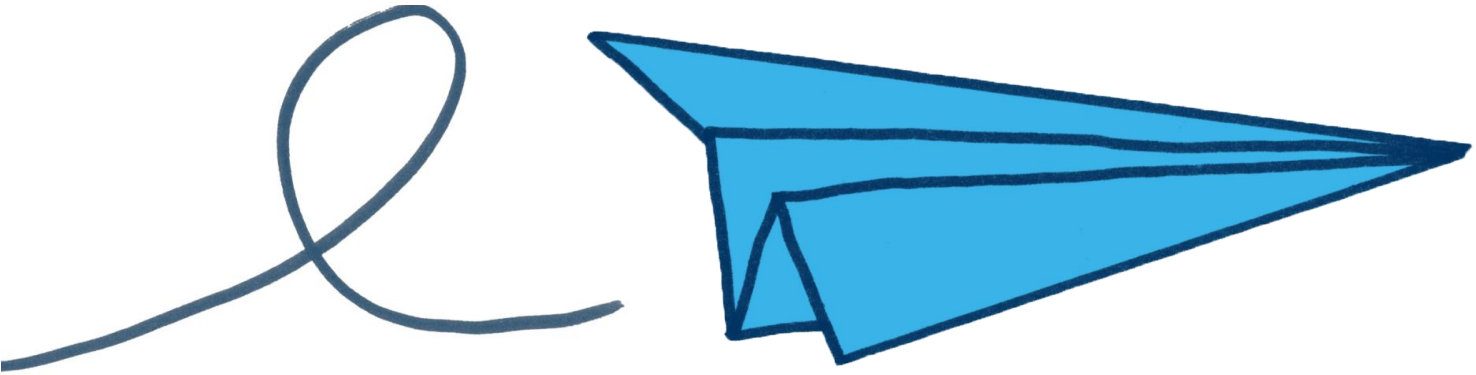
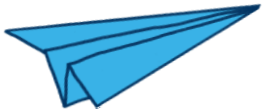


blue yonder

Forward looking. Forward thinking.



Python in the world of mail order and retail

EuroPython 2015, Dr. Philipp Mack

blue yonder

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 do you we need 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

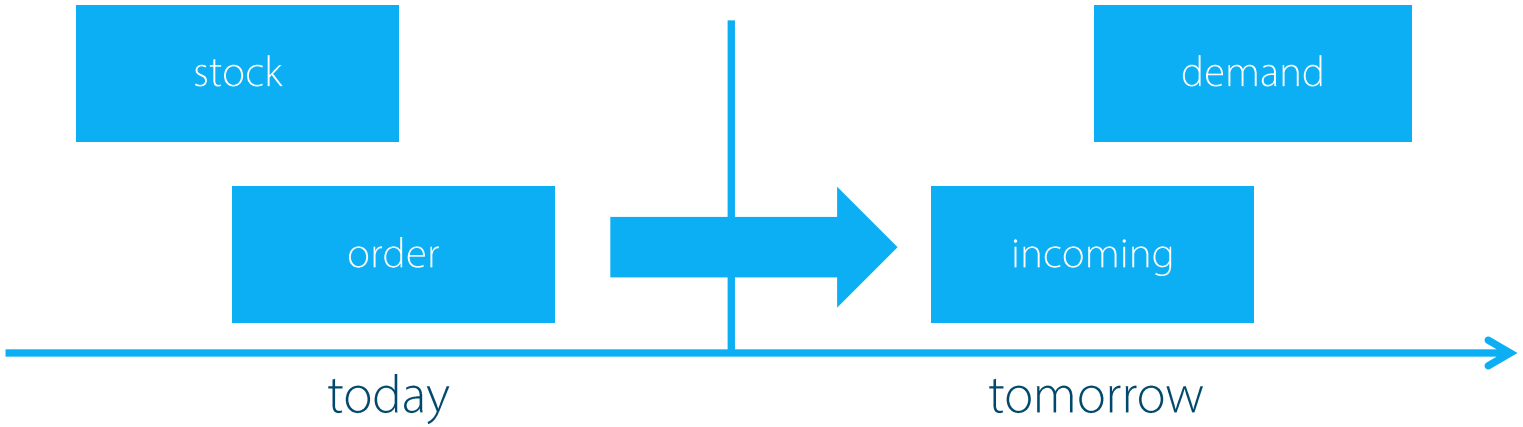
Model examples :

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



order = demand of tomorrow – 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 probabilty 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

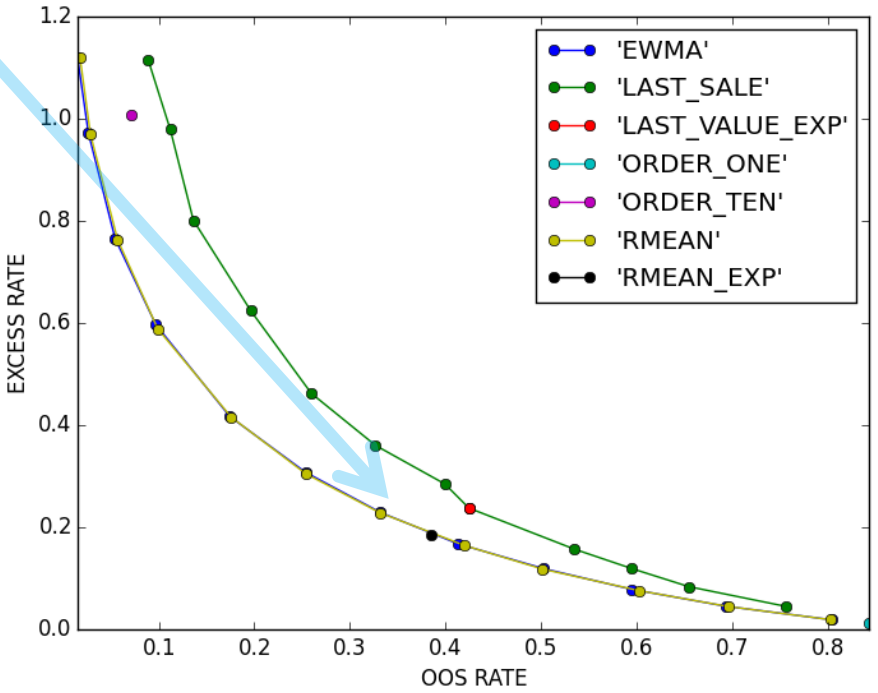
The cook book

Evaluation of working points for a replenishment solution

Excess rate :

surplus amount/
sold amount

OOS rate :
‚item' days out of stock/
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

Working point for Rmean + Poission order
60% Quantile ->
Simulated OOS : 33%
Simulated excess : 23%

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 :

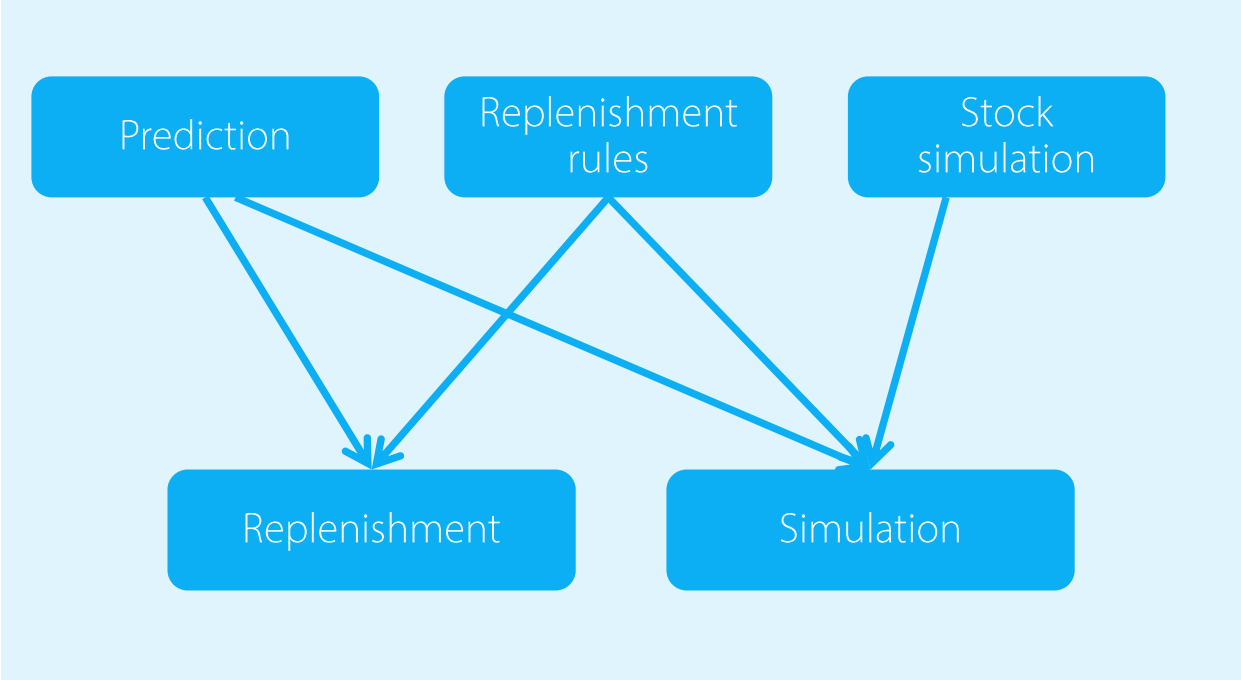
http://sphinx-doc.org/

Deployment :

http://docs.ansible.com/developing_api.html
http://www.ansible.com/application-deployment

The meal

Putting it all together



Documentation
Logging
Monitoring
Tests
Configuration
Deployment
Reporting

This simple replenishent framework provides a very basic solution for an order forecast system and illustrates the simplicity and strenght of PYTHON.

What's the lesson ?

Thank you for your attention and visit us our booth