicho caso no aplican descuentos por volumen o por pronto pago. Aplican los restantes descuentos.
   - Descuento por Volumen Módulos: Cuando el estudiante haya tomado tres módulos, en el cuarto módulo que matricule se le otorgará un descuento del 40% (incluye el descuento de todos los módulos por volumen).

5. Contactos:
   - América: andrea.velasquez@decisionware.net – WhatsApp: +57 311 4966970
   - Europa: alejandro.velasquez@decisionware.net – WhatsApp: +34 689 83 28 287
   - Académico: jesus.velasquez@decisionware.net – WhatsApp: +57 315 3099131

6. Validez:
   Las condiciones económicas pueden cambiar cuando DW lo considere conveniente.

CONDICIONES GENERALES

1. Cada módulo tiene una intensidad de 20 horas, dividido en diez (10) sesiones de 2 horas. Cada sesión está dividida en cuatro temas de 30 minutos cada uno (aproximadamente).

2. Las clases se dictan bajo la modalidad virtual: Conferencia virtual y material de soporte. Los estudiantes pueden realizar consultas técnicas mediante e-mail y se organizan conversatorios conferencias virtuales para resolver dudas.

3. El estudiante puede seleccionar un proyecto específico para aplicar los conocimientos adquiridos. Durante la ejecución de dicho proyecto recibirá apoyo técnico en optimización por parte del instructor.

4. Instructor: Ing. Jesús Velásquez, Ph. D.

5. Formato de Inscripción:
   http://www.doanalytics.net/Documents/DW-Diplomados-Mathematical-Programing-Analyst-Inscripcion-Personal.docx

CONDICIONES GENERALES

1. Todas las clases se entregan grabadas videos en formato **WRF**, **ARF** o **MP4**. Se incluyen las instrucciones para bajar y visualizar los videos en formato **ARF,** la visualización de los videos **MP4** la decide el estudiante por su cuenta.

2. Una vez se formaliza la inscripción al diplomado, el participante recibe un documento de instrucciones con las URLs que requiere para obtener el material de apoyo el cual contiene: videos, presentaciones y artículos en formato PDF, artículos técnicos, programas de computador en diferentes lenguajes, principalmente en **GAMS/AMPL**.

3. Se expide un certificado de inscripción firmado por el Coordinador Académico y soportado por DecisionWare en el que consta las horas de capacitación y el tema del diplomado.

4. Las consultas técnicas y/o académicas se realizan directamente a la Coordinación Académica:
   Ing. Jesús Velásquez <jesus.velasquez@decisionware.net>

5. Las consultas administrativas se realizan directamente a cualquiera de las Coordinaciones Comerciales:
   - América: andrea.velasquez@decisionware.net – WhatsApp: +57 311 4966970
   - Europa: alejandro.velasquez@decisionware.net – WhatsApp: +34 689 83 28 287

6. Si el estudiante esta interesado en un tema especial que no está incluido en el curso, lo puede sugerir a la Coordinación Académica para que se analice la posibilidad de incluirlo en el plan de temas.

CONDICIONES GENERALES
TECNOLOGÍAS DE OPTIMIZACIÓN - LICENCIAS Y PROGRAMAS FUENTES

1. Para el caso en los que el estudiante no disponga de licencia de las tecnología de optimización de un curso, DW tramitará ante el proveedor de la tecnología de optimización licencias temporales del software para ser utilizadas durante el curso. Sin embargo, se deja en claro que esta posibilidad puede ser negada por el proveedor de la tecnología. En estos casos se sugiere al usuario descargar versiones demo del software.

2. Los participantes en un curso tendrán acceso a **OPTEX Expert Optimization System.** Para ello DW otorgará una licencia válida por un año, contado a partir de la fecha de iniciación del curso.

3. La licencias son de carácter personal; por lo tanto, el participante deberá firmar el compromiso de no compartir dichas licencias con otros profesionales.

4. Los participantes en un curso tendrán acceso a códigos fuentes de problemas reales para las diferentes tecnologías. Estos programas son de carácter personal; por lo tanto, el participante deberá firmar el compromiso de no compartir dichos programas con otros profesionales.

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DIPLOMADO

MACHINE LEARNING & OPTIMIZATION USING MATHEMATICAL PROGRAMMING TECHNOLOGIES

EXPERIENCIA, INVESTIGACION Y DESARROLLO TECNOLÓGICO DESARROLLO MODELOS MATEMÁTICOS

La información sobre la experiencia en

- Investigacion en nuevas metodologías de optimización,
- Publicaciones técnicas y científicas,
- Desarrollo e implementación de tecnologías de optimización,
- Implementación de modelos aplicados de Programación Matemática y
- Actividades Académicas

La puede consultar en:
http://www.doanalytics.net/Documents/DW-Diplomados-Experiencia.pdf

DECISIONWARE

DECISIONWARE

OPTEX Optimization Expert System

OPTIMIZATION EXPERT SYSTEM

FREE VIRTUAL COURSE

RCADT

GLPK GMPL · COIN-OR · GLOP · python · C++ · PYOMO · LINGO LINDO · TOMLAB OPTIMIZATION · GUROBI OPTIMIZATION · KNITRO · julia · IBM OPL / CPLEX · GAMS · AMPL · AIMMS Prescriptive Analytics Platform · IBM Decision Optimization Center · FICO Xpress Optimization Suite · SAS Optimization

https://www.linkedin.com/pulse/optex-optimization-expert-system-free-virtual-course-velasquez/

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DIPLOMADO VIRTUAL PERMANENTE

RCADT
Research Center for Advanced Decision Technologies

ARTIFICIAL INTELLIGENCE & MATHEMATICAL PROGRAMMING APLICADAS AL SECTOR ELÉCTRICO

METODOLOGÍAS DE ANALÍTICA PREDICTIVA AVANZADA:

MODELOS PROBABILÍSTICOS AVANZADOS
MACHINE LEARNING, MARKOVIAN & BAYESIAN MODELS
KALMAN FILTER, ARTIFICIAL NEURAL NETS,
STOCHASTIC PROGRAMMING & RISK MANAGEMENT

ALGORITMOS DE OPTIMIZACIÓN DE GRAN ESCALA:

BENDERS PARTITION & DECOMPOSITION, LAGRANGEAN RELAXATION,
DANTZIG-WOLFE DECOMPOSITION, DISJUNCTIVE PROGRAMMING,
CROSS DECOMPOSITION, ASYNCHRONOUS PARALLEL OPTIMIZATION
REAL-TIME DISTRIBUTED OPTIMIZATION

MODELAMIENTO MATEMÁTICO ESTRUCTURADO

APLICACIONES:

TRADITIONAL ECONOMIC DISPATCH
FTR: FINANCIAL TRANSMISSION RIGHTS
MIXED NON-LINEAR ECONOMIC DISPATCH
EQUILIBRIUM MODELING OF OPEN MARKETS
ETRM: ENERGY TRADING & RISK MANAGEMENT

SMART GRIDS OPTIMIZATION
EXPANSION OF RADIAL CRITICAL SYSTEMS
OPERATION & EXPANSION & AVAILABILITY OF FLEXIBLE SYSTEMS

GLPK
GMPL
COIN-OR
GLOP
python
C++
LINGO
LINDO
PYOMO
GUROBI OPTIMIZATION
KNITRO
TOMLAB OPTIMIZATION
julia
IBM OPL / CPLEX
GAMS
AMPL
AIMMS PRESCRIPTIVE ANALYTICS PLATFORM
IBM DECISION OPTIMIZATION CENTER
FICO XPRESS OPTIMIZATION SUITE
sas OPTIMIZATION

http://www.doanalytics.net/Documents/DW-Diplomado-Advanced-Optimization-Applied-to-Electric-Sector-Programa.pdf

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DIPLOMADO VIRTUAL PERMANENTE

RCADT
Research Center for Advanced Decision Technologies

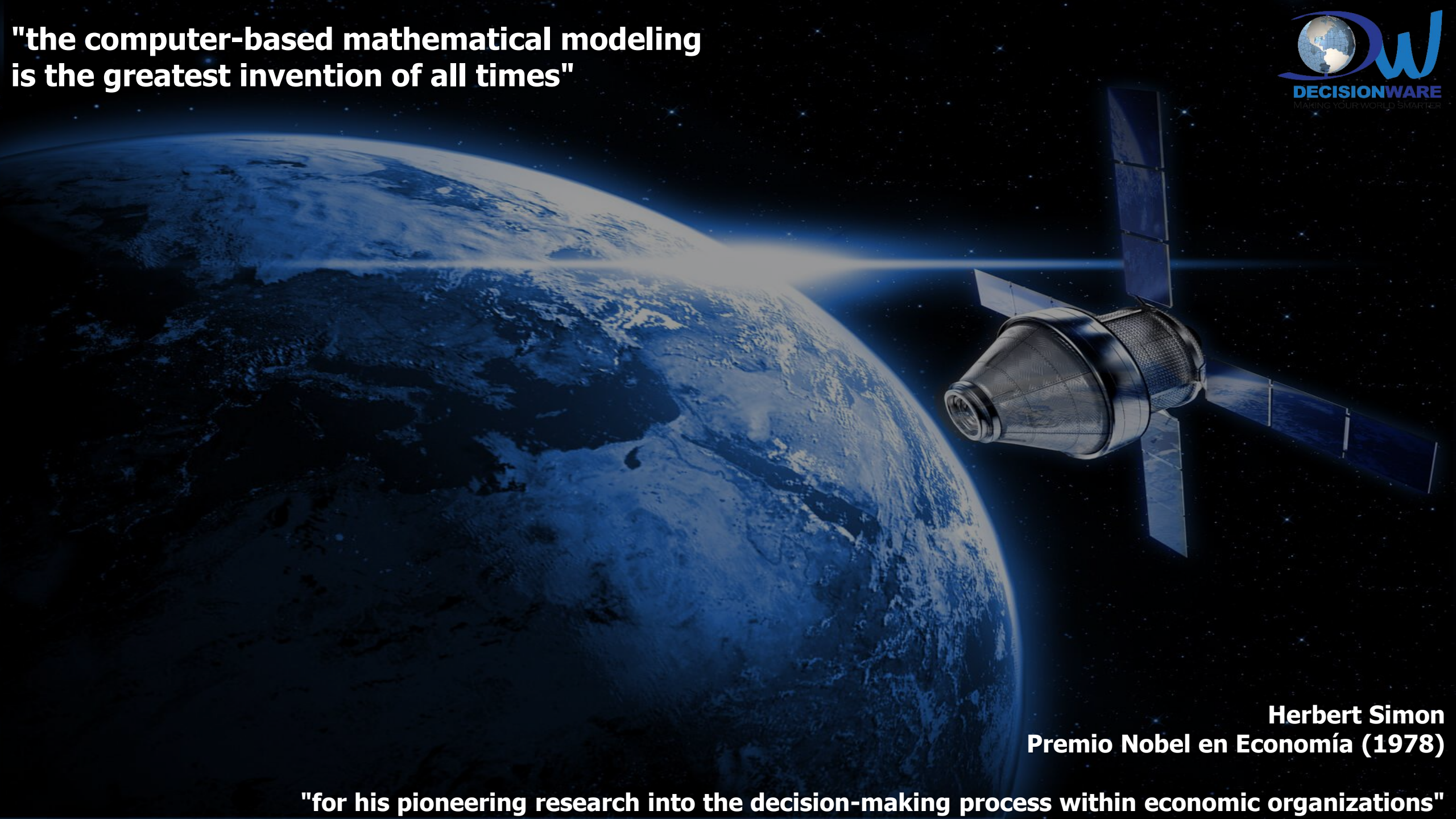
ARTIFICIAL INTELLIGENCE & MATHEMATICAL PROGRAMMING APLICADAS A CADENAS DE ABASTECIMIENTO 4.0

Demand Chain Optimization
Industrial Supply Chain Optimization
Bio-industrial Supply Chain Optimization
Transport &

GLPK
GMPL
COIN-OR
GLOP
python
C++
PYOMO
LINGO
LINDO
TOMLAB OPTIMIZATION
GUROBI OPTIMIZATION
KNITRO
julia
IBM OPL / CPLEX
GAMS
AMPL
AIMMS Prescriptive Analytics Platform
IBM Decision Optimization Center
FICO Xpress Optimization Suite
sas Optimization

http://www.doanalytics.net/Documents/DW-Diplomado-Optimization-Industrial-Value-Chains-Programa.pdf

"the computer-based mathematical modeling
is the greatest invention of all times"



Herbert Simon
Premio Nobel en Economía (1978)

"for his pioneering research into the decision-making process within economic organizations"