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COMPARISON OF FIXED-LENGTH PARSING TOOLS

Abstract: *This article provides an overview of the Astera Centerprise, Pandas, fixed-width-parser, SQL*Loader, JRecordBind, and JSaPar tools used to parse fixed length files. These tools are compared in terms of the ability to process fixed-length records of different types, as well as in terms of the ability to process files with a hierarchical structure. As a result of the comparison, the tools that are most suitable for processing fixed-length files with a hierarchical structure are selected.*

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Introduction

This aticle touches upon the problem of processing fixed-length files with a hierarchical structure.

Fixed length files are increasingly becoming an integral part of everyday life. They are used in systems that regularly receive data that is easier, faster and cheaper to process and transmit using a text format in which each position is reserved for a specific value. An example of such systems are automated booking systems.

To ensure the booking of air tickets and optimize the work of the airline industry, complex work with passenger data and their flights is necessary, which leads to the creation and analysis of fixed-length files. These files contain information about passengers, their flights and other data necessary for booking. Thus, automated booking systems are inextricably linked to fixed-length files.

Part of the fixed length files presented in automated booking systems has a hierarchical structure, that is, records of a certain type cannot appear in a file without a previous record of another known type.

In this article, we will review and compare popular tools for parsing fixed-length files and identify among them those that are most convenient for working with hierarchies within files.

Astera Centerprise

One of the popylar tools for handling fixed length files is the data management platform Astera Centerprise. The platform is an efficient data integration solution that enhances the convenience of working with ETL projects.

Astera Centerprise offers a rich library of built-in data transformations that allows you to validate, clean, and transform data without writing any code.

The built-in parser processes the incoming stream of data from fixed-length files into ready-made outputs [1].

The parser is very easy to prepare for work, as it has a small list of functions for processing files: The parser allows you to:

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- enable or disable the processing of the first line of the file as a file header;
- set a custom record separator;
- enable or disable the removal of leading and trailing spaces in a string;
- enable or disable the processing of multiple entries.

To set rules for parsing files, you need to create a parsing schema. The parsing scheme is a description of the file record structure. For one field, the name, title, data type, format, starting position, length, description, and nullability are specified.

The parsed data is exported to a text file, an Excel file, or a database table [3].

Because the platform does not offer the ability to organize dependencies between two records when parsing a file, it is not suitable for parsing fixed-length hierarchical files.

Pandas Library

The Python core library – Pandas – has a read_fwf() function for parsing fixed-length files.

In addition to the input file, the function takes a list of tuples as parameters. In each of the tuples, the interval of the corresponding field is indicated. For the fields that will be obtained during the parsing, it is possible to specify a name.

The function can skip some lines, process the file header separately, and also allows you to set a custom field separator [8].

One of the advantages of the function over analogues is the ability to automatically select the parsing scheme (that is, the intervals of each field) according to the parametrically specified number of the first records of the file.

However, since the function can only process records of one type at a time, it is not suitable for processing files of a fixed length with a hierarchical structure.

Package fixed-width-parser

fixed-width-parser package is provided as a JavaScript language module focused on parsing and assembling fixed-length files.

The FixedWidthParser class is responsible for working with the file. When a new class instance is initialized, the file parsing scheme is set. The parsing schema in this case is an array of configurations that define the relationship between lines of text and final JSON objects. The result of parsing the file is a JSON structure.

In addition to the standard functions for setting the location and length of a field within a single record, as well as assigning a string or number data type to each field, it is possible to set the alignment value within the field and specify the field fill character [6].

Like the considered Pandas library, the package processes only one type of record at a time, which, with a wide variety of records and their hierarchical structure, greatly complicates the processing of the corresponding files.

SQL*Loader

By virtue of its purpose (loading data into a database), the SQL*Loader utility very often has to deal with positional data, that is, fixed-length files.

The file format is specified in the control file. By file format is meant a description of the specific locations of the start and end bytes of each field [10].

In total, SQL*Loader provides 3 approaches for setting the field format:

- through the initial and final position of the field;
- through the initial position and length of the field;
- through the length of the field.

In the latter case, the relative positioning of the fields is used - that is, the next field begins exactly where the previous one ended.

To process one record, it is better to use one approach for all fields.

POSITION keyword is used to specify the start and end positions of a field when describing a schema.

Figure 1 shows an example of a control file using this approach. So, for example, the column COLUMN_INT_VALUE_4 starts at position 6 and ends at position 9. The total length of the field is 4 characters.

```
1  LOAD DATA
2  INFILE 'fileFixedLength.dat'
3  INTO TABLE EXAMPLE_TABLE
4  (
5      COLUMN_INT_VALUE_4 POSITION(1:4) INTEGER,
6      COLUMN_INT_VALUE_4 POSITION(6:9) INTEGER,
7      COLUMN_CHAR_VALUE_5 POSITION(11:15) CHAR,
8      COLUMN_DATE_VALUE POSITION(16:21) DATE "YYMMDD"
9  )
```

Figure 1 – SQL*Loader control file with fixed-length file parsing scheme

To specify the initial position and length, the POSITION(S) DATATYPE(L) binding is used, where S is the initial position, DATATYPE is the field data type, and L is the field length.

To specify only the length of the field, the DATATYPE keyword is used, where the length of the field is indicated in brackets [7].

SQL*Loader offers more fine-grained customization of each field. For example, it allows you to turn on and off the trimming of leading or trailing (can be removed both from both sides and from one specific) spaces. The utility also allows you to replace a user-defined set of values with NULL or a default value [9]. These are just a few of the field customization options.

SQL*Loader allows you to process several different record types in a single load. To do this, use the WHEN clause, which specifies a condition that refers to the field being processed.

Therefore, SQL*Loader is suitable for processing hierarchical data if the records in a particular field will refer to the parent.

JRecordBind

JRecordBind library is written in Java and is used to parse fixed length text files [5].

To set the parsing format for positional files, the library uses a custom XSD parsing schema. The XSD schema enumerates and separately configures all record types in a file. When creating a schema, the root record main is specified, with which the library will work when parsing. By specifying the length of the root entry, we are talking about dealing with a fixed length file. In the future, all records will be checked for compliance with this length. The root entry is given the type of entry that is the root of the entry hierarchy. When describing a root record type, the records nested within it are listed as separate elements. Thus, JRecordBind allows you to process files of a fixed length with a hierarchical structure in one pass through the file.

In addition, the XSD schema offers many attributes to customize the processing of any field. It is possible to set the field length, element separator and filler, line separator, converter (conversion from a string to the desired data type), the number of lines that make up one record, specify the element subclass (in case a record of the same type consists of several different types) [5].

On figure 2 is an example of an XSD schema for parsing a file.


```xml
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema targetNamespace="http://url.example/"
           xmlns:xs="http://url.example/XMLSchema"
           xmlns="http://url.example/xmlns"
           xmlns:jrb="http://jrecordbind.org/3/xsd"
           elementFormDefault="qualified">
  <xs:complexType name="rootRecord">
    <xs:sequence>
      <xs:element name="field1"   type="xs:string"  length="4" fixed="ROOT"/>
      <xs:element name="filed2"   type="xs:int"  length="6" jrb:converter="converters$SimpleIntConverter"/>
      <xs:element name="filed3"   type="xs:string"  length="5"/>
      <!--subrecord-->
      <xs:element name="subrecord" type="subrecordType" minOccurs="1"/>
    </xs:sequence>
  </xs:complexType>

  <xs:complexType name="rootRecord">
    <xs:sequence>
      <xs:element name="field1"   type="xs:string"  length="9" fixed="SUBRECORD"/>
      <xs:element name="filed2"   type="xs:string"  length="6"/>
      <!--subrecord-->
      <xs:element name="subrecord" type="subrecordType" minOccurs="1"/>
    </xs:sequence>
  </xs:complexType>

  <xs:element name="main" type="rootRecord" jrb:length="15" jrb:lineSeparator="&#10;"/>
</xs:schema>
```

Figure 2 – XSD schema for parsing a fixed-length file with a hierarchical structure for the JRecordBind library

JSaPar

JSaPar (Java Schema based Parser) is a Java library that provides a schema-based fixed-length file parser and linker. The description of the data format of a fixed length file is done in an XML schema [4].

In the parsing scheme for records (strings), you can specify the minimum length of the string, a fill character (in case the string does not reach the minimum in length), the string condition (the condition under which the string in question is determined to this type), the number of expected strings, the name record type, field separator, line separator (at the schema level).

For fields, in addition to the name, length and data types, you can set the alignment of the value within the string (center, left, right), filler characters (for alignments), the mode of deleting filler characters during parsing, the mode of deleting leading characters during parsing [2].

Despite the rich functionality of the library, it does not support the parsing of hierarchical files since records do not have the ability to refer to each other.

Tool Comparison

Each of the tools discussed has its own unique capabilities for processing fixed-length files, and each tool was created to solve its problems when working with such files. Because of this, not all of them can handle hierarchical file structures.

Among the tools reviewed, three options are of most interest – SQL*Loader, JRecordBind and JSaPar.

Although JSaPar does not directly handle hierarchical structures, it is able to handle several different types of records and has the ability to fine-tune the parsing of records. Since JSaPar is implemented in Java, where ready-made records are uploaded, matching records into a hierarchy after parsing does not cause much difficulty.

SQL*Loader will be convenient to use if the data needs to be uploaded to the database without serious pre-processing.

JRecordBind allows you to process hierarchies during file parsing and provides a ready-made class with structure preservation. JRecordBind is a great option, especially if the parsed data needs some serious processing, which can be done using the Java language.

Conclusion

Thus, we have considered 6 tools for parsing fixed length files: Astera Centerprise, Pandas, fixed-width-parser, SQL*Loader, JRecordBind, JSaPar.

Among the considered tools, the most suitable for working with files with a hierarchical structure were selected: SQL*Loader, JRecordBind and JSaPar. For each of the selected tools, strengths were emphasized, and situations were identified in which their use would be the best solution for the developer.

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