Watson Studio

Prescriptive Analytics

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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

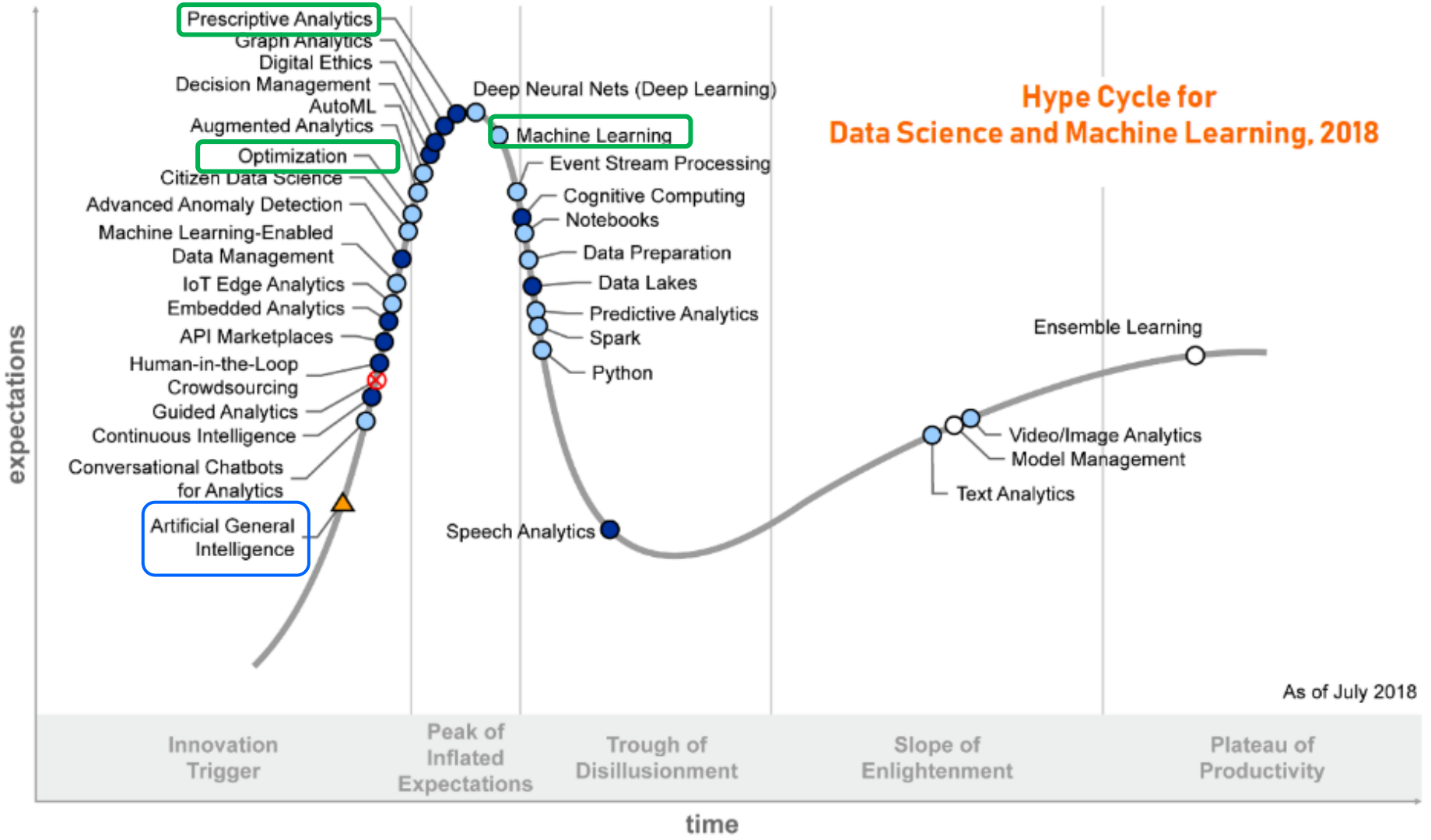
which use optimization and cognitive computing to advice on possible outcomes and answer: **“What should we do?”**

What is Prescriptive Analytics?

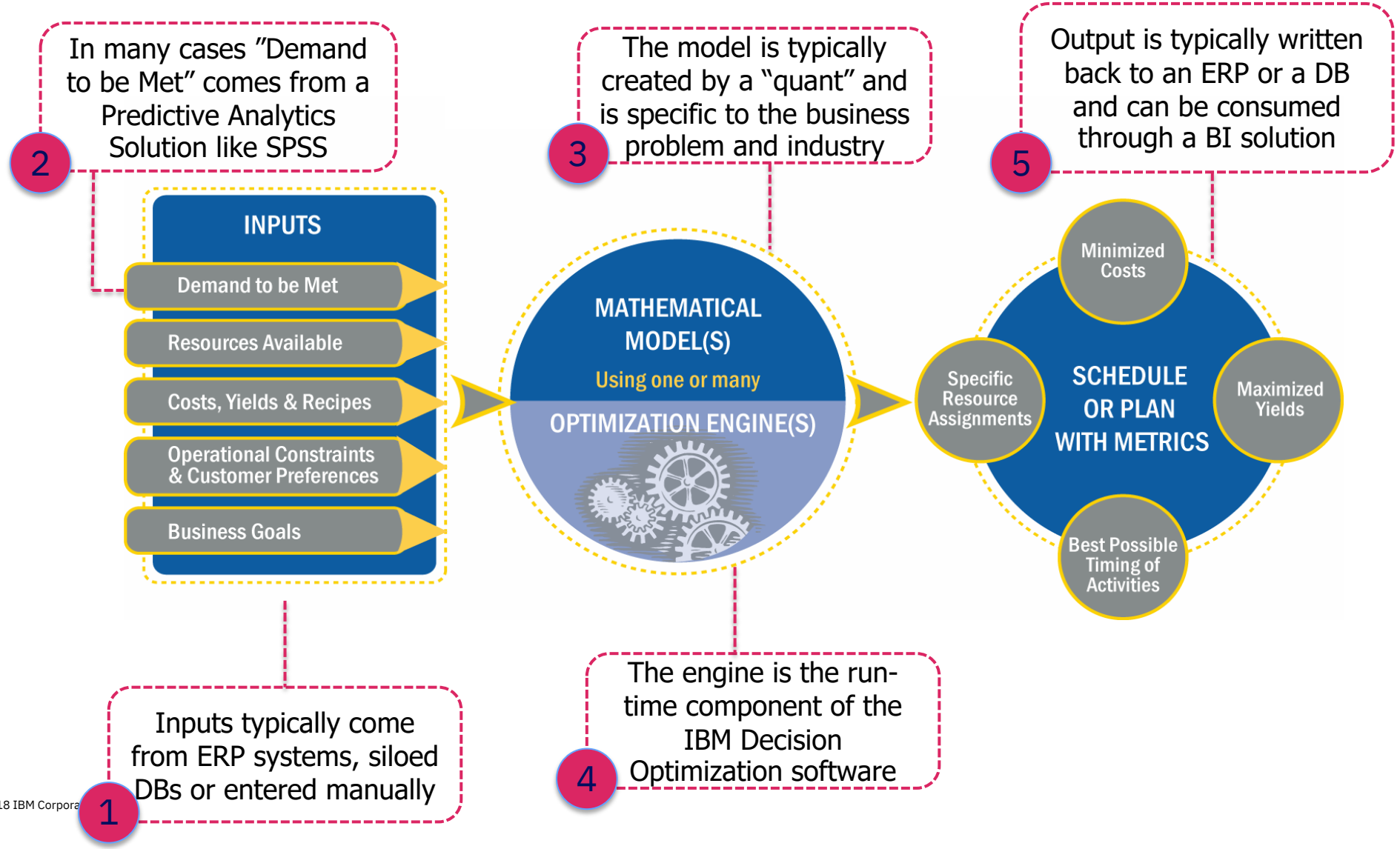
What's the best that can happen?
What ACTIONS do I need to take to achieve my desired goals?

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)



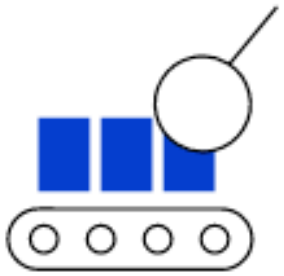
Prescriptive Analytics – How does it work?



Decision Optimization
the secret sauce for better decisions

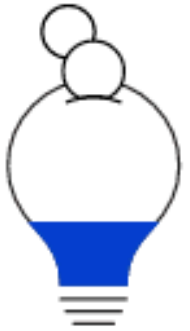
Decision optimization technology has delivered significant ROI across industries

25% increase
in transport punctuality.
33% reduction in daily
kilometres walked[1]



Optimize
manufacturing of
10K products
across 20 plants[2]

30%
reduction in risk
for same yields[3]



Upto
30% savings
on energy costs[4]

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

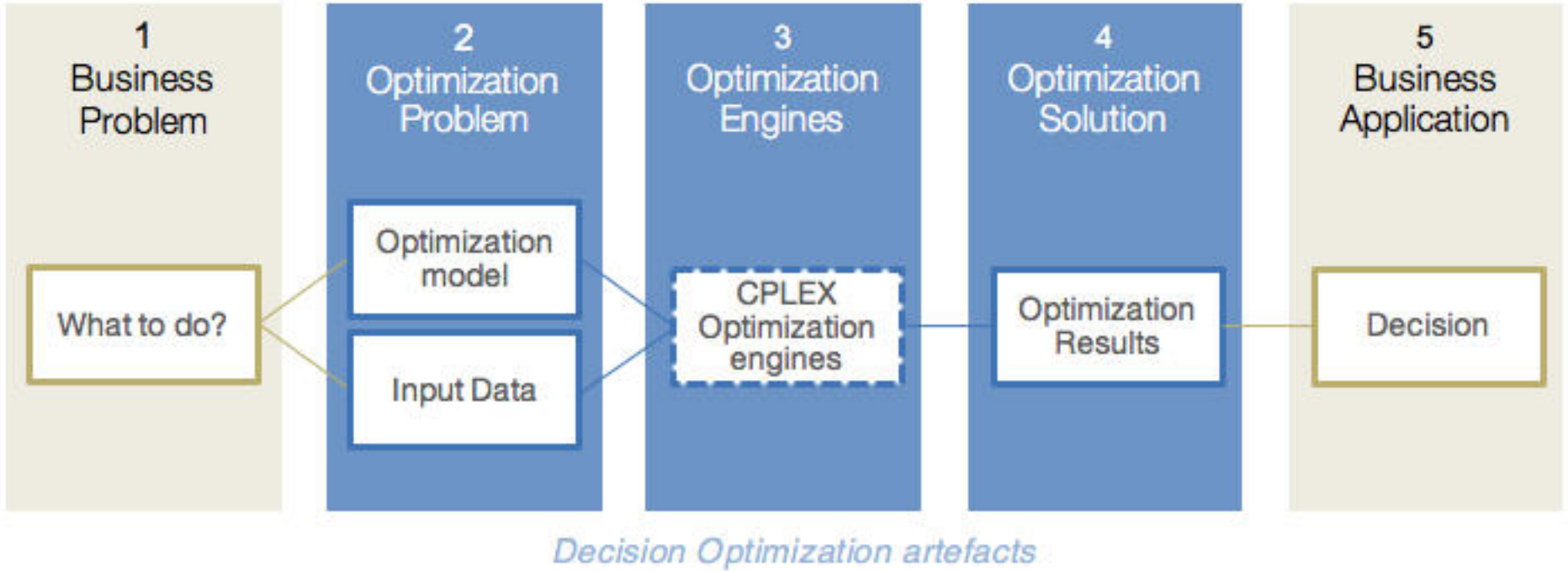
- What-if analysis to evaluate alternate scenarios
- Recommended actions to achieve business goals

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

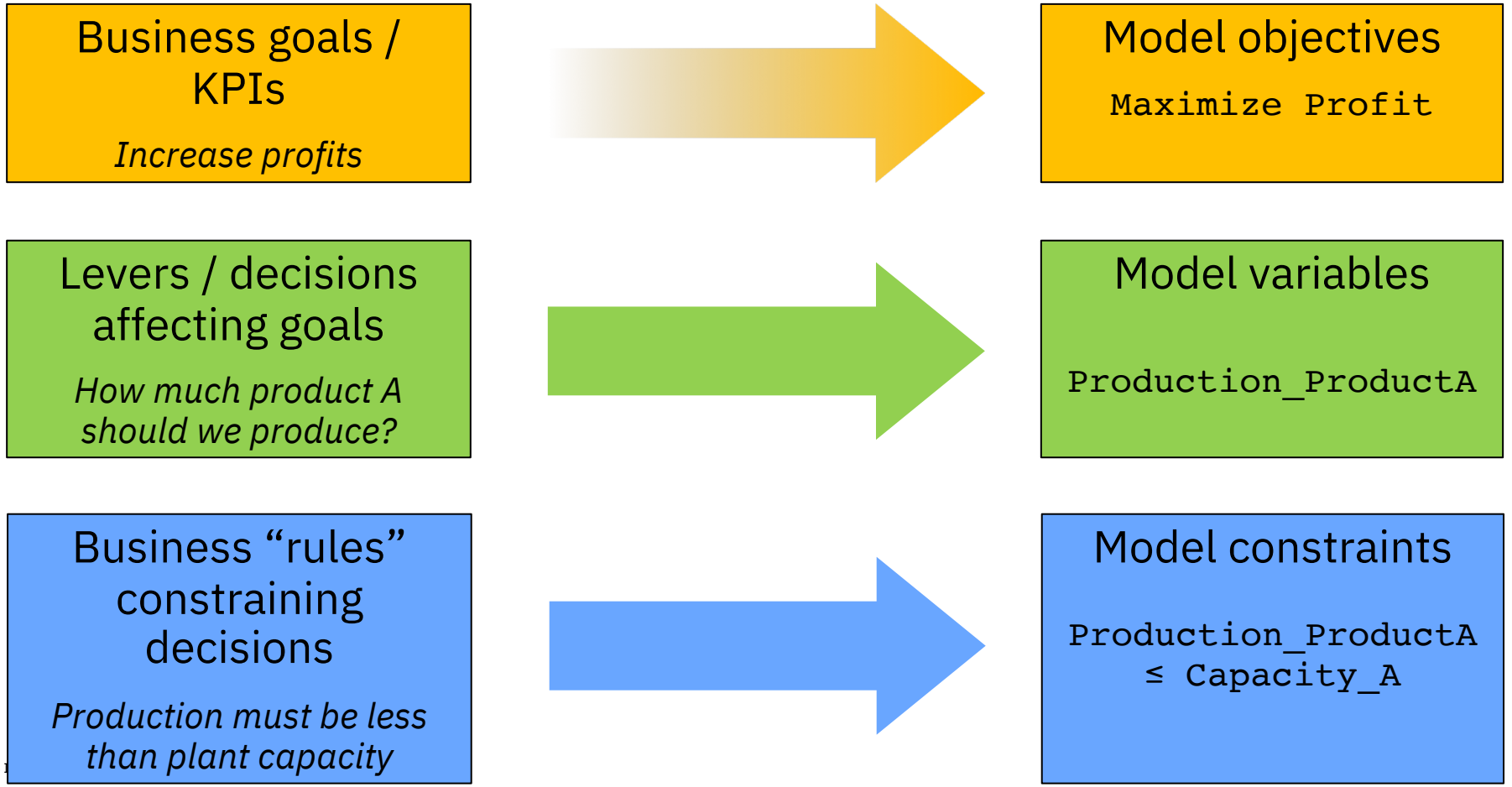
Python API

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]  = ...;
```


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

Problem Model Is Identical (2/2)

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

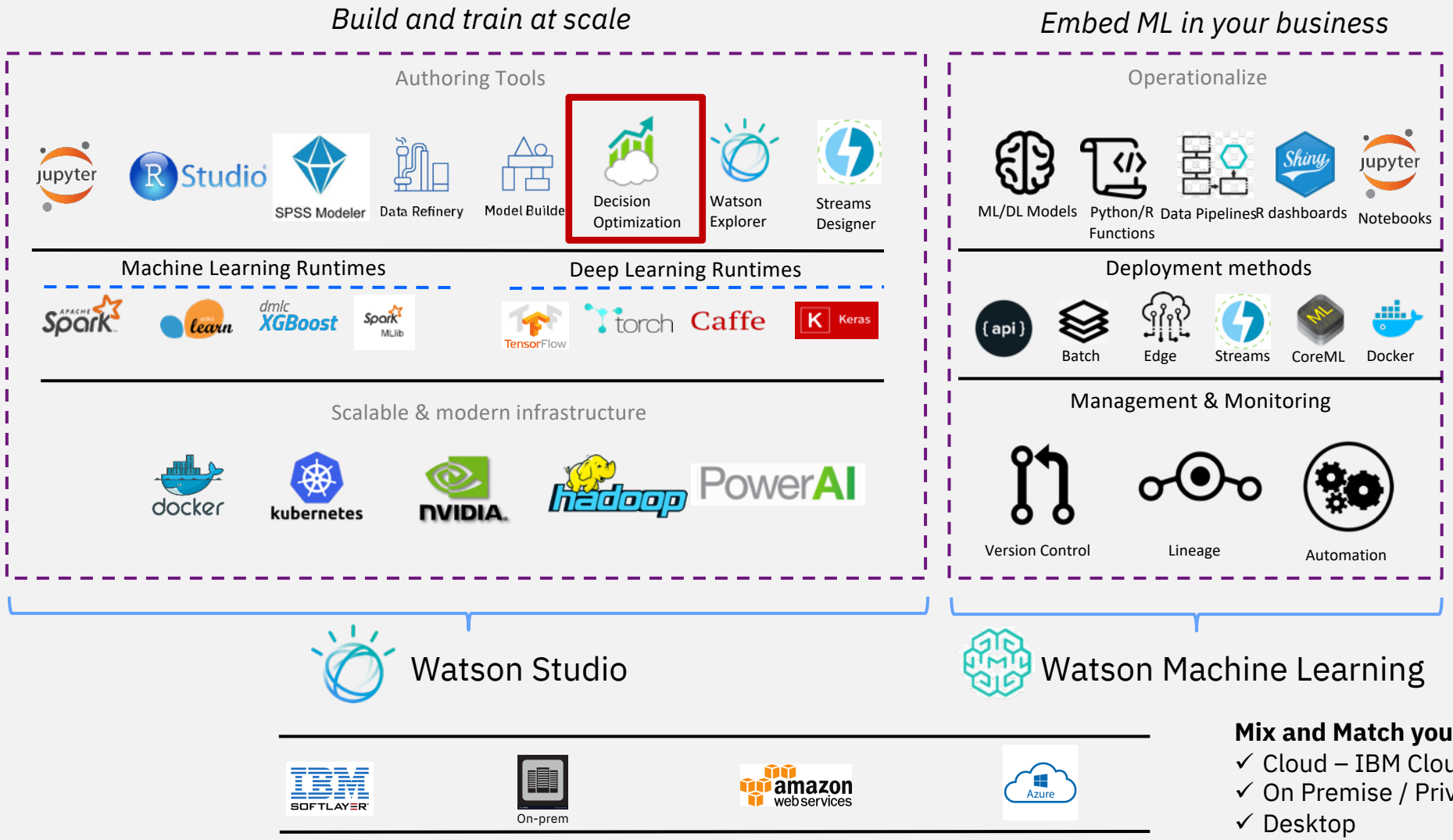
Objective Function

```
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

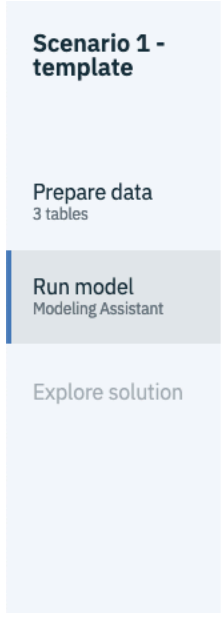
Watson Studio and Watson Machine Learning inject AI firepower into your business

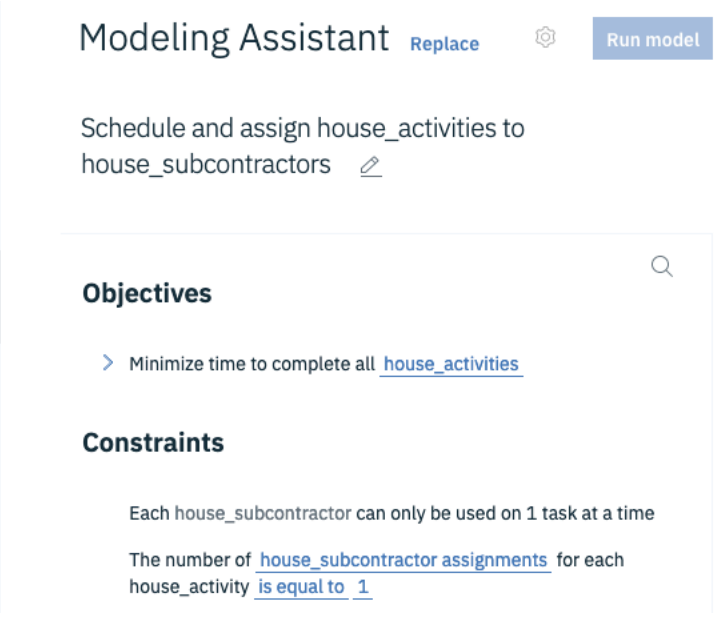


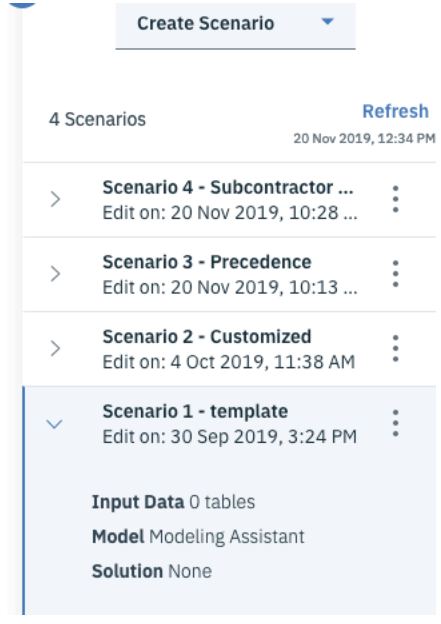
Mix and Match your deployment

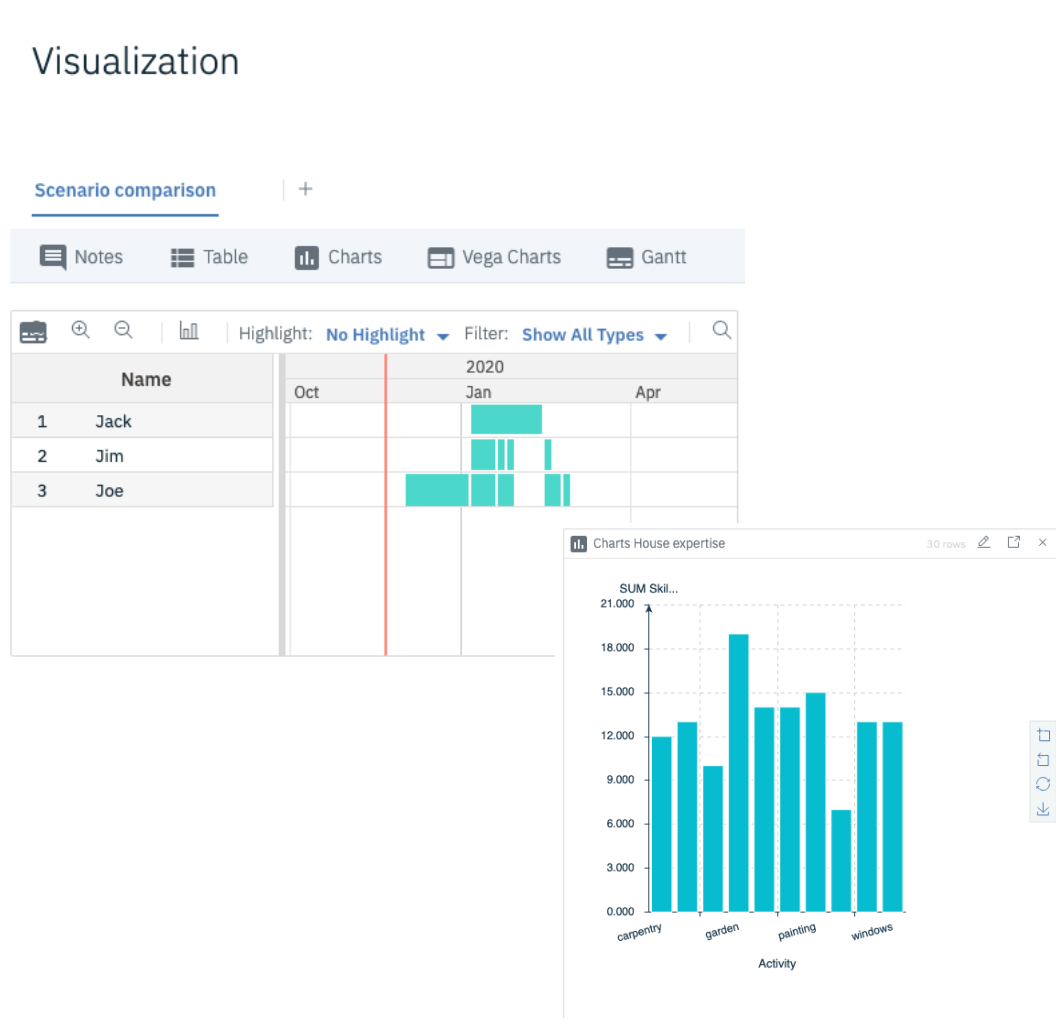
- ✓ Cloud – IBM Cloud, Azure, AWS
- ✓ On Premise / Private Data center
- ✓ Desktop

Decision Optimization within Watson Studio









Thank You