

Watson Studio

Prescriptive Analytics

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October 2019



Descriptive Analytics

uses statistical models and forecasts techniques to understand the past and answer: **“What has happened?”**

Predictive Analytics

which uses data aggregation and data mining to provide insight and answer: **“What could happen?”**

Prescriptive Analytics

which use optimization and cognitive computing to advice on possible outcomes and answer: **“What should we do?”**

What is Prescriptive Analytics?

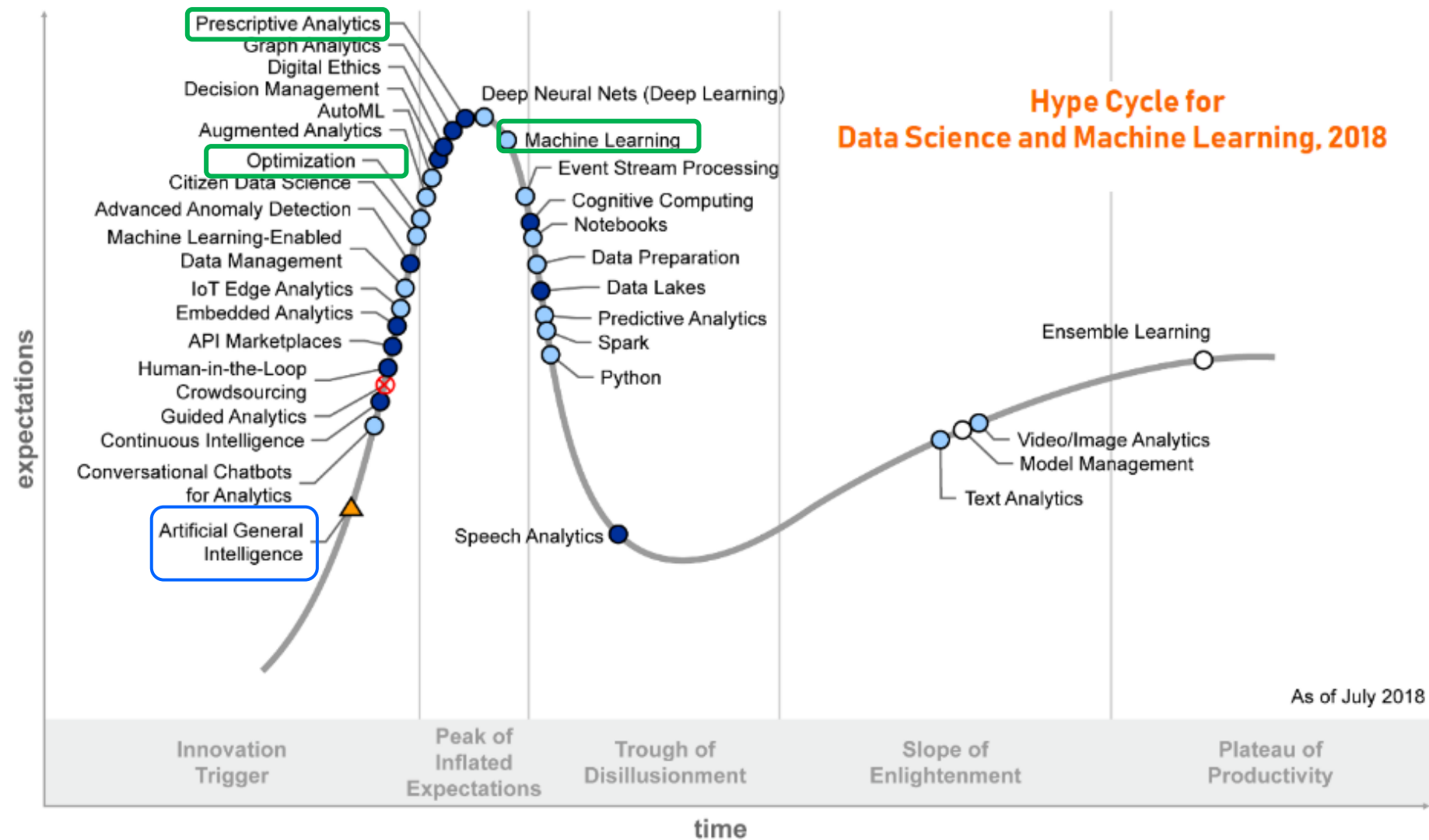


What's the best that can happen?

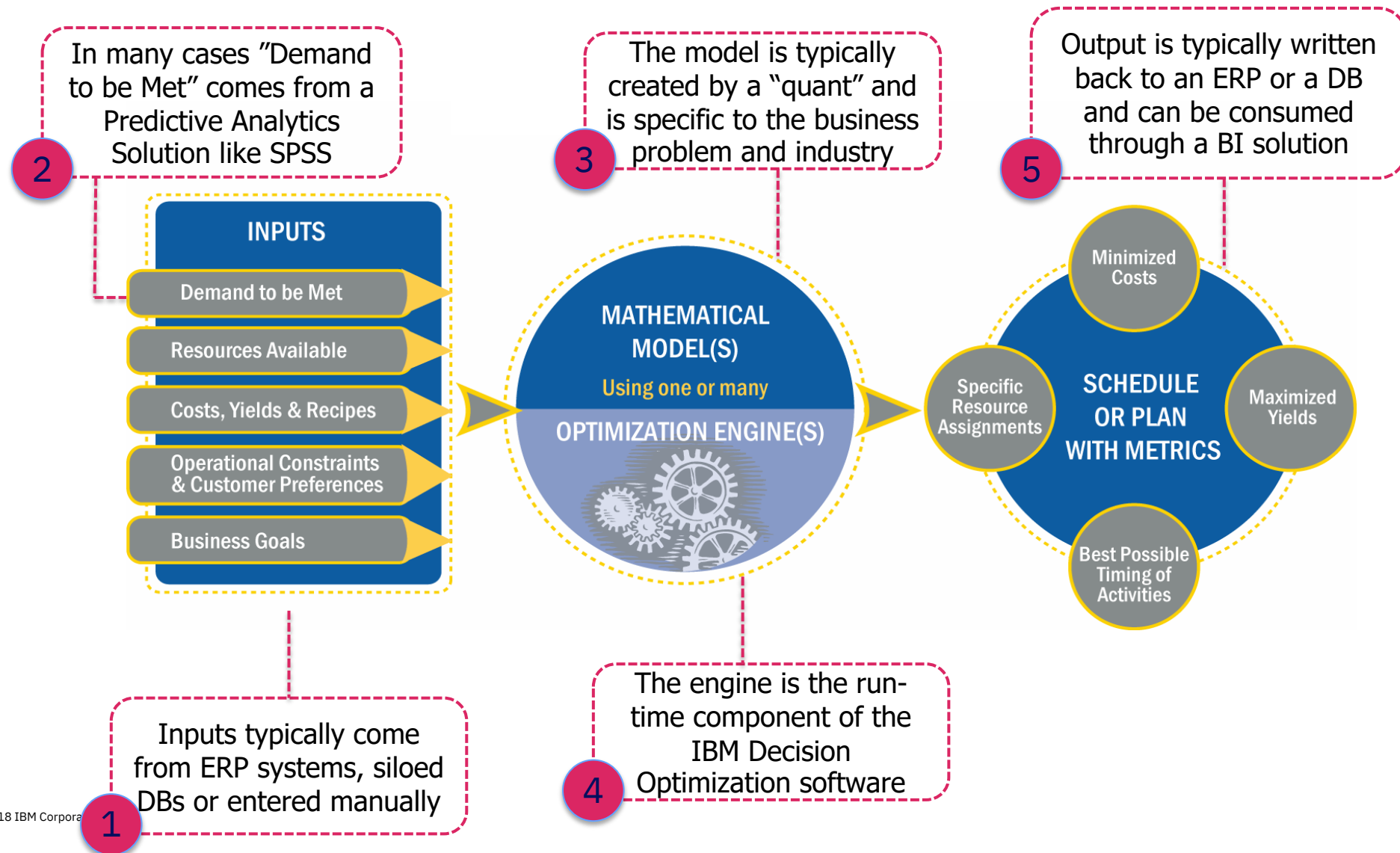
What ACTIONS do I need to take to achieve my desired goals?

Gartner Hype Cycle

11% of large and mid-size organizations have some form of prescriptive analytics; this will grow to 37% by 2022.
Gartner (Jan 2019)



Prescriptive Analytics – How does it work?



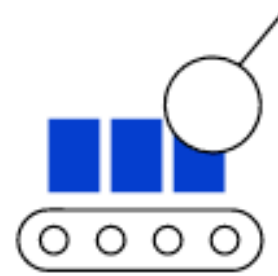
Decision Optimization

the secret sauce for better decisions

Decision optimization technology has delivered significant ROI across industries



25% increase
in transport punctuality.
33% reduction in daily
kilometres walked¹



Optimize
manufacturing of
10K products
across 20 plants²



30%
reduction in risk
for same yields³



Upto
30% savings
on energy costs⁴

What is Decision Optimization?

Business problem

Build optimization models
using either:



General purpose
programming language APIs



Optimization
Programming Language

Mathematical model

Optimization engines that can solve:



Mathematical programming models



Constraint programming and
constraint-based scheduling models

Optimal decisions



What-if analysis to
evaluate alternate scenarios



Recommended actions
to achieve business goals



Supports all sizes of
optimization models

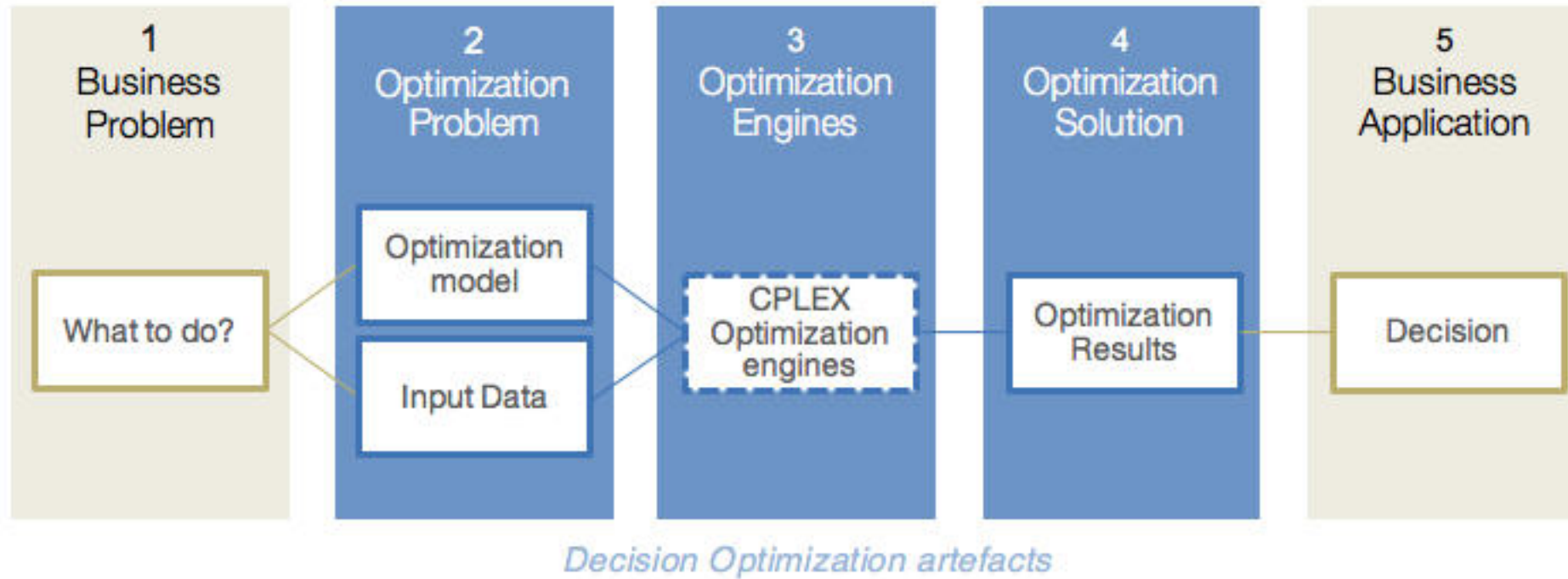


Support for unlimited
decision variables
and constraints



High performance
and scalable

What is Decision Optimization?



Docplex available on Cloud

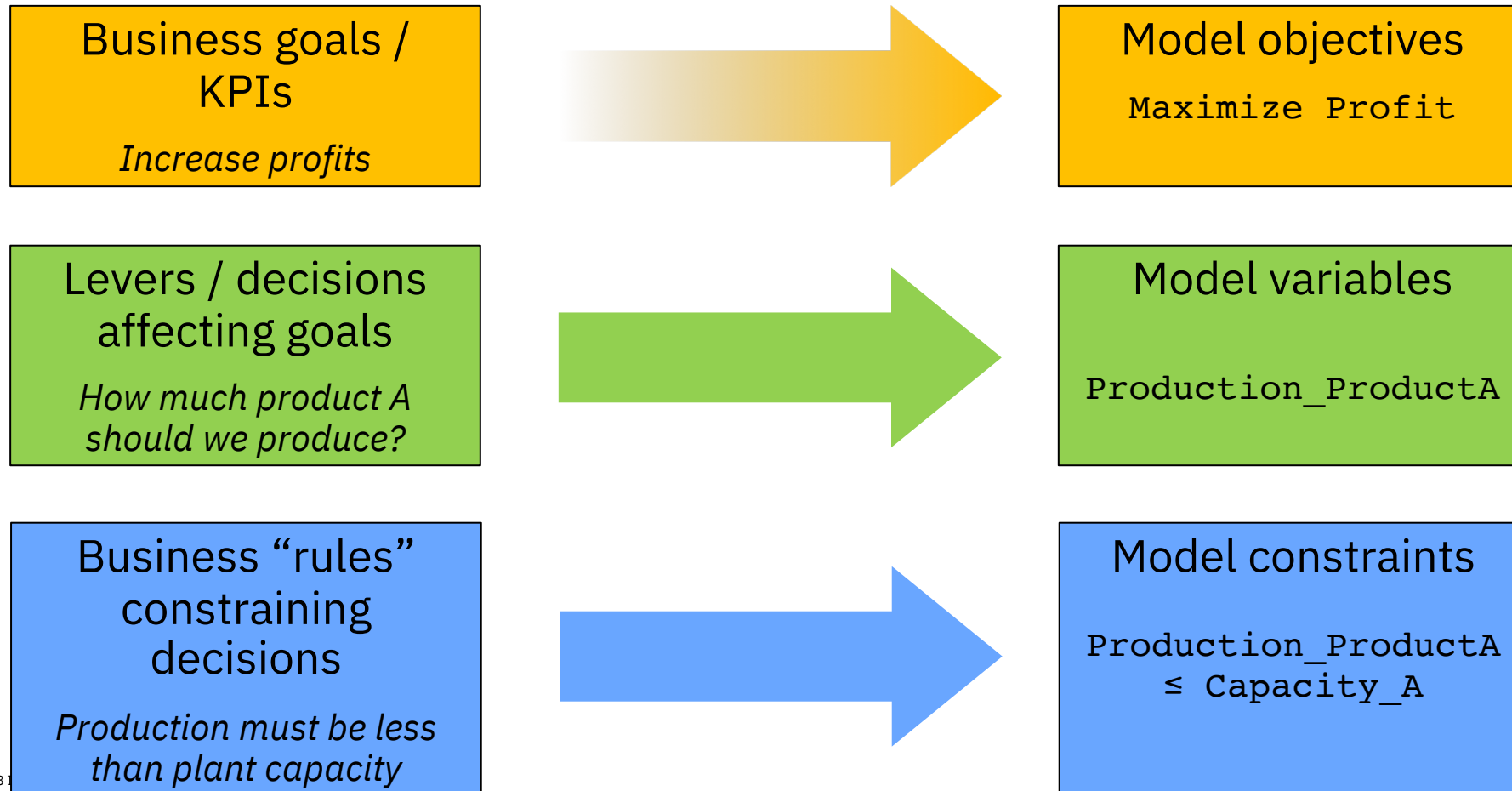
Python API

Model Builder (UI based modeling assistant)

OPL model

What is an optimization model?

A translation of your business problem into math...
... *without any specific instructions on how to solve*



A Production Planning Example

A manufacturer wants to sell a product

The product can be made either

- **Inside the factory**

- Scarce resources are used
- Cost per unit to manufacture

- **Outside the factory**

- Higher cost per unit to purchase

All demand must be satisfied

Goal: minimize total cost



Data Declarations

- Sets of products and resources

```
setof(string) Products = ...;
```

```
setof(string) Resources = ...;
```

- Number of units of each resource needed to produce one unit of each product

```
float consumption[Products][Resources] = ...;
```

- Total number of available resources

```
float capacity[Resources] = ...;
```

- Number of units in demand for each product

```
float demand[Products] = ...;
```

- Cost per unit of inside and outside production

```
float insideCost[Products] = ...;
```

```
float outsideCost[Products] = ...;
```

Products Could Be Jewelry

- **Products and Resources**

`Products = { rings earrings };`

`Resources = { gold diamonds };`

- **Consumption**

- A ring requires 3 units of gold and 1 diamond

- A set of earrings requires 2 units of gold and 2 diamonds

`consumption = [[3, 1], [2, 2]];`

- **Capacity (Available units of gold and diamonds)**

`capacity = [130, 180];`

- **Demand (Number of rings and earrings)**

`demand = [100, 150];`

- **Costs (per unit for rings and earrings)**

`insideCost = [250, 200];`

`outsideCost = [260, 270];`



Products Could Be Pasta

Products and Resources

```
Products = { kluski capellini fettucine };
```

```
Resources = { flour eggs };
```

Consumption

- Kluski requires 0.5 units of flour and 0.2 eggs
- Capellini requires 0.4 units of flour and 0.4 eggs
- Fettucine requires 0.3 units of flour and 0.6 eggs

```
consumption = [ [0.5, 0.2], [0.4, 0.4], [0.3, 0.6] ];
```

Capacity (Available units of flour and eggs)

```
capacity = [20, 40];
```

Demand (Number of each pasta needed)

```
demand = [100, 200, 300];
```

Costs (per unit for each pasta)

```
insideCost = [0.6, 0.8, 0.3];
```

```
outsideCost = [0.8, 0.9, 0.4];
```



Problem Model Is Identical (1/2)

```
setof(string) Products = ...;  
setof(string) Resources = ...;  
  
float consumption[Products][Resources] = ...;  
float capacity[Resources] = ...;  
float demand[Products] = ...;  
float insideCost[Products] = ...;  
float outsideCost[Products] = ...;
```

Data initialization

```
dvar float+ inside[Products];  
dvar float+ outside[Products];
```

Decision Variables

Problem Model Is Identical (2/2)

```
minimize
  sum(p in Products)
    (insideCost[p] * inside[p] +
     outsideCost[p]* outside[p] );
```

Objective Function



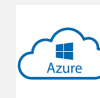
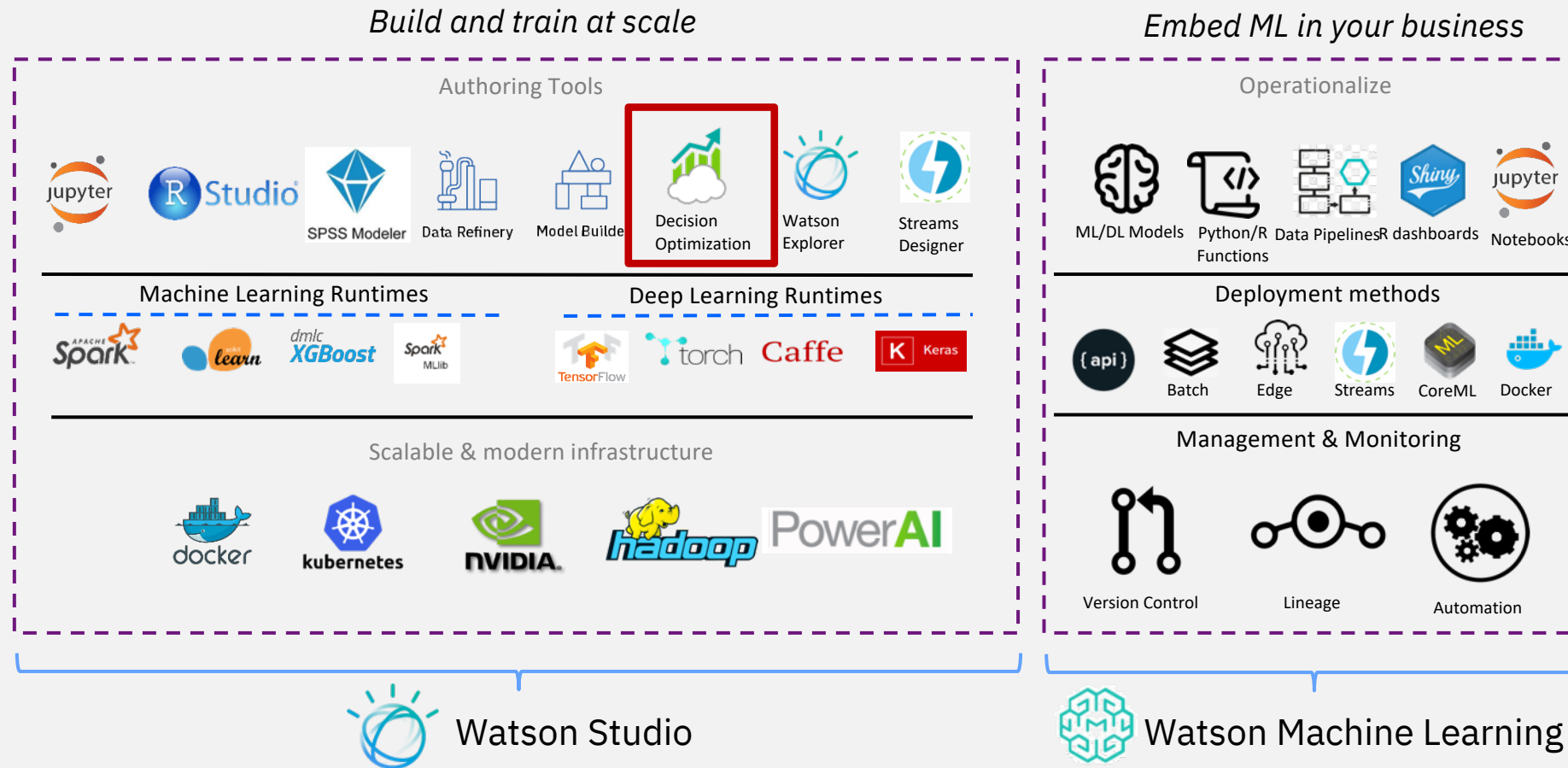
```
subject to {
  forall (r in Resources)
    sum (p in Products)
      consumption[p][r]*inside[p] <= capacity[r];

  forall (p in Products)
    inside[p] + outside[p] >= demand[p];
};
```

Constraints



Watson Studio and Watson Machine Learning inject AI firepower into your business



- Mix and Match your deployment**
- ✓ Cloud – IBM Cloud, Azure, AWS
 - ✓ On Premise / Private Data center
 - ✓ Desktop

Decision Optimization within Watson Studio

Scenario 1 - template

Prepare data
3 tables

Run model
Modeling Assistant

Explore solution

Modeling Assistant

Replace

Run model

Schedule and assign house_activities to house_subcontractors

Objectives

Minimize time to complete all house_activities

Constraints

Each house_subcontractor can only be used on 1 task at a time

The number of house_subcontractor assignments for each house_activity is equal to 1

Create Scenario

4 Scenarios

Refresh

20 Nov 2019, 12:34 PM

Scenario 4 - Subcontractor ...
Edit on: 20 Nov 2019, 10:28 ...

Scenario 3 - Precedence
Edit on: 20 Nov 2019, 10:13 ...

Scenario 2 - Customized
Edit on: 4 Oct 2019, 11:38 AM

Scenario 1 - template
Edit on: 30 Sep 2019, 3:24 PM

Input Data 0 tables

Model Modeling Assistant

Solution None

Visualization

Scenario comparison

Notes

Table

Charts

Vega Charts

Gantt

Highlight: No Highlight

Filter: Show All Types

Name	2020		
	Oct	Jan	Apr
1 Jack			
2 Jim			
3 Joe			

Charts House expertise

30 rows

SUM Skil...

21.000

18.000

15.000

12.000

9.000

6.000

3.000

0.000

carpentry

garden

painting

windows

Activity

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Thank You