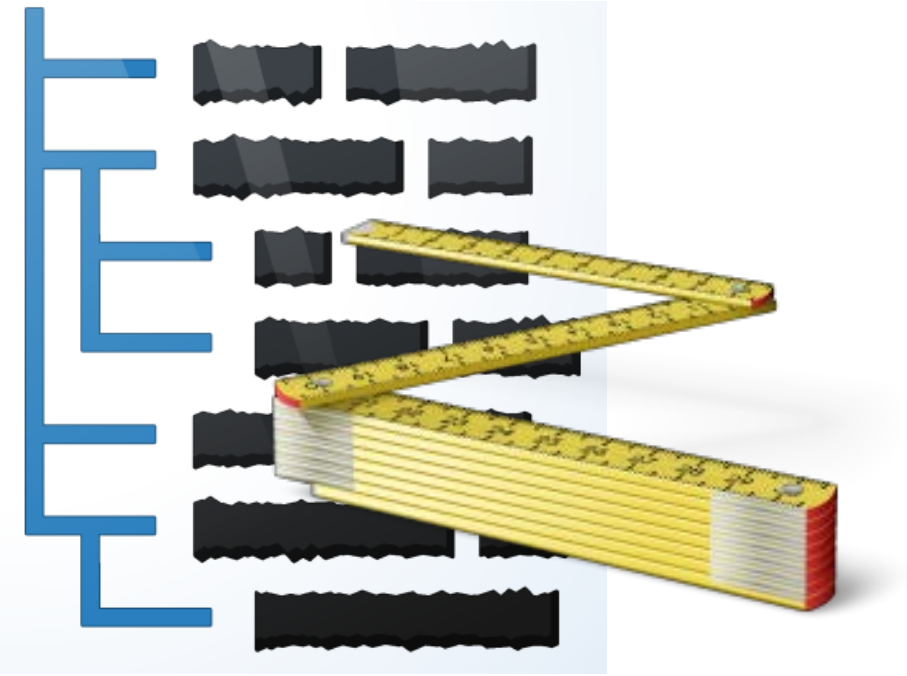
Analyzing ABL Source Code with *Proparse*



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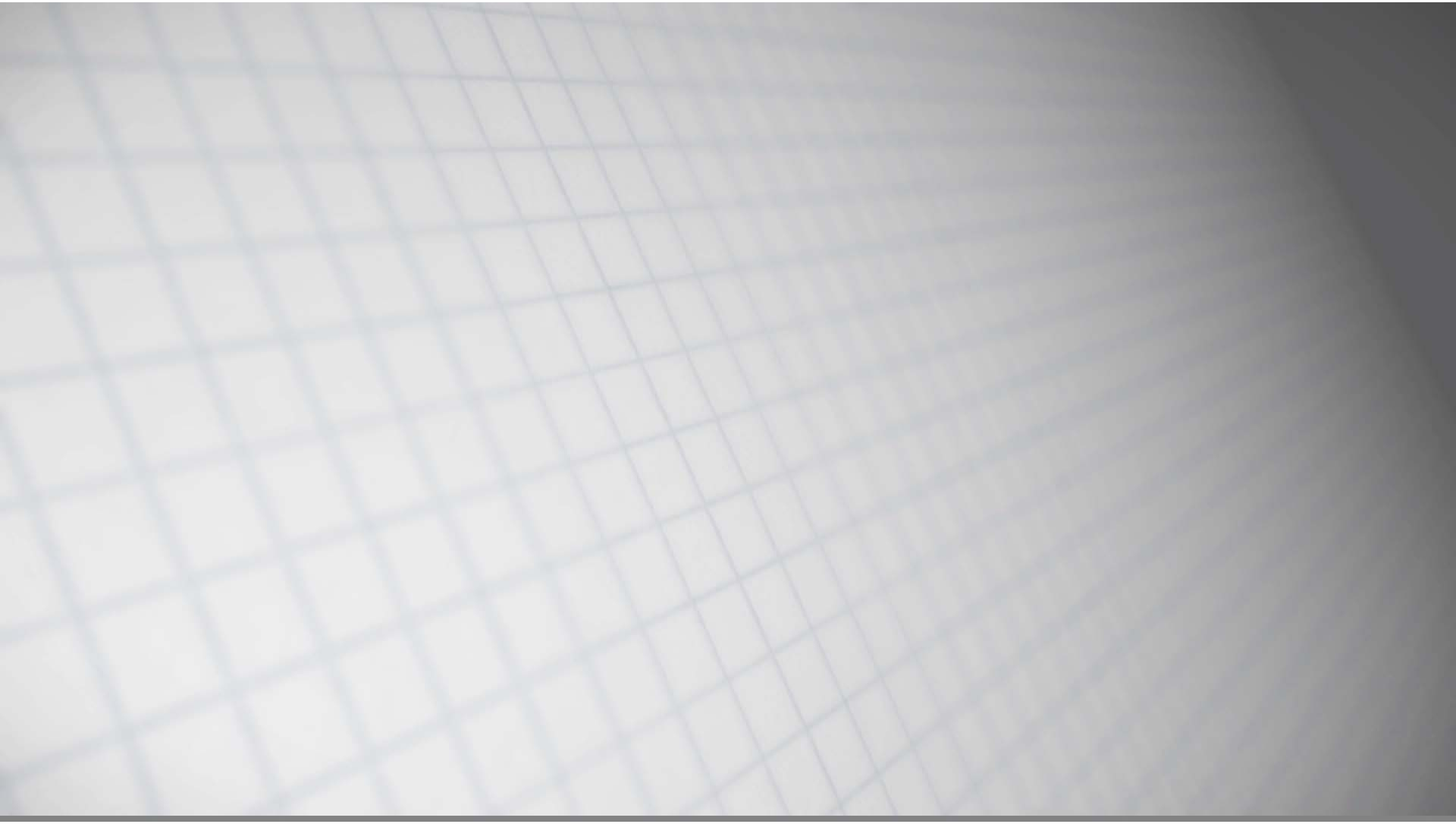

Consultingwerk Ltd.

- Independent IT consulting organization
- Focusing on **OpenEdge** and **related technology**
- Located in Cologne, Germany, subsidiary in UK
- Customers in Europe, North America, Australia and South Africa
- Vendor of tools and consulting services
- 27 years of Progress experience (V5 … OE11)
- Specialized in GUI for .NET, Angular, OO, Software Architecture, Application Integration

Sample code download

- https://github.com/mikefechner/proparse-samples
- Most sample code has no dependencies
- Some samples rely on commercial code from Consultingwerk

Agenda

- **Why Source Code Analysis**
- Proparse
- Utilities based on Proparse
- Proparse.NET
- Using Proparse from ABL
- Building and enhancing Proparse

Why Source Code Analysis?

- Quality Assurance, Linting of Code

- Refactoring, Foundation for converting code form one form to another

Linting

- Linting is the process of flagging suspicions code within a programming language
- Linting requires understanding of source code

- Extension to syntax checks
- Code may compile, but still be wrong
  - DEFINE VARIABLE without NO-UNDO
  - FIND with no NO-ERROR

Refactoring, Code conversion

- Refactoring is the process of restructuring computer code without changing its external behavior
- Refactoring requires understanding of code
- Identifying and locating relevant pieces of code
- Ignoring less relevant bits
- Provide ability to change or extract code

ABL Built in Source Code Analysis

- Compiler Output
  - Cross Reference (XREF, XML-XREF)
  - LISTING (Buffer and Transaction Scope)
  - PREPROCESS/DEBUG-LISTING
- Profiler Output
  - Tracing of executed lines of code + performance

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Proparse

- Proparse is a utility to return an ***abstract syntax tree*** for ABL code (AST)
- Static code analysis
- Interpreting the grammar of the ABL
- Knowledge about keywords and their valid combinations
- Should understand any piece of ABL code that compiles
- Providing a structured view on source code

Why an *abstract* syntax tree?

- ABL syntax “flexible”:
  - Formatting
  - Large number of keywords
  - Abbreviated keywords
  - Keyword order in statements
  - Uppercasing, lower casing, many keywords may be used as identifiers
  - Single / Double Quotes
  - Comments

Why use an abstract syntax tree

- Because analyzing ABL source code as a text file is hard!

That‘s why:

simple-1.p | simple-2.p

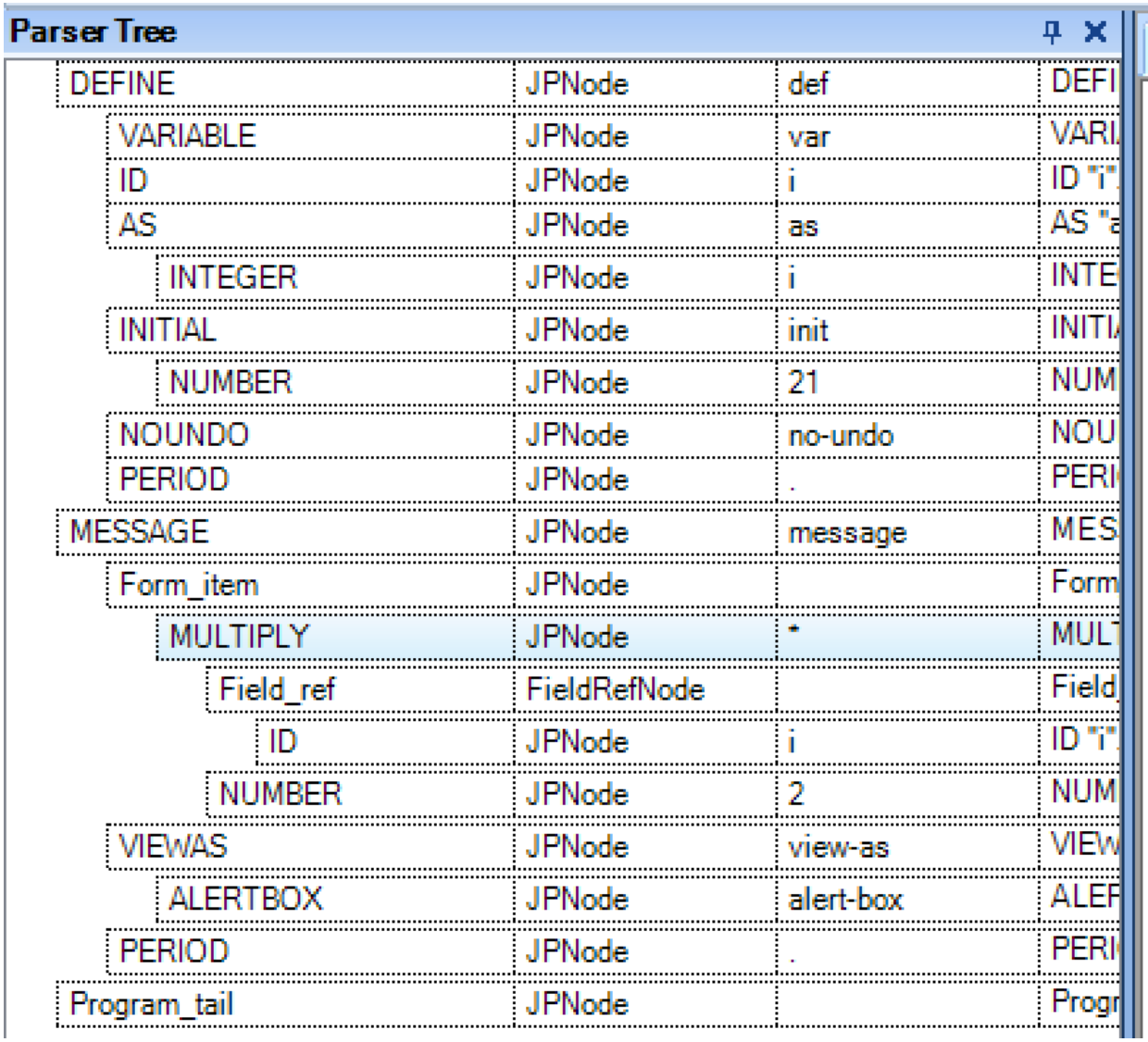
```
/*------------------------------------------------------------------------*/

/* ***************************  Definitions  ************************** */

DEFINE VARIABLE i AS INTEGER NO-UNDO INITIAL 21 .

/* ***************************  Main Block  *************************** */

MESSAGE i * 2
    VIEW-AS ALERT-BOX.
```

simple-1.p | simple-2.p

```
def var i as i init 21 no-undo. message i * 2 view-as alert-box.
```

simple-1.p | simple-2.p | simple-3.p

```
def var i as i init 21 no-undo.
message i * 2 // * 3
view-as /*alert-box*/
        alert-box.
```



simple-3.p

```
def var i as i init 21 no-undo.
message i * 2 // * 3
view-as /*alert-box*/
        alert-box.
```

Proparse

- Original Author: John Green / Joanju
- http://www.joanju.com/proparse/
- http://www.oehive.org/proparse
- Eclipse public license
- Extracts the *Abstract Syntax Tree* from a compilation unit (procedure or class)
- Is NOT a compiler, nor a Syntax Checker
  - similar requirements as the compiler to understand source code
- Based on **ANTLR**, quite an ancient version - 2.7

ANTLR

- "**An**other **T**ool for **L**anguage **R**ecognition"
- Toolkit for building language parses
- Java based
- Generated parsers are Java code
- A lot more tooling available in more recent versions of ANTLR

- If you're not maintaining Proparse, you don't need to use any of that tooling

Proparse JavaDoc

- http://www.joanju.com/analyst/javadoc/index.html
- Look for
  - org.prorefactor.core.JPNode
  - org.prorefactor.treeparser.ParseUnit

Proparse

- Multiple public repositories
  - OE Hive SVN
  - github.com/oehive/proparse
  - **github.com/consultingwerk/proparse**
  - github.com/riverside-software/proparse

- After a dormant phase a few years back, it's actively maintained again
- Support for full OpenEdge 11.7 syntax available

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Utilities based on Proparse

- Prolint
- SonarSource plug-ins for OpenEdge
- SmartComponent Library

Prolint

- http://www.oehive.org/prolint
- Tool for automated source code review of Progress 4GL code
- Reads one or more source files and examines them for bad programming practice
- Mostly procedural syntax support
- Active times around V9 and V10 …

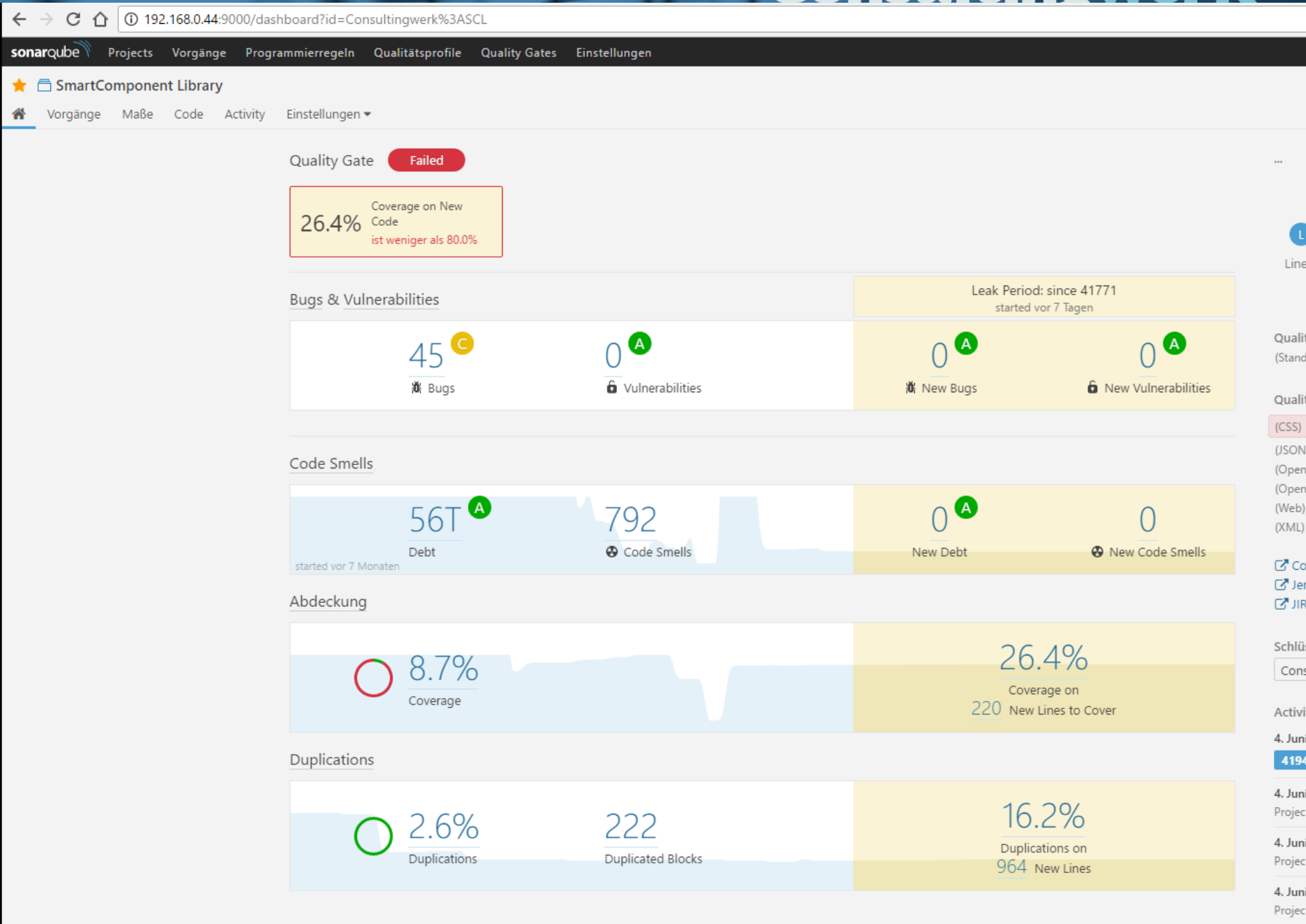
SonarQube by SonarSource

- Commonly used open source Lint Tool
- Support for various programming languages via plug-ins, Java, JavaScript, C#, HTML, XML, …
- OpenEdge plug-in developed by Riverside Software (Gilles Querret)
  - engine open source
  - rules commercial
- Available since 2016, permanently new features added

SonarQube by SonarSource

- Locates problems or potential bugs
- Violation of coding-standards
- Code duplication detection
- Unit-Test coverage

- Web-Dashboard
- CLI Utility (HTML or XML Reports)
- Eclipse Integration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sonarqube
Projects
Vorgänge
Programmierregeln
Qualitätsprofile
Quality Gates
Einstellungen
SmartComponent Library
Vorgänge
Maße
Code
Activity
Einstellungen
Quality Gate
Failed
26.4%
Coverage on New Code
ist weniger als 80.0%
Bugs & Vulnerabilities
Leak Period: since 41771
started vor 7 Tagen
45
C
Bugs
0
A
Vulnerabilities
0
A
New Bugs
0
A
New Vulnerabilities
Code Smells
56T
A
Debt
started vor 7 Monaten
792
Code Smells
0
A
New Debt
0
New Code Smells
Abdeckung
8.7%
Coverage
26.4%
Coverage on
220
New Lines to Cover
Duplications
2.6%
Duplications
222
Duplicated Blocks
16.2%
Duplications on
964
New Lines

SonarLint for Eclipse Demo

- Integration into Progress Developer Studio

```
/*------------------------------------------------------------------------
 Purpose:
 Notes:
------------------------------------------------------------------------*/
@VisualDesigner.
METHOD PRIVATE VOID button1_Click( INPUT sender AS System.Object, INPUT e AS

    DEFINE VARIABLE cTest AS CHARACTER NO-UNDO INIT "abc" .

    cTest = "def" .

    REPEAT:

    END.

END METHOD.

METHOD PRIVATE VOID InitializeComponent(  ):
```

SmartComponent Library based Tools

- Commercial ABL developer framework by Consultingwerk
- Business Entity Designer round trip development is based on Proparse
- Legacy code modernization utilities uses Proparse for analyzing legacy code

Demo

- Business Entity Designer round trip Development

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Proparse.NET

- Proparse is written in Java
- ABL has no built in bridge to Java
- ABL has a bridge to .NET
- .NET saves the day – actually, the Mono Project

IKVM.NET

- Part of the Mono Project – Open Source implementation of the .NET framework
- Java VM implemented in .NET
- Java Byte Code embedded in .NET Assembly (.dll file)
- Allows execution of Java code from .NET applications
- Since ABL can use (most) .NET Assemblies, ABL can use Proparse via IKVM.NET

Integrating Proparse.NET into OpenEdge

- Get familiar with the *GUI for .NET Programming* guide!!!
- -assemblies startup parameter
- assemblies.xml file
- Proparse.NET Assemblies available at https://github.com/consultingwerk/proparse

- Think of –assemblies like a PROPATH definition for .NET classes

assemblies.xml

```
<?xml version="1.0" encoding="UTF-8"
standalone="no"?>
<references>
   <assembly name="IKVM.OpenJDK.Core,
   Version=7.2.4630.5, Culture=neutral,
   PublicKeyToken=13235d27fcbfff58"/>
   <assembly name="IKVM.Runtime, Version=7.2.4630.5,
   Culture=neutral,
   PublicKeyToken=13235d27fcbfff58"/>
   <assembly name="proparse.net, Version=4.0.1.1166,
   Culture=neutral,
   PublicKeyToken=cda1b098b1034b24"/>
</references>
```

Codepage used by Proparse.NET

- Option in **prowin32.exe.config** / **prowin.exe.config**
- http://www.oehive.org/proparse#comment-2118
- Add **ikvm:file.encoding** property to the .config file
- File is dependent on the OpenEdge version – ***don't break it! That file is important!***
- Refer to the .NET framework documentation for details

```
<appSettings>
<add key="ikvm:file.encoding" value="ibm850" />
</appSettings>
</configuration>
```

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Using Proparse from the ABL

1. Setting up environment
2. Invoking the parser
3. Iterating the AST
4. Understanding your code

Setting up the environment for Proparse

- Similar requirements as an ABL compile time session
- PROPATH
- Database connections and schema
- SESSION settings like OPSYS, PROVERSION and WINDOW-SYSTEM that might be used in &IF

Initializing the Proparse environment

```
USING com.joanju.proparse.NodeTypes FROM ASSEMBLY .
USING org.prorefactor.core.JPNode   FROM ASSEMBLY .
USING org.prorefactor.nodetypes.*   FROM ASSEMBLY .
USING org.prorefactor.treeparser.*  FROM ASSEMBLY .
USING Progress.Lang.*               FROM PROPATH .

DEFINE VARIABLE proparseEnv    AS com.joanju.proparse.Environment
DEFINE VARIABLE proparseSchema AS org.prorefactor.core.schema.Schema
DEFINE VARIABLE prsession      AS org.prorefactor.refactor.RefactorSession
```

```
RUN ExportSessionSettings .
RUN ExportDatabaseSchema .
RUN InitializeParserSession .
```

Session Settings

```
/**
 * Purpose: Exports the ABL Session Settings
 * Notes:
 */
PROCEDURE ExportSessionSettings:

    proparseEnv = com.joanju.proparse.Environment:instance().

    /* Export ABL Session settings to Proparse */
    proparseEnv:configSet ("batch-mode":U, STRING(SESSION:BATCH-MODE, "true/false":U)).
    proparseEnv:configSet ("opsys":U, OPSYS).
    proparseEnv:configSet ("propath":U, PROPATH).
    proparseEnv:configSet ("proversion":U, PROVERSION).
    proparseEnv:configSet ("window-system":U, SESSION:WINDOW-SYSTEM).

END PROCEDURE .
```

```
/**
 * Purpose: Exports the Database Schema to Proparse
 * Notes:   Will only export the database schema to proparse when there are new
 *          databases connected or new aliases defined
 */
PROCEDURE ExportDatabaseSchema:

    DEFINE VARIABLE iAlias                  AS INTEGER        NO-UNDO .
    DEFINE VARIABLE schemaDumpFile          AS CHARACTER      NO-UNDO .

    proparseSchema = org.prorefactor.core.schema.Schema:getInstance().

    proparseSchema:clear().

    IF NUM-DBS > 0 THEN DO:
        schemaDumpFile = Consultingwerk.Util.FileHelper:GetTempFileName() .

        RUN Consultingwerk/Studio/Proparse/schemadump1.p (schemaDumpFile).

        proparseSchema:loadSchema(schemaDumpFile).

        DO iAlias = 1 TO NUM-ALIASES:
            proparseSchema:aliasCreate (ALIAS (iAlias), LDBNAME (ALIAS (iAlias))) .
        END.
    END.

    FINALLY:
        OS-DELETE VALUE (schemaDumpFile) .
    END FINALLY.

END PROCEDURE .
```

Initialize the Proparse Session

```
/**
 * Purpose: Initializes the Propase Session
 * Notes:
 */
PROCEDURE InitializeParserSession:

    org.prorefactor.refactor.RefactorSession:invalidateCurrentSettings () .

    prsession = org.prorefactor.refactor.RefactorSession:getInstance().
    prsession:setContextDirName (SESSION:TEMP-DIRECTORY) .

END PROCEDURE.
```

Invoke the Parser ☺

```
DEFINE VARIABLE javafile        AS java.io.File
DEFINE VARIABLE pu              AS org.prorefactor.treeparser.ParseUnit



/* Parse ABL source code */
javafile = NEW java.io.File ("simple-3.p").

IF (NOT javafile:exists()) THEN
    UNDO, THROW NEW AppError (SUBSTITUTE ("Could not find file: &1.",
                                          "simple-3.p"), 0) .

pu = NEW ParseUnit(javafile).
/* Invoke the actual parser */
pu:treeParser01().

DELETE OBJECT javafile .
```

Walk the Parse Unit

- Proparse represents ABL source as a tree
- Single root
- Every node may have children and siblings – depending on allowed syntax
- Class: org.prorefactor.core.JPNode
- http://www.joanju.com/analyst/javadoc/index.html?org/prorefactor/core/JPNode.html

Walk the Parse Unit

- Starting from **pu:getTopNode() // Program_Root**
- Process that JPNode instance
- Start from **:firstChild()**, iterate while :**nextSibling()** is valid

```
PROCEDURE ProcessAst:

    DEFINE INPUT PARAMETER poNode    AS JPNode  NO-UNDO .

    DEFINE VARIABLE oChild    AS JPNode    NO-UNDO .

    ASSIGN oChild = poNode:firstChild () .

    DO WHILE VALID-OBJECT (oChild):
        RUN ProcessAst (oChild) .

        oChild = oChild:nextSibling () .
    END.

END PROCEDURE.
```

JPNode properties (Java style)

- **getType()** – the actual type of the node, representing a keyword, block structure or identifier NodeTypes:getTypeName(oNode:getType())
- **getText()** – the node's piece of ABL source code
- **getColumn()**, **getLine()**, **getFileName()**
- **firstChild()**, **nextSibling()** – similar to the ABL widget trees

Demo

- Parsing the simple-3.p
- Review recursive loop

JPNode child types

- Some JPNode's provide very specific additional information, which is implemented through child types of JPNode
- BlockNode, FieldRefNode, RecordNameNode, …
- Requires CAST from JPNode reference
- Provides direct properties and references to additional types

Demo

- Parsing the customer-tt.p
- Review recursive loop including RecordNameNode handling

Demo

- Parsing temp-table-sample.p
- Extract TEMP-TABLE fields from ABL source into XML file
- Review ProparseHelper methods
- Review TempTableParser methods

Demo

```
ASSIGN oNode = pu:getTopNode():firstChild() .

/* Assuming, the temp-table is not falsely defined inside a block */
DO WHILE VALID-OBJECT (oNode):
    IF NodeTypes:getTypeName(oNode:getType()) = "DEFINE" AND
       ProparseHelper:HasChildNodeOfNodeType(oNode, "TEMPTABLE") THEN DO:

        ASSIGN cTempTableName = ProparseHelper:FindChildNodeOfNodeType(oNode, "ID"):getText ().

        oParser = NEW TempTableParser() .

        oParser:ProcessTable(oNode, cTempTableName) .
        oParser:GetTable (OUTPUT TABLE eField) .

        TEMP-TABLE eField:WRITE-XML ("file",
                                     SUBSTITUTE ("&1.xml", cTempTableName),
                                     YES, ?, ?) .
    END.

    oNode = oNode:nextSibling () .
END.
```

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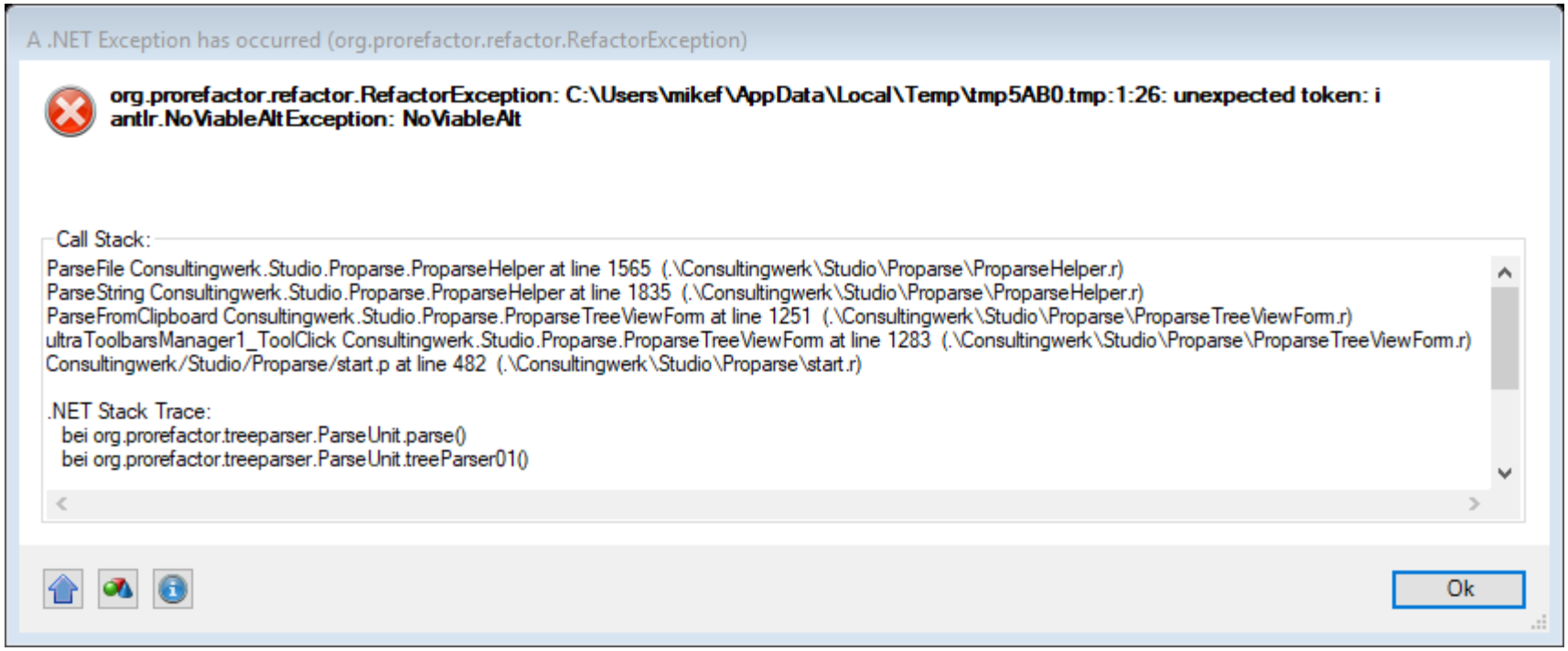
Maintaining Proparse

- ABL Syntax is evolving, new keywords added in almost every release.
  - 11.7 added SERIALIZABLE options for class members
  - Proparse requires knowledge of keywords and syntax
- Some “odd” syntax constructs may cause parsing issues (e.g. parenthesis in unexpected locations)

DEF VAR VAR i AS INTEGER NO-UNDO .



- Error message refers to file, line number and column of the token causing the issue.

Keeping Proparse up to date

- ANTLR grammars need to be extended with new syntax constructs
- KEYWORDS need to be added to vocabulary ("*importVocab*")
- Built-in functions need to be added to "*builtinfunc*" rule
- Almost everything needs to be added to "*NodeTypes*" (keyword, reserved, function, system handle, etc…)
- Extended parser ("*treeparser01*") – add some scope detection and references support
- Parser for preprocessor code evaluation ("*proeval*")

Tooling

- Ecliplse, JDT based
- ANTLR IDE doesn't support ANTLR version 2.x ☹
- Old Eclipse plugin works with Eclipse Mars (4.5.2) - http://antlreclipse.sourceforge.net

Build new version

- Add new keywords to vocabulary – *BaseTokenTypes.txt*
- Update grammar file - *proparse.g*
- ”Compile” grammar file
- Compilation “translate” the grammar file to two Java classes that implements the parser: *ProParser.java* and *ProParserTokenTypes.java*
- Add new entries on *NodeTypes.java*
- Run Unit Test scripts, add new one as needed or simply add new syntax samples to be validated

Building Proparse.NET

- Build proparse.jar from Java binaries

```
<jar jarfile="proparse.jar" >

    <manifest>
        <attribute name="Author" value="Joanju Software"/>
        <attribute name="Class-Path" value=". ${lib.list}"/>
        <section name="Proparse">
            <attribute name="Author" value="Joanju Software" />
            <attribute name="Home" value="joanju.com, oehive.org"/>
            <attribute name="Build" value="${build.number}"/>
            <attribute name="Date" value="${TODAY}"/>
        </section>
        <section name="Copyright">
            <attribute name="Copy" value="(C) Joanju Software 2002-2011"/>
            <attribute name="License" value="Eclipse Public License version 1.0"/>
        </section>
    </manifest>

    <zipfileset dir="bin" excludes="${core_xclds}" />

</jar>
```

Building Proparse .NET

- Build proparse.net.dll from proparse.jar

```
<target name="make_dotnet">
    <exec executable="C:\Work\Proparse\Github\proparse\ikvmbin\ikvmc.exe" dir="." failonerror="true">
        <arg line="-out:proparse.net.dll -version:4.0.1.${build.number} -keyfile:proparse.snk proparse.jar lib\*.jar"/>
    </exec>
    <delete dir="prorefactor/projects/unittest/pubs" />
    <zip destfile="proparse.assemblies.zip">
        <zipfileset file="proparse.net.dll" prefix="proparse.assemblies" />
        <zipfileset file="ikvmbin/IKVM.OpenJDK.Core.dll" prefix="proparse.assemblies" />
        <zipfileset file="ikvmbin/IKVM.Runtime.dll" prefix="proparse.assemblies" />
    </zip>
</target>
```

- ANT script contained in Github repo
- Requires IKVM.NET tools
- Compare .dll size before and after

Future tasks

- Reduce redundancy in code caused by legacy
  - Proparse
  - Prorefactor
- Upgrade to more recent ANTLR
- Keep up with new ABL syntax

Questions