MetaOS Architecture.

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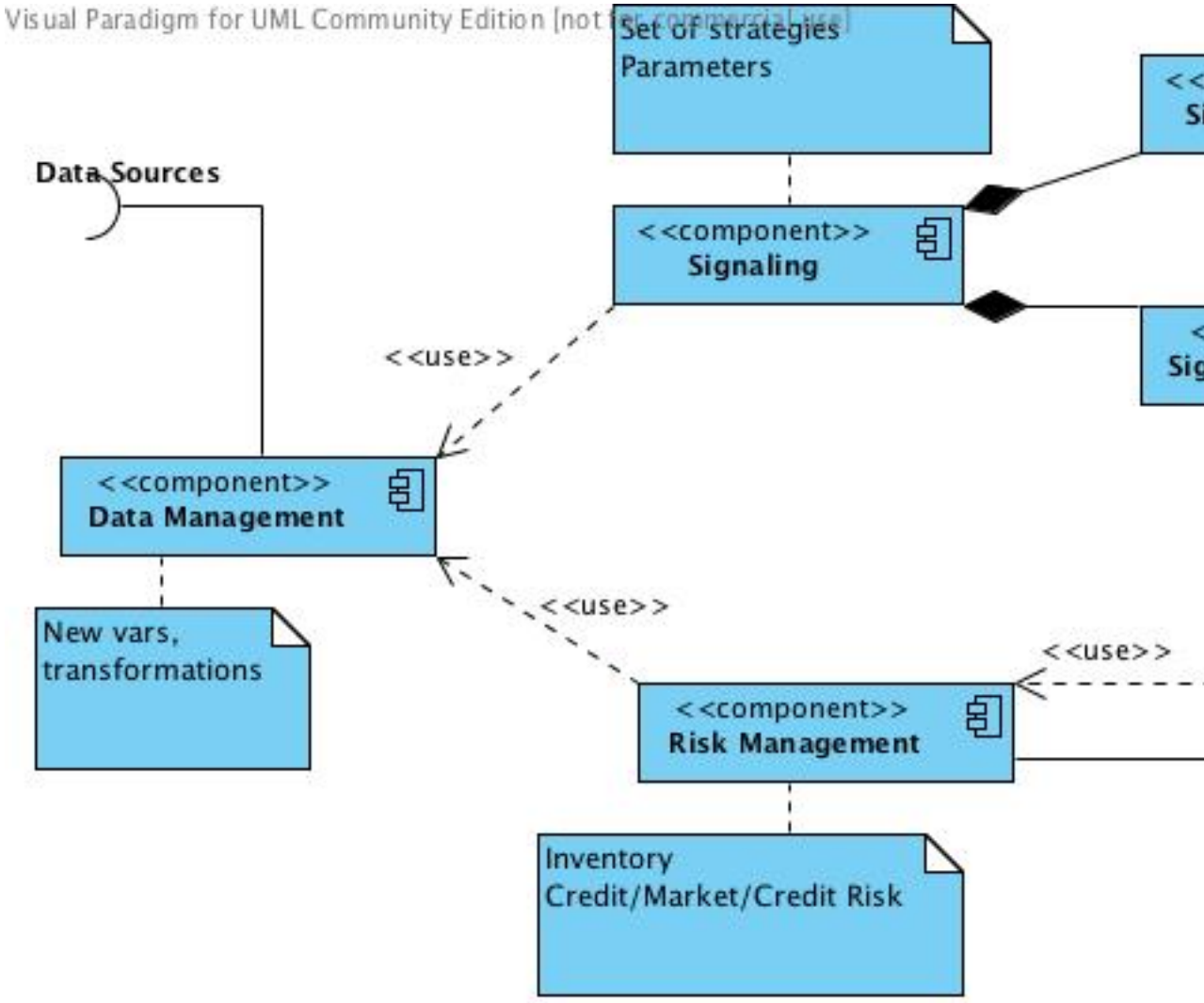
1 Abstract

2 MetaOS modules.



3 Java packages.

Quite similar information is available in Javadoc, maybe with more examples oriented to programming tasks.

In this section, we're trying to provide an architectural view and the ways system may grow.

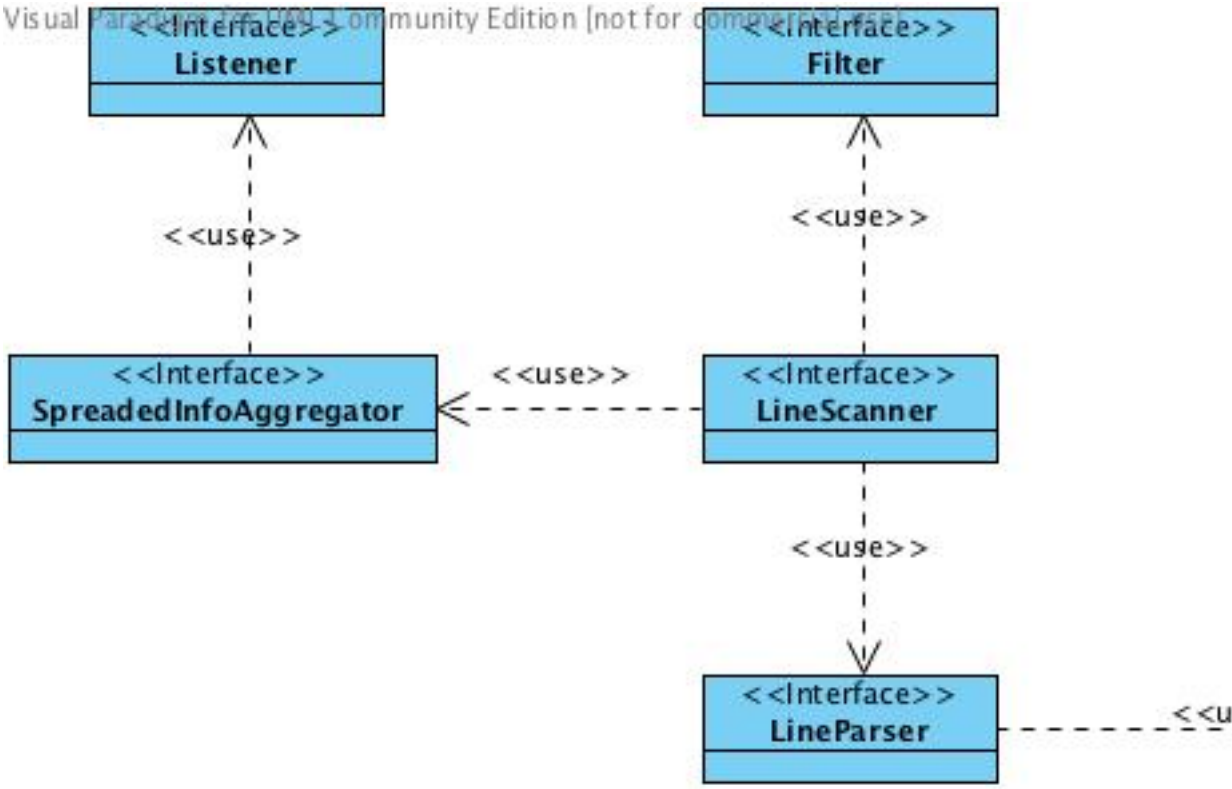
3.1 datamgt

Classes related to data access, transformation and making of new variables. Remote (on demand and on line trading systems) and even local datasources (like CSV files) are represented using a common interface thanks to this package.

Listener and factory patterns are in the core of the package to let: a.- the startegies work into a simulated environment (for instance created with historical data) and real time world agnostically, thus without changing anything into strategies code;

b.- synthesize new data (in real time and in simulations) in an homogeneus way, providing the same appear for crude and synthesized data;

General package overview is shown is this figure, in which only interfaces are represented. The other elements in package are classes implementing interfaces for general cases (CSV files, sources with one or several symbols, file splitting manipulation, etc)


Visual Paradigm CE (OSU Community Edition [not for commercial use])
<<Interface>>
Listener
<<Interface>>
Filter
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SpreadedInfoAggregator
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LineScanner
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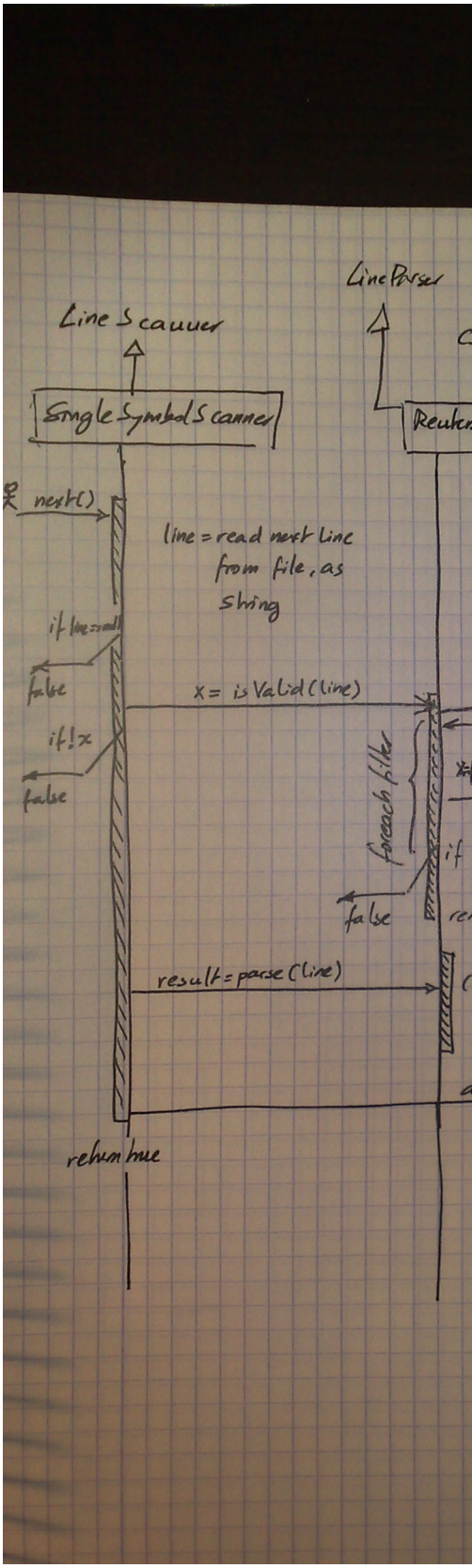
<<Interface>>
LineParser



The usage of the classes from this package is like this figure

The only main principle driving the package is the concept of listener: trading data is gotten from sources and several listeners are subscribed to the data management classes; listeners are, for instance, predictors, strategies or data transformations.

3.2 engine

3.3 riskmgt

3.4 signalgrt

3.5 trading

3.6 util

3.7 ext

4 Integration with other languages

4.1 R project

4.2 Python

4.3 Any other

5 Examples ——— erase me, please

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```
interpreteR = R(["correlation.r"])

interpreteR.eval("corre<-correlator()")
for i in range(1,200):
    interpreteR.eval("corre$memo(" + str(i) + "," + str(i) + ")")

print interpreteR.eval("corre$show()")

interpreteR.end()
```

As it's seen from the code, a R source code named *correlation.r* where a class *correlator* is defined. The class should have got the methods *memo* and *show*, as in this example:

```
correlator <- function() {
    xVals <- c()
    yVals <- c()

    memo <- function(x, y) {
        xVals <<- union(xVals, x)
        yVals <<- union(yVals, y)
    }


    show <- function() {
        r <- lm(xVals ~ yVals)
        return(r)
    }

    return(list(memo=memo, show=show))
}
```

6 Generalization

The following code (*rintegration.py*) uses the same described principle in the previous section but letting the name of R source containing the class as a runtime parameter:

```
#
# Predictor using R defined classes over BRIC40.
#

# TO DO: get symbols from file source
symbols = [ '1288.HK', '3988.HK', '0883.HK', '0939.HK', '2628.HK', '3968.HK', '0941.HK', '0688.HK', '0386.HK'

symbol1 = symbols[16]
symbol2 = symbols[0]

source = CSVUnorderedData.getInstance().reuters('BRIC40_1min.csv', symbols)

# R code: create predictor object
interpreteR = R([args[0]])
interpreteR.eval("predictor <- lsPredictor()")

# Bind R predictor to source events through an observer
class MyObserver(MarketObserver):
    def __init__(self):
        self.anyCoincidence = False;

    def update(self, ss, when):
        if symbol1 in ss and symbol2 in ss:
            self.anyCoincidence = True
            interpreteR.eval('predictor$learn(' \
                + str(market.getLastPrice(0, symbol1 + '-CLOSE')) + ','
                + str(market.getLastPrice(0, symbol2 + '-CLOSE')) + ')')

            strLine = Long.toString(when.getTimeInMillis()).encode('utf-8')
            strLine = strLine + ',' \
                    + Double.toString(market.getLastPrice(0,symbol1 + '-OPEN'))\
                            .encode('utf-8') + ','\
                    + Double.toString(market.getLastPrice(0,symbol1 + '-HIGH'))\
                            .encode('utf-8') + ',' \
                    + Double.toString(market.getLastPrice(0,symbol1 + '-LOW'))\
                            .encode('utf-8') + ','\
                    + Double.toString(market.getLastPrice(0,symbol1+'-CLOSE'))\
                            .encode('utf-8') + ','\
                    + Long.toString(market.getLastVolume(0,symbol1))\
                            .encode('utf-8')
            strLine = strLine + ',' \
                    + Double.toString(market.getLastPrice(0,symbol2 + '-OPEN'))\
                            .encode('utf-8') + ','\
                    + Double.toString(market.getLastPrice(0,symbol2 + '-HIGH'))\
                            .encode('utf-8') + ',' \
                    + Double.toString(market.getLastPrice(0,symbol2 + '-LOW'))\
                            .encode('utf-8') + ','\
                    + Double.toString(market.getLastPrice(0,symbol2+'-CLOSE'))\
                            .encode('utf-8') + ','\
                    + Long.toString(market.getLastVolume(0,symbol2))\
                            .encode('utf-8')
            print strLine

        if symbol1 in ss and not symbol2 in ss and self.anyCoincidence:
            y = interpreteR.evalDouble('predictor$predict(' \
                + str(market.getLastPrice(0, symbol1 + '-CLOSE')) + ')')

            strLine = Long.toString(when.getTimeInMillis()).encode('utf-8')
            strLine = strLine + ',' \
                    + Double.toString(market.getLastPrice(0,symbol1 + '-OPEN'))\
                            .encode('utf-8') + ','\
                    + Double.toString(market.getLastPrice(0,symbol1 + '-HIGH'))\
                            .encode('utf-8') + ',' \
                    + Double.toString(market.getLastPrice(0,symbol1 + '-LOW'))\
                            .encode('utf-8') + ','\
                    + Double.toString(market.getLastPrice(0,symbol1+'-CLOSE'))\
                            .encode('utf-8') + ','\
                    + Long.toString(market.getLastVolume(0,symbol1))\
                            .encode('utf-8')
            strLine = strLine + ',-,-,-,' + str(y) + ',-'
            print strLine


# Join everything together
market = SequentialAccessMarket(0.0, 5000)
```

```
source.addMarketListener(market)
source.addListener(MyObserver())

# Ready, steady, go
print 'milliseconds,' + symbol1 + '-OPEN,' + symbol1 + '-HIGH,' \
    + symbol1 + '-LOW,' + symbol1 + '-CLOSE,' + symbol1 + '-VOLUME,' \
    + symbol2 + '-OPEN,' + symbol2 + '-HIGH,' \
    + symbol2 + '-LOW,' + symbol2 + '-CLOSE,' + symbol2 + '-VOLUME'

source.run()

# Land down
interpreteR.end()
```

In this case, interface for R class has been modified, to create a simple predictor with two methods, *learn* and *predict*. An example of predictor based on linear regression might look like this:

From the example, we write down the interface all R-class should satisfy to be compatible with *rintegration.py* requirements (in pseudocode Java-like):

```
    interface PredictorInR {
        // Learns a new relation x->y
        void learn(double x, double y);

        // Tries to predict the value of y from x
        double predict(double x);
    }
```

7 Usage from command line and visual interface

The code in *rintegration.py* can be invoked even from command line or from visual interface. In both cases, file acting as a source of prices, the main Python script (*rintegration.py* in this case) and the R file containing the source code of the class with the predictor following the interface described in the interface 6.

8 License terms