FH-OÖ Hagenberg/HSD
SDP3, WS 2025
Übung 4

Name: Simon Offenberger / Simon Vogelhuber — Aufwand in h: siehe Doku

Mat.Nr: S2410306027 / S2410306014 — Punkte:

Übungsgruppe: 1 — korrigiert:

Beispiel 1 (24 Punkte) Symbolparser: Entwerfen Sie aus der nachfolgenden Spezifikation ein Klassendiagramm, instanzieren Sie dieses und implementieren Sie die Funktionalität entsprechend:

Ein Symbolparser soll Symbole (Typen und Variablen) für verschiedene Programmiersprachen (Java, IEC,...) erzeugen und verwalten können! Dazu soll folgende öffentliche Schnittstelle angeboten werden:

```
class SymbolParser : public Object
{
public:
    ...
   void AddType(std::string const& name);
   void AddVariable(std::string const& name, std::string const& type);
   void SetFactory(...);
protected:
   ...
private:
   ...
};
```

Sowohl Typen als auch Variablen haben einen Namen und können jeweils in eine fix festgelegte Textdatei geschrieben bzw. von dieser wieder gelesen werden:

- Dateien für Java: *JavaTypes.sym* und *JavaVars.sym*
- Dateien für IEC: *IECTypes.sym* und *IECVars.sym*

Die Einträge in den Dateien sollen in ihrer Struktur folgendermaßen aussehen:

JavaTypes.sym:

```
class Button
class Hugo
class Window
...
```

JavaVars.sym:

```
Button mBut;
Window mWin;
...
```

IECTypes.sym:

```
TYPE SpeedController
TYPE Hugo
TYPE Nero
...
```

IECVars.sym:

```
VAR mCont : SpeedController;
VAR mHu : Hugo;
...
```

Variablen speichern einen Verweis auf ihren zugehörigen Typ. Variablen können nur erzeugt werden, wenn deren Typ im Symbolparser bereits vorhanden ist, ansonsten ist auf der Konsole eine entsprechende Fehlermeldung auszugeben! Variablen und Typen dürfen im Symbolparser nicht doppelt vorkommen! Variablen mit unterschiedlichen Namen können den gleichen Typ haben!

Der Parser hält immer nur Variablen und Typen einer Programmiersprache. Das bedeutet bei einem Wechsel der Programmiersprache sind alle Variablen und Typen in ihre zugehörigen Dateien zu schreiben und aus dem Symbolparser zu entfernen. Anschließend sind die Typen und Variablen der neuen Programmiersprache, falls bereits Symboldateien vorhanden sind, entsprechend in den Parser einzulesen.

Verwenden Sie zur Erzeugung der Typen und Variablen das Design Pattern *Abstract Factory* und implementieren Sie den Symbolparser so, dass er mit verschiedenen Fabriken (Programmiersprachen) arbeiten kann. Stellen Sie weiters sicher, dass für die Fabriken jeweils nur ein Exemplar in der Anwendung möglich ist.

Eine mögliche Anwendung im Hauptprogramm könnte so aussehen:

```
1 #include "SymbolParser.h"
2 #include "JavaSymbolFactory.h"
3 #include "IECSymbolFactory.h"
4
5
6 int main()
7 {
```

```
8     SymbolParser parser;
9
10    parser.SetFactory(JavaSymbolFactory::GetInstance());
11    parser.AddType("Button");
12    parser.AddType("Hugo");
13    parser.AddType("Window");
14    parser.AddVariable("mButton","Button");
15    parser.AddVariable("mWin","Window");
16
17    parser.SetFactory(IECSymbolFactory::GetInstance());
18    parser.AddType("SpeedController");
19    parser.AddType("Hugo");
20    parser.AddType("Nero");
21    parser.AddVariable("mCont","SpeedController");
22    parser.AddVariable("mHu","Hugo");
23
24    parser.SetFactory(JavaSymbolFactory::GetInstance());
25    parser.AddVariable("b", "Button");
26
27    parser.SetFactory(IECSymbolFactory::GetInstance());
28    parser.AddType("Hugo");
29    parser.AddVariable("mCont","Hugo");
30
31    return 0;
32 }
```

Achten Sie darauf, dass im Hauptprogramm nur der Symbolparser und die Fabriken zu inkludieren sind! Das Design sollte so gestaltet werden, dass für eine neue Programmiersprache (wieder nur mit Variablen u. Typen) der Symbolparser und alle Schnittstellen unverändert bleiben!

Treffen Sie für alle unzureichenden Angaben sinnvolle Annahmen und begründen Sie diese. Verfassen Sie weiters eine Systemdokumentation (entsprechend den Vorgaben aus Übung1)!

Allgemeine Hinweise: Legen Sie bei der Erstellung Ihrer Übung großen Wert auf eine **saubere Strukturierung** und auf eine **sorgfältige Ausarbeitung!** Dokumentieren Sie alle Schnittstellen und versehen Sie Ihre Algorithmen an entscheidenden Stellen ausführlich mit Kommentaren! Testen Sie ihre Implementierungen ausführlich! Geben Sie den **Testoutput** mit ab!

Systemdokumentation
Projekt Symbolparser

Version 1.0

S. Offenberger, S. Vogelhuber

Hagenberg, 13. November 2025

Inhaltsverzeichnis

1 Organisatorisches

1.1 Team

- Simon Offenberger, Matr.-Nr.: S2410306027, E-Mail: Simon.Offenberger@fh-hagenberg.at
- Susi Sorglos, Matr.-Nr.: yyyy, E-Mail: Susi.Sorglos@fh-hagenberg.at

1.2 Aufteilung der Verantwortlichkeitsbereiche

- Simon Offenberger
  - Design Klassendiagramm
  - Implementierung und Test der Klassen:
  - Implementierung des Testtreibers
  - Dokumentation
    - Object
    - Symbolparser
    - ISymbolFactory
    - Variable
    - Type
    - JavaVariable
    - JavaType
    - JavaSymbolFactory
    - IECVariable

        * IECType
        * IECSymbolFactory
- Simon Vogelhuber
    - Design Klassendiagramm
    - Implementierung des Testtreibers
    - Dokumentation
    - Implementierung und Komponententest der Klassen:
        * Object
        * Symbolparser
        * ISymbolFactory
        * Variable
        * Type
        * JavaVariable
        * JavaType
        * JavaSymbolFactory
        * IECVariable
        * IECType
        * IECSymbolFactory

1.3 Aufwand

- Simon Offenberger: geschätzt 10 Ph / tatsächlich 8 Ph
- Simon Vogelhuber: geschätzt 10 Ph / tatsächlich 10 Ph

2 Anforderungsdefinition (Systemspezifikation)

Das Ziel ist es einen Symbolparser zu implementieren, der verschiedene Programmiersprachen unterstützt. Der Parser soll in der Lage sein Typen und Variablen zu erkennen und zu verarbeiten. Dazu wird eine Factory benötigt, die die entsprechenden Objekte für die verschiedenen Sprachen erzeugt.

Funktionen des Symbolparsers:

- Auswählen der Programmiersprachen (auswählen der SymbolFactory)
- Speichern der erzeugten Objekte in einem Container.
- Erzeugen von Variablen und Typen über die SymbolFactory
- Überprüfung ob Typen und Variablen gültig sind.
- Beim Wechsel der SymbolFactory, werden alle Objekte der alten Faktory in ein File gespeichert. Und die Objekte der neuen Factory werden aus dem File geladen.

Funktionen der SymbolFactory:

- Erzeugen von Variablen und Typen der jeweiligen Programmiersprache.

Funktionen der Variable:

- Speichern des Variablennamens
- Speichern des Variablentyps
- Auswerten der Variablendeklaration (Syntaxprüfung)
- Zurückgeben des Variablennamens
- Zurückgeben des Variablentyps

Funktionen des Type:

- Auswerten der Typdeklaration (Syntaxprüfung)
- Speichern des Typnamens
- Zurückgeben des Typnamens

3 Systementwurf

3.1 Designentscheidungen

Verwendung des Factory-Patterns:
Das Factory-Pattern wurde verwendet, um die Erstellung von Objekten der verschiedenen Programmiersprachen zu kapseln. Das ermöglicht eine einfache Erweiterung des Systems um weitere Sprachen, ohne dass der Symbolparser angepasst werden muss. Der Parser Speichert hierführ eine Referenz auf die aktuelle SymbolFactory, die zur Laufzeit gewechselt werden kann.

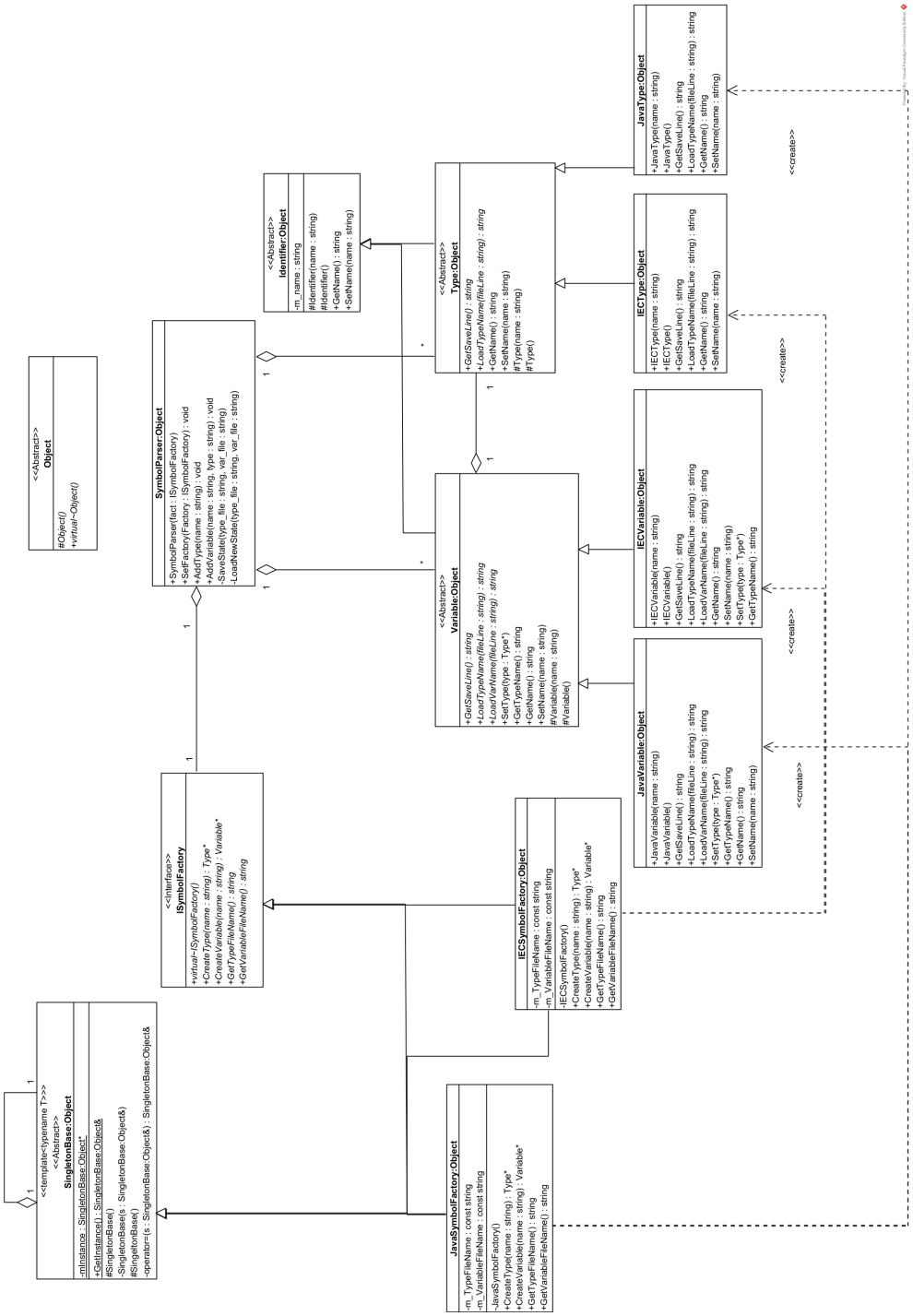
Verwendung des Singleton-Patterns:
Das Singleton- Pattern wurde für die SymbolFactory implementiert, um sicherzustellen, dass nur eine Instanz der Factory existiert.

Verwendung von Vererbung und Polymorphie:
Die Klassen Variable und Type sind Basisklassen, von denen spezifische Implementierungen für jede Programmiersprache abgeleitet sind. Dadurch kann der Symbolparser generisch mit den Basisklassen arbeiten, ohne die spezifischen Implementierungen zu kennen.

Container für Objekte:
Der Symbolparser verwendet einen Container (std::vector), um die erzeugten Objekte zu speichern. Dies ermöglicht eine einfache Verwaltung und Iteration über die Objekte. Für die Variablen werden unique- Pointer gespeichert, die Types werden jedoch als shared-Pointer gespeichert, da mehrere Variablen denselben Type referenzieren können.

SymbolParser:
Der SymbolParser ist die zentrale Klasse, die die Interaktion mit dem Benutzer und die Verwaltung der Objekte übernimmt. Er bietet Methoden zum Setzen der aktuellen SymbolFactory, zum Erzeugen von Variablen und Typen sowie zum Speichern und Laden der Objekte. Der Parser überprüft ob eine eingegebene Variable oder ein Type gültig ist, indem er die entsprechenden Methoden der Objekte aufruft.

Klassendiagramm



4 Dokumentation der Komponenten (Klassen)

Die HTML-Startdatei befindet sich im Verzeichnis ./../doxy/html/index.html

5 Testprotokollierung

```
1
2  ****************************************
3              TESTCASE START
4  ****************************************
5
6
7
8  **** Test IEC Var Getter ****
9
10
11 ****************************************
12             TESTCASE START
13 ****************************************
14
15 Test Variable Get Name
16 [Test OK] Result: (Expected: asdf == Result: asdf)
17
18 Test Variable Get Type
19 [Test OK] Result: (Expected: int == Result: int)
20
21 Test Variable Set Name
22 [Test OK] Result: (Expected: uint_fast_256_t == Result:
      ↪ uint_fast_256_t)
23
24 Check for Exception in Testcase
25 [Test OK] Result: (Expected: true == Result: true)
26
27 Test Exception in Set Name
28 [Test OK] Result: (Expected: ERROR: Empty String == Result:
      ↪ ERROR: Empty String)
29
30 Test Exception in Set Type with nullptr
31 [Test OK] Result: (Expected: ERROR: Passed in Nullptr! ==
      ↪ Result: ERROR: Passed in Nullptr!)
32
33 Test Variable Get Type after set with nullptr
34 [Test OK] Result: (Expected: int == Result: int)
35
36 Test Variable Get Type after set
37 [Test OK] Result: (Expected: uint_fast512_t == Result:
      ↪ uint_fast512_t)
38
```

```
Test for Exception in TestCase
[Test OK] Result: (Expected: true == Result: true)


*****************************************


**** Test Java Var Getter ****


*****************************************
             TESTCASE START
*****************************************

Test Variable Get Name
[Test OK] Result: (Expected: jklm == Result: jklm)

Test Variable Get Type
[Test OK] Result: (Expected: int == Result: int)

Test Variable Set Name
[Test OK] Result: (Expected: uint_fast_256_t == Result:
   ↪ uint_fast_256_t)

Check for Exception in Testcase
[Test OK] Result: (Expected: true == Result: true)

Test Exception in Set Name
[Test OK] Result: (Expected: ERROR: Empty String == Result:
   ↪ ERROR: Empty String)

Test Exception in Set Type with nullptr
[Test OK] Result: (Expected: ERROR: Passed in Nullptr! ==
   ↪ Result: ERROR: Passed in Nullptr!)

Test Variable Get Type after set with nullptr
[Test OK] Result: (Expected: int == Result: int)

Test Variable Get Type after set
[Test OK] Result: (Expected: uint_fast512_t == Result:
   ↪ uint_fast512_t)

Test for Exception in TestCase
```

```
[Test OK] Result: (Expected: true == Result: true)


*****************************************


**** Test IEC Type Getter ****


*****************************************
             TESTCASE START
*****************************************

Test Type Get Name after Set
[Test OK] Result: (Expected: unit_1024_t == Result:
   ↪ unit_1024_t)

Test Exception in Set Type
[Test OK] Result: (Expected: true == Result: true)

Test Exception in Set Type
[Test OK] Result: (Expected: ERROR: Empty String == Result:
   ↪ ERROR: Empty String)


*****************************************


**** Test Java Type Getter ****


*****************************************
             TESTCASE START
*****************************************

Test Type Get Name after Set
[Test OK] Result: (Expected: unit_1024_t == Result:
   ↪ unit_1024_t)

Test Exception in Set Type
[Test OK] Result: (Expected: true == Result: true)

```

```
Test Exception in Set Type
[Test OK] Result: (Expected: ERROR: Empty String == Result:
    ↪ ERROR: Empty String)


****************************************


****************************************
             TESTCASE START
****************************************

Test Load Type Name IEC Var
[Test OK] Result: (Expected: mCont == Result: mCont)

Test Load Var Name IEC Var
[Test OK] Result: (Expected: SpeedController == Result:
    ↪ SpeedController)

Test Load Type Name IEC Var invalid Format
[Test OK] Result: (Expected:  == Result: )

Test Load Var Name IEC Var invalid Format
[Test OK] Result: (Expected:  == Result: )

Test Load Type Name IEC Var invalid Format
[Test OK] Result: (Expected: mCont == Result: mCont)

Test Load Var Name IEC Var invalid Format
[Test OK] Result: (Expected:  == Result: )

Test Load Type Name IEC Var invalid Format
[Test OK] Result: (Expected:  == Result: )

Test Load Var Name IEC Var invalid Format
[Test OK] Result: (Expected:  == Result: )

Test Load Type Name IEC Var invalid Format
[Test OK] Result: (Expected: mCont == Result: mCont)

Test Load Var Name IEC Var invalid Format
[Test OK] Result: (Expected:  == Result: )

Test Load Type Name IEC Var invalid Format
```

```
[Test OK] Result: (Expected:  == Result: )

Test Load Var Name IEC Var invalid Format
[Test OK] Result: (Expected:  == Result: )

Test Load Type Name IEC Var invalid Format
[Test OK] Result: (Expected:  == Result: )

Test Load Var Name IEC Var invalid Format
[Test OK] Result: (Expected:  == Result: )

Test Save LineFormat IEC Variable
[Test OK] Result: (Expected: VAR mCont : SpeedController;
 == Result: VAR mCont : SpeedController;
)

Test Save LineFormat IEC Variable
[Test OK] Result: (Expected:  == Result: )

Test for Exception in TestCase
[Test OK] Result: (Expected: true == Result: true)


****************************************


****************************************
              TESTCASE START
****************************************

Test Load Type Name Java Var
[Test OK] Result: (Expected: mCont == Result: mCont)

Test Load Var Name Java Var
[Test OK] Result: (Expected: mBut == Result: mBut)

Test Load Type Name Java Var invalid Format
[Test OK] Result: (Expected:  == Result: )

Test Load Var Name Java Var invalid Format
[Test OK] Result: (Expected:  == Result: )

Test Load Type Name Java Var invalid Format
[Test OK] Result: (Expected: mCont == Result: mCont)
```

```
206
207 Test Load Var Name Java Var invalid Format
208 [Test OK] Result: (Expected:  == Result: )
209
210 Test Load Type Name Java Var invalid Format
211 [Test OK] Result: (Expected:  == Result: )
212
213 Test Load Var Name Java Var invalid Format
214 [Test OK] Result: (Expected:  == Result: )
215
216 Test Load Type Name Java Var invalid Format
217 [Test OK] Result: (Expected: mCont == Result: mCont)
218
219 Test Load Var Name Java Var invalid Format
220 [Test OK] Result: (Expected:  == Result: )
221
222 Test Load Type Name Java Var invalid Format
223 [Test OK] Result: (Expected:  == Result: )
224
225 Test Load Var Name Java Var invalid Format
226 [Test OK] Result: (Expected:  == Result: )
227
228 Test Load Type Name Java Var invalid Format
229 [Test OK] Result: (Expected:  == Result: )
230
231 Test Load Var Name Java Var invalid Format
232 [Test OK] Result: (Expected:  == Result: )
233
234 Test Save LineFormat IEC Variable
235 [Test OK] Result: (Expected: mCont mBut;
236  == Result: mCont mBut;
237 )
238
239 Test Save LineFormat IEC Variable
240 [Test OK] Result: (Expected:  == Result: )
241
242 Test for Exception in TestCase
243 [Test OK] Result: (Expected: true == Result: true)
244
245
246 ****************************************
247
248
249 ****************************************
```

```
250 |              TESTCASE START
251 |****************************************
252 |
253 |Test Load Type Name IEC Type
254 |[Test OK] Result: (Expected: SpeedController == Result:
    |   ↪ SpeedController)
255 |
256 |Test Load Type Name IEC Type invalid Format
257 |[Test OK] Result: (Expected:  == Result: )
258 |
259 |Test Load Type Name IEC Type invalid Format
260 |[Test OK] Result: (Expected:  == Result: )
261 |
262 |Test Load Type Name IEC Type invalid Format
263 |[Test OK] Result: (Expected: S2peedController == Result:
    |   ↪ S2peedController)
264 |
265 |Test Load Type Name IEC Type invalid Format
266 |[Test OK] Result: (Expected:  == Result: )
267 |
268 |Test Load Type Name IEC Type invalid Format
269 |[Test OK] Result: (Expected:  == Result: )
270 |
271 |Test Save LineFormat IEC Type
272 |[Test OK] Result: (Expected: TYPE SpeedController
273 | == Result: TYPE SpeedController
274 |)
275 |
276 |Test for Exception in TestCase
277 |[Test OK] Result: (Expected: true == Result: true)
278 |
279 |
280 |****************************************
281 |
282 |
283 |****************************************
284 |              TESTCASE START
285 |****************************************
286 |
287 |Test Load Type Name Java Type
288 |[Test OK] Result: (Expected: SpeedController == Result:
    |   ↪ SpeedController)
289 |
290 |Test Load Type Name Java Type invalid Format
```

```
[Test OK] Result: (Expected:  == Result: )

Test Load Type Name Java Type invalid Format
[Test OK] Result: (Expected:  == Result: )

Test Load Type Name Java Type invalid Format
[Test OK] Result: (Expected: S2peedController == Result:
   ↪ S2peedController)

Test Load Type Name Java Type invalid Format
[Test OK] Result: (Expected:  == Result: )

Test Load Type Name Java Type invalid Format
[Test OK] Result: (Expected:  == Result: )

Test Save LineFormat Java Type
[Test OK] Result: (Expected: class SpeedController
 == Result: class SpeedController
)

Test for Exception in TestCase
[Test OK] Result: (Expected: true == Result: true)


****************************************


****************************************
              TESTCASE START
****************************************

Normal Operating Parser
[Test OK] Result: (Expected: true == Result: true)

.AddType() - add empty type to parser
[Test OK] Result: (Expected: ERROR: Provided string is empty.
   ↪ == Result: ERROR: Provided string is empty.)

.AddVariable() - add empty type to factory
[Test OK] Result: (Expected: ERROR: Provided string is empty.
   ↪ == Result: ERROR: Provided string is empty.)

.AddVariable() - add empty var to factory
```

```
[Test OK] Result: (Expected: ERROR: Provided string is empty.
    ↪ == Result: ERROR: Provided string is empty.)

.AddVariable() - add variable with nonexisting type
[Test OK] Result: (Expected: ERROR: Provided type does not
    ↪ exist. == Result: ERROR: Provided type does not exist.)

.AddType() - add duplicate type
[Test OK] Result: (Expected: ERROR: Provided type already
    ↪ exists. == Result: ERROR: Provided type already exists.)

.AddVar() - add duplicate Var
[Test OK] Result: (Expected: ERROR: Provided Variable already
    ↪ exists. == Result: ERROR: Provided Variable already
    ↪ exists.)

Test Store and Load Java Fact with exeption Dup Type
[Test OK] Result: (Expected: ERROR: Provided type already
    ↪ exists. == Result: ERROR: Provided type already exists.)

Test Store and Load IEC Fact with exeption Dup Type
[Test OK] Result: (Expected: ERROR: Provided type already
    ↪ exists. == Result: ERROR: Provided type already exists.)


****************************************

TEST OK!!
```

6 Quellcode

6.1 Object.hpp

```
/*****************************************************************//**
 * \file   Object.hpp
 * \brief  common ancestor for all objects
 *
 * \author Simon
 * \date   November 2025
 *********************************************************************/
#ifndef OBJECT_HPP
#define OBJECT_HPP

#include <string>

class Object {
public:

        // Exceptions constants
        inline static const std::string ERROR_BAD_OSTREAM = "ERROR: Provided Ostream is bad";
        inline static const std::string ERROR_FAIL_WRITE = "ERROR: Fail to write on provided Ostream";
        inline static const std::string ERROR_NULLPTR = "ERROR: Passed in Nullptr!";

        // once virtual always virtual
        virtual ~Object() = default;


protected:
        Object() = default;
};

#endif // !OBJECT_HPP
```

6.2 Symbolparser.hpp

```
/*****************************************************************//**
 * \file   SymbolParser.hpp
 * \brief  A multi language parser for types and variables
 * \author Simon
 * \date   Dezember 2025
 *********************************************************************/

#ifndef SYMBOL_PARSER_HPP
#define SYMBOL_PARSER_HPP

#include <vector>
#include <map>

#include "Object.h"
#include "Variable.hpp"
#include "Type.hpp"
#include "ISymbolFactory.hpp"

class SymbolParser : public Object
{
public:
    inline static const std::string ERROR_EMPTY_STRING = "ERROR: Provided string is empty.";
    inline static const std::string ERROR_NONEXISTING_TYPE = "ERROR: Provided type does not exist.";
    inline static const std::string ERROR_DUPLICATE_TYPE = "ERROR: Provided type already exists.";
    inline static const std::string ERROR_DUPLICATE_VAR = "ERROR: Provided Variable already exists.";

    /**
     * \brief Polymorphic conatiner for saving variables
     */
    using TVariableCont = std::vector<Variable::Uptr>;

    /**
     * \brief Polymorphic conatiner for saving types
     */
    using TTypeCont = std::vector<Type::Sptr>;


    /**
     * \brief Sets Factory for parsing a language
     * \brief Previus variables and types of prior factory get saved,
     * \brief then the subsequent factories variables and types get loaded.
     * \param Reference to a SymbolFactory
     * \return void
     */
    void SetFactory(ISymbolFactory& Factory);

    /**
     * \brief Adds a new type to the language
     * \param string of typename
     * \return void
     */
    void AddType(std::string const& name);

    /**
     * \brief Adds a new variable if type exists
     * \param string of variable, string of type
     * \return void
     */
    void AddVariable(std::string const& name, std::string const& type);

    /**
     * \brief CTOR of a Symbol Parser Object.
     *
     * \param fact
     */
    SymbolParser(ISymbolFactory& fact);

    virtual ~SymbolParser();

    // Delete CopyCtor and Assign Op to prevent untestet behaviour.
    SymbolParser(SymbolParser& s) = delete;
    void operator=(SymbolParser s) = delete;
```

```
73
74  protected:
75  private:
76      /**
77       * \brief Saves the current state of a SymbolFacotry to its file
78       * \param string of type files path, tring of variable files path
79       * \return void
80       */
81      void SaveState(const std::string& type_file, const std::string& var_file);
82
83      /**
84       * \brief Loads a SymbolFactory's variables and types from file
85       * \param string of type files path, tring of variable files path
86       * \return void
87       */
88      void LoadNewState(const std::string& type_file, const std::string& var_file);
89
90      TTypeCont m_typeCont;
91      TVariableCont m_variableCont;
92      ISymbolFactory * m_Factory;
93  };
94  #endif
```

6.3 Symbolparser.cpp

```cpp
/*****************************************************************//**
 * \file   SymbolParser.cpp
 * \brief  A multi language parser for types and variables
 * \author Simon
 * \date   Dezember 2025
 *********************************************************************/
#include <algorithm>
#include <fstream>
#include <iostream>
#include "SymbolParser.hpp"
#include "ISymbolFactory.hpp"

using namespace std;

void SymbolParser::SaveState(const std::string & type_file, const std::string & var_file)
{
    if (m_Factory == nullptr)
        throw SymbolParser::ERROR_NULLPTR;

    ofstream type_File;
    ofstream var_File;

    type_File.open(m_Factory->GetTypeFileName());

    // check if file is good
    if (!type_File.good()) {
        type_File.close();
        return;
    }

    for_each(m_typeCont.cbegin(), m_typeCont.cend(), [&](const auto& type) { type_File << type->
        GetSaveLine(); });

    type_File.close();


    var_File.open(m_Factory->GetVariableFileName());

    // check if file is good
    if (!var_File.good()) {
        var_File.close();
        return;
    }

    for_each(m_variableCont.cbegin(), m_variableCont.cend(), [&](const auto& var) { var_File << var->
        GetSaveLine(); });

    var_File.close();
}

void SymbolParser::LoadNewState(const std::string& type_file, const std::string& var_file)
{
    if (m_Factory == nullptr)
        throw SymbolParser::ERROR_NULLPTR;

    ifstream type_File;
    ifstream var_File;

    m_typeCont.clear();
    m_variableCont.clear();

    type_File.open(type_file);

    // check if file is good
    if (!type_File.good()) {
        type_File.close();
        return;
    }

    string line;

    while (getline(type_File, line)) {
```

```
71
72          Type::Uptr pType = m_Factory->CreateType("");
73
74          pType->SetName(pType->LoadTypeName(line));
75
76          m_typeCont.push_back(move(pType));
77      }
78
79      type_File.close();
80
81
82      var_File.open(var_file);
83
84      // check if file is good
85      if (!var_File.good()) {
86          var_File.close();
87          return;
88      }
89
90      while (getline(var_File, line)) {
91
92          auto pVar = m_Factory->CreateVariable("");
93
94          const string type = pVar->LoadTypeName(line);
95          const string name = pVar->LoadVarName(line);
96
97          pVar->SetName(name);
98
99          // look up if type even exists if yes add to type container
100         for (const auto& m_type : m_typeCont)
101         {
102             if (type == m_type->GetName())
103             {
104
105                 pVar->SetType(m_type);
106
107                 // If each variable should only match one type, break early
108                 break;
109             }
110         }
111
112         if (pVar->GetTypeName() != "") {
113             m_variableCont.push_back(move(pVar));
114         }
115     }
116
117     var_File.close();
118 }
119
120
121 void SymbolParser::SetFactory(ISymbolFactory& Factory)
122 {
123     if (m_Factory == nullptr)
124         throw SymbolParser::ERROR_NULLPTR;
125
126     SaveState(m_Factory->GetTypeFileName(), m_Factory->GetVariableFileName());
127
128     m_Factory = &Factory;
129
130     LoadNewState(m_Factory->GetTypeFileName(), m_Factory->GetVariableFileName());
131 }
132
133 void SymbolParser::AddType(std::string const& name)
134 {
135     if (m_Factory == nullptr)
136         throw SymbolParser::ERROR_NULLPTR;
137
138     if (name.empty())
139         throw SymbolParser::ERROR_EMPTY_STRING;
140
141     // check if type already exists
142     auto it = find_if(m_typeCont.cbegin(), m_typeCont.cend(), [&](const auto& t) { return t->GetName()
            == name;});
143
144     if (it != m_typeCont.cend()) throw ERROR_DUPLICATE_TYPE;
```

```
145
146     Type::Uptr pType = m_Factory->CreateType(name);
147     m_typeCont.push_back(move(pType));
148
149 }
150
151 void SymbolParser::AddVariable(std::string const& name, std::string const& type)
152 {
153     if (m_Factory == nullptr)
154         throw SymbolParser::ERROR_NULLPTR;
155
156     if (name.empty())
157         throw SymbolParser::ERROR_EMPTY_STRING;
158
159     if (type.empty())
160         throw SymbolParser::ERROR_EMPTY_STRING;
161
162     // check if variable already exists
163     auto it = find_if(m_variableCont.cbegin(), m_variableCont.cend(),
164         [&](const auto& t) { return t->GetTypeName() == type && t->GetName() == name;});
165
166     // instead of a fixed output to the console
167     // an exception is thrown!!
168     if (it != m_variableCont.cend()) throw ERROR_DUPLICATE_VAR;
169
170     // look up if type even exists if yes add to type container
171     for (const auto& m_type : m_typeCont)
172     {
173         if (type == m_type->GetName())
174         {
175             auto pVar = m_Factory->CreateVariable(name);
176             pVar->SetType(m_type);
177
178             // Move ownership into container
179             m_variableCont.push_back(std::move(pVar));
180
181             // If each variable should only match one type, return early
182             return;
183         }
184     }
185
186     // Error is thrown instead of a console output!
187     // in our opinion this is more flexible than a
188     // fixed output to the console!!
189     throw ERROR_NONEXISTING_TYPE;
190 }
191
192 SymbolParser::SymbolParser(ISymbolFactory& fact) : m_Factory{ &fact }
193 {
194     // Load State from previos parsing
195     LoadNewState(m_Factory->GetTypeFileName(), m_Factory->GetVariableFileName());
196 }
197
198 SymbolParser::~SymbolParser()
199 {
200     SaveState(m_Factory->GetTypeFileName(), m_Factory->GetVariableFileName());
201 }
```

6.4 ISymbolFactory.hpp

```cpp
/*****************************************************************//**
 * \file   ISymbolFactory.hpp
 * \brief  A Interface for creating SymbolFactories
 * \author Simon
 * \date   Dezember 2025
 *********************************************************************/
#ifndef ISYMBOL_FACTORY_HPP
#define ISYMBOL_FACTORY_HPP

#include "Variable.hpp"
#include "Type.hpp"

class ISymbolFactory
{
public:
        /**
         * \brief Creates a variable
         *
         * \param string of variables name
         * \return uniqie pointer to variable
         */
        virtual Variable::Uptr CreateVariable(const std::string& name)=0;

        /**
         * \brief Creates a type
         *
         * \param string of typename
         * \return unique pointer to type
         */
        virtual Type::Uptr CreateType(const std::string& name)=0;

        /**
         * \brief Getter for file path of type file
         *
         * \return string of filePath
         */
        virtual const std::string& GetTypeFileName()=0;

        /**
         * \brief Getter for file path of variable file
         *
         * \return string of filePath
         */
        virtual const std::string& GetVariableFileName()=0;



        virtual ~ISymbolFactory() = default;

protected:
private:
};
#endif
```

6.5 Identifier.hpp

```cpp
/*****************************************************************//**
 * \file   Identifier.hpp
 * \brief  Generalization of Types and Variables
 * \author Simon
 * \date   Dezember 2025
 *********************************************************************/
#ifndef IDENTIFIER_HPP
#define IDENTIFIER_HPP

#include <memory>
#include <string>
#include "Object.h"

class Identifier : public Object
{
public:

        inline static const std::string ERROR_EMPTY_STRING = "ERROR: Empty String";

        /**
         * \brief Getter for  name
         *
         * \return string of name
         */
        std::string GetName() const;

        /**
         * \brief Sets a  name
         *
         * \param string fileLine
         * \return string of type - SymbolParser has to check type for validity
         * \throw ERROR_EMPTY_STRING
         */
        void SetName(const std::string& name);


protected:
        Identifier(const std::string& name) : m_name{ name } {}
        Identifier() = default;

        std::string m_name;
private:
};

#endif
```

6.6 Identifier.cpp

```cpp
/*****************************************************************//**
 * \file   Identifier.cpp
 * \brief  Generalization of Types and Variables
 * \author Simon
 * \date   Dezember 2025
 *********************************************************************/

#include "Identifier.hpp"


std::string Identifier::GetName() const{
        return m_name;
}

void Identifier::SetName(const std::string& name)
{
        if (name.empty()) throw Identifier::ERROR_EMPTY_STRING;

        m_name = name;
}
```

6.7 Variable.hpp

```
/*****************************************************************//**
 * \file   Variable.hpp
 * \brief  Abstract class for parsing types
 * \author Simon Vogelhuber
 * \date   Dezember 2025
 *********************************************************************/

#ifndef VARIABLE_HPP
#define VARIABLE_HPP
#include <memory>
#include <vector>
#include <string>

#include "Identifier.hpp"
#include "Type.hpp"

class Variable: public Identifier
{
public:
    /**
     * \brief Unique pointer type for variable
     */
    using Uptr = std::unique_ptr<Variable>;

    /**
     * \brief Returns formatted line of a variables declaration
     *
     * \return string of variable
     */
    virtual std::string GetSaveLine() const = 0;

    /**
     * \brief Loads the name of a variables type
     *
     * \param string fileLine
     * \return string of type - SymbolParser has to check type for validity
     */
    virtual std::string LoadTypeName(std::string const& fileLine) const  = 0;

    /**
     * \brief Loads name of a variable
     *
     * \param string fileLine
     * \return string of variables name
     */
    virtual std::string LoadVarName(std::string const& fileLine) const = 0;

    /**
     * \brief Sets the type of a variable
     *
     * \param shared pointer of type
     * \return void
     * \throw ERROR_NULLPTR
     */
    void SetType(Type::Sptr type);


    /**
     * \brief Name getter
     *
     * \return string of variable
     */
    std::string GetTypeName() const;


protected:
    Variable(const std::string& name) : Identifier{ name } {}
    Variable() = default;

    Type::Sptr m_type;

private:
```

```
73 };
74 #endif
```

6.8 Variable.cpp

```cpp
/*****************************************************************//**
 * \file   Variable.cpp
 * \brief  Abstract class for parsing types
 * \author Simon Vogelhuber
 * \date   Dezember 2025
 *********************************************************************/

#include "Variable.hpp"
#include <cassert>


using namespace std;


void Variable::SetType(Type::Sptr type)
{
    if (type == nullptr) throw Type::ERROR_NULLPTR;

    m_type = std::move(type);
}

std::string Variable::GetTypeName() const
{
    return m_type->GetName();
}
```

6.9 Type.hpp

```cpp
/*****************************************************************//**
 * \file   Type.hpp
 * \brief  Abstract class for parsing types
 * \author Simon Vogelhuber
 * \date   Dezember 2025
 *********************************************************************/
#ifndef TYPE_HPP
#define TYPE_HPP

#include <memory>
#include <string>
#include "Identifier.hpp"

class Type : public Identifier
{
public:

        /**
         * \brief Unique pointer type for type
         */
        using Uptr = std::unique_ptr<Type>;

        /**
         * \brief Shared pointer type for type
         */
        using Sptr = std::shared_ptr<Type>;

        /**
         * \brief Loads a types name from a files line
         *
         * \param string fileLine
         * \return string of type
         */
        virtual std::string LoadTypeName(const std::string& fileLine) const = 0;

        /**
         * \brief Returns formatted line of a types declaration
         *
         * \return string of type declaration
         */
        virtual std::string GetSaveLine() const = 0;


protected:
        Type(const std::string& name) : Identifier{ name } {}
        Type() = default;
private:
};
#endif
```

6.10 Type.cpp

```
1  /*****************************************************************//**
2   * \file   Type.cpp
3   * \brief  Abstract class for parsing types
4   * \author Simon Vogelhuber
5   * \date   Dezember 2025
6   *********************************************************************/
7
8  #include "Type.hpp"
```

6.11 SingetonBase.hpp

```cpp
/*****************************************************************//**
 * \file   SingetonBase.hpp
 * \brief  Base Class for creating singletons
 *
 * \author Simon
 * \date   November 2025
 *********************************************************************/
#ifndef SINGLETON_BASE_HPP
#define SINGLETON_BASE_HPP

#include "Object.h"
#include <memory>

template <typename T> class SingletonBase : public Object {
public:
	static T& GetInstance() {
		if (mInstance == nullptr) { mInstance = std::unique_ptr<T>{ new T{} }; };
		return *mInstance;
	}
protected:
	SingletonBase() = default;
	virtual ~SingletonBase() = default;

private:
	SingletonBase(SingletonBase const& s) = delete;
	SingletonBase& operator = (SingletonBase const& s) = delete;
	static std::unique_ptr<T> mInstance;
};

template <typename T> std::unique_ptr<T> SingletonBase<T>::mInstance = nullptr;

#endif // !SINGLETON_BASE_HPP
```

6.12 JavaVariable.hpp

```cpp
/*****************************************************************//**
 * \file   JavaVariable.hpp
 * \brief  A Class for parsing java variables
 * \author Simon
 * \date   Dezember 2025
 *********************************************************************/
#ifndef JAVA_VARIABLE_HPP
#define JAVA_VARIABLE_HPP
#include "Object.h"
#include "Variable.hpp"

class JavaVariable :public Variable
{
public:
    /**
     * \brief Returns formatted line of a variables declaration
     *
     * \return string of variable
     */
    virtual std::string GetSaveLine() const override;

    /**
     * \brief Loads the name of a variables type
     *
     * \param string fileLine
     * \return string of type - SymbolParser has to check type for validity
     */
    virtual std::string LoadTypeName(std::string const& fileLine) const override;

    /**
     * \brief Loads name of a variable
     *
     * \param string fileLine
     * \return string of variables name
     */
    virtual std::string LoadVarName(std::string const& fileLine) const override;

    JavaVariable() = default;

    JavaVariable(const std::string& name) : Variable{ name } {}

protected:
private:
};
#endif
```

6.13 JavaVariable.cpp

```
/*****************************************************************//**
 * \file   JavaVariable.cpp
 * \brief  A Class for parsing java variables
 * \author Simon
 * \date   Dezember 2025
 *********************************************************************/

#include "JavaVariable.hpp"
#include <sstream>
#include <string>
#include "scanner.h"

using namespace pfc;
using namespace std;

/**
 * \brief Scans an input string for the Type name of the Var.
 *
 * \param scan Reference to scanner object
 * \return emtpy string if no valid type name is found
 * \return name of type
 */
static std::string ScanTypeName(scanner& scan)
{
        string typeName = scan.get_identifier();
        scan.next_symbol();
        return typeName;
}

/**
 * \brief Scans an input string for the Variable name of the Var.
 *
 * \param scan Reference to scanner object
 * \return emtpy string if no valid Variable name is found
 * \return name of Variable
 */
static std::string ScanVarName(scanner& scan)
{
        string varName;
        varName = scan.get_identifier();
        scan.next_symbol();

        // The line should be emty after the var Name!
        if (scan.is(';'))       return varName;
        else                                    return "";
}

std::string JavaVariable::GetSaveLine() const
{
        if (m_type == nullptr) return "";

        return m_type->GetName() + "␣" + m_name + ";\n";
}

std::string JavaVariable::LoadTypeName(std::string const& fileLine) const
{
        stringstream lineStream;
        lineStream << fileLine;
        scanner scan{lineStream};

        return ScanTypeName(scan);
}

std::string JavaVariable::LoadVarName(std::string const& fileLine) const
{
        stringstream lineStream;
        lineStream << fileLine;
        scanner scan{ lineStream };

        string typeName = ScanTypeName(scan);
        string varName = ScanVarName(scan);
        if (typeName.empty()) varName = "";
```

```
73
74          return varName;
75  }
```

6.14 JavaSymbolFactory.hpp

```cpp
/*****************************************************************//**
 * \file   JavaSymbolFactory.hpp
 * \brief  A factory for creating java variables and types
 * \author Simon
 * \date   Dezember 2025
 *********************************************************************/
#ifndef JAVA_SYMBOL_FACTORY_HPP
#define JAVA_SYMBOL_FACTORY_HPP

#include "ISymbolFactory.hpp"
#include "SingetonBase.hpp"

class JavaSymbolFactory :public ISymbolFactory, public SingletonBase<JavaSymbolFactory>
{
public:

        friend class SingletonBase<JavaSymbolFactory>;

        /**
         * \brief Creates a java variable
         *
         * \param string of variables name
         * \return unique pointer to variable
         */
        virtual Variable::Uptr CreateVariable(const std::string& name) override;

        /**
         * \brief Creates a java type
         *
         * \param string of typename
         * \return unique pointer to type
         */
        virtual Type::Uptr CreateType(const std::string& name) override;

        /**
         * \brief Getter for file path of type file
         *
         * \return string of filePath
         */
        virtual const std::string& GetTypeFileName() override;

        /**
         * \brief Getter for file path of variable file
         *
         * \return string of filePath
         */
        virtual const std::string& GetVariableFileName() override;

        // delete CopyCtor and Assign operator to prevent untestet behaviour
        JavaSymbolFactory(JavaSymbolFactory& fact) = delete;
        void operator=(JavaSymbolFactory fact) = delete;

protected:
private:
        JavaSymbolFactory() = default;
        const std::string m_TypeFileName = "JavaTypes.sym";
        const std::string m_VariableFileName = "JavaVars.sym";
};
#endif
```

6.15 JavaSymbolFactory.cpp

```cpp
/*****************************************************************//**
 * \file   JavaSymbolFactory.cpp
 * \brief  A factory for creating java variables and types
 * \author Simon
 * \date   Dezember 2025
 *********************************************************************/
#include "JavaSymbolFactory.hpp"
#include "JavaType.hpp"
#include "JavaVariable.hpp"


Variable::Uptr JavaSymbolFactory::CreateVariable(const std::string& name)
{
    return std::make_unique<JavaVariable>( name );
}

Type::Uptr JavaSymbolFactory::CreateType(const std::string& name)
{
    return std::make_unique<JavaType>(name);
}

const std::string& JavaSymbolFactory::GetTypeFileName()
{
    return m_TypeFileName;
}

const std::string& JavaSymbolFactory::GetVariableFileName()
{
    return m_VariableFileName;
}
```

6.16 IECVariable.hpp

```
/*****************************************************************//**
 * \file   IECVariable.hpp
 * \brief  A Class for parsing IEC variables
 * \author Simon Vogelhuber
 * \date   Dezember 2025
 *********************************************************************/

#ifndef IEC_VARIABLE_HPP
#define IEC_VARIABLE_HPP

#include "Variable.hpp"

class IECVariable : public Variable
{
public:
    virtual std::string GetSaveLine() const override;

    /**
     * \brief Loads the name of a variables type
     *
     * \param string fileLine
     * \return string of type - SymbolParser has to check type for validity
     */
    virtual std::string LoadTypeName(std::string const& fileLine) const override;

    /**
     * \brief Loads name of a variable
     *
     * \param string fileLine
     * \return string of variables name
     */
    virtual std::string LoadVarName(std::string const& fileLine) const override;

    IECVariable() = default;

    IECVariable(const std::string& name) : Variable{ name } {}

protected:
private:
};
#endif
```

6.17 IECVariable.cpp

```
/*****************************************************************//**
 * \file   IECVariable.cpp
 * \brief  A Class for parsing IEC variables
 * \author Simon Vogelhuber
 * \date   Dezember 2025
 *********************************************************************/

#include "IECVariable.hpp"
#include <sstream>
#include <string>
#include <iostream>
#include "scanner.h"

using namespace pfc;
using namespace std;

std::string IECVariable::GetSaveLine() const
{
	if (m_type == nullptr) return "";

	return  "VAR " + m_type->GetName() + " : " + m_name + ";\n";
}

/**
 * \brief Scans an input string for the Type name of the Var.
 *
 * \param scan Reference to scanner object
 * \return emtpy string if no valid type name is found
 * \return name of type
 */
static std::string ScanTypeName(scanner & scan) {
	string TypeName;

	if (scan.get_identifier() == "VAR") {
		scan.next_symbol();
		TypeName = scan.get_identifier();
		scan.next_symbol();
		return TypeName;
	}

	return "";
}

/**
 * \brief Scans an input string for the Variable name of the Var.
 *
 * \param scan Reference to scanner object
 * \return emtpy string if no valid Variable name is found
 * \return name of Variable
 */
static std::string ScanVarName(scanner & scan) {
	string VarName;

	if (scan.is(':')) {
		scan.next_symbol();
		VarName = scan.get_identifier();
		scan.next_symbol();
		if (!scan.is(';')) {
			VarName = "";
		}
	}

	return VarName;
}


std::string IECVariable::LoadTypeName(std::string const& fileLine) const
{
	stringstream converter;
	converter << fileLine;
	scanner Scan;

```

```
73          Scan.set_istream(converter);
74
75          return ScanTypeName(Scan);
76  }
77
78  std::string IECVariable::LoadVarName(std::string const& fileLine) const
79  {
80          stringstream converter;
81          converter << fileLine;
82          scanner Scan;
83
84          Scan.set_istream(converter);
85
86          string Typename = ScanTypeName(Scan);
87          string VarName = ScanVarName(Scan);
88
89          if (Typename.empty()) VarName = "";
90
91          return VarName;
92  }
```

6.18 IECSymbolFactory.hpp

```cpp
/*****************************************************************//**
 * \file   IECSymbolFactory.hpp
 * \brief  A factory for creating IEC variables and types
 * \author Simon
 * \date   Dezember 2025
 *********************************************************************/
#ifndef IEC_SYMBOL_FACTORY_HPP
#define IEC_SYMBOL_FACTORY_HPP

#include "Object.h"
#include "ISymbolFactory.hpp"
#include "SingetonBase.hpp"

class IECSymbolFactory : public ISymbolFactory , public SingletonBase<IECSymbolFactory>
{
public:

        // This class is a Singleton
        friend class SingletonBase<IECSymbolFactory>;

        /**
         * \brief Creates a IEC variable
         *
         * \param string of variables name
         * \return uniqie pointer to variable
         */
        virtual Variable::Uptr CreateVariable(const std::string& name) override;

        /**
         * \brief Creates a IEC type
         *
         * \param string of typename
         * \return unique pointer to type
         */
        virtual Type::Uptr CreateType(const std::string& name) override;

        /**
         * \brief Getter for file path of type file
         *
         * \return string of filePath
         */
        virtual const std::string& GetTypeFileName() override;

        /**
         * \brief Getter for file path of variable file
         *
         * \return string of filePath
         */
        virtual const std::string& GetVariableFileName() override;

        // delete CopyCtor and Assign operator to prevent untestet behaviour
        IECSymbolFactory(IECSymbolFactory& fact) = delete;
        void operator=(IECSymbolFactory fact) = delete;

protected:
private:
        IECSymbolFactory() = default;

        const std::string m_TypeFileName = "IECTypes.sym";
        const std::string m_VariableFileName  =  "IECVars.sym";
};

#endif
```

6.19 IECSymbolFactory.cpp

```cpp
/*****************************************************************//**
 * \file   IECSymbolFactory.cpp
 * \brief  A factory for creating IEC variables and types
 * \author Simon
 * \date   Dezember 2025
 *********************************************************************/

#include "IECSymbolFactory.hpp"
#include "IECType.hpp"
#include "IECVariable.hpp"


Variable::Uptr IECSymbolFactory::CreateVariable(const std::string& name)
{
    return std::make_unique<IECVariable>(name);
}

Type::Uptr IECSymbolFactory::CreateType(const std::string& name)
{
    return std::make_unique<IECType>(name);
}

const std::string& IECSymbolFactory::GetTypeFileName()
{
    return m_TypeFileName;
}

const std::string& IECSymbolFactory::GetVariableFileName()
{
    return m_VariableFileName;
}
```

6.20 main.cpp

```
/*****************************************************************//**
 * \file   Main.cpp
 * \brief  Testdriver for Symbol Parser and all connected Classes
 * \author Simon
 * \date   November 2025
 *********************************************************************/

// These Includes are needed because of the testcases !!
#include "IECVariable.hpp"
#include "JavaVariable.hpp"
#include "IECType.hpp"
#include "JavaType.hpp"

// These are the Includes if the Symbolparses is used by a Client!!
#include "SymbolParser.hpp"
#include "JavaSymbolFactory.hpp"
#include "IECSymbolFactory.hpp"
#include "Client.hpp"

// Testing Includes
#include "Test.hpp"
#include "vld.h"
#include <fstream>
#include <iostream>
#include <cassert>

#include <cstdio>

using namespace std;

#define WriteOutputFile ON

static bool TestVariable(Variable* var, const string & name, Type::Sptr typ, ostream & ost = cout);
static bool TestType(Type::Sptr typ, ostream & ost = cout);
static bool TestIECVar(ostream& ost = cout);
static bool TestJavaVar(ostream& ost = cout);
static bool TestIECType(ostream& ost = cout);
static bool TestJavaType(ostream& ost = cout);



static void EraseFile(const char* path) {
    // Versucht, die Datei zu loeschen
    if (std::remove(path) == 0) {
        // Datei wurde erfolgreich geloescht
        std::printf("Datei '%s' erfolgreich geloescht.\n", path);
    }
    else {
        // Fehler beim Loeschen der Datei
        std::perror("Fehler beim Loeschen der Datei");
    }
}

int main()
{
    // Erase previos Symbol files for test cases
    EraseFile("IECTypes.sym");
    EraseFile("IECVars.sym");
    EraseFile("JavaTypes.sym");
    EraseFile("JavaVars.sym");


    bool TestOK = true;

    Type::Sptr Itype{make_shared<IECType>( IECType{ "int" } )};

    Type::Sptr Jtyp{make_shared<JavaType>(JavaType{ "int" } )};

    IECVariable IECVar{ "asdf" };
    IECVar.SetType(Itype);

    JavaVariable JavaVar{ "jklm" };
```

```
73      JavaVar.SetType(Jtyp);
74
75      cout << "\n␣\n****␣Test␣IEC␣Var␣Getter␣****\n␣\n␣";
76      TestOK = TestOK && TestVariable(&IECVar, "asdf", Itype);
77
78      cout << "\n␣\n****␣Test␣Java␣Var␣Getter␣****\n␣\n␣";
79      TestOK = TestOK && TestVariable(&JavaVar, "jklm",Jtyp);
80
81      cout << "\n␣\n****␣Test␣IEC␣Type␣Getter␣****\n␣\n␣";
82      TestOK = TestOK && TestType(Itype);
83
84      cout << "\n␣\n****␣Test␣Java␣Type␣Getter␣****\n␣\n␣";
85      TestOK = TestOK && TestType(Jtyp);
86
87      TestOK = TestOK && TestIECVar();
88
89      TestOK = TestOK && TestJavaVar();
90
91      TestOK = TestOK && TestIECType();
92
93      TestOK = TestOK && TestJavaType();
94
95      TestOK = TestOK && TestSymbolParser();
96
97      if (WriteOutputFile) {
98
99          // Erase previos Symbol files for test cases
100         EraseFile("IECTypes.sym");
101         EraseFile("IECVars.sym");
102         EraseFile("JavaTypes.sym");
103         EraseFile("JavaVars.sym");
104
105         ofstream output{ "output.txt" };
106
107         Type::Sptr Itype1{ make_shared<IECType>(IECType{ "int" }) };
108
109         Type::Sptr Jtyp1{ make_shared<JavaType>(JavaType{ "int" }) };
110
111         IECVariable IECVar1{ "asdf" };
112         IECVar1.SetType(Itype1);
113
114         JavaVariable JavaVar1{ "jklm" };
115         JavaVar1.SetType(Jtyp1);
116
117         output << TestStart;
118
119         output << "\n␣\n****␣Test␣IEC␣Var␣Getter␣****\n␣\n␣";
120         TestOK = TestOK && TestVariable(&IECVar1, "asdf", Itype1,output);
121
122         output << "\n␣\n****␣Test␣Java␣Var␣Getter␣****\n␣\n␣";
123         TestOK = TestOK && TestVariable(&JavaVar1, "jklm", Jtyp1, output);
124
125         output << "\n␣\n****␣Test␣IEC␣Type␣Getter␣****\n␣\n␣";
126         TestOK = TestOK && TestType(Itype1, output);
127
128         output << "\n␣\n****␣Test␣Java␣Type␣Getter␣****\n␣\n␣";
129         TestOK = TestOK && TestType(Jtyp1, output);
130
131         TestOK = TestOK && TestIECVar(output);
132
133         TestOK = TestOK && TestJavaVar(output);
134
135         TestOK = TestOK && TestIECType(output);
136
137         TestOK = TestOK && TestJavaType(output);
138
139         TestOK = TestOK && TestSymbolParser(output);
140
141         if (TestOK) {
142             output << TestCaseOK;
143         }
144         else {
145             output << TestCaseFail;
146         }
147
```

```
148         output.close();
149     }
150 
151     if (TestOK) {
152         cout << TestCaseOK;
153     }
154     else {
155         cout << TestCaseFail;
156     }
157 
158     return 0;
159 }
160 
161 bool TestVariable(Variable* var, const string& name, Type::Sptr typ, ostream& ost)
162 {
163     assert(ost.good());
164     assert(var != nullptr);
165     assert(typ != nullptr);
166 
167     ost << TestStart;
168 
169     bool TestOK = true;
170     string error_msg;
171 
172     try {
173 
174         TestOK = TestOK && check_dump(ost, "Test␣Variable␣Get␣Name", name, var->GetName());
175         TestOK = TestOK && check_dump(ost, "Test␣Variable␣Get␣Type", typ->GetName(), var->GetTypeName()
                ());
176 
177         const string var_name = "uint_fast_256_t";
178 
179         var->SetName(var_name);
180 
181         TestOK = TestOK && check_dump(ost, "Test␣Variable␣Set␣Name", var_name, var->GetName());
182 
183     }
184     catch (const string& err) {
185         error_msg = err;
186     }
187     catch (bad_alloc const& error) {
188         error_msg = error.what();
189     }
190     catch (const exception& err) {
191         error_msg = err.what();
192     }
193     catch (...) {
194         error_msg = "Unhandelt␣Exception";
195     }
196 
197     TestOK = TestOK && check_dump(ost, "Check␣for␣Exception␣in␣Testcase", true, error_msg.empty());
198     error_msg.clear();
199 
200 
201     try {
202         var->SetName("");
203     }
204     catch (const string& err) {
205         error_msg = err;
206     }
207     catch (bad_alloc const& error) {
208         error_msg = error.what();
209     }
210     catch (const exception& err) {
211         error_msg = err.what();
212     }
213     catch (...) {
214         error_msg = "Unhandelt␣Exception";
215     }
216 
217     TestOK = TestOK && check_dump(ost, "Test␣Exception␣in␣Set␣Name", Variable::ERROR_EMPTY_STRING,
            error_msg);
218     error_msg.clear();
219 
220     try {
```

```
221         var->SetType(nullptr);
222     }
223     catch (const string& err) {
224         error_msg = err;
225     }
226     catch (bad_alloc const& error) {
227         error_msg = error.what();
228     }
229     catch (const exception& err) {
230         error_msg = err.what();
231     }
232     catch (...) {
233         error_msg = "Unhandelt Exception";
234     }
235 
236     TestOK = TestOK && check_dump(ost, "Test Exception in Set Type with nullptr", Variable::
            ERROR_NULLPTR, error_msg);
237     error_msg.clear();
238 
239 
240     try {
241         TestOK = TestOK && check_dump(ost, "Test Variable Get Type after set with nullptr", typ->
                GetName(), var->GetTypeName());
242 
243         typ->SetName("uint_fast512_t");
244         var->SetType(typ);
245 
246         TestOK = TestOK && check_dump(ost, "Test Variable Get Type after set", typ->GetName(), var->
                GetTypeName());
247 
248     }
249     catch (const string& err) {
250         error_msg = err;
251     }
252     catch (bad_alloc const& error) {
253         error_msg = error.what();
254     }
255     catch (const exception& err) {
256         error_msg = err.what();
257     }
258     catch (...) {
259         error_msg = "Unhandelt Exception";
260     }
261 
262     TestOK = TestOK && check_dump(ost, "Test for Exception in TestCase", true, error_msg.empty());
263     error_msg.clear();
264 
265     ost << TestEnd;
266 
267     return TestOK;
268 }
269 
270 bool TestType(Type::Sptr typ, ostream& ost)
271 {
272     assert(ost.good());
273     assert(typ != nullptr);
274 
275     ost << TestStart;
276 
277     bool TestOK = true;
278     string error_msg;
279 
280     try {
281         typ->SetName("unit_1024_t");
282         TestOK = TestOK && check_dump(ost, "Test Type Get Name after Set", static_cast<string>("
                unit_1024_t"), typ->GetName());
283     }
284     catch (const string& err) {
285         error_msg = err;
286     }
287     catch (bad_alloc const& error) {
288         error_msg = error.what();
289     }
290     catch (const exception& err) {
291         error_msg = err.what();
```

```
292     }
293     catch (...) {
294         error_msg = "Unhandelt Exception";
295     }
296 
297     TestOK = TestOK && check_dump(ost, "Test Exception in Set Type", true , error_msg.empty());
298     error_msg.clear();
299 
300 
301 
302     try {
303         typ->SetName("");
304     }
305     catch (const string& err) {
306         error_msg = err;
307     }
308     catch (bad_alloc const& error) {
309         error_msg = error.what();
310     }
311     catch (const exception& err) {
312         error_msg = err.what();
313     }
314     catch (...) {
315         error_msg = "Unhandelt Exception";
316     }
317 
318     TestOK = TestOK && check_dump(ost, "Test Exception in Set Type", Type::ERROR_EMPTY_STRING,
            error_msg);
319     error_msg.clear();
320 
321     ost << TestEnd;
322 
323     return TestOK;
324 }
325 
326 bool TestIECVar(ostream& ost)
327 {
328     assert(ost.good());
329 
330     ost << TestStart;
331 
332 
333     bool TestOK = true;
334     string error_msg;
335 
336     try {
337 
338         IECVariable var;
339 
340         const string LineToDecode = "VAR mCont : SpeedController;\n";
341         TestOK == TestOK && check_dump(ost,"Test Load Type Name IEC Var",static_cast<string>("mCont"),
              var.LoadTypeName(LineToDecode));
342         TestOK == TestOK && check_dump(ost,"Test Load Var Name IEC Var",static_cast<string>("
              SpeedController"), var.LoadVarName(LineToDecode));
343 
344         const string InvLineToDecode = "1VAR mCont : SpeedController;";
345         TestOK == TestOK && check_dump(ost,"Test Load Type Name IEC Var invalid Format",static_cast<
              string>(""), var.LoadTypeName(InvLineToDecode));
346         TestOK == TestOK && check_dump(ost,"Test Load Var Name IEC Var invalid Format",static_cast<
              string>(""), var.LoadVarName(InvLineToDecode));
347 
348         const string Inv2LineToDecode = "VAR mCont : SpeedController";
349         TestOK == TestOK && check_dump(ost,"Test Load Type Name IEC Var invalid Format",static_cast<
              string>("mCont"), var.LoadTypeName(Inv2LineToDecode));
350         TestOK == TestOK && check_dump(ost,"Test Load Var Name IEC Var invalid Format",static_cast<
              string>(""), var.LoadVarName(Inv2LineToDecode));
351 
352         const string Inv3LineToDecode = "Var mCont : SpeedController;";
353         TestOK == TestOK && check_dump(ost,"Test Load Type Name IEC Var invalid Format",static_cast<
              string>(""), var.LoadTypeName(Inv3LineToDecode));
354         TestOK == TestOK && check_dump(ost,"Test Load Var Name IEC Var invalid Format",static_cast<
              string>(""), var.LoadVarName(Inv3LineToDecode));
355 
356         const string Inv4LineToDecode = "VAR mCont : 12343;";
```

```
357         TestOK == TestOK && check_dump(ost,"Test␣Load␣Type␣Name␣IEC␣Var␣invalid␣Format",static_cast<
                string>("mCont"), var.LoadTypeName(Inv4LineToDecode));
358         TestOK == TestOK && check_dump(ost,"Test␣Load␣Var␣Name␣IEC␣Var␣invalid␣Format",static_cast<
                string>(""), var.LoadVarName(Inv4LineToDecode));
359
360         const string Inv5LineToDecode = "VAR␣123␣:␣a12343;";
361         TestOK == TestOK && check_dump(ost,"Test␣Load␣Type␣Name␣IEC␣Var␣invalid␣Format",static_cast<
                string>(""), var.LoadTypeName(Inv5LineToDecode));
362         TestOK == TestOK && check_dump(ost,"Test␣Load␣Var␣Name␣IEC␣Var␣invalid␣Format",static_cast<
                string>(""), var.LoadVarName(Inv5LineToDecode));
363
364         const string Inv6LineToDecode = "";
365         TestOK == TestOK && check_dump(ost,"Test␣Load␣Type␣Name␣IEC␣Var␣invalid␣Format",static_cast<
                string>(""), var.LoadTypeName(Inv6LineToDecode));
366         TestOK == TestOK && check_dump(ost,"Test␣Load␣Var␣Name␣IEC␣Var␣invalid␣Format",static_cast<
                string>(""), var.LoadVarName(Inv6LineToDecode));
367
368         Type::Sptr IECTyp = make_shared<IECType>( IECType{} );
369         var.SetName(var.LoadVarName(LineToDecode));
370         IECTyp->SetName(var.LoadTypeName(LineToDecode));
371         var.SetType(IECTyp);
372
373         TestOK == TestOK && check_dump(ost, "Test␣Save␣LineFormat␣IEC␣Variable", LineToDecode, var.
                GetSaveLine());
374
375         IECVariable IVar;
376
377         TestOK == TestOK && check_dump(ost, "Test␣Save␣LineFormat␣IEC␣Variable", static_cast<string>(""
                ), IVar.GetSaveLine());
378
379     }
380     catch (const string& err) {
381         error_msg = err;
382     }
383     catch (bad_alloc const& error) {
384         error_msg = error.what();
385     }
386     catch (const exception& err) {
387         error_msg = err.what();
388     }
389     catch (...) {
390         error_msg = "Unhandelt␣Exception";
391     }
392
393     TestOK = TestOK && check_dump(ost, "Test␣for␣Exception␣in␣TestCase", true, error_msg.empty());
394     error_msg.clear();
395
396     ost << TestEnd;
397
398     return TestOK;
399 }
400
401 bool TestJavaVar(ostream& ost)
402 {
403     assert(ost.good());
404
405     ost << TestStart;
406
407
408     bool TestOK = true;
409     string error_msg;
410
411     try {
412
413         JavaVariable var;
414
415         const string LineToDecode = "mCont␣mBut;\n";
416         TestOK == TestOK && check_dump(ost,"Test␣Load␣Type␣Name␣Java␣Var",static_cast<string>("mCont"),
                var.LoadTypeName(LineToDecode));
417         TestOK == TestOK && check_dump(ost,"Test␣Load␣Var␣Name␣Java␣Var",static_cast<string>("mBut"),
                var.LoadVarName(LineToDecode));
418
419         const string InvLineToDecode = "1mCont␣mBut;";
420         TestOK == TestOK && check_dump(ost,"Test␣Load␣Type␣Name␣Java␣Var␣invalid␣Format",static_cast<
                string>(""), var.LoadTypeName(InvLineToDecode));
```

```
421         TestOK == TestOK && check_dump(ost,"Test␣Load␣Var␣Name␣Java␣Var␣invalid␣Format",static_cast<
                string>(""), var.LoadVarName(InvLineToDecode));
422
423         const string Inv2LineToDecode = "mCont␣;mBut;";
424         TestOK == TestOK && check_dump(ost,"Test␣Load␣Type␣Name␣Java␣Var␣invalid␣Format",static_cast<
                string>("mCont"), var.LoadTypeName(Inv2LineToDecode));
425         TestOK == TestOK && check_dump(ost,"Test␣Load␣Var␣Name␣Java␣Var␣invalid␣Format",static_cast<
                string>(""), var.LoadVarName(Inv2LineToDecode));
426
427         const string Inv3LineToDecode = "2mCont␣mBut;";
428         TestOK == TestOK && check_dump(ost,"Test␣Load␣Type␣Name␣Java␣Var␣invalid␣Format",static_cast<
                string>(""), var.LoadTypeName(Inv3LineToDecode));
429         TestOK == TestOK && check_dump(ost,"Test␣Load␣Var␣Name␣Java␣Var␣invalid␣Format",static_cast<
                string>(""), var.LoadVarName(Inv3LineToDecode));
430
431         const string Inv4LineToDecode = "mCont␣123;";
432         TestOK == TestOK && check_dump(ost,"Test␣Load␣Type␣Name␣Java␣Var␣invalid␣Format",static_cast<
                string>("mCont"), var.LoadTypeName(Inv4LineToDecode));
433         TestOK == TestOK && check_dump(ost,"Test␣Load␣Var␣Name␣Java␣Var␣invalid␣Format",static_cast<
                string>(""), var.LoadVarName(Inv4LineToDecode));
434
435         const string Inv5LineToDecode = "123␣:␣a12343;";
436         TestOK == TestOK && check_dump(ost,"Test␣Load␣Type␣Name␣Java␣Var␣invalid␣Format",static_cast<
                string>(""), var.LoadTypeName(Inv5LineToDecode));
437         TestOK == TestOK && check_dump(ost,"Test␣Load␣Var␣Name␣Java␣Var␣invalid␣Format",static_cast<
                string>(""), var.LoadVarName(Inv5LineToDecode));
438
439         const string Inv6LineToDecode = "";
440         TestOK == TestOK && check_dump(ost,"Test␣Load␣Type␣Name␣Java␣Var␣invalid␣Format",static_cast<
                string>(""), var.LoadTypeName(Inv6LineToDecode));
441         TestOK == TestOK && check_dump(ost,"Test␣Load␣Var␣Name␣Java␣Var␣invalid␣Format",static_cast<
                string>(""), var.LoadVarName(Inv6LineToDecode));
442
443         Type::Sptr JTyp = make_shared<JavaType>(JavaType{});
444         var.SetName(var.LoadVarName(LineToDecode));
445         JTyp->SetName(var.LoadTypeName(LineToDecode));
446         var.SetType(JTyp);
447
448         TestOK == TestOK && check_dump(ost, "Test␣Save␣LineFormat␣IEC␣Variable", LineToDecode, var.
                GetSaveLine());
449
450         JavaVariable JVar;
451
452         TestOK == TestOK && check_dump(ost, "Test␣Save␣LineFormat␣IEC␣Variable", static_cast<string>(""
                ), JVar.GetSaveLine());
453     }
454     catch (const string& err) {
455         error_msg = err;
456     }
457     catch (bad_alloc const& error) {
458         error_msg = error.what();
459     }
460     catch (const exception& err) {
461         error_msg = err.what();
462     }
463     catch (...) {
464         error_msg = "Unhandelt␣Exception";
465     }
466
467     TestOK = TestOK && check_dump(ost, "Test␣for␣Exception␣in␣TestCase", true, error_msg.empty());
468     error_msg.clear();
469
470     ost << TestEnd;
471
472     return TestOK;
473 }
474
475 bool TestIECType(ostream& ost)
476 {
477     assert(ost.good());
478
479     ost << TestStart;
480
481
482     bool TestOK = true;
```

```
483     string error_msg;
484
485     try{
486         IECType typ;
487
488         const string LineToDecode = "TYPE␣SpeedController\n";
489         TestOK == TestOK && check_dump(ost, "Test␣Load␣Type␣Name␣IEC␣Type", static_cast<string>("
                SpeedController"), typ.LoadTypeName(LineToDecode));
490
491         const string InvLineToDecode = "1TYPE␣SpeedController";
492         TestOK == TestOK && check_dump(ost, "Test␣Load␣Type␣Name␣IEC␣Type␣invalid␣Format", static_cast<
                string>(""), typ.LoadTypeName(InvLineToDecode));
493
494         const string Inv2LineToDecode = "TYPE␣1SpeedController";
495         TestOK == TestOK && check_dump(ost, "Test␣Load␣Type␣Name␣IEC␣Type␣invalid␣Format", static_cast<
                string>(""), typ.LoadTypeName(Inv2LineToDecode));
496
497         const string Inv3LineToDecode = "TYPE␣S2peedController";
498         TestOK == TestOK && check_dump(ost, "Test␣Load␣Type␣Name␣IEC␣Type␣invalid␣Format", static_cast<
                string>("S2peedController"), typ.LoadTypeName(Inv3LineToDecode));
499
500         const string Inv4LineToDecode = "TYPE␣SpeedController;";
501         TestOK == TestOK && check_dump(ost, "Test␣Load␣Type␣Name␣IEC␣Type␣invalid␣Format", static_cast<
                string>(""), typ.LoadTypeName(Inv4LineToDecode));
502
503         const string Inv6LineToDecode = "";
504         TestOK == TestOK && check_dump(ost, "Test␣Load␣Type␣Name␣IEC␣Type␣invalid␣Format", static_cast<
                string>(""), typ.LoadTypeName(Inv6LineToDecode));
505
506         typ.SetName(typ.LoadTypeName(LineToDecode));
507
508         TestOK == TestOK && check_dump(ost, "Test␣Save␣LineFormat␣IEC␣Type", LineToDecode, typ.
                GetSaveLine());
509
510     }
511     catch (const string& err) {
512         error_msg = err;
513     }
514     catch (bad_alloc const& error) {
515         error_msg = error.what();
516     }
517     catch (const exception& err) {
518         error_msg = err.what();
519     }
520     catch (...) {
521         error_msg = "Unhandelt␣Exception";
522     }
523
524     TestOK = TestOK && check_dump(ost, "Test␣for␣Exception␣in␣TestCase", true, error_msg.empty());
525     error_msg.clear();
526
527     ost << TestEnd;
528
529     return TestOK;
530 }
531
532 bool TestJavaType(ostream& ost)
533 {
534     assert(ost.good());
535
536     ost << TestStart;
537
538
539     bool TestOK = true;
540     string error_msg;
541
542     try{
543
544         JavaType typ;
545
546         const string LineToDecode = "class␣SpeedController\n";
547         TestOK == TestOK && check_dump(ost, "Test␣Load␣Type␣Name␣Java␣Type", static_cast<string>("
                SpeedController"), typ.LoadTypeName(LineToDecode));
548
549         const string InvLineToDecode = "1class␣SpeedController";
```

```
550         TestOK == TestOK && check_dump(ost, "Test␣Load␣Type␣Name␣Java␣Type␣invalid␣Format", static_cast
                <string>(""), typ.LoadTypeName(InvLineToDecode));
551
552         const string Inv2LineToDecode = "class␣1SpeedController";
553         TestOK == TestOK && check_dump(ost, "Test␣Load␣Type␣Name␣Java␣Type␣invalid␣Format", static_cast
                <string>(""), typ.LoadTypeName(Inv2LineToDecode));
554
555         const string Inv3LineToDecode = "class␣S2peedController";
556         TestOK == TestOK && check_dump(ost, "Test␣Load␣Type␣Name␣Java␣Type␣invalid␣Format", static_cast
                <string>("S2peedController"), typ.LoadTypeName(Inv3LineToDecode));
557
558         const string Inv4LineToDecode = "class␣SpeedController;";
559         TestOK == TestOK && check_dump(ost, "Test␣Load␣Type␣Name␣Java␣Type␣invalid␣Format", static_cast
                <string>(""), typ.LoadTypeName(Inv4LineToDecode));
560
561         const string Inv6LineToDecode = "";
562         TestOK == TestOK && check_dump(ost, "Test␣Load␣Type␣Name␣Java␣Type␣invalid␣Format", static_cast
                <string>(""), typ.LoadTypeName(Inv6LineToDecode));
563
564         typ.SetName(typ.LoadTypeName(LineToDecode));
565
566         TestOK == TestOK && check_dump(ost, "Test␣Save␣LineFormat␣Java␣Type", LineToDecode, typ.
                GetSaveLine());
567
568     }
569     catch (const string& err) {
570         error_msg = err;
571     }
572     catch (bad_alloc const& error) {
573         error_msg = error.what();
574     }
575     catch (const exception& err) {
576         error_msg = err.what();
577     }
578     catch (...) {
579         error_msg = "Unhandelt␣Exception";
580     }
581
582     TestOK = TestOK && check_dump(ost, "Test␣for␣Exception␣in␣TestCase", true, error_msg.empty());
583     error_msg.clear();
584
585     ost << TestEnd;
586
587     return TestOK;
588 }
```

6.21 Client.hpp

```
1  /*****************************************************************//**
2   * \file   Client.hpp
3   * \brief  Test File to show that you only need to include Symbol Parser
4   * \brief  plus factories to work with the parser!
5   *
6   * \author Simon
7   * \date   November 2025
8   *********************************************************************/
9
10 #ifndef CLIENT_HPP
11 #define CLIENT_HPP
12
13 #include <iostream>
14
15 bool TestSymbolParser(std::ostream& ost = std::cout);
16
17 #endif // !1
```

6.22 Client.cpp

```cpp
/*****************************************************************//**
 * \file   Client.cpp
 * \brief  Test File to show that you only need to include Symbol Parser
 * \brief  plus factories to work with the parser!
 *
 * \author Simon
 * \date   November 2025
 *********************************************************************/


#include "SymbolParser.hpp"
#include "JavaSymbolFactory.hpp"
#include "IECSymbolFactory.hpp"

// Testing Includes
#include "Test.hpp"
#include <fstream>
#include <cassert>
#include "Client.hpp"

using namespace std;

bool TestSymbolParser(std::ostream& ost)
{
    bool TestOK = true;
    string error_msg;
    ost << TestStart;

    // normal operating mode - no exception should be thrown
    try {
        SymbolParser parser{ JavaSymbolFactory::GetInstance() };
        parser.AddType("Button");
        parser.AddVariable("mButton", "Button");
        parser.SetFactory(IECSymbolFactory::GetInstance());
        parser.AddType("TYPE");
        parser.AddVariable("VARIABLE", "TYPE");
        parser.SetFactory(JavaSymbolFactory::GetInstance());
        parser.AddVariable("mButton2", "Button"); // <- this is only possible if the loading of the
            vars was successful
    }
    catch (const string& err) {
        error_msg = err;
    }
    catch (bad_alloc const& error) {
        error_msg = error.what();
    }
    catch (const exception& err) {
        error_msg = err.what();
    }
    catch (...) {
        error_msg = "Unhandelt Exception";
    }

    TestOK = TestOK && check_dump(ost, "Normal Operating Parser", true, error_msg.empty());
    error_msg.clear();

    // addtype - adding empty type - throws error
    try {
        SymbolParser parser{ JavaSymbolFactory::GetInstance() };
        parser.AddType("");
    }
    catch (const string& err) {
        error_msg = err;
    }
    catch (bad_alloc const& error) {
        error_msg = error.what();
    }
    catch (const exception& err) {
        error_msg = err.what();
    }
    catch (...) {
        error_msg = "Unhandelt Exception";
```

```
72      }
73
74      TestOK = TestOK && check_dump(ost, ".AddType() - add_empty_type_to_parser", SymbolParser::
            ERROR_EMPTY_STRING, error_msg);
75      error_msg.clear();
76
77      // addVariable add empty type - throws error
78      try {
79          SymbolParser parser{ JavaSymbolFactory::GetInstance() };
80          parser.AddVariable("VarName", "");
81      }
82      catch (const string& err) {
83          error_msg = err;
84      }
85      catch (bad_alloc const& error) {
86          error_msg = error.what();
87      }
88      catch (const exception& err) {
89          error_msg = err.what();
90      }
91      catch (...) {
92          error_msg = "Unhandelt Exception";
93      }
94
95      TestOK = TestOK && check_dump(ost, ".AddVariable() - add_empty_type_to_factory", SymbolParser::
            ERROR_EMPTY_STRING, error_msg);
96      error_msg.clear();
97
98      // addVariable add empty var - throws error
99      try {
100         SymbolParser parser{ JavaSymbolFactory::GetInstance() };
101         parser.AddVariable("", "Type");
102     }
103     catch (const string& err) {
104         error_msg = err;
105     }
106     catch (bad_alloc const& error) {
107         error_msg = error.what();
108     }
109     catch (const exception& err) {
110         error_msg = err.what();
111     }
112     catch (...) {
113         error_msg = "Unhandelt Exception";
114     }
115
116     TestOK = TestOK && check_dump(ost, ".AddVariable() - add_empty_var_to_factory", SymbolParser::
            ERROR_EMPTY_STRING, error_msg);
117     error_msg.clear();
118
119     // addVariable add variable for non existing type
120     try {
121         SymbolParser parser{ JavaSymbolFactory::GetInstance() };
122         parser.AddVariable("Var", "Type");
123     }
124     catch (const string& err) {
125         error_msg = err;
126     }
127     catch (bad_alloc const& error) {
128         error_msg = error.what();
129     }
130     catch (const exception& err) {
131         error_msg = err.what();
132     }
133     catch (...) {
134         error_msg = "Unhandelt Exception";
135     }
136
137     TestOK = TestOK && check_dump(ost, ".AddVariable() - add_variable_with_nonexisting_type",
            SymbolParser::ERROR_NONEXISTING_TYPE, error_msg);
138
139
140     // addVariable add variable for non existing type
141     try {
142         SymbolParser parser{ JavaSymbolFactory::GetInstance() };
```

```
143         parser.AddType("uint65536_t");
144         parser.AddType("uint65536_t");
145     }
146     catch (const string& err) {
147         error_msg = err;
148     }
149     catch (bad_alloc const& error) {
150         error_msg = error.what();
151     }
152     catch (const exception& err) {
153         error_msg = err.what();
154     }
155     catch (...) {
156         error_msg = "Unhandelt Exception";
157     }
158
159     TestOK = TestOK && check_dump(ost, ".AddType() - add duplicate type", SymbolParser::
          ERROR_DUPLICATE_TYPE, error_msg);
160     error_msg.clear();
161
162     // addVariable add variable for non existing type
163     try {
164         SymbolParser parser{ JavaSymbolFactory::GetInstance() };
165         parser.AddType("uint4096_t");
166         parser.AddVariable("Large_int", "uint4096_t");
167         parser.AddVariable("Large_int", "uint4096_t");
168     }
169     catch (const string& err) {
170         error_msg = err;
171     }
172     catch (bad_alloc const& error) {
173         error_msg = error.what();
174     }
175     catch (const exception& err) {
176         error_msg = err.what();
177     }
178     catch (...) {
179         error_msg = "Unhandelt Exception";
180     }
181
182     TestOK = TestOK && check_dump(ost, ".AddVar() - add duplicate Var", SymbolParser::
          ERROR_DUPLICATE_VAR, error_msg);
183     error_msg.clear();
184
185
186
187     // Test Load and Store of the SymbolParser
188     try {
189         SymbolParser parser{ JavaSymbolFactory::GetInstance() };
190         parser.AddType("uint8192_t");
191         parser.AddVariable("Large_int", "uint8192_t");
192         parser.SetFactory( IECSymbolFactory::GetInstance());
193         parser.AddType("ui32");
194         parser.AddVariable("Hello", "ui32");
195         parser.SetFactory(JavaSymbolFactory::GetInstance());
196         parser.AddType("uint8192_t"); // <-- this should throw exception type already exists!!
197     }
198     catch (const string& err) {
199         error_msg = err;
200     }
201     catch (bad_alloc const& error) {
202         error_msg = error.what();
203     }
204     catch (const exception& err) {
205         error_msg = err.what();
206     }
207     catch (...) {
208         error_msg = "Unhandelt Exception";
209     }
210
211     TestOK = TestOK && check_dump(ost, "Test Store and Load Java Fact with exeption Dup Type",
          SymbolParser::ERROR_DUPLICATE_TYPE, error_msg);
212     error_msg.clear();
213
214
```

```
215     // Test Load and Store of the SymbolParser
216     try {
217
218         SymbolParser parser{ IECSymbolFactory::GetInstance() };
219
220         parser.AddType("ui32");
221
222     }
223     catch (const string& err) {
224         error_msg = err;
225     }
226     catch (bad_alloc const& error) {
227         error_msg = error.what();
228     }
229     catch (const exception& err) {
230         error_msg = err.what();
231     }
232     catch (...) {
233         error_msg = "Unhandelt␣Exception";
234     }
235
236     TestOK = TestOK && check_dump(ost, "Test␣Store␣and␣Load␣IEC␣Fact␣with␣exeption␣Dup␣Type",
            SymbolParser::ERROR_DUPLICATE_TYPE, error_msg);
237     error_msg.clear();
238
239     ost << TestEnd;
240     return TestOK;
241 }
```

6.23 Test.hpp

```
/*****************************************************************//**
 * \file   Test.hpp
 * \brief  File that provides a Test Function with a formated output
 *
 * \author Simon
 * \date   April 2025
 *********************************************************************/
#ifndef TEST_HPP
#define TEST_HPP

#include <string>
#include <iostream>
#include <vector>
#include <list>
#include <queue>
#include <forward_list>

#define ON 1
#define OFF 0
#define COLOR_OUTPUT OFF

// Definitions of colors in order to change the color of the output stream.
const std::string colorRed = "\x1B[31m";
const std::string colorGreen = "\x1B[32m";
const std::string colorWhite = "\x1B[37m";

inline std::ostream& RED(std::ostream& ost) {
        if (ost.good()) {
                ost << colorRed;
        }
        return ost;
}
inline std::ostream& GREEN(std::ostream& ost) {
        if (ost.good()) {
                ost << colorGreen;
        }
        return ost;
}
inline std::ostream& WHITE(std::ostream& ost) {
        if (ost.good()) {
                ost << colorWhite;
        }
        return ost;
}

inline std::ostream& TestStart(std::ostream& ost) {
        if (ost.good()) {
                ost << std::endl;
                ost << "****************************************" << std::endl;
                ost << "          TESTCASE START          " << std::endl;
                ost << "****************************************" << std::endl;
                ost << std::endl;
        }
        return ost;
}

inline std::ostream& TestEnd(std::ostream& ost) {
        if (ost.good()) {
                ost << std::endl;
                ost << "****************************************" << std::endl;
                ost << std::endl;
        }
        return ost;
}

inline std::ostream& TestCaseOK(std::ostream& ost) {

#if COLOR_OUTPUT
        if (ost.good()) {
                ost << colorGreen << "TEST OK!!" << colorWhite << std::endl;
        }
#else
```

```
73          if (ost.good()) {
74                  ost <<  "TEST␣OK!!" <<  std::endl;
75          }
76  #endif // COLOR_OUTPUT
77
78          return ost;
79  }
80
81  inline std::ostream& TestCaseFail(std::ostream& ost) {
82
83  #if COLOR_OUTPUT
84          if (ost.good()) {
85                  ost << colorRed << "TEST␣FAILED␣!!" << colorWhite << std::endl;
86
87          }
88  #else
89          if (ost.good()) {
90                  ost << "TEST␣FAILED␣!!" << std::endl;
91
92          }
93  #endif // COLOR_OUTPUT
94
95          return ost;
96  }
97
98  /**
99          * \brief function that reports if the testcase was successful.
100         *
101         * \param testcase       String that indicates the testcase
102         * \param succsessful true -> reports to cout test OK
103         * \param succsessful false -> reports test failed
104         */
105 template <typename T>
106 bool check_dump(std::ostream& ostr, const std::string& testcase, const T& expected, const T& result) {
107         if (ostr.good()) {
108 #if COLOR_OUTPUT
109                 if (expected == result) {
110                         ostr << testcase << std::endl <<  colorGreen << "[Test␣OK]␣" << colorWhite <<"
                                Result:␣(Expected:␣" << std::boolalpha << expected << "␣==" << "␣Result:␣"
                                 << result << ")"  << std::noboolalpha << std::endl << std::endl;
111                 }
112                 else {
113                         ostr << testcase << std::endl << colorRed << "[Test␣FAILED]␣" << colorWhite <<
                                "Result:␣(Expected:␣" << std::boolalpha << expected << "␣!=" << "␣Result:␣
                                " << result << ")"  << std::noboolalpha << std::endl << std::endl;
114                 }
115 #else
116                 if (expected == result) {
117                         ostr << testcase << std::endl << "[Test␣OK]␣"  << "Result:␣(Expected:␣" << std
                                ::boolalpha << expected << "␣==" << "␣Result:␣" << result << ")" << std::
                                noboolalpha << std::endl << std::endl;
118                 }
119                 else {
120                         ostr << testcase << std::endl  << "[Test␣FAILED]␣"  << "Result:␣(Expected:␣" <<
                                 std::boolalpha << expected << "␣!=" << "␣Result:␣" << result << ")" <<
                                std::noboolalpha << std::endl << std::endl;
121                 }
122 #endif
123                 if (ostr.fail()) {
124                         std::cerr << "Error:␣Write␣Ostream" << std::endl;
125                 }
126         }
127         else {
128                 std::cerr << "Error:␣Bad␣Ostream" << std::endl;
129         }
130         return expected == result;
131 }
132
133 template <typename T1, typename T2>
134 std::ostream& operator<< (std::ostream& ost,const std::pair<T1,T2> & p) {
135         if (!ost.good()) throw std::exception{ "Error␣bad␣Ostream!" };
136         ost << "(" << p.first << "," << p.second << ")";
137         return ost;
138 }
139
```

```
140 template <typename T>
141 std::ostream& operator<< (std::ostream& ost,const std::vector<T> & cont) {
142         if (!ost.good()) throw std::exception{ "Error␣bad␣Ostream!" };
143         std::copy(cont.cbegin(), cont.cend(), std::ostream_iterator<T>{ost, "␣"});
144         return ost;
145 }
146
147 template <typename T>
148 std::ostream& operator<< (std::ostream& ost,const std::list<T> & cont) {
149         if (!ost.good()) throw std::exception{ "Error␣bad␣Ostream!" };
150         std::copy(cont.cbegin(), cont.cend(), std::ostream_iterator<T>{ost, "␣"});
151         return ost;
152 }
153
154 template <typename T>
155 std::ostream& operator<< (std::ostream& ost,const std::deque<T> & cont) {
156         if (!ost.good()) throw std::exception{ "Error␣bad␣Ostream!" };
157         std::copy(cont.cbegin(), cont.cend(), std::ostream_iterator<T>{ost, "␣"});
158         return ost;
159 }
160
161 template <typename T>
162 std::ostream& operator<< (std::ostream& ost,const std::forward_list<T> & cont) {
163         if (!ost.good()) throw std::exception{ "Error␣bad␣Ostream!" };
164         std::copy(cont.cbegin(), cont.cend(), std::ostream_iterator<T>{ost, "␣"});
165         return ost;
166 }
167
168
169 #endif // !TEST_HPP
```