Teal Partners

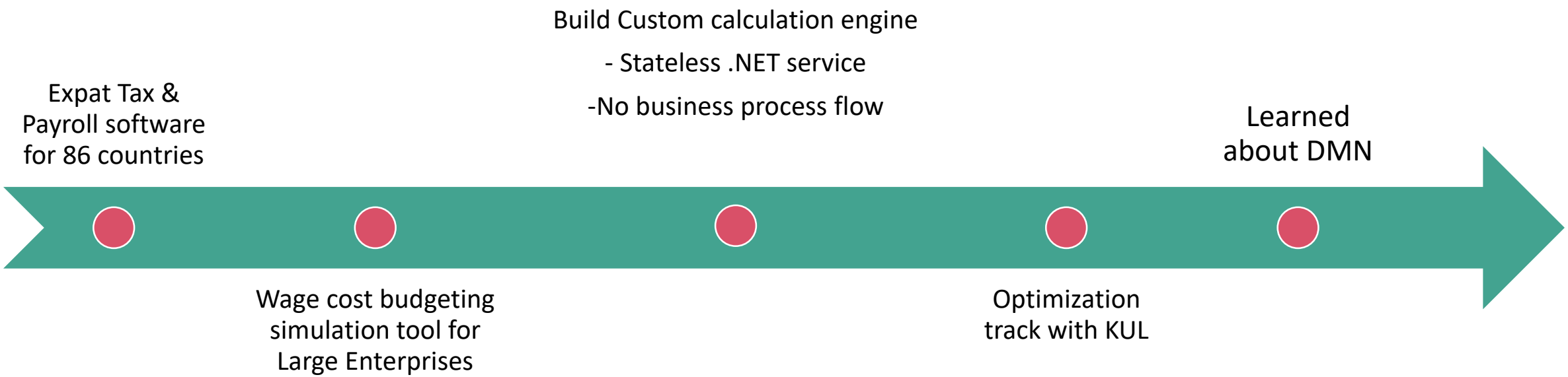
EXPLOITING PAYROLL KNOWLEDGE

Supporting decisions from an end-user point of view

Challenges when modelling knowledge

TEAL PARTNERS BACKGROUND

- Partner in elaborating digitalization tracks
- Goal: Putting business in control when legislation changes



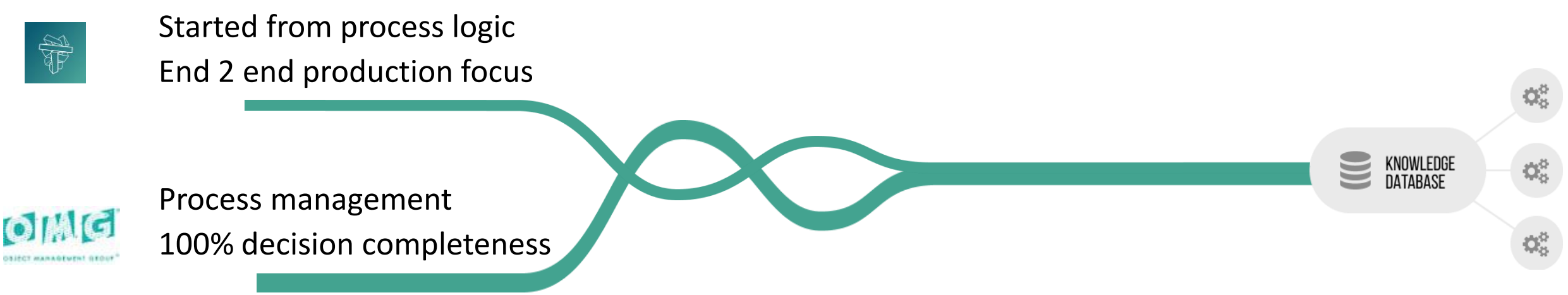
CONTEXT –PAYROLL/HR IN BELGIUM

- Complex domain
  - Six governments
  - Third place Global Payroll Complexity
- High taxes
  - Second highest taxed country in Europe
  - Multiple legal statutes
    - Different taxation
    - Different social security

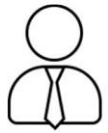
=> Uncertainty about choosing most beneficial statute

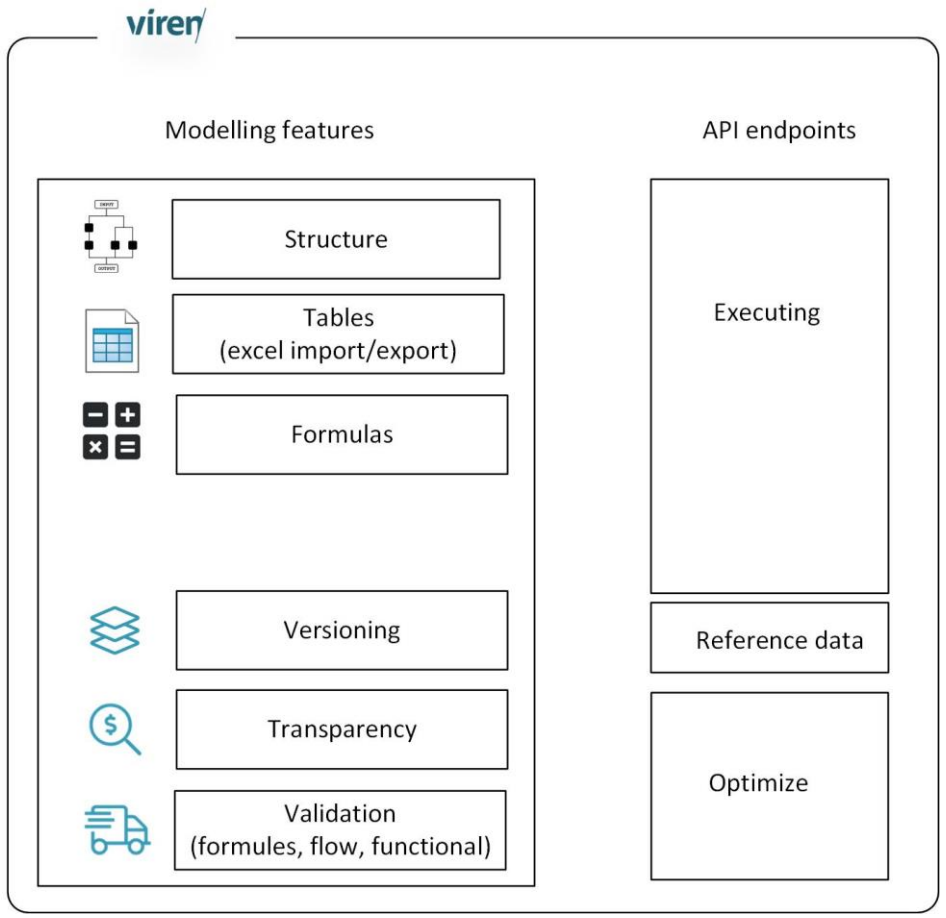
OBJECTIVES

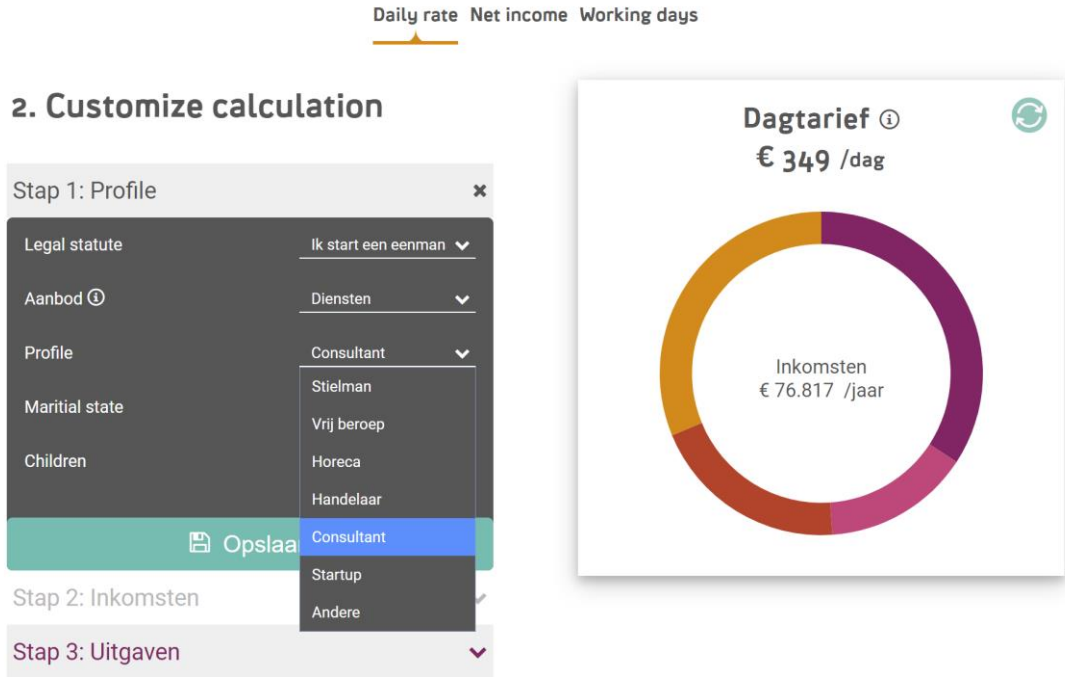
- Show setup simulation tool
  - Short demo
  - General architecture
  - Optimization solution
- Different route to similar destination



GENERAL ARCHITECTURE

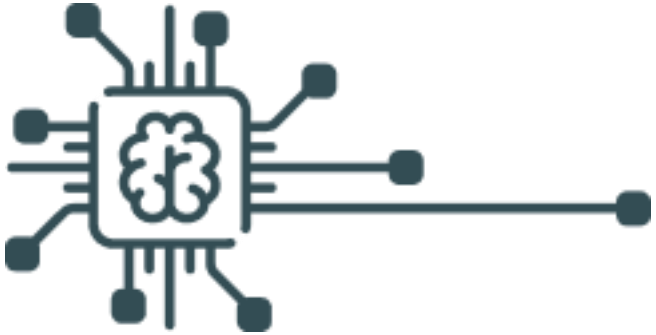






EXPLOIT KNOWLEDGE

- Knowledge
  - Declarative set of rules
  - Structured data
    - Descriptive tables
    - Clear in-and outputs
  - Types with meta info



- *Optimal* Decision taking
  - How many days should I work to earn a certain income
  - What is the optimal day rate to minimize taxes and earn a certain income

OPTIMALIZATION SOLUTION (1/3)

- “Brute Force”
  - Simple scenarios are possible
- Started with miniZinc
  - Widely used for constraint programming
  - Has built-in optimization
  - No solver suited for our domain
    - Decimal numbers are not well supported
    - Non-linear constraints,
      not always possible to linearize.

```
variable dailyWage: Int;
variable workingDays: Int;
variable incomeNetto: Int;
variable incomeBrutto: Int;
constraint incomeBrutto = dailyWage * workingDays;
constraint incomeNetto =
    if incomeBrutto > X then incomeBrutto * p1
    else incomeBrutto * p2;
constraint incomeNetto > 50000;
constraint incomeNetto < 70000;
constraint workingDays < 150;
solve maximize incomeNetto;
```

DTAI

KU LEUVEN

OPTIMALIZATION SOLUTION (2/3)

Used Z3 constraint solver

- Fast in determining (un)satisfiability
- Compile model to SMT-LIB2
  - JIT compilation with input values
  - Limit search space
- Custom optimization algorithm
- Created by Microsoft

BasisForfaitaireBeroepskosten	`JaarloonBedrijfsleider + TotaalVoordelenVaa + wagenVAA`
PercentageForfait	`lookup(BV_ForfaitaireBeroepskosten,'Percentage', TypeBerekeningBedrijfsleider)`
MaximumForfait	`lookup(BV_ForfaitaireBeroepskosten,'Maximum', TypeBerekeningBedrijfsleider)`
Forfait	`min( BasisForfaitaireBeroepskosten* PercentageForfait, MaximumForfait)`
Basis	`BasisForfaitaireBeroepskosten - Forfait`

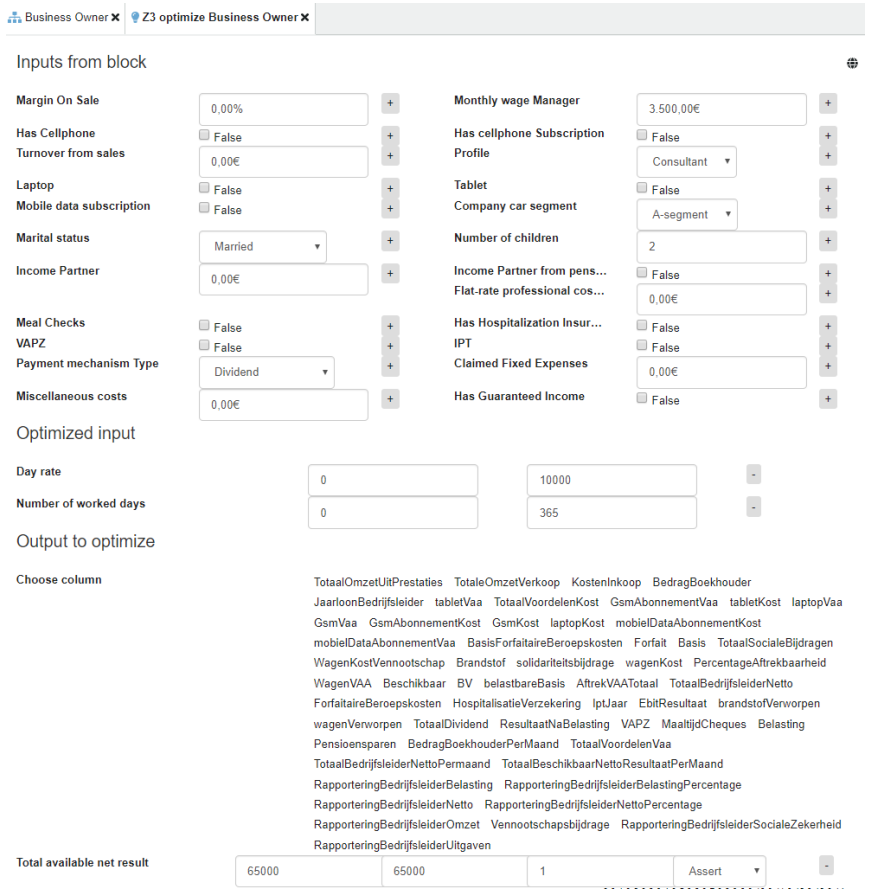
```
(declare-const PercentageForfait_BasisSocialeBijdragen Real)
(declare-const MaximumForfait_BasisSocialeBijdragen Real)
(declare-const Basis_BasisSocialeBijdragen Real)
(declare-const BasisForfaitaireBeroepskosten_BasisSocialeBijdragen Real)
(declare-const Forfait_BasisSocialeBijdragen Real)
(assert (= BasisForfaitaireBeroepskosten_BasisSocialeBijdragen
  (+ (+ JaarloonBedrijfsleider_BedrijfsleiderLoon 252.0) 2200.0)))
(define-fun min_Real ((x Real)(y Real)) Real
  (ite (< x y) x y))
(assert (= Forfait_BasisSocialeBijdragen
  (min_Real MaximumForfait_BasisSocialeBijdragen
            (* BasisForfaitaireBeroepskosten_BasisSocialeBijdragen
               PercentageForfait_BasisSocialeBijdragen))))
(assert (= Basis_BasisSocialeBijdragen
  (- BasisForfaitaireBeroepskosten_BasisSocialeBijdragen
     Forfait_BasisSocialeBijdragen)))}
```

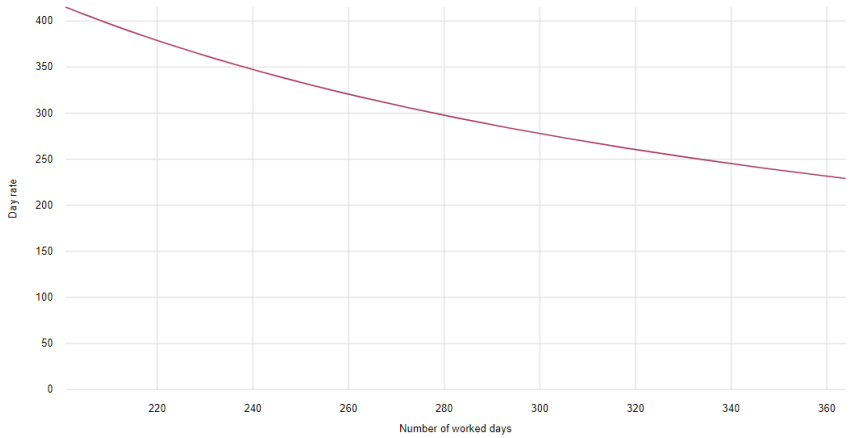
DTAI

KU LEUVEN

OPTIMALIZATION SOLUTION (3/3)

- Multiple dynamic parameters => pareto front

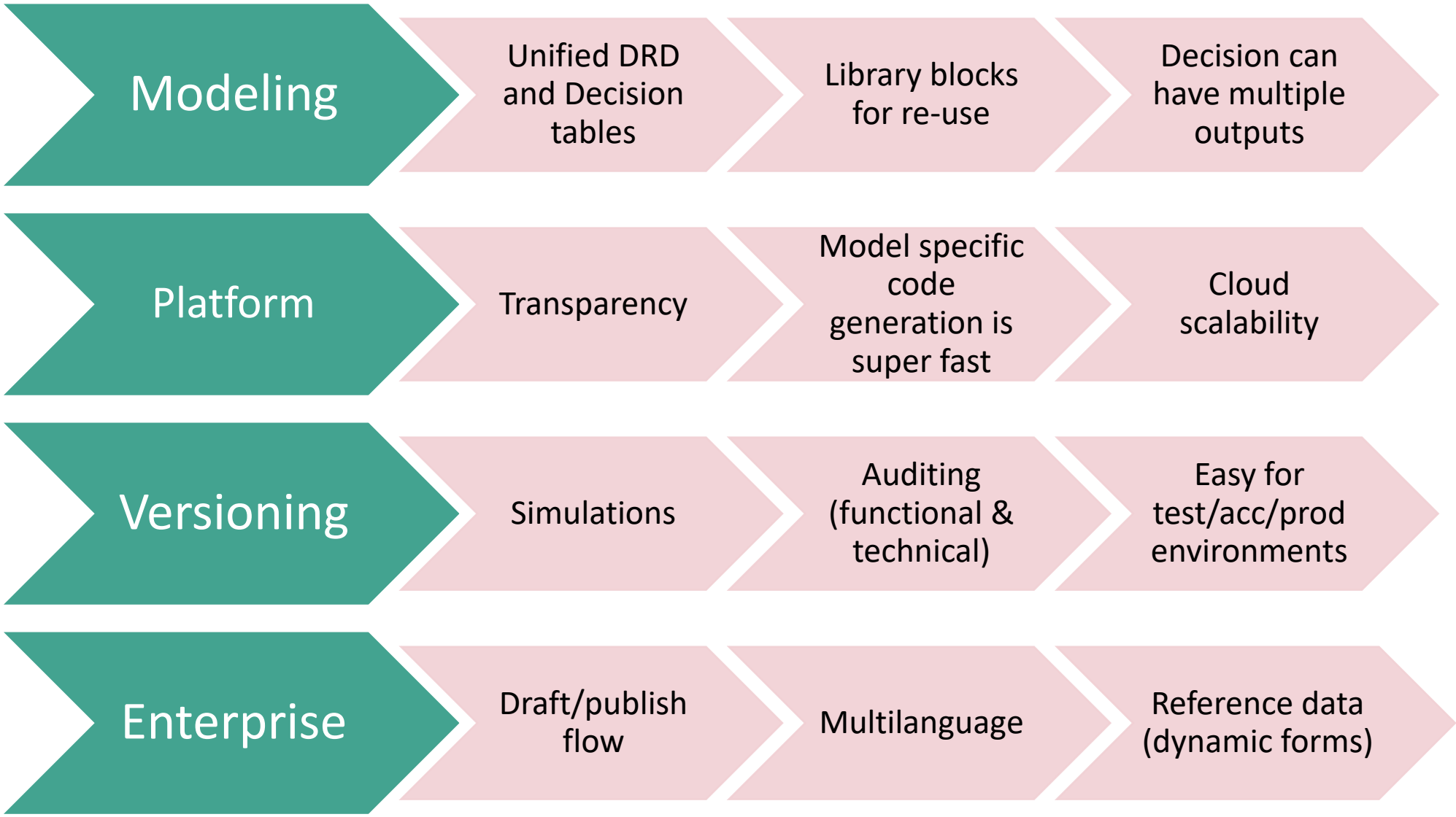




Z3 optimize result

Result 1 found in 98ms
Day rate 229
Number of worked days 363.9207329278
Result 2 found in 99ms
Day rate 240
Number of worked days 347.2410326686
Result 3 found in 107ms
Day rate 251
Number of worked days 332.0232981692
Result 4 found in 142ms
Day rate 262
Number of worked days 318.0833887041
Result 5 found in 120ms
Day rate 273
Number of worked days 305.2668419065

SIGHTSEEING TIPS FROM OUR JOURNEY



CONTACT INFORMATION

Teal Partners

Van de Wervestraat 20 - bus 206
2060 Antwerpen

http://www.tealpartners.com
info@tealpartners.com

Your contact

Tim Stuyckens
Software Product Gardener

tim@tealpartners.com

BACKUP SLIDE: WHERE WE HEADING NEXT

- Comparing versions
  - Git like functionality to “merge” knowledge
  - “apply patches” to propagate new knowledge
- DMN compliancy
  - Decision tables: extra abstraction above blocks and tables
    - Auto convert them to switch block
    - Limit formula syntax to be in sync with FEEL