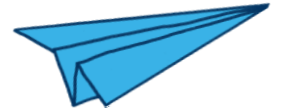


blueyonder

Forward looking. Forward thinking.



Python in the world of mail order and retail

EuroPython 2015, Dr. Philipp Mack

Agenda

Use cases in the 'real' world for a replenishment solution
Simplified and purified use case – the essence
What you need – the ingredients
Putting it all together – the cook book
What do you get at the end – the meal
or a simple replenishment application

Material

Where can you find everything ?

<https://github.com/philippmack/europython2015-pmack.git>

Includes this presentation, notebooks, examples and the framework

Real world use cases

Mail order

Estimate what will be ordered by customers the next days and preorder the right amount to minimize delivery time for the customers

$O(100000)$ items

Seasonality / delivery time of goods

Slow selling goods and returns

Real world use cases

Retail

Predict the correct order amount of goods to minimize out-of-stock situations as well as the surplus

$O(100)$ items and $O(100)$ locations

Seasonality / events / weather / expiry date

Fast moving goods

Simplified use case

What is the purified essence of these examples ?

Know the demand and stocks for certain periods or points in time depending on the delivery time and the frequency of orders

Order the right amount of items considering given conditions like expiry range, availability, excess ...

Simplified use case

Predict the correct order amount of goods to minimize out-of-stock situations as well as the surplus

Simulated data – timeseries of poisson distributed sales

Order every day in the evening

Throw everything away in the evening

Delivery the next morning

Framework

What are the prerequisites for a basic/simple solution?

No input/output interface

Data is stored in csv-files – no database

Prediction/simulation/replenishment module

Testing – code and configuration

Plotting/reporting/monitoring

Logging

Documentation

Deployment

Ingredients

Predictions

We need to know the tomorrow's demand

Model examples :

Take yesterday's sales

Take last week sales of same weekday

Rolling mean

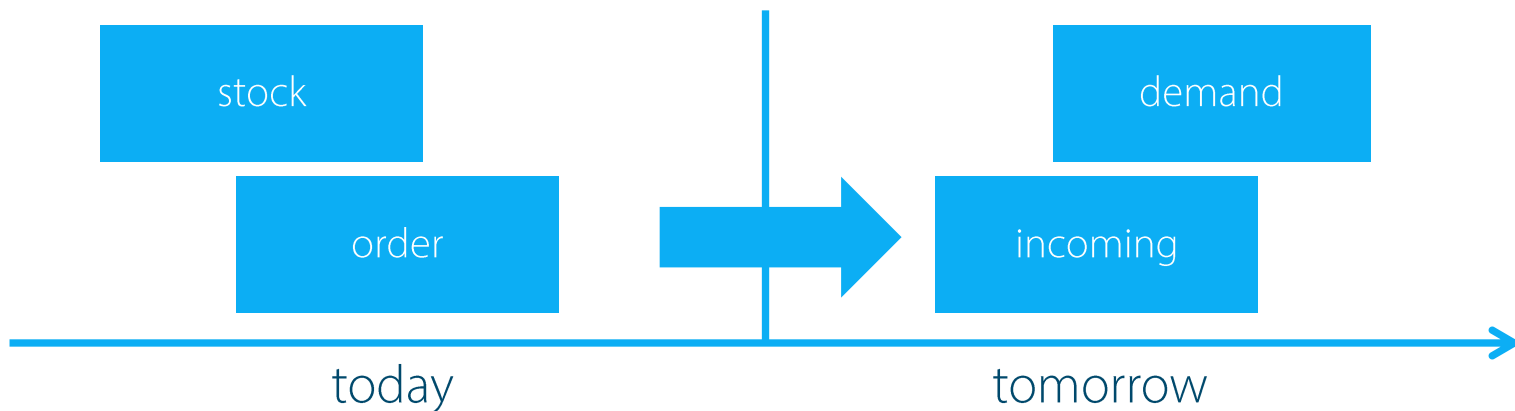
Moving average

Gradient boost ...

Ingredients

Order calculation

stock in the evening : 0 ,
demand interval : 1 day , forecast horizon : 1 day



$$\text{order} = \text{demand of tomorrow} - \text{stock in the evening}$$

The cook book

Simulation

Predict demand for each day on test sample

- a) Take yesterday's demand
- b) Rolling mean of the last five days

Calculate order for these demands with a given strategy

- a) Order the expectation value of your prediction
- b) Take quantile x from a assumed probability density

The cook book

DEMO

Prediction	Replenishment	Quantiles
-	Order 1	-
-	Order 10	-
Last known sale	Order expectation	-
Rolling mean (5 days)	Order expectation	-
Last known sale	Order quantile from Poisson	10,20,30,40,50,60,70,80,90,95,98,99
Rolling mean (5 days)	Order quantile from Poisson	10,20,30,40,50,60,70,80,90,95,98,99

The cook book

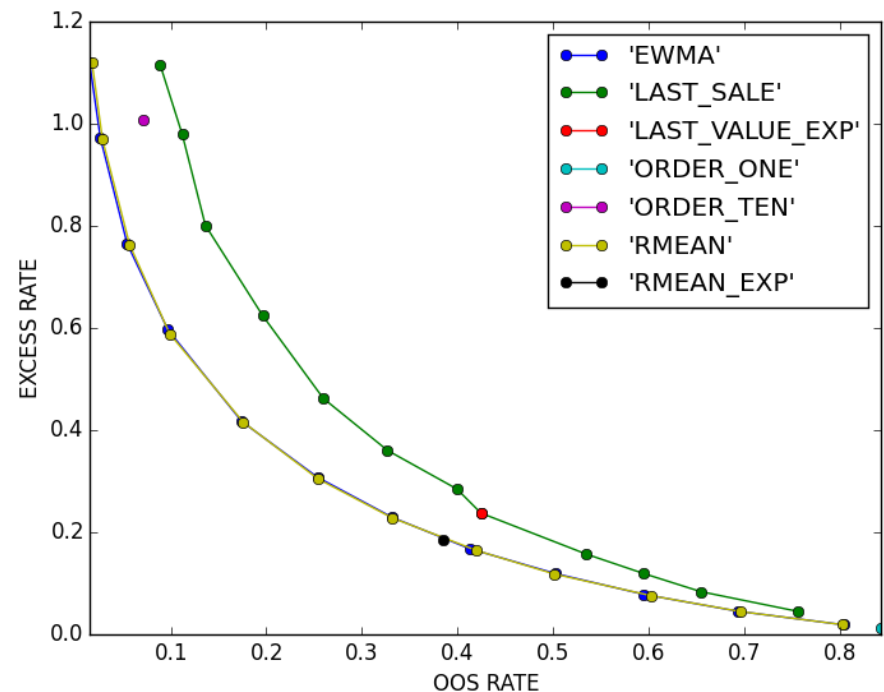
Evaluation of working points for a replenishment solution

Excess rate :

$\frac{\text{surplus amount}}{\text{sold amount}}$

OOS rate :

$\frac{\text{'item' days out of stock}}{\text{all items times days}}$



The cook book

Paralellisation :

<https://docs.python.org/2/library/multiprocessing.html>

```
from multiprocessing import Pool  
p = Pool(4)  
result = p.map(f,list_of_values)
```

For multiple hosts :

Redis : <https://redis-py.readthedocs.org/en/latest/>

The cook book

Testing :

Code :

<http://pytest.org/latest/>

<https://pypi.python.org/pypi/pytest-cov>

Config : yaml / json

<https://pypi.python.org/pypi/voluptuous>

The cook book

Replenishment

Chose a strategy and the working point derived from your simulation and calculate an order for the next day for each given product

The same code can be used as in the simulation, !

The cook book

What is missing ?

Logging :

<https://docs.python.org/2/library/logging.html>

Reporting/Monitoring/Plotting :

<http://matplotlib.org/>

<http://stanford.edu/~mwaskom/software/seaborn/>

<http://bokeh.pydata.org/en/latest/>

The cook book

What is missing ?

Documentation :

<http://sphinx-doc.org/>

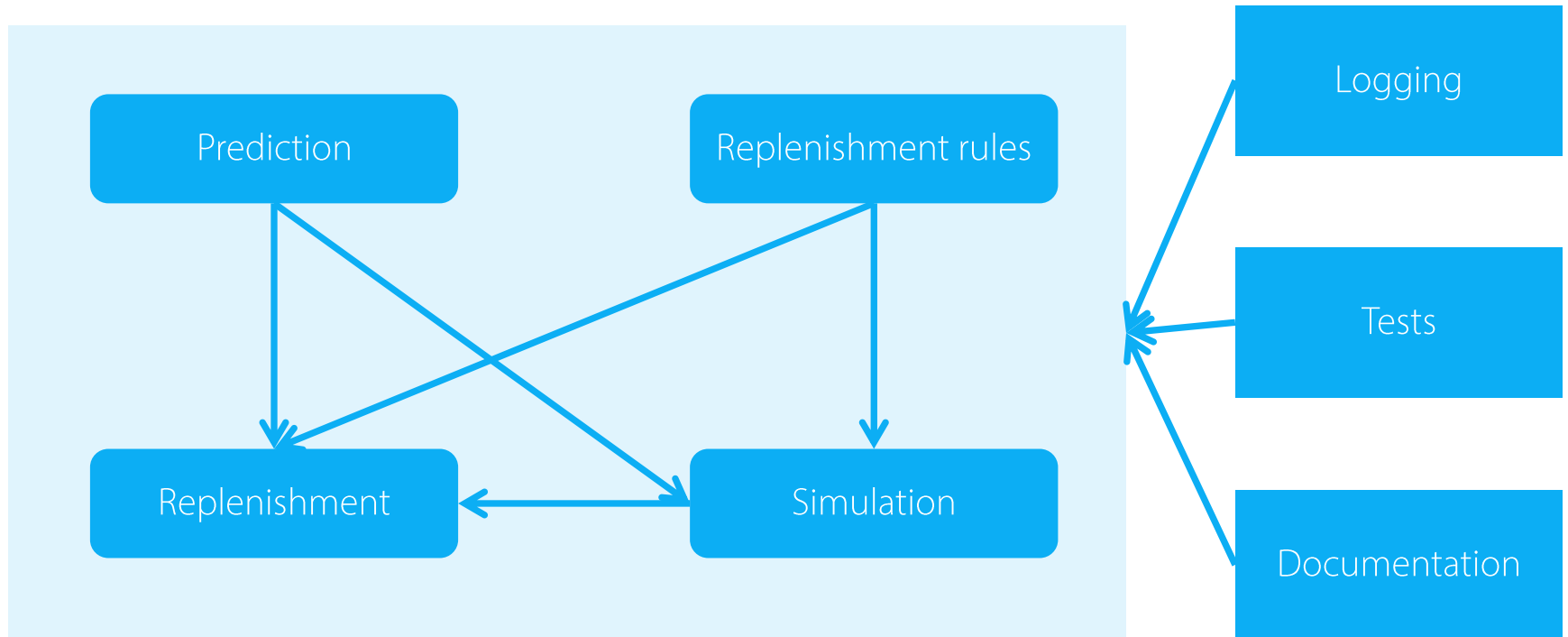
Deployment :

http://docs.ansible.com/developing_api.html

<http://www.ansible.com/application-deployment>

The meal

Putting it all together



What's the lesson ?

This simple replenishment framework provides a basic solution for an order forecast system and includes all the necessary requirements on a simple level.

Thank you for your attention and visit us at our blue yonder booth