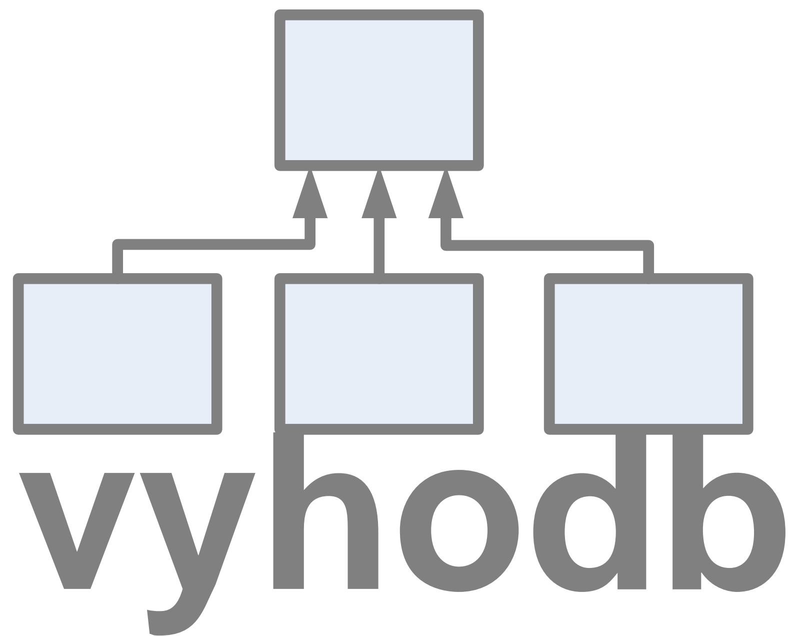

Functions Reference

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1. Introduction

This document describes fabric classes (function fabrics – further in the text) which are used for building function objects.

Function Fabrics are located in **com.vyhodb.f** package (**vdb-core-0.9.0.jar** archive).

Function fabric	Description
CommonFactory	Base functions
PredicateFactory	Predicate functions
NavigationFactory	Traversing over child/parent records and index search results.
PrintFactory	Printing record graph for specified traversal route.
RecordFactory	Working with records: getting/setting fields, parent record etc.
AggregateFactory	Aggregate functions: sum(), min(), max(), count().
CollectionFactory	Operations over collection, resided in evaluation context.
StringFactory	String functions.

For every fabric's method there are method signature, its description and usage example.

This guide is included in the vyhodb documentation package which consists of the following documents:

Document	Description
Getting Started	Fast start. Document gives idea what is vyhodb API about using simple code examples.
Developer Guide	Describes different vyhodb APIs and how to use them.
Functions Reference	Functions API Reference. Describes functions with usage examples.
Administrator Guide	Describes vyhodb architecture, configuring and administration.

1.1. Code examples

All code examples in this document can be split into three groups. Note that for using examples from second and third groups, class **com.vyhodb.freference.Example** should be changed!

1.1.1. First group

First group of examples is the most simple. It doesn't require any data or running vyhodb server. All examples pass null as a current object for function tree evaluation. Those examples are used to illustrate fabrics: CommonFactory, StringFactory, PredicateFactory. For instance:

```
package com.vyhodb.freference.common;

import static com.vyhodb.f.CommonFactory.*;

public class Current {

    public static void main(String[] args) {
        System.out.println( current().eval(null) );
        System.out.println( current().eval("Hello") );
        System.out.println( current().eval(12) );
        System.out.println( current().eval(false) );
    }
}
```

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1.1.2. Second group

Second group of examples require running in embedded mode vyhodb server. Classes of those examples are inherited from **com.vyhodb.freference.Example:**

```
package com.vyhodb.freference;

import java.io.IOException;
import java.util.Properties;

import com.vyhodb.f.F;
import com.vyhodb.server.Server;
import com.vyhodb.server.TrxSpace;
import com.vyhodb.space.Record;
import com.vyhodb.utils.DataGenerator;

public abstract class Example {

    public static final String LOG = "C:\\vyhodb-0.9.0\\storage\\vyhodb.log";
    public static final String DATA = "C:\\vyhodb-0.9.0\\storage\\vyhodb.data";

    protected void run() throws IOException {
        Properties props = new Properties();
        props.setProperty("storage.log", LOG);
        props.setProperty("storage.data", DATA);

        try (Server server = Server.start(props)) {
            TrxSpace space = server.startModifyTrx();
            Record root = space.getRecord(0L);
            generateTestData(root);

            getF().eval(root);

            space.rollback();
        }
    }

    protected abstract F getF();

    protected void generateTestData(Record root) {
        DataGenerator.generate(root);
    }
}
```

Examples classes implements **getF()** method, which returns function. This function is evaluated inside Example class under Modify transaction. Root record is passed as a current object for function’s evaluation. Transaction is rolled back after function’s evaluation.

For correct working, Example class should be changed. Namely, static fields LOG, DATA should point to existed vyhodb storage’s files (to log file and data file). See “Administrator Guide” about vyhodb storage and configuring.

By default, before function’s evaluation but after opening transaction, sample data is generated. Method **com.vyhodb.utils.DataGenerator#generate()** is used to generate sample data (**com.vyhodb.utils.DataGenerator** class methods are also used in examples for “Developer Guide” and “Getting Started” documents).

Diagram below shows data model for generated sample data:

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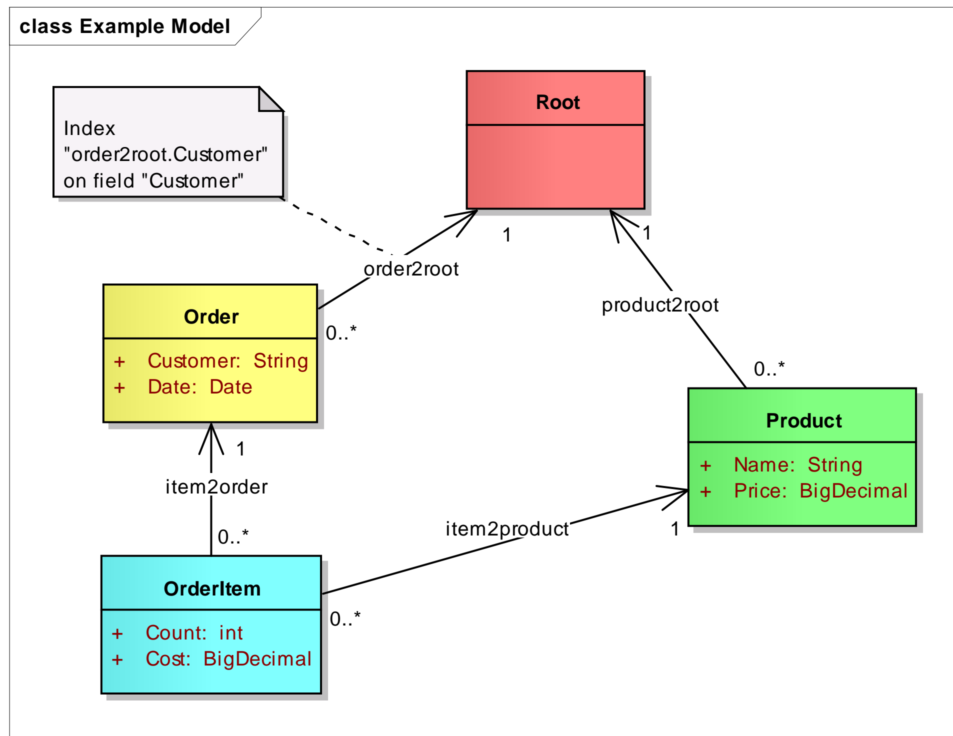

Sample data themselves are shown on next diagram:

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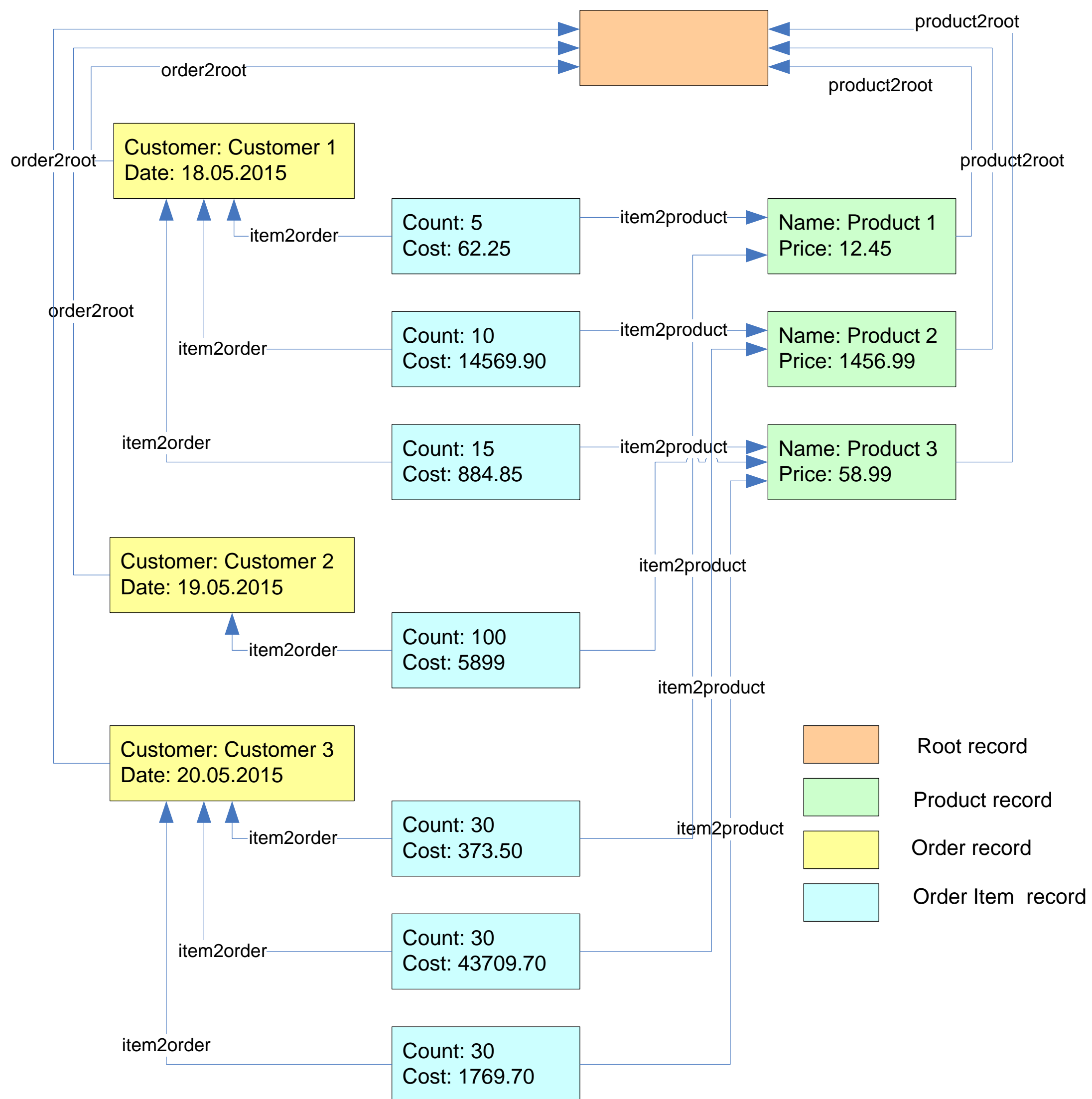


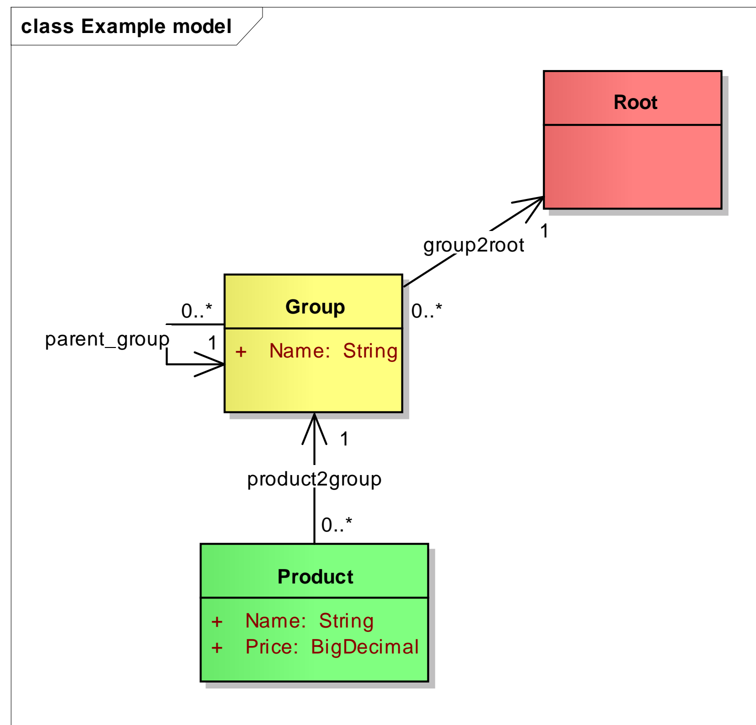
1.2.3. Third group

This group of examples is used to illustrate traversing over hierarchy of records and is inherited from **com.vyhodb.freference.HierarchyExample** class.

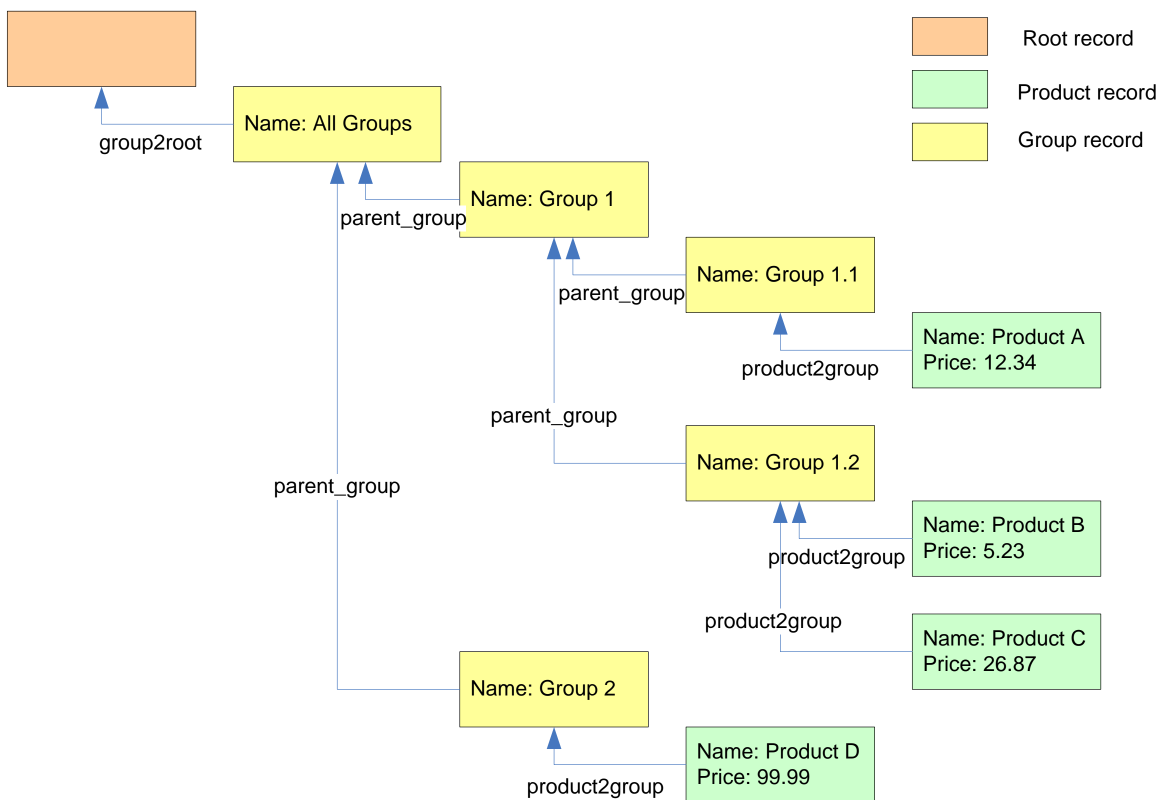
```
package com.vyhodb.freference;

import com.vyhodb.DataGenerator;
import com.vyhodb.space.Record;

public abstract class HierarchyExample extends Example {

    @Override
    protected void generateTestData(Record root) {
        DataGenerator.generateHierarchy(root);
    }
}
```

The main distinction between this group and second one is in data model and sample data. In examples of this group **com.vyhodb.utils.DataGenerator#generateHierarchy()** method is used to generate sample data.

Diagram below shows data model which is used for third group examples:



Sample data:



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2. CommonFactory

Factory contains methods for building common functions.

1.1. nil()

```
public static final F nil()
```

Function returns null. Function name inspired by nil function from LISP programming language.

Example:

```
package com.vyhodb.freference.common;

import static com.vyhodb.f.CommonFactory.*;

public class Nil {

    public static void main(String[] args) {
        System.out.println( nil().startEval(null) );
    }
}
```

Output:

```
null
```

1.2. c()

```
public static F c(Object value)
```

Function returns the same object for each evaluation. Result object is specified by **value** parameter.

Example:

```
package com.vyhodb.freference.common;

import static com.vyhodb.f.CommonFactory.*;

public class C {

    public static void main(String[] args) {
        System.out.println( c("Hello").startEval(null) );
        System.out.println( c(42).startEval(null) );
        System.out.println( c(true).startEval(null) );
        System.out.println( c(null).startEval(null) );
    }
}
```

Output:

```
Hello
42
true
null
```

1.3. current()

```
public static F current()
```

Function returns current object, which is passed as a parameter in **evalTree()** method.

Example:

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```
package com.vyhodb.freference.common;

import static com.vyhodb.f.CommonFactory.*;

public class Current {

    public static void main(String[] args) {
        System.out.println( current().startEval(null) );
        System.out.println( current().startEval("Hello") );
        System.out.println( current().startEval(12) );
        System.out.println( current().startEval(false) );
    }
}
```

Output:

```
null
Hello
12
false
```

1.4. composite()

This fabric method is very important, because it is used in almost all fabric methods.

It accepts array of functions (specified as F... next) and returns only one function. Method has it's own logic which isn't just create appropriate function object:

```
    public final static F composite(F... functions) {
        if (functions == null) return nil();

        switch(functions.length) {
            case 0:
                return nil();

            case 1:
                return functions[0];

            default:
                return new Composite(functions);
        }
    }
```

com.vyhodb.f.common.Composite function itself subsequently evaluates each function from passed array and returns evaluation result of last function in array.

Example:

```
package com.vyhodb.freference.common;

import static com.vyhodb.f.CommonFactory.*;

import com.vyhodb.f.F;

public class Composite {

    public static void main(String[] args) {
        F nilF = composite();
        F oneF = composite(c("One"));
        F twoF = composite(c("One"), c("Two"));

        System.out.println( nilF.startEval(null) );
        System.out.println( oneF.startEval(null) );
        System.out.println( twoF.startEval(null) );
    }
}
```

Output:

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```
null
One
Two
```

1.5. put(), get(), clear()

These functions are intended for working with evaluation context: putting value into it, getting value from it and clearing value in context.

Evaluation context is a Map<String, Object> object, which is created at function tree evaluation, passed from one function to another during evaluation and is used as a shared memory.

```
public static F put(String contextKey, F valueF)

public static F put(String contextKey, Object value)
```

Function puts **valueF** evaluation result into context with **contextKey** key. Overloaded version puts constant, specified by **value** parameter.

Function returns value saved in context.

```
public static F get(String contextKey)
```

Function reads and returns value from context by **contextKey**.

```
public static F clear(String contextKey)
```

Function clears value stored in context by **contextKey** key. It returns previous value, stored in context.

Example:

```
package com.vyhodb.freference.common;

import static com.vyhodb.f.CommonFactory.*;

import com.vyhodb.f.F;

public class PutGetClear {

    public static void main(String[] args) {
        F f = composite(
            print( put("Some key", 42) ),
            print( get("Some key") ),
            print( clear("Some key") ),
            print( get("Some key") )
        );

        f.startEval(null);
    }
}
```

Output:

```
42
42
42
null
```

1.6. _if_else(), _if()

```
public static F _if_else(Predicate predicate, F trueF, F falseF)
```

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Depending on **predicate** evaluation result, function **_if_else()** evaluates one of the functions (**trueF** or **falseF**) and returns its result.

```
public static F _if(Predicate predicate, F... trueF)
```

Function evaluates **trueF** functions if **predicate** function returns **true**. Otherwise, function returns **null** and doesn't evaluates **trueF**.

Example:

```
package com.vyhodb.freference.common;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.PredicateFactory.*;

import com.vyhodb.f.F;

public class If {

    public static void main(String[] args) {
        F f1 =
        _if_else(
            falseF(),
            print("True"),
            print("False")
        );

        F f2 =
        _if(
            trueF(),
            print("True")
        );

        f1.startEval(null);
        f2.startEval(null);
    }
}
```

Output:

```
False
True
```

1.7. when()

Couple of functions _case(), when() is used together to supersede value by condition.

```
public static When when(Object when, Object then)
```

When isn't a real function, although it has **eval(Object value)** method, which is used by **_case** function for testing value and superseding it:

```
public Object eval(Object value)
```

This method is operating in the following way: if **value** object equals to **when** object then **then** object is returned; otherwise, **value** object is returned.

1.8. _case()

```
public static F _case(F valueF, When... whens)
```

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Function evaluates **valueF** and passes result to first **when** object. Result of **when** evaluation is passed to the second **when** object and so forth.

Function returns result of last **when** invocation.

Example:

```
package com.vyhodb.freference.common;

import static com.vyhodb.f.CommonFactory.*;

import com.vyhodb.f.F;

public class CaseWhen {

    public static void main(String[] args) {
        F f =
        _case(c("Hello"),
            when("Hello", "Buy"),
            when("Buy", "Question"),
            when("Question", 42)
        );

        System.out.println( f.startEval(null));
    }
}
```

Output:

```
42
```

1.9. _caseNull()

```
public static F _caseNull(F valueF, Object nullReplaceValue)
```

Function returns **nullReplaceValue** object if **valueF** evaluation is **null**; otherwise returns **valueF** evaluation result.

Example:

```
package com.vyhodb.freference.common;

import static com.vyhodb.f.CommonFactory.*;

public class CaseNull {

    public static void main(String[] args) {
        System.out.println( _caseNull(c(null), "Null value").startEval(null) );
        System.out.println( _caseNull(c(265), "Null value").startEval(null) );
    }
}
```

Output:

```
Null value
265
```

1.10. omitContext()

```
public static F omitContext(String contextKey, F... next)
```

Function temporally removes object with **contextKey** key from evaluation context for a period of **next** functions evaluation. After **next** function's evaluation, function restores object in context.

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Example:

```
package com.vyhodb.freference.common;

import static com.vyhodb.f.CommonFactory.*;

import com.vyhodb.f.F;

public class OmitContext {

    public static void main(String[] args) {
        F f =
        composite(
            put("Key", 42),

            omitContext("Key",
                print(get("Key")),
                put("Key", "Hello")
            ),

            print(get("Key"))
        );

        f.startEval(null);
    }
}
```

Output:

```
null
42
```

1.11. loop()

```
public static Loop loop()
```

Despite of the fact, that special factory method is dedicated to create Loop function, usually this function is created by its constructor.

Loop function is used to create cycle of functions. Loop evaluates some function tree, which includes reference to Loop object itself. Function tree, which is evaluated in cycle, is passed into Loop function by using method:

```
public void setLoop(F... loopF)
```

In example below, to illustrate Loop function we create new Decrement function which decrements by 1 value, stored in context:

```
package com.vyhodb.freference.common;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.PredicateFactory.*;

import java.util.Map;

import com.vyhodb.f.F;
import com.vyhodb.f.common.Loop;

public class LoopExample {

    public static void main(String[] args) {
        Loop loop = new Loop();

        loop.setLoop(
```

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```
                _if(less(c(0L), get("Dec")),
                    dec("Dec"),
                    print(get("Dec")),
                    loop
                )
        );

        F f =
        composite(
            put("Dec", 7L),
            loop
        );

        f.startEval(null);
    }

    public static F dec(String contextKey) {
        return new DecrementF(contextKey);
    }

    public static class DecrementF extends F {
        private String _contextKey;

        public DecrementF(String contextKey) {
            _contextKey = contextKey;
        }

        @Override
        public Object eval(Object current, Map<String, Object> context) {
            Number number = (Number) context.get(_contextKey);
            long result = number.longValue() - 1;
            context.put(_contextKey, result);
            return result;
        }
    }
}
```

Output:

```
6
5
4
3
2
1
0
```

1.12. print()

```
public static F print(F valueF)

public static F print(Object value)
```

Prints (using System.out.println()) **value** object or **valuaF** evaluation result.

Example:

```
package com.vyhodb.freference.common;

import static com.vyhodb.f.CommonFactory.*;

import com.vyhodb.f.F;

public class Print {

    public static void main(String[] args) {
        F f =
```

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```
        composite(
            print("Hello"),
            print(c(42))
        );

        f.startEval(null);
    }
}
```

Output:

```
Hello
42
```

1.13. printCurrent()

```
public static F printCurrent()
```

Prints current object to (System.out.println()). In fact it is a synonym for **print(current());**

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2. PredicateFactory

Fabric provides methods for building predicate functions. Predicate is a function, which evaluation method returns Boolean object:

```
package com.vyhodb.f;

import java.util.Map;

public abstract class Predicate extends F {

    @Override
    public abstract Boolean evalTree(Object current, Map<String, Object> context);
}
```

Predicate class is a function class and is inherited from **com.vyhodb.f.F**.

Predicates are used for condition validation. For instance, predicates are used by record navigation functions for filtering visited records (see **NavigationFactory**).

2.1. toBoolean()

```
public static Predicate toBoolean(F value)
```

Function is used to cast result of **value** function to Boolean.

The following cast rules are used:

1) If value() returns Boolean, then function returns Boolean value.
2) If value() returns Number value != 0, then function returns true.
3) In all other cases, function returns false.

Example:

```
package com.vyhodb.freference.predicate;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.PredicateFactory.*;

import java.io.IOException;

public class ToBoolean {

    public static void main(String[] args) throws IOException {
        System.out.println( toBoolean(c(0)).startEval(null) );
        System.out.println( toBoolean(nil()).startEval(null));
        System.out.println( toBoolean(c("Hello")).startEval(null) );
        System.out.println( toBoolean(c(-0.1234)).startEval(null) );
        System.out.println( toBoolean(c(true)).startEval(null) );
    }
}
```

Output:

```
false
false
false
true
true
```

2.2. trueF() and false()

Functions return Boolean.TRUE and Boolean.FALSE values correspondently.

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Example:

```
package com.vyhodb.freference.predicate;

import static com.vyhodb.f.PredicateFactory.*;

import java.io.IOException;

public class TrueAndFalse {

    public static void main(String[] args) throws IOException {
        System.out.println( trueF().startEval(null));
        System.out.println( falseF().startEval(null));
    }
}
```

Output:

```
true
false
```

2.3. isNull and isNotNull()

```
public static Predicate isNull(F value)
```

Returns true, if value() == null, false – otherwise.

```
public static Predicate isNotNull(F value)
```

Returns true, if value() != null, false – otherwise.

Example:

```
package com.vyhodb.freference.predicate;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.PredicateFactory.*;

import java.io.IOException;

public class IsNull {

    public static void main(String[] args) throws IOException {
        System.out.println( isNull(nil()).startEval(null) );
        System.out.println( isNull(c("Hello")).startEval(null));
        System.out.println( isNotNull(nil()).startEval(null) );
        System.out.println( isNotNull(c("Hello")).startEval(null));
    }
}
```

Output:

```
true
false
false
true
```

2.4. not(), and(), or()

```
public static Predicate not(Predicate predicate)
```

Logical NOT.

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```
public static Predicate and(Predicate... predicates)
```

Logical AND.

Function evaluates **predicates** one by one, until one of them returns **false**. **False** is returned in this case. If all predicates returns **true**, then function returns **true**.

```
public static Predicate or(Predicate... predicates)
```

Logical OR.

Function evaluates **predicates** one by one, until one of them returns **true**. **True** is returned in this case. If all predicates returns **false**, then function returns **false**.

Example:

```
package com.vyhodb.freference.predicate;

import static com.vyhodb.f.PredicateFactory.*;

public class NotAndOr {

    public static void main(String[] args) {
        System.out.println( not( trueF()).startEval(null) );
        System.out.println( not( falseF()).startEval(null) );

        System.out.println( and( trueF(), trueF(), falseF()).startEval(null) );
        System.out.println( and( trueF(), trueF(), trueF()).startEval(null) );

        System.out.println( or( falseF(), falseF(), trueF()).startEval(null) );
        System.out.println( or( falseF(), falseF(), falseF()).startEval(null) );
    }
}
```

Output:

```
false
true
false
true
true
false
```

2.5. equal()

```
public static Predicate equal(F... values)
```

Function returns **true**, when all evaluation results of **values** functions are equal to each other; otherwise returns **false**.

Object#equals() method is used for equality check.

Example:

```
package com.vyhodb.freference.predicate;

import static com.vyhodb.f.PredicateFactory.*;
import static com.vyhodb.f.CommonFactory.*;

public class Equal {
    public static void main(String[] args) {
```

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```
        System.out.println( equal( c("Hello"), c("Hello"), c("Hello")).startEval(null) );
        System.out.println( equal( c("Hello"), c("Hello"), c("")).startEval(null) );
    }
}
```

Output:

```
true
false
```

2.6. fieldsEqual()

```
public static Predicate fieldsEqual(String[] keyFieldNames, Object... keyValues)

public static Predicate fieldsEqual(String keyFieldName, Object keyValue)
```

Function casts current object to Record and returns true, if Record contains specified field names with specified values; otherwise returns false.

Object#equals() method is used for equality check.

Example:

```
package com.vyhodb.freference.predicate;

import java.io.IOException;
import java.util.Date;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;
import static com.vyhodb.f.PredicateFactory.*;

public class FieldsEqual extends Example {

    public static void main(String[] args) throws IOException {
        new FieldsEqual().run();
    }

    @Override
    protected F getF() {
        String[] fields = {"Customer", "Date"};
        Object[] values = {"Customer 2", new Date(115, 4, 19)};

        return
        childrenIf("order2root", fieldsEqual(fields, values),
            printCurrent()
        );
    }
}
```

Output:

```
{Customer="Customer 2", Date=[Tue May 19 00:00:00 BRT 2015]} id=45745
```

2.7. less(), lessEqual()

```
public static Predicate less(F... values)
```

Function returns **true**, when values[i]() < values[i + 1](). **False** – otherwise.

Results of **values** functions' evaluation should be of **java.lang.Comparable** class.

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Example:

```
package com.vyhodb.freference.predicate;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.PredicateFactory.*;

public class Less {
    public static void main(String[] args) {
        System.out.println( less( c(1), c(2), c(10)).startEval(null) );
        System.out.println( less( c(1), c(1), c(-3)).startEval(null) );
    }
}
```

Output:

```
true
false
```

```
public static Predicate lessEqual(F... values)
```

Function returns **true**, when values[i]() <= values[i + 1](). **False** – otherwise.

Results of **values** functions' evaluation should be of **java.lang.Comparable** class.

Example:

```
package com.vyhodb.freference.predicate;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.PredicateFactory.*;

public class LessEqual {
    public static void main(String[] args) {
        System.out.println( lessEqual( c(1), c(1), c(10)).startEval(null) );
        System.out.println( lessEqual( c(1), c(1), c(-3)).startEval(null) );
    }
}
```

Output:

```
true
false
```

2.8. more(), moreEqual()

```
public static Predicate more(F... values)
```

Function returns **true**, when values[i]() > values[i + 1](). **False** – otherwise.

Results of **values** functions' evaluation should be of **java.lang.Comparable** class.

Example:

```
package com.vyhodb.freference.predicate;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.PredicateFactory.*;

public class More {
    public static void main(String[] args) {
        System.out.println( more( c(10), c(5), c(1)).startEval(null) );
        System.out.println( more( c(10), c(10), c(100)).startEval(null) );
```

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```
    }
}
```

Output:

```
true
false
```

```
public static Predicate moreEqual(F... values)
```

Function returns **true**, when values[i]() >= values[i + 1](). **False** – otherwise.

Results of **values** functions' evaluation should be of **java.lang.Comparable** class.

Example:

```
package com.vyhodb.freference.predicate;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.PredicateFactory.*;

public class MoreEqual {
    public static void main(String[] args) {
        System.out.println( moreEqual( c(10), c(10), c(5)).startEval(null) );
        System.out.println( moreEqual( c(10), c(100), c(1000)).startEval(null) );
    }
}
```

Output:

```
true
false
```

2.9. unique()

```
public static Predicate unique(F... values)
```

Function returns **true**, when evaluation results of **values** functions are unique between each other. Function uses HashMap object internally for uniqueness check.

Example:

```
package com.vyhodb.freference.predicate;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.PredicateFactory.*;

public class Unique {
    public static void main(String[] args) {
        System.out.println( unique( c("Hello"), c(42), c(10)).startEval(null) );
        System.out.println( unique( c(42), c(42), c(100)).startEval(null) );
    }
}
```

Output:

```
true
false
```

2.10. everyChild()

```
public static Predicate everyChild(String childrenLinkName, Predicate predicate)
```

Function casts current object to Record, retrieves child Record with **“childLinkName”** link, and for each child record evaluates **predicate** function.

If evaluation result of **predicate** function is **false** for at least one child record, then **everyChild()** evaluation is stopped and **false** is returned. Otherwise function returns **true** (when predicate returns **true** for every child record).

Function returns **true**, when there are no child records for specified link name.

Example:

```
package com.vyhodb.freference.predicate;

import java.io.IOException;
import java.util.Date;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;

import static com.vyhodb.f.PredicateFactory.*;
import static com.vyhodb.f.RecordFactory.*;
import static com.vyhodb.f.CommonFactory.*;

public class EveryChild extends Example {

    public static void main(String[] args) throws IOException {
        new EveryChild().run();
    }

    @Override
    protected F getF() {
        Date moreDate = new Date(115, 4, 17);

        return
        print(
            everyChild("order2root",
                more(getField("Date"), c(moreDate))
            )
        );
    }
}
```

Output:

```
true
```

2.11. someChildren()

```
public static Predicate someChildren(String childrenLinkName, Predicate predicate)
```

Function casts current object to Record, retrieves child Record with **“childLinkName”** link, and for each child record evaluates **predicate** function.

If evaluation result of **predicate** function is **true** for at least one child record, then **someChildren()** function evaluation is stopped and **true** is returned. Otherwise function returns **false** (when predicate returns **false** for every child record).

Function returns **false**, when there are no child records for specified link name.

Example:

```
package com.vyhodb.freference.predicate;
```

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```
import java.io.IOException;
import java.util.Date;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;

import static com.vyhodb.f.PredicateFactory.*;
import static com.vyhodb.f.CommonFactory.*;

public class SomeChildren extends Example {

    public static void main(String[] args) throws IOException {
        new SomeChildren().run();
    }

    @Override
    protected F getF() {
        Date searchDate = new Date(115, 4, 18);

        return
        print(
            someChildren("order2root",
                fieldsEqual("Date", searchDate)
            )
        );
    }
}
```

Output:

```
true
```

2.12. everySearch()

```
public static Predicate everySearch(String indexName, Criterion criterion, Predicate
predicate)
```

The same as **everyChild()** function, but instead of retrieving all child records, function searches child record using index with specified criterion.

In more details:

Function casts current object to Record, searches its child records using index with name “indexName” and search criterion. For each found record, function evaluates **predicate** function.

If evaluation result of **predicate** function is **false** for at least one found record, then **everySearch()** evaluation is stopped and **false** is returned. Otherwise function returns **true** (when predicate returns **true** for every found record).

Function returns **true**, when search result is empty.

Example:

```
package com.vyhodb.freference.predicate;

import java.io.IOException;
import java.util.Date;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;
import com.vyhodb.space.CriterionFactory;

import static com.vyhodb.f.CommonFactory.*;
```

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```
import static com.vyhodb.f.PredicateFactory.*;
import static com.vyhodb.f.RecordFactory.*;

public class EverySearch extends Example {

    public static void main(String[] args) throws IOException {
        new EverySearch().run();
    }

    @Override
    protected F getF() {
        Date moreDate = new Date(115, 4, 17);

        return
        print(
            everySearch("order2root.Customer", CriterionFactory.startsWith("Customer"),
                more(getField("Date"), c(moreDate))
            )
        );
    }
}
```

Output:

```
true
```

2.13. someSearch()

```
public static Predicate someSearch(String indexName, Criterion criterion, Predicate predicate)
```

The same as **someChildren()** function, but instead of retrieving all child records, function searches child record using index with specified criterion.

In more details:

Function casts current object to Record, searches its child records using index with name “indexName” and search criterion. For each found record, function evaluates **predicate** function.

If evaluation result of **predicate** function is **true** for at least one found record, then **everySearch()** evaluation is stopped and **true** is returned. Otherwise function returns **false** (when predicate returns **false** for every found record).

Function returns **false**, when search result is empty.

Example:

```
package com.vyhodb.freference.predicate;

import java.io.IOException;
import java.util.Date;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;
import com.vyhodb.space.CriterionFactory;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.PredicateFactory.*;

public class SomeSearch extends Example {

    public static void main(String[] args) throws IOException {
        new SomeSearch().run();
    }
```

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```
    @Override
    protected F getF() {
        Date searchDate = new Date(115, 4, 18);

        return
        print(
            someSearch("order2root.Customer", CriterionFactory.startsWith("Customer"),
                fieldsEqual("Date", searchDate)
            )
        );
    }
}
```

Output:

```
true
```

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3. NavigationFactory

This factory contains methods which construct record navigation functions (or simply navigation functions). Navigation functions cast current object to vyhodb Record and then retrieve child/parent records from it. For each child/parent record navigation functions evaluate next function(s) by passing child/parent record as a current object into next function(s).

Navigation functions can filter out parent/child records and prevent next function from evaluation. Predicate is used to determine whether record is valid and next functions can be evaluated for it.

3.1. children()

```
public static F children(String linkName, F... next)
```

Function casts current object to record, gets child record from it with link name **linkName**. For each retrieved child record **next** functions are evaluated and child record is passed as a current object.

Function returns evaluation result of **next** functions for the last child record. Function returns null when there aren't any child records or **next** function is **nil()**.

3.2. childrenIf()

```
public static F childrenIf(String linkName, Predicate predicate, F... next)
```

This function is used for filtering child records by predicate.

Predicate function is evaluated for every child record. Next functions are evaluated only for those child records, for which predicate evaluation result is true.

Function returns evaluation result of **next** functions for the last child record. Function returns null when there aren't any child records or **next** function is **nil()**.

Example:

```
package com.vyhodb.freference.navigation;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;
import static com.vyhodb.f.PredicateFactory.*;

public class Children extends Example {

    public static void main(String[] args) throws IOException {
        new Children().run();
    }

    @Override
    public F getF() {
        return
        childrenIf("order2root", fieldsEqual("Customer", "Customer 3"),
            children("item2order",
                printCurrent()
            )
        );
    }
```

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```
}
```

Output (record ids might differ):

```
{Cost=373.50, Count=30} id=2217
{Cost=43709.70, Count=30} id=2228
{Cost=1769.70, Count=30} id=2239
```

3.3. search()

```
public static F search(String indexName, Criterion criterion, F... next)
```

Function casts current object to record, and searches its child records by using index with **indexName** name and search criterion specified by **criterion** parameter.

Next functions are evaluated for every child record from search result. Found child record is passed as a current object.

Function returns evaluation result of **next** functions for the last record from search result. Function returns null when search result is empty or next functions is **nil().**

Example:

```
package com.vyhodb.freference.navigation;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;
import com.vyhodb.space.CriterionFactory;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;

public class Search extends Example {

    public static void main(String[] args) throws IOException {
        new Search().run();
    }

    @Override
    public F getF() {
        return
        search("order2root.Customer", CriterionFactory.equal("Customer 3"),
            printCurrent()
        );
    }
}
```

Output:

```
{Customer="Customer 3", Date="Wed May 20 00:00:00 BRT 2015"} id=2195
```

3.4. searchIf()

```
public static F searchIf(String indexName, Criterion criterion, Predicate predicate, F...
next)
```

Function casts current object to record, and searches its child records by using index with **indexName** name and search criterion specified by **criterion** parameter.

Each found child record is evaluated by **predicate** and, in case of successful evaluation (True), next functions are evaluated for child record.

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Function returns evaluation result of **next** functions for the last record from search result. Function returns null when search result is empty, no found child records satisfy predicate or next functions is **nil().**

Example:

```
package com.vyhodb.freference.navigation;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;
import static com.vyhodb.f.PredicateFactory.*;
import static com.vyhodb.f.RecordFactory.*;

import java.io.IOException;
import java.util.Date;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;
import com.vyhodb.space.CriterionFactory;

public class SearchIf extends Example {

    public static void main(String[] args) throws IOException {
        new SearchIf().run();
    }

    @Override
    public F getF() {
        Date moreDate = new Date("06/01/2015");

        return
        searchIf("order2root.Customer", CriterionFactory.equal("Customer 3"),
            more(getField("Date"), c(moreDate)),
            printCurrent()
        );
    }
}
```

Output. Output is empty, because child record, found by using index, is filtered out by predicate.

```

```

3.5. parent()

```
public static F parent(String linkName, F... next)
```

Function casts current object to Record, retrieves its parent record by the link with **linkName** name.

If parent record is not **null**, then next functions are evaluated for parent record (parent record is passed as a current object for them).

Function returns evaluation result of **next** functions or null, if parent record is null.

Example (traverses over “order item” records and prints their parent “product” records):

```
package com.vyhodb.freference.navigation;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;
```

```
public class Parent extends Example {

    public static void main(String[] args) throws IOException {
        new Parent().run();
    }

    @Override
    public F getF() {
        return
        children("order2root",
            children("item2order",
                parent("item2product",
                    printCurrent()
                )
            )
        );
    }
}
```

Output (ids can differ):

```
{Name="Product 1", Price=12.45} id=2063
{Name="Product 2", Price=1456.99} id=2074
{Name="Product 3", Price=58.99} id=2085
{Name="Product 3", Price=58.99} id=2085
{Name="Product 1", Price=12.45} id=2063
{Name="Product 2", Price=1456.99} id=2074
{Name="Product 3", Price=58.99} id=2085
```

3.6. parentIf()

```
public static F parentIf(String linkName, Predicate predicate, F... next)
```

Function casts current object to Record, retrieves its parent record by the link with **linkName** name.

If parent record is not **null**, and predicate's evaluation for is **true** for parent record, then **next** functions are evaluated for parent record.

Function returns evaluation result of **next** functions. If parent record is null or parent record doesn't satisfy specified **predicate**, then **null** is returned.

Example (traverses over "order item" records and prints their parent "product" records only if their names are "Product 2"):

```
package com.vyhodb.freference.navigation;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;
import static com.vyhodb.f.PredicateFactory.*;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;

public class ParentIf extends Example {

    public static void main(String[] args) throws IOException {
        new ParentIf().run();
    }

    @Override
    public F getF() {
        return
```

```
        children("order2root",
            children("item2order",
                parentIf("item2product", fieldsEqual("Name", "Product 2"),
                    printCurrent()
                )
            )
        );
    }
}
```

Output (ids can differ):

```
{Name="Product 2", Price=1456.99} id=2074
{Name="Product 2", Price=1456.99} id=2074
```

3.7. _break()

```
public static F _break()
```

Function stops iteration over child records in nearest parent function: children(), childrenIf(), search(), searchIf().

Function can increase performance in cases when required record is found and it is not required to keep iterating over child records.

This function throws exception, which is caught by nearest parent function (one of children(), childrenIf(), search(), searchIf()).

Example prints “Order Item” records for the first “Order” record:

```
package com.vyhodb.freference.navigation;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;

public class Break extends Example {

    public static void main(String[] args) throws IOException {
        new Break().run();
    }

    @Override
    public F getF() {
        return
        children("order2root",
            children("item2order",
                printCurrent()
            ),
            _break()
        );
    }
}
```

Output:

```
{Cost=62.25, Count=5} id=2129
{Cost=14569.90, Count=10} id=2140
{Cost=884.85, Count=15} id=2151
```

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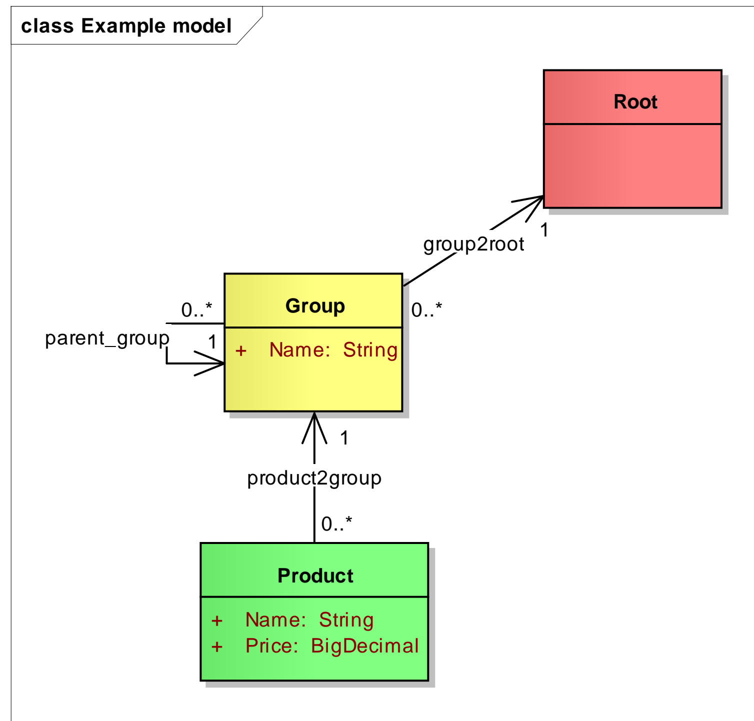
3.8. Hierarchy traversing

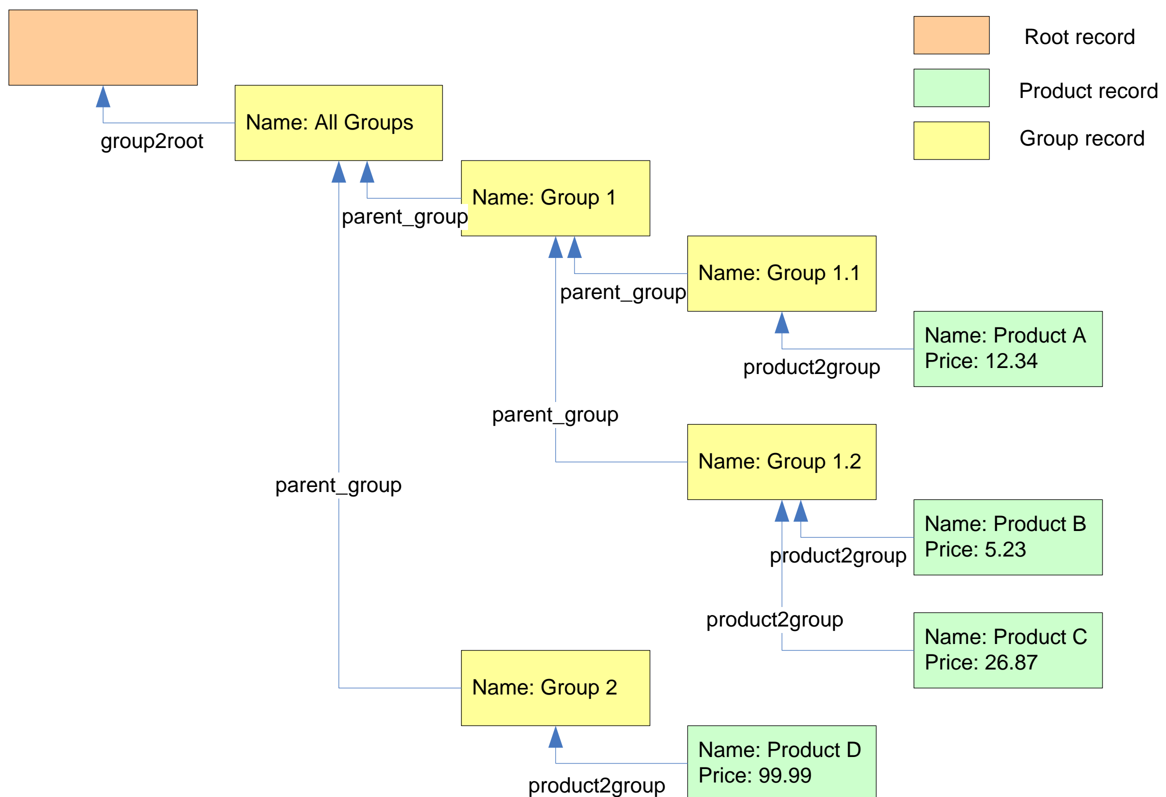
Hierarchy is a structure of vyhodb records, in which particular record has one parent link and child links with the same link name.

We will use the following data model to illustrate hierarchies:



Records **“Groups”** forms hierarchy. So, any **“Group”** record might have parent link **“parent_group”** to other **“Group”** record, and child **“Group”** records, which refer to the current by **“parent_group”** links.

Class **com.vyhodb.utils.DataGenerator** contains **generateHierarchy()** static method. It creates sample data, according to data model above. Records, links and fields, generated by this method, are shown on diagram below:



Yellow records are **"Group"** records and forms hierarchy. We will use these sample data in our examples.

3.8.1. hierarchy()

```
public static F hierarchy(String childLinkName, F... levelF)
```

Function traverses through hierarchy in downward direction.

Function casts current object to Record and performs the following steps recursively:

1) Evaluates **levelF** function for current record.
2) Retrieves child records with **childLinkName** link name from current record.
3) Runs this algorithm recursively (from step 1) for each child record.

Function returns last evaluation result of **levelF** function. For instance, in example below, hierarchy() function return record with field Name="Group 2" (printCurrent() function returns printed object).

Next example prints all hierarchy groups:

```
package com.vyhodb.freference.navigation.hierarchy;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.HierarchyExample;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;

public class HierarchyGroup extends HierarchyExample {

    public static void main(String[] args) throws IOException {
        new HierarchyGroup().run();
```

```
    }

    @Override
    public F getF() {
        return
        children("group2root",
                hierarchy("parent_group",
                        printCurrent()
                )
        );
    }
}
```

Output (ids might differ):

```
{Name="All Groups"} id=2063
{Name="Group 1"} id=2074
{Name="Group 1.1"} id=2085
{Name="Group 1.2"} id=2096
{Name="Group 2"} id=2107
```

Prints all “Product” records:

```
package com.vyhodb.freference.navigation.hierarchy;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.HierarchyExample;

public class HierarchyProduct extends HierarchyExample {

    public static void main(String[] args) throws IOException {
        new HierarchyProduct().run();
    }

    @Override
    public F getF() {
        return
        children("group2root",
            hierarchy("parent_group",
                children("product2group",
                    printCurrent()
                )
            )
        );
    }
}
```

Output (ids might differ):

```
{Name="Product A", Price=12.34} id=2118
{Name="Product B", Price=5.23} id=2129
{Name="Product C", Price=26.87} id=2140
{Name="Product D", Price=99.99} id=2151
```

3.8.2. hierarchyIf()

```
public static F hierarchyIf(String childLinkName, Predicate levelPredicate, F... levelF)
```

Function traverses through hierarchy in downward direction, with record filtering.

Function casts current object to Record and performs the following steps recursively:

1) Evaluates **levelF** function for current record.

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2) Retrieves child records with **childLinkName** link name from current record.
3) Child record is evaluated by **levelPredicate** predicate function.
4) If **levelPredicate** returns true for child record, then current algorithm is run for it, starting with step 1. Otherwise child record is skipped (including child's children) in traversal.

Function returns last evaluation result of **levelF** function.

Example:

```
package com.vyhodb.freference.navigation.hierarchy;

import static com.vyhodb.f.CollectionFactory.*;
import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;
import static com.vyhodb.f.RecordFactory.*;

import java.io.IOException;
import java.util.Arrays;
import java.util.List;

import com.vyhodb.f.F;
import com.vyhodb.freference.HierarchyExample;

public class HierarchyIfGroup extends HierarchyExample {

    public static void main(String[] args) throws IOException {
        new HierarchyIfGroup().run();
    }

    @Override
    public F getF() {
        List<String> groupNames = Arrays.asList("All Groups", "Group 1.1", "Group 1.2", "Group
2");

        return
        composite(
            put("groups", groupNames),
            children("group2root",
                hierarchyIf("parent_group", collectionContains("groups", getField("Name")),
                    printCurrent()
                )
            )
        );
    }
}
```

Output:

```
{Name="All Groups"} id=2063
{Name="Group 2"} id=2107
```

Despite of the fact, that group names {"Group 1.1", "Group 1.2"} all included in a list of allowed groups, hierarchyIf() doesn't traverse records with these names. This is because their parent record ("Group 1") isn't included in allowed list and is filtered out.

3.8.3. loop()

Hierarchy traversing is a recursive process, so you can use **loop** function for this purpose.

Example:

```
package com.vyhodb.freference.navigation.hierarchy;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;
```

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```
import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.f.common.Loop;
import com.vyhodb.freference.HierarchyExample;

public class HierarchyLoop extends HierarchyExample {

    public static void main(String[] args) throws IOException {
        new HierarchyLoop().run();
    }

    @Override
    public F getF() {
        Loop loop = new Loop();

        loop.setLoop(
            printCurrent(),
            children("parent_group", loop)
        );

        return
        children("group2root",
            loop
        );
    }
}
```

Output (ids might differ):

```
{Name="All Groups"} id=2063
{Name="Group 1"} id=2074
{Name="Group 1.1"} id=2085
{Name="Group 1.2"} id=2096
{Name="Group 2"} id=2107
```

3.9. Stack

It is often required to do some actions with visited records during traversing. One approach is to create separate function for each action, although such functions duplicate logic of children(), parent(), hierarchy(). Another approach is using Stack object.

Stack object is an object which class implements **com.vyhodb.f.Stack** interface. Stack object is put into evaluation context and is used by record navigation functions for notifying about visited records. In other words, Stack object implements Visitor pattern.

This approach allows describe traversal logic using standard navigation functions (children(), parent(), search(), hierarchy()) which radically increases code readability, simplicity and understandably.

The following methods are defined in **com.vyhodb.f.Stack** interface:

```
package com.vyhodb.f;

public interface Stack {

    public static final String DEFAULT_CONTEXT_KEY = "Sys$Stack";

    public void pushParent(String linkName, Object parent);

    public void pushChild(String linkName, Object child);

    public void pop();

    public Object peek();
}
```

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By default, “Sys$Stack” context key is used to store Stack object in evaluation context. It is not required to have Stack object in context, navigation functions are operated without it in this case.

Let’s move to examples. We are going to create our own Stack implementation class, which just prints parent and child object, passed to it. We will also illustrate using it by traversing over our sample data.

PrintStack:

```
package com.vyhodb.freference.navigation.stack;

import com.vyhodb.f.Stack;

public class PrintStack implements Stack {

    @Override
    public void pushParent(String linkName, Object parent) {
        System.out.println("Parent: " + parent);
    }

    @Override
    public void pushChild(String linkName, Object child) {
        System.out.println("Child: " + child);
    }

    @Override
    public void pop() {}

    @Override
    public Object peek() {
        return null;
    }
}
```

In next example we traverse through Order, Order Item and Product records with PrintStack object in context:

```
package com.vyhodb.freference.navigation.stack;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;
import static com.vyhodb.f.PredicateFactory.*;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.f.Stack;
import com.vyhodb.freference.Example;

public class StackOrders extends Example {

    public static void main(String[] args) throws IOException {
        new StackOrders().run();
    }

    @Override
    protected F getF() {
        PrintStack stack = new PrintStack();

        return
        composite(
            put(Stack.DEFAULT_CONTEXT_KEY, stack),
            childrenIf("order2root", fieldsEqual("Customer", "Customer 2"),
                children("item2order",
                    parent("item2product")
                )
            )
```

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```
        );
    }
}
```

Output:

```
Child: {Customer="Customer 2", Date="Tue May 19 00:00:00 BRT 2015"} id=2162
Child: {Cost=5899.00, Count=100} id=2184
Parent: {Name="Product 3", Price=58.99} id=2085
```

Example below uses PrintStack object in hierarchy traversing:

```
package com.vyhodb.freference.navigation.stack;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.f.Stack;
import com.vyhodb.freference.HierarchyExample;

public class StackHierarchy extends HierarchyExample {

    public static void main(String[] args) throws IOException {
        new StackHierarchy().run();
    }

    @Override
    protected F getF() {
        PrintStack stack = new PrintStack();

        return
        composite(
            put(Stack.DEFAULT_CONTEXT_KEY, stack),
            children("group2root",
                hierarchy("parent_group")
            )
        );
    }
}
```

Output:

```
Child: {Name="All Groups"} id=2063
Child: {Name="Group 1"} id=2074
Child: {Name="Group 1.1"} id=2085
Child: {Name="Group 1.2"} id=2096
Child: {Name="Group 2"} id=2107
```

3.9.1. Stack, predicates and _if()

There is a great difference between using navigation functions with filtering (childrenIf(), parentIf(), etc) and **_if()** function. This difference is comes from using Stack object and is described in this section.

We will illustrate this difference by examples where we will use **PrintStack** object from previous section.

In both examples, we traverse “Order” records and filter them by particular Customer name. In first case we use **childrenIf()** function while in the second **_if()** function.

First example with **childrenIf()**:

```
package com.vyhodb.freference.navigation.stack;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;
import static com.vyhodb.f.PredicateFactory.*;
```

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```
import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.f.Stack;
import com.vyhodb.freference.Example;

public class StackPredicate extends Example {

    public static void main(String[] args) throws IOException {
        new StackPredicate().run();
    }

    @Override
    protected F getF() {
        PrintStack stack = new PrintStack();

        return
        composite(
            put(Stack.DEFAULT_CONTEXT_KEY, stack),
            childrenIf("order2root", fieldsEqual("Customer", "Customer 2"))
        );
    }
}
```

Output:

```
Child: {Customer="Customer 2", Date="Tue May 19 00:00:00 BRT 2015"} id=2162
```

Second example with **_if()** function:

```
package com.vyhodb.freference.navigation.stack;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;
import static com.vyhodb.f.PredicateFactory.*;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.f.Stack;
import com.vyhodb.freference.Example;

public class StackIf extends Example {

    public static void main(String[] args) throws IOException {
        new StackIf().run();
    }

    @Override
    protected F getF() {
        PrintStack stack = new PrintStack();

        return
        composite(
            put(Stack.DEFAULT_CONTEXT_KEY, stack),
            children("order2root",
                _if(fieldsEqual("Customer", "Customer 2"))
            )
        );
    }
}
```

Output:

```
Child: {Customer="Customer 1", Date="Mon May 18 00:00:00 BRT 2015"} id=2096
Child: {Customer="Customer 2", Date="Tue May 19 00:00:00 BRT 2015"} id=2162
Child: {Customer="Customer 3", Date="Wed May 20 00:00:00 BRT 2015"} id=2195
```

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As you can see, first example prints only one Order record, whereas the second prints three records, despite of the fact, that we use the same predicate function.

The cause of the difference in behavior is that Stack's methods are invoked only if predicate, specified in record navigation functions, returns true.

So, in first example, during **childrenIf("order2root", fieldsEqual("Customer", "Customer 2"))** evaluation, only one record satisfy predicate and only for this record **com.vyhodb.f.Stack#pushChild()** method is invoked.

In second example, **children("order2root", …)** has no predicate and **pushChild()** method on Stack object is invoked for each child record.

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4. PrintFactory

Methods of **com.vyhodb.f.PrintFactory** factory are used for printing graph of vyhodb records into String. Record graph is specified by record navigation functions, which are wrapped by print function from **PrintFactory** factory.

There are two print functions in **PrintFactory** factory for writing record graph in two formats: simple and json.

Each print function creates its Stack object which implements printing visited records into String.

By default, all records' fields are printed. However filter with allowed field names, can be specified at function building time. Field filter is specified as **String[]**.

4.1. startPrint()

```
public static F startPrint(F... next)

public static F startPrint(String[] fieldsFilter, F... next)
```

Functions return string in “simple” format which represents traversed tree of records.

Example:

```
package com.vyhodb.freference.print;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;
import static com.vyhodb.f.PrintFactory.*;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;

public class PrintSimple extends Example {

    public static void main(String[] args) throws IOException {
        new PrintSimple().run();
    }

    @Override
    protected F getF() {
        return
        print(
            startPrint(
                children("order2root",
                    children("item2order",
                        parent("item2product")
                    )
                )
            )
        );
    }
}
```

Output:

```
    {Current Time="Wed Sep 09 02:52:18 BRT 2015"} id=0
        "order2root" ←
            {Customer="Customer 1", Date="Mon May 18 00:00:00 BRT 2015"} id=2096
                "item2order" ←
                    {Cost=62.25, Count=5} id=2129
                        "item2product" →
```

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```
                            {Name="Product 1", Price=12.45} id=2063
                    {Cost=14569.90, Count=10} id=2140
                        "item2product" →
                            {Name="Product 2", Price=1456.99} id=2074
                    {Cost=884.85, Count=15} id=2151
                        "item2product" →
                            {Name="Product 3", Price=58.99} id=2085
            {Customer="Customer 2", Date="Tue May 19 00:00:00 BRT 2015"} id=2162
                "item2order" ←
                    {Cost=5899.00, Count=100} id=2184
                        "item2product" →
                            {Name="Product 3", Price=58.99} id=2085
            {Customer="Customer 3", Date="Wed May 20 00:00:00 BRT 2015"} id=2195
                "item2order" ←
                    {Cost=373.50, Count=30} id=2217
                        "item2product" →
                            {Name="Product 1", Price=12.45} id=2063
                    {Cost=43709.70, Count=30} id=2228
                        "item2product" →
                            {Name="Product 2", Price=1456.99} id=2074
                    {Cost=1769.70, Count=30} id=2239
                        "item2product" →
                            {Name="Product 3", Price=58.99} id=2085
```

Simple output format

Each line is either record's string representation (method **com.vyhodb.space.Record#toString()**) or link description.

Link description consists of link name and type. Type is shown by array character: left oriented for child links, right oriented for parent link.

```
"item2order" ←
"item2product" →
```

Next example shows printing with field filter:

```
package com.vyhodb.freference.print;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;
import static com.vyhodb.f.PrintFactory.*;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;

public class PrintSimpleFiltered extends Example {

    public static void main(String[] args) throws IOException {
        new PrintSimpleFiltered().run();
    }

    @Override
    protected F getF() {
        return
        print(
            startPrint(new String[]{"Customer", "Count"},
                children("order2root",
                    children("item2order",
                        parent("item2product")
                    )
                )
            )
```

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```
        );
    }
}
```

Output:

```
    {} id=0
        "order2root" ←
            {Customer="Customer 1"} id=2096
                "item2order" ←
                    {Count=5} id=2129
                        "item2product" →
                            {} id=2063
                    {Count=10} id=2140
                        "item2product" →
                            {} id=2074
                    {Count=15} id=2151
                        "item2product" →
                            {} id=2085
            {Customer="Customer 2"} id=2162
                "item2order" ←
                    {Count=100} id=2184
                        "item2product" →
                            {} id=2085
            {Customer="Customer 3"} id=2195
                "item2order" ←
                    {Count=30} id=2217
                        "item2product" →
                            {} id=2063
                    {Count=30} id=2228
                        "item2product" →
                            {} id=2074
                    {Count=30} id=2239
                        "item2product" →
                            {} id=2085
```

4.2. startPrintJson()

```
public static F startPrintJson(F... next)

public static F startPrintJson(boolean formatted, F... next)

public static F startPrintJson(String[] fieldsFilter, F... next)

public static F startPrintJson(String[] fieldsFilter, boolean formatted, F... next)
```

Functions return String in JSON format, which represents traversed tree of records.

By default, result string is formatted (by include space characters), but it can be changed by specifying **formatted** parameter.

Example:

```
package com.vyhodb.freference.print;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;
import static com.vyhodb.f.PrintFactory.*;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;

public class PrintJson extends Example {
```

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```
    public static void main(String[] args) throws IOException {
        new PrintJson().run();
    }

    @Override
    protected F getF() {
        return
        print(
            startPrintJson(
                children("order2root",
                    children("item2order",
                        parent("item2product")
                    )
                )
            )
        );
    }
}
```

Output:

```
{
    "id":0,
    "Current Time":"Wed Sep 09 02:52:18 BRT 2015",
    "order2root":[
        {
            "id":2096,
            "Customer":"Customer 1",
            "Date":"Mon May 18 00:00:00 BRT 2015",
            "item2order":[
                {
                    "id":2129,
                    "Cost":62.25,
                    "Count":5,
                    "item2product":
                        {
                            "id":2063,
                            "Name":"Product 1",
                            "Price":12.45
                        }
                },
                {
                    "id":2140,
                    "Cost":14569.90,
                    "Count":10,
                    "item2product":
                        {
                            "id":2074,
                            "Name":"Product 2",
                            "Price":1456.99
                        }
                },
                {
                    "id":2151,
                    "Cost":884.85,
                    "Count":15,
                    "item2product":
                        {
                            "id":2085,
                            "Name":"Product 3",
                            "Price":58.99
                        }
                }
            ]
        },
        {
            "id":2162,
            "Customer":"Customer 2",
            "Date":"Tue May 19 00:00:00 BRT 2015",
```

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```
            "item2order":[
                {
                    "id":2184,
                    "Cost":5899.00,
                    "Count":100,
                    "item2product":
                        {
                            "id":2085,
                            "Name":"Product 3",
                            "Price":58.99
                        }
                }
            ]
        },
        {
            "id":2195,
            "Customer":"Customer 3",
            "Date":"Wed May 20 00:00:00 BRT 2015",
            "item2order":[
                {
                    "id":2217,
                    "Cost":373.50,
                    "Count":30,
                    "item2product":
                        {
                            "id":2063,
                            "Name":"Product 1",
                            "Price":12.45
                        }
                },
                {
                    "id":2228,
                    "Cost":43709.70,
                    "Count":30,
                    "item2product":
                        {
                            "id":2074,
                            "Name":"Product 2",
                            "Price":1456.99
                        }
                },
                {
                    "id":2239,
                    "Cost":1769.70,
                    "Count":30,
                    "item2product":
                        {
                            "id":2085,
                            "Name":"Product 3",
                            "Price":58.99
                        }
                }
            ]
        }
    ]
}
```

Fields filtering example:

```
package com.vyhodb.freference.print;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;
import static com.vyhodb.f.PrintFactory.*;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;
```

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```
public class PrintJsonFiltered extends Example {

    public static void main(String[] args) throws IOException {
        new PrintJsonFiltered().run();
    }

    @Override
    protected F getF() {
        return
        print(
            startPrintJson(new String[]{"Customer", "Count"},
                children("order2root",
                    children("item2order",
                        parent("item2product")
                    )
                )
            )
        );
    }
}
```

Output:

```
{
    "id":0,
    "order2root":[
        {
            "id":2096,
            "Customer":"Customer 1",
            "item2order":[
                {
                    "id":2129,
                    "Count":5,
                    "item2product":
                        {
                            "id":2063
                        }
                },
                {
                    "id":2140,
                    "Count":10,
                    "item2product":
                        {
                            "id":2074
                        }
                },
                {
                    "id":2151,
                    "Count":15,
                    "item2product":
                        {
                            "id":2085
                        }
                }
            ]
        },
        {
            "id":2162,
            "Customer":"Customer 2",
            "item2order":[
                {
                    "id":2184,
                    "Count":100,
                    "item2product":
                        {
                            "id":2085
                        }
                }
```

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```
            ]
        },
        {
            "id":2195,
            "Customer":"Customer 3",
            "item2order":[
                {
                    "id":2217,
                    "Count":30,
                    "item2product":
                        {
                            "id":2063
                        }
                },
                {
                    "id":2228,
                    "Count":30,
                    "item2product":
                        {
                            "id":2074
                        }
                },
                {
                    "id":2239,
                    "Count":30,
                    "item2product":
                        {
                            "id":2085
                        }
                }
            ]
        }
    ]
}
```

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5. RecordFactory

Factory is aimed for creating functions which operate on vyhodb records. Each function casts current object to Record and work with it during evaluation.

5.1. getRecord()

```
public static F getRecord(long recordId)
```

Function retrieves record with specified identifier. Current object is cast to Record and its' space object (by using method **com.vyhodb.space.Record#getSpace()**) is used to retrieve required record.

Function returns record with specified identifier, if it exists. Otherwise, returns null.

Example:

```
package com.vyhodb.freference.record;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.RecordFactory.*;

public class GetRecord extends Example {

    public static void main(String[] args) throws IOException {
        new GetRecord().run();
    }

    @Override
    protected F getF() {
        return
        print(getRecord(0L));
    }
}
```

Output:

```
{} id=0
```

5.2. getField(), setField()

```
public static F getField(String fieldName)
```

Function casts current object to Record and returns it's field value.

```
public static F setField(String fieldName, F valueF)
```

Function casts current object to Record and sets field with name **“fieldname”** to **valueF** evaluation result.

Example:

```
package com.vyhodb.freference.record;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;
```

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```
import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.RecordFactory.*;

public class GetSetField extends Example {

    public static void main(String[] args) throws IOException {
        new GetSetField().run();
    }

    @Override
    protected F getF() {
        return
        composite(
            print( getField("Field")),
            setField("Field", c(42)),
            print( getField("Field"))
        );
    }
}
```

Output:

```
null
42
```

5.3. getParent()

```
public static F getParent(String linkName)
```

Function casts current object to Record and returns its parent record for link with **“linkName”** name.

Example:

```
package com.vyhodb.freference.record;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.RecordFactory.*;
import static com.vyhodb.f.NavigationFactory.*;

public class GetParent extends Example {

    public static void main(String[] args) throws IOException {
        new GetParent().run();
    }

    @Override
    protected F getF() {
        return
        children("order2root",
            children("item2order",
                print(
                    getParent("item2product")
                )
            )
        );
    }
}
```

Output:

```
{Name="Product 1", Price=12.45} id=2063
{Name="Product 2", Price=1456.99} id=2074
```

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```
{Name="Product 3", Price=58.99} id=2085
{Name="Product 3", Price=58.99} id=2085
{Name="Product 1", Price=12.45} id=2063
{Name="Product 2", Price=1456.99} id=2074
{Name="Product 3", Price=58.99} id=2085
```

5.4. setParent()

```
public static F setParent(String linkName, F parent)
```

Function casts current object to Record and sets parent record for link with **"linkName"** link name. Parent record is returned by **parent** function.

Example:

```
package com.vyhodb.freference.record;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.RecordFactory.*;
import static com.vyhodb.f.NavigationFactory.*;

public class SetParent extends Example {

    public static void main(String[] args) throws IOException {
        new SetParent().run();
    }

    @Override
    protected F getF() {
        return
        composite(
            children("order2root",
                children("item2order",
                    setParent("item2root", getRecord(0L))
                )
            ),
            children("item2root",
                printCurrent()
            )
        );
    }
}
```

Output:

```
{Name="Product 1", Price=12.45} id=2063
{Name="Product 2", Price=1456.99} id=2074
{Name="Product 3", Price=58.99} id=2085
{Name="Product 3", Price=58.99} id=2085
{Name="Product 1", Price=12.45} id=2063
{Name="Product 2", Price=1456.99} id=2074
{Name="Product 3", Price=58.99} id=2085
```

5.5. getChildrenCount()

```
public static F getChildrenCount(String childrenLinkName)
```

Function casts current object to Record and returns count of its child record for **"childrenLinkName"** link.

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Example:

```
package com.vyhodb.freference.record;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.RecordFactory.*;

public class GetChildrenCount extends Example {

    public static void main(String[] args) throws IOException {
        new GetChildrenCount().run();
    }

    @Override
    protected F getF() {
        return
        print(
            getChildrenCount("order2root")
        );
    }
}
```

Output:

```
3
```

5.6. getChildFirst(), getChildLast()

```
public static F getChildFirst(String childLinkName)
```

Function casts current object to Record and returns its first child record with **"childLinkName"** link name.

```
public static F getChildLast(String childLinkName)
```

Function casts current record to Record and returns its last child record with **"childLinkName"** link name.

Example:

```
package com.vyhodb.freference.record;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.RecordFactory.*;

public class GetFirstLast extends Example {

    public static void main(String[] args) throws IOException {
        new GetFirstLast().run();
    }

    @Override
    protected F getF() {
        return
```

```
        composite(
            print(getChildFirst("order2root")),
            print(getChildLast("order2root"))
        );
    }
}
```

Output:

```
{Customer="Customer 1", Date="Mon May 18 00:00:00 BRT 2015"} id=2096
{Customer="Customer 3", Date="Wed May 20 00:00:00 BRT 2015"} id=2195
```

5.7. searchMinChild(), searchMaxChild()

```
public static F searchMinChild(String indexName)
```

Function casts current object to Record and returns indexed child record with minimal field(s) value. Index with “indexName” name is used.

Method **com.vyhodb.space.Record#searchMinChild()** is used by function.

```
public static F searchMaxChild(String indexName)
```

Function casts current object to Record and returns indexed child record with maximal field(s) value. Index with “indexName” name is used.

Method **com.vyhodb.space.Record#searchMaxChild()** is used by function.

Example:

```
package com.vyhodb.freference.record;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.RecordFactory.*;

public class SearchMinMax extends Example {

    public static void main(String[] args) throws IOException {
        new SearchMinMax().run();
    }

    @Override
    protected F getF() {
        return
        composite(
            print(searchMinChild("order2root.Customer")),
            print(searchMaxChild("order2root.Customer"))
        );
    }
}
```

Output:

```
{Customer="Customer 1", Date="Mon May 18 00:00:00 BRT 2015"} id=2096
{Customer="Customer 3", Date="Wed May 20 00:00:00 BRT 2015"} id=2195
```

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6. AggregateFactory

Aggregates are functions which are used for calculating sums, count, min/max values.

Aggregates are implemented as functions, which use other functions evaluation results to aggregate value in context.

Let's have a look at example of calculating sales amount:

```
package com.vyhodb.freference.aggregates;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;

import static com.vyhodb.f.AggregatesFactory.*;
import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;
import static com.vyhodb.f.RecordFactory.*;

public class AggregatesExample1 extends Example {

    public static void main(String[] args) throws IOException {
        new AggregatesExample1().run();
    }

    @Override
    protected F getF() {
        return
        composite(
            children("order2root",
                children("item2order",
                    sum(getField("Cost"))
                )
            ),
            print(getSum())
        );
    }
}
```

Output:

```
67268.90
```

Function sum() receives getField() evaluation result and adds it to value, saved in context.

By default, sum() function uses "Sys$Sum" context key to store aggregate value. All context keys, used by aggregate functions are defined in **com.vyhodb.f.AggregatesFactory** class.

For getting sum result, function **getSum()** is used. In fact, this function is a synonym for **CommonFactory#get("Sys$Sum")** function. Other functions for getting aggregates values (getMin(), getMax(), getCount()) are defined in the same way.

The same approach is used for functions, which clear aggregate value in context (clearSum(), clearCount(), clearMin(), clearMax()), in fact they are just **CommonFactory#clear()**.

In this section we only cover sum(), min(), max(), count() functions, whereas get() and clear() function descriptions are omitted.

You can specify context key, which is used to store aggregate value in evaluation context. This is useful, when function calculates many aggregates in only one evaluation (which usually means increase in performance). For instance, example below calculates sales amount and item count at one traversing:

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```
package com.vyhodb.freference.aggregates;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;

import static com.vyhodb.f.AggregatesFactory.*;
import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;
import static com.vyhodb.f.RecordFactory.*;

public class AggregatesExample2 extends Example {

    public static void main(String[] args) throws IOException {
        new AggregatesExample2().run();
    }

    @Override
    protected F getF() {
        return
        composite(
            children("order2root",
                children("item2order",
                    sum("Cost", getField("Cost")),
                    sum("Count", getField("Count"))
                )
            ),
            print(getSum("Cost")),
            print(getSum("Count"))
        );
    }
}
```

Output:

```
67268.90
220.0
```

6.1. sum()

```
public static F sum(F valueF)

public static F sum(String contextKey, F valueF)

public static F sum(SumType sumType, F valueF)

public static F sum(SumType sumType, String contextKey, F valueF)
```

Function adds **valueF** evaluation result to aggregate value stored in context. “Sys$Sum” context key is used by default.

Evaluation result of **valueF** function is casted to java.lang.Number type.

By default, BigDecimal type is used for calculation and storing aggregate value in context, but it can be changed by specifying **sumType** parameter. Currently, the following types are available: Long, Double, Decimal.

Example:

```
package com.vyhodb.freference.aggregates;

import java.io.IOException;

import com.vyhodb.f.F;
```

```
import com.vyhodb.f.aggregates.SumType;
import com.vyhodb.freference.Example;

import static com.vyhodb.f.AggregatesFactory.*;
import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;
import static com.vyhodb.f.RecordFactory.*;

public class Sum extends Example {

    public static void main(String[] args) throws IOException {
        new Sum().run();
    }

    @Override
    protected F getF() {
        return
        composite(
            children("order2root",
                children("item2order",
                    sum(SumType.DOUBLE, getField("Cost"))
                )
            ),
            print(getSum())
        );
    }
}
```

Output:

```
67268.9
```

6.2. count()

```
public static F count()

public static F count(String contextKey)
```

Function increases aggregate's value in context by one.

Example below calculates count of **"order2root"** child record:

```
package com.vyhodb.freference.aggregates;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;
import static com.vyhodb.f.AggregatesFactory.*;

public class Count extends Example {

    public static void main(String[] args) throws IOException {
        new Count().run();
    }

    @Override
    protected F getF() {
        return
        composite(
            children("order2root",
                    count()
            ),
            print(getCount())
```

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```
        );
    }
}
```

Output:

```
3
```

6.3. min()

```
public static F min(F valueF)

public static F min(String contextKey, F valueF)

public static F min(Comparator<?> comparator, F valueF)

public static F min(String contextKey, Comparator<?> comparator, F valueF)
```

Function compares **valueF** evaluation result with value in context and puts minimal of them back into context. By default, function uses “Sys$Min” context key for storing minimal value. However, context key can be changed.

If **comparator** is specified, then it is used for comparing values. Otherwise, both values are cast to java.lang.Comparable type and compared between each other.

null values are not participated in comparison.

Example below searches “Order Item” with minimal cost (field “Cost”):

```
package com.vyhodb.freference.aggregates;

import java.io.IOException;
import java.util.Comparator;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;
import com.vyhodb.space.Record;
import com.vyhodb.utils.FieldComparator;

import static com.vyhodb.f.AggregatesFactory.*;
import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;

public class Min extends Example {

    public static void main(String[] args) throws IOException {
        new Min().run();
    }

    @Override
    protected F getF() {
        Comparator<Record> comparator = new FieldComparator("Cost");

        return
        composite(
            children("order2root",
                children("item2order",
                    min(comparator, current())
                )
            ),
            print(getMin())
        );
    }
}
```

Output:

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```
{Cost=62.25, Count=5} id=2129
```

6.4. max()

```
public static F max(F valueF)

public static F max(String contextKey, F valueF)

public static F max(Comparator<?> comparator, F valueF)

public static F max(String contextKey, Comparator<?> comparator, F valueF)
```

Function compares **valueF** evaluation result with value in context and puts maximal of them back into context. By default, function uses “Sys$Max” context key for storing maximal value. However, context key can be changed.

If **comparator** is specified, then it is used for comparing values. Otherwise, both values are cast to java.lang.Comparable type and compared between each other.

null values are not participated in comparison.

Example below searches max “Order” date:

```
package com.vyhodb.freference.aggregates;

import java.io.IOException;

import com.vyhodb.f.F;
import com.vyhodb.freference.Example;

import static com.vyhodb.f.AggregatesFactory.*;
import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.NavigationFactory.*;
import static com.vyhodb.f.RecordFactory.*;

public class Max extends Example {

    public static void main(String[] args) throws IOException {
        new Max().run();
    }

    @Override
    protected F getF() {
        return
        composite(
            children("order2root",
                max(getField("Date"))
            ),
            print(getMax())
        );
    }
}
```

Output:

```
Wed May 20 00:00:00 BRT 2015
```

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7. CollectionFactory

This factory contains factory methods functions, which are working on java.util.Collection object, stored in evaluation context.

7.1. collectionAdd()

```
public static F collectionAdd(String contextKey, F elementF)

public static F collectionAdd(String contextKey, Object element)
```

Function adds element into collection, stored in context with **contextKey** key. Element can be specified as a constant **element**, or be evaluation result of **elementF** function.

Function returns added element.

Example:

```
package com.vyhodb.freference.collection;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.CollectionFactory.*;

import java.util.ArrayList;

import com.vyhodb.f.F;

public class collectionAdd {

    public static void main(String[] args) {
        F f =
        composite(
            put("array", new ArrayList<>()),
            collectionAdd("array", c(42)),
            collectionAdd("array", 265),
            collectionAdd("array", "Hello"),
            get("array")
        );

        System.out.println(f.startEval(null));
    }
}
```

Output:

```
[42, 265, Hello]
```

7.2. collectionContains()

```
public static Predicate collectionContains(String contextKey, F elementF)

public static Predicate collectionContains(String contextKey, Object element)
```

Function returns **true**, if collection, stored in context with **contextKey** key, contains specified element; otherwise – returns **false**.

Element is specified by a constant or by **elementF** function, which evaluation result is used as element object.

Example:

```
package com.vyhodb.freference.collection;
```

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```
import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.CollectionFactory.*;

import java.util.Arrays;
import java.util.List;

import com.vyhodb.f.F;

public class CollectionContains {

    public static void main(String[] args) {
        List<String> array = Arrays.asList("Hello", "world", "!");

        F f =
        composite(
            put("array", array),
            print( collectionContains("array", "!")),
            print( collectionContains("array", c("WWW")))
        );

        f.startEval(null);
    }
}
```

Output:

```
true
false
```

7.3. collectionRemove()

```
public static F collectionRemove(String contextKey, F elementF)

public static F collectionRemove(String contextKey, Object element)
```

Function removes element from collection, stored in context by **contextKey** key. Removed element is specified as constant or as **elementF** function evaluation result.

Function returns removed element.

Example:

```
package com.vyhodb.freference.collection;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.CollectionFactory.*;

import java.util.ArrayList;
import java.util.Arrays;

import com.vyhodb.f.F;

public class CollectionRemove {

    public static void main(String[] args) {
        ArrayList<String> array = new ArrayList<>(Arrays.asList("Hello", "world", "!"));

        F f =
        composite(
            put("array", array),
            collectionRemove("array", "!"),
            collectionRemove("array", c("Hello"))
        );

        f.startEval(null);
```

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```
        System.out.println(array);
    }
}
```

Output:

```
[world]
```

7.4. collectionClear()

```
public static F collectionClear(String contextKey)
```

Function clears collection, stored in evaluation context by **contextKey** key.

Function returns cleared collection object.

Example:

```
package com.vyhodb.freference.collection;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.CollectionFactory.*;

import java.util.ArrayList;
import java.util.Arrays;

import com.vyhodb.f.F;

public class CollectionClear {

    public static void main(String[] args) {
        ArrayList<String> array = new ArrayList<>(Arrays.asList("Hello", "world", "!"));

        F f =
        composite(
            put("array", array),
            collectionClear("array")
        );

        f.startEval(null);

        System.out.println(array);
    }
}
```

Output:

```
[]
```

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8. StringFactory

Fabric contains methods for building string functions. All function, returned by class methods are wrappers around corresponding **java.lang.String** class methods.

8.1. strLowerCase(), strUpperCase()

```
public static F strLowerCase(F stringValueF)
```

Function converts **stringValueF** evaluation result to lower case and returns converted string.

```
public static F strUpperCase(F stringValueF)
```

Function converts **stringValueF** evaluation result to upper case and returns converted string.

Example:

```
package com.vyhodb.freference.string;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.StringFactory.*;

import com.vyhodb.f.F;

public class LowerUpperCase {

    public static void main(String[] args) {
        F f =
        composite(
            print( strUpperCase(c("Hello")) ),
            print( strLowerCase(c("Hello")) )
        );

        f.startEval(null);
    }
}
```

Output:

```
HELLO
hello
```

8.2. strIndex(), strLastIndex()

```
public static F strIndex(String pattern, F stringValueF)
```

Function returns index of the first occurrence of **pattern** string in **stringValueF** evaluation result string.

```
public static F strLastIndex(String pattern, F stringValueF)
```

Function returns index of the last occurrence of **pattern** string in **stringValueF** evaluation result string.

Example:

```
package com.vyhodb.freference.string;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.StringFactory.*;

import com.vyhodb.f.F;

public class Index {
```

```
    public static void main(String[] args) {
        F f =
        composite(
            print( strIndex("l", c("Hello")) ),
            print( strLastIndex("l", c("Hello")) )
        );

        f.startEval(null);
    }
}
```

Output:

```
2
3
```

8.3. strSub()

```
public static F strSub(F beginF, F endF, F stringValueF)
```

Function returns new string that is a substring of **stringValueF** evaluation result. The substring begins with the character at the **beginF** and extends to the character (**endF()** - 1).

Evaluation results of functions **beginF**, **endF** are casted to java.lang.Number type. Result of **stringValueF** function is converted to java.lang.String.

```
public static F strSub(F beginF, F stringValueF)
```

Function returns new string that is a substring of **stringValueF** evaluation result. The substring begins with the character at the **beginF** and extends to the end of the string.

Example:

```
package com.vyhodb.freference.string;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.StringFactory.*;

import com.vyhodb.f.F;

public class StrSub {

    public static void main(String[] args) {
        F f =
        composite(
            print( strSub(c(2), c(4), c("Hello")) ),
            print( strSub(c(2), c("Hello")) )
        );

        f.startEval(null);
    }
}
```

Output:

```
ll
llo
```

8.4. strTrim()

```
public static F strTrim(F stringValueF)
```

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Function returns copy of string with leading and trailing whitespace omitted.

Example:

```
package com.vyhodb.freference.string;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.StringFactory.*;

import com.vyhodb.f.F;

public class StrTrim {

    public static void main(String[] args) {
        F f =
        composite(
            print( strTrim(c("   Hello   ")) )
        );

        f.startEval(null);
    }
}
```

Output:

```
Hello
```

8.5. strLength()

```
public static F strLength(F stringValueF)
```

Function returns length of string, returned by **stringValueF** function.

Example:

```
package com.vyhodb.freference.string;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.StringFactory.*;

import com.vyhodb.f.F;

public class StrLength {

    public static void main(String[] args) {
        F f =
        composite(
            print( strLength(c("Hello")) )
        );

        f.startEval(null);
    }
}
```

Output:

```
5
```

8.6. strContains()

```
public static Predicate strContains(String pattern, F stringValueF)
```

Predicate returns **true**, if **stringValueF** evaluation result contains **pattern** string; **false** – otherwise.

Example:

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```
package com.vyhodb.freference.string;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.StringFactory.*;

import com.vyhodb.f.F;

public class StrContains {

    public static void main(String[] args) {
        F f =
        composite(
            print( strContains("ll", c("Hello")) ),
            print( strContains("lll", c("Hello")) )
        );

        f.startEval(null);
    }
}
```

Output:

```
true
false
```

8.7. strStartsWith(), strEndsWith()

```
public static Predicate strStartsWith(String prefix, F stringValueF)
```

Predicate returns **true** if **stringValueF** evaluation result starts with **prefix** string; **false** – otherwise.

```
public static Predicate strEndsWith(String suffix, F stringValueF)
```

Predicate returns **true** if **stringValueF** evaluation result ends with **suffix** string; **false** – otherwise.

Example:

```
package com.vyhodb.freference.string;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.StringFactory.*;

import com.vyhodb.f.F;

public class StartsEndsWith {

    public static void main(String[] args) {
        F f =
        composite(
            print( strStartsWith("He", c("Hello")) ),
            print( strEndsWith("llo", c("Hello")) )
        );

        f.startEval(null);
    }
}
```

Output:

```
true
true
```

8.8. strMatches()

```
public static Predicate strMatches(String regExpression, F stringValueF)
```

Predicate returns **true** if **stringValueF** evaluation result matches specified regular expression **regExpression**; **false** - otherwise.

Predicate uses method **java.lang.String#matches()** internally.

Example:

```
package com.vyhodb.freference.string;

import static com.vyhodb.f.CommonFactory.*;
import static com.vyhodb.f.StringFactory.*;

import com.vyhodb.f.F;

public class StrMatches {

    public static void main(String[] args) {
        F f =
        composite(
            print( strMatches("H.*o", c("Hello")) )
        );

        f.startEval(null);
    }
}
```

Output:

```
true
```

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