Designing Custom Encoders

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Contents

Designing Custom Encoders

This document covers the following topics:

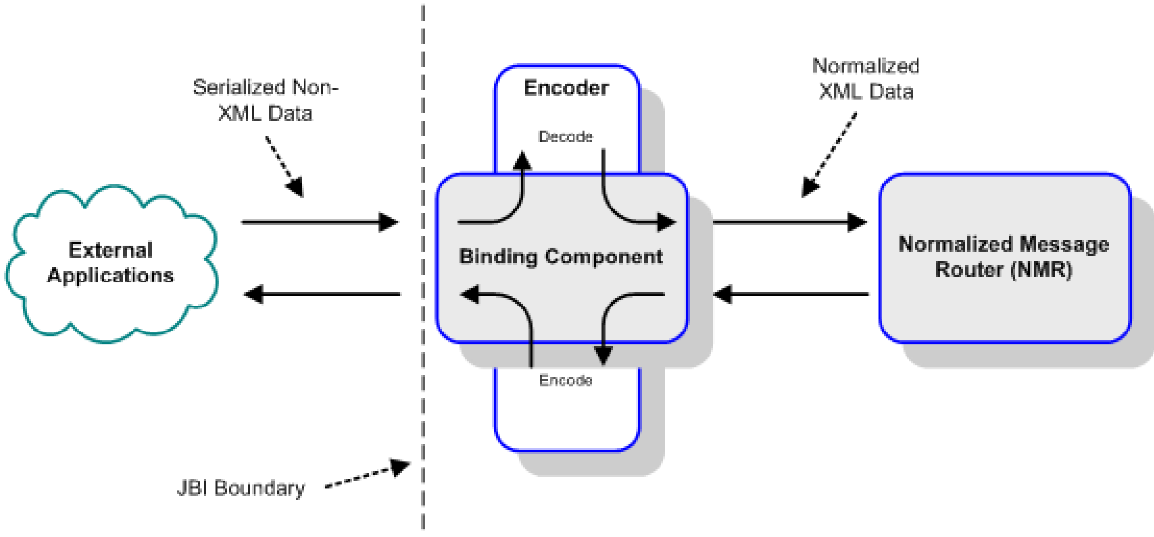
Additional information is provided in the following sections:

Understanding the Encoder Framework

An *Encoder* is a bidirectional software component that transforms an XML message into a non-XML message, and vice versa. The term *encoding* has a very specific meaning within this context, representing act of transforming an XML message into a non-XML message. The act of transforming a non-XML message into an XML message is termed *decoding*. Despite its name, the Encoder performs both functions.

XML is used as a common data format for processing within GlassFish ESB. In general, most data used in external applications is in some non-XML, serialized format; hence, the need for an Encoder.

A very highly simplified illustration of the data flow to and from GlassFish ESB is shown in the following diagram. The area to the right of the JBI boundary represents GlassFish ESB, while the area to the left of the boundary represents whatever external applications are communicating with GlassFish ESB.



Three sets of information define the runtime behavior of an Encoder:

- *Encoder Type*, also known as encoding style, defines the high-level encoding rules for a specific type of encoding and applies globally to all encoders of that type. The specific type of encoding relates to the data format used by the external application or communications protocol that is sending data to, or receiving data from, GlassFish ESB. Examples include SAP, Oracle DBMS, HL7, SWIFT, and X12. Encoding rules include:
  - A grammar to scan an input message in its external representation, and rules on mapping the result to the internal representation (an operation known as *decoding* or *parsing*).
  - Rules on generating the external representation of an output message from the internal representation (an operation called *encoding* or *serialization*).
- *Detailed Encoding Rules* are specific to a single instance of an Encoder Type. These rules include:
  - Delimiters
  - Field Lengths
  - Data offsets
- The *Abstract Message Structure* specifies the logical structure of the messages being processed. This metadata is represented as XML schema (XSD), and may be viewed and edited by an XSD viewer/editor.

Abstract Message Structure

The runtime message structure is composed of a hierarchical system of *nodes*. These nodes are characterized by terms indicating their relationships with each other:

Parent, Child, and Sibling Nodes

Any subnode of a given node is called a *child* node, and the given node, in turn, is the child's *parent*. *Sibling* nodes are nodes on the same hierarchical level under the same parent node. Nodes higher than a given node in the same lineage are *ancestors* and those below it are *descendants*.

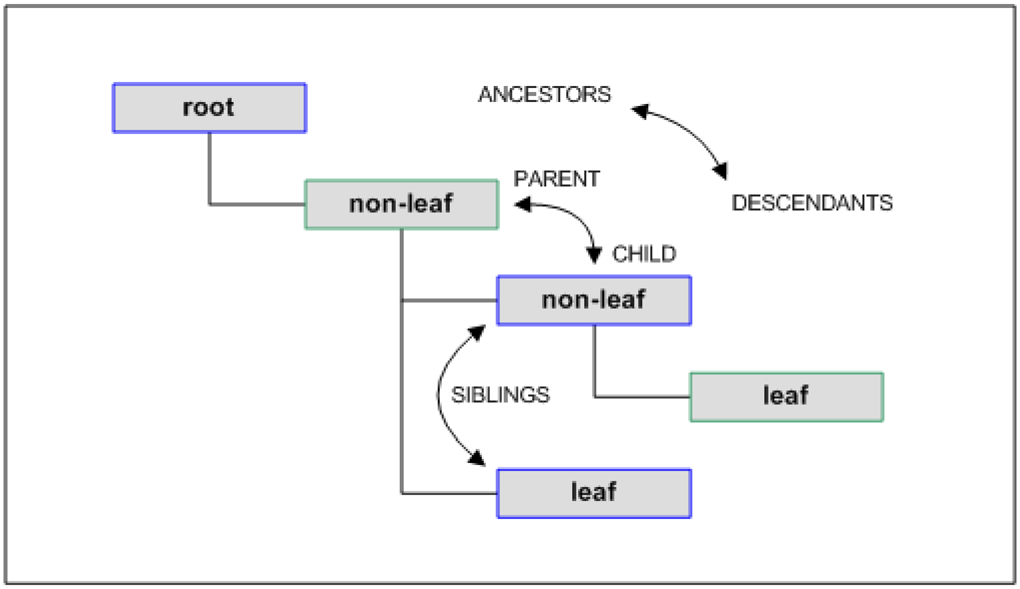


FIGURE 1 Encoder Node Relationships

Root Nodes

The *root* node is the highest node in the tree structure, and has no parent. This node is a global element and represents the entire message. It may have one or more child nodes, but can never have sibling nodes or be repeating. The name of the root node can be edited.

Non-leaf Nodes

Non-leaf nodes, which can have children, provide the framework through which this data is accessed and organized. They are of complex types.

There are two major types of non-leaf nodes (aside from a root node, which is a special case):

- *Sequence group* nodes, which provide organizational grouping for purposes such as repetition. In XSD, they are of complexType of a sequence of elements.
- *Choice group* nodes, which represent sets of alternatives— only one of which is valid at any given time for an instance of that node. For example, a choice node named `order` might have two children, respectively named `domestic` and `overseas`. For each order instance, only one of these children will be present. In XSD, they are of complexType of a choice group of elements.

Leaf Nodes

Leaf nodes have no children, and normally carry the actual data from the message. They are of simple types such as string.

The basic node types are *fixedLength* and *delimited*. See "Encoding Properties" on page 11 for information about other node types.

- With fixedLength data, the length of the unit of data is always the same. The position of the data within the message string is described by *byte offset* and *length*.
- With delimited data, the length of the unit of data is variable. Information is separated by a pre-determined system of delimiters defined within the properties of the Encoder (see "Specifying Delimiters" on page 21).

Creating the Abstract Message Definition

This document assumes that you are working with an existing XML Schema Definition (XSD) or that you are creating an XSD. There are a number of tools available that help you create an XML schema, including NetBeans. Once you create an XSD you can apply the Custom Encoder as described in this document.

Recursive Structure

A recursive structure is allowed in an XML schema document used to define a custom structure. The recursive elements can be introduced inside a local XML schema definition by import statements, or by include statements, in the XSD.

The Custom Encoder supports both linear recursion and mutual recursion by import statements. It also supports mutual recursion from include statements.

Binary Data Types

The Custom Encoder supports elements of binary data type, as well as String data type. Far an element field of binary data type, the data type of "hexBinary" or "base64Binary" can be specified in the XML schema using the XSD editor.

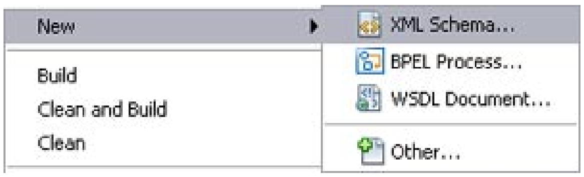
Note that, base64 encoded data expands by a factor of 1.33 times the original size, and hexadecimal encoded data expands by a factor of 2 times original size, assuming an underlying UTF-8 text encoding in both cases. If the underlying text encoding is UTF-16, then these numbers double.

Applying Custom Encoding to an XSD

In the absence of a predefined representation of the metadata describing the data format, you must manually create the Abstract Message Definition and apply the Custom Encoder. To begin this process, you must create an XSD and apply the Custom Encoder, as follows:

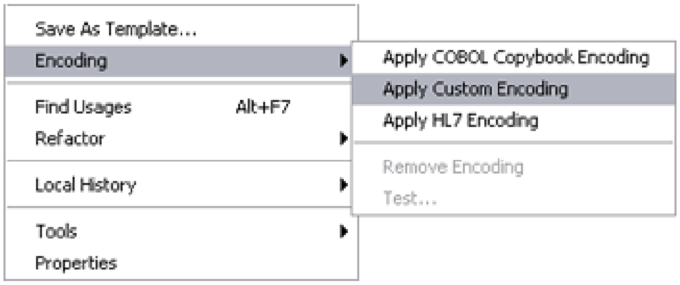
▼ To Apply the Custom Encoder to an XSD

1. **In your project, right—click to access the project context menu and add a new XML Schema.**

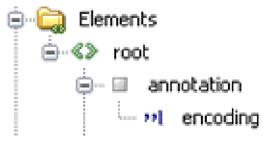


You will need to develop the XSD node structure to match the parsing of the serialized message stream being processed. This process is described in the topics following this one.

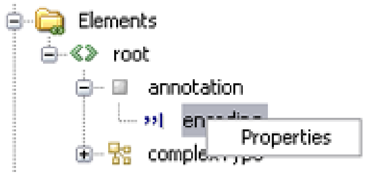
2. **In the resulting XSD, right—click to access its context menu and select Encoder > Apply Custom Encoder.**



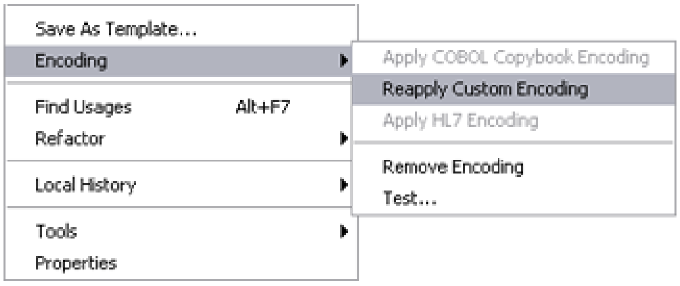
3. **Once the Encoder has been applied, a special `encoding` node will automatically be added as a child node of an `annotation` node.**



4 **By right-clicking the `encoding` node and selecting *Properties*, you can edit the encoding rules for the individual elements.**



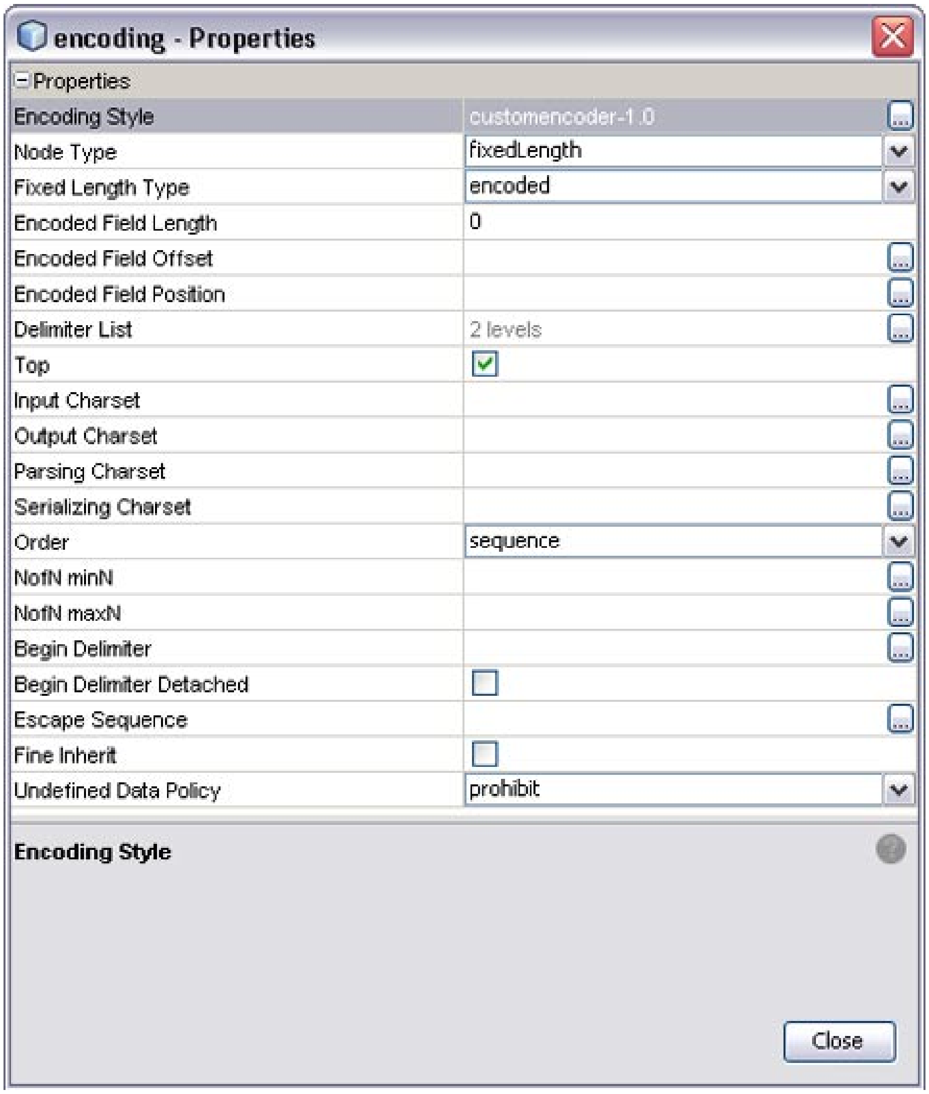
5 **After applying the Encoder, the context menu changes as shown in the following illustration. Reapplying the Encoder resets the parameters for all nodes to their default values. The node structure you have created will be preserved.**



Editing Encoding Properties

Once the encoding style is applied, you can edit detailed encoding rules at the node level using the special `encoding` node under the element's `annotation` node.

The following figure shows the majority of encoding properties associated with various nodes.



Encoding Style	customencoder-1.0
Node Type	fixedLength
Fixed Length Type	encoded
Encoded Field Length	0
Encoded Field Offset	
Encoded Field Position	
Delimiter List	2 levels
Top	✓
Input Charset	
Output Charset	
Parsing Charset	
Serializing Charset	
Order	sequence
NofN minN	
NofN maxN	
Begin Delimiter	
Begin Delimiter Detached	☐
Escape Sequence	
Fine Inherit	☐
Undefined Data Policy	prohibit

Encoding Style

FIGURE 2 Encoding Properties Dialog

Encoding Properties

TABLE 1 General Properties

Name	Description
Encoding Style	Specifies the encoding style, for example: `customencoder-[version]`.

TABLE 1 General Properties *(Continued)*

Name	Description
Node Type	Specifies the format for parsing and serialization. The options are: ■ `group`, which provides organizational grouping for purposes such as repetition. Does not apply to Choice Element nodes. ■ `array`, which is a delimited structure. If repeated, occurrences are separated by the `repeat` delimiter. The last occurrence may be terminated by a `normal` delimiter. Does not apply to Choice Element nodes. ■ `delimited`, which is a delimited structure. If repeated, occurrences are separated by a `normal` delimiter. Does not apply to Choice Element nodes. See "Specifying Delimiters" on page 21 for additional information. ■ `fixedLength`, which indicates a fixed length and is specified by non-negative integer (or zero to indicate end of parent node data). Does not apply to Choice Element nodes. ■ `transient`, which appears only in an internal tree as a scratchpad field. It does not appear in external data representation, and can only have `transient` node types as children. The default value is `delimited`. See also "Node Type Default Values" on page 16 (following this table) for more information.
Delimiter List	Opens the Delimiter List Editor. See "Specifying Delimiters" on page 21 for information.
Order	Specifies the ordering of the selected group node or complex type element node's children during the parsing process. ■ `sequence` specifies that the child nodes must appear in the sequence given in the metadata. ■ `any` specifies that the child nodes must remain grouped, but the groups can appear in any order. ■ `mixed` specifies that the child nodes can appear in any order. Does not apply to choice element nodes. See "Order Property" on page 17 for additional information.

TABLE 2 Root Node Properties

Name	Description
Top	Specifies whether or not parsing/serializing encoding is supported for descendant nodes. The default value is `true` (checked box).
Input Charset	Specifies the character set of the input data. This is only needed if the parsing is done upon byte array data and the character set that the byte array data is encoded against is not safe for delimiter scanning. If this property is not specified, the value specified for the `Parsing Charset` property will be used. This property is displayed only when the `Top` property is set to `true` (checked box). Applies to root node only. See "Data Encoding" on page 17 for additional information.
Output Charset	Specifies the character set of the output data if it needs to be different from the serializing character set. If this property is not specified, the value specified for the `Serializing Charset` property will be used. This property is displayed only when the `Top` property is set to `true` (checked box). See"Data Encoding" on page 17 for additional information. **Note –** This character set may be unsafe for delimiter scanning.
Parsing Charset	Specifies the character set used to decode byte array data into string during parsing. It is recommended to use UTF-8 for DBCS data, since the hex value of some ASCII delimiter may coincide with a hex value contained within a double-byte character. This property is displayed only when the `Top` property is set to `true` (checked box). See"Data Encoding" on page 17 for additional information.
Serializing Charset	Specifies the character set used to encode string data into byte array data during serialization of the data. This property is displayed only when the `Top` property is set to `true` (checked box). See"Data Encoding" on page 17 for additional information.
Escape Sequence	Global-level escape sequence, which should be set only at the root level. This property is displayed only when the `top` property is set to `true` (checked box)..
Fine Inherit	When set to `true` (checked box), enables the following delimiters to be inherited individually from the parent nodes: ■ begin ■ end ■ repeating Otherwise, once a delimiter level is specified for a child node, it overrides the relevant delimiter level as a whole on parent nodes. This setting is global, so the flag only needs to be set on a root element. The default value is `false` (unchecked box). Displayed only when the `top` property is set to `true` (checked box).

TABLE 2 Root Node Properties *(Continued)*

Name	Description
Undefined Data Policy	Specifies whether or not undefined (trailing) data is allowed and/or will be mapped. This property is displayed only when the `top` property is set to `true` (checked box). The options are as follows: ■ `map` specifies that undefined (trailing) data is allowed and will be mapped to field named `undefined` with the predefined namespace `urn:com.sun:encoder:instance`. ■ `skip` specifies that undefined (trailing) data is skipped silently. ■ `prohibit` specifies that undefined (trailing) data is not allowed, and if present an exception will be thrown. This setting is global, so the flag only needs to be set on a root element.

TABLE 3 Leaf Node Properties

Name	Description
Match	Defines match pattern. If alignment is `regex`, then this field holds the regex match pattern. See "Matching Data Patterns" on page 18 for more information.
No Match	Flag indicating if the match condition should be reverted. The flag acts as a logical `NOT` against the match condition. See "Matching Data Patterns" on page 18 for more information.
Alignment	Defines the alignment mode for a match pattern. See "Matching Data Patterns" on page 18 for more information.
NofN minN	Specifies the minimum number of child nodes that must contain data. If absent, then so such constraint exists.
NofN maxN	Specifies the maximum number of child nodes that must contain data. If absent, then so such constraint exists.
MinOcc	Specifies the minimum number of occurrences of a repeating node. The value specified here overrides the `minOccurs` value in XSD's element declaration. This property is needed only when the order is `mixed`; so in the XSD, *repeating choice group* must be used, and the `minOccurs` specified in the XSD does not actually represent the minimum occurrence.

TABLE 3 Leaf Node Properties *(Continued)*

Name	Description
MaxOcc	Specifies the maximum number of occurrences of a repeating node. The value specified here overrides the `maxOccurs` value in XSD's element declaration. This property is needed only when the order is `mixed`; so in the XSD, *repeating choice group* must be used, and the `maxOccurs` specified in the XSD does not actually represent the maximum occurrence.
Scavenger Chars	Specifies the characters to be stripped out when parsing the data, if they appear at the start of the byte stream for this element.
Output Scavenger 1st Char	Specifies the character to be stripped out when serializing the data, if it appears as the first character of the output byte stream from this element (even occurring before the begin delimiter, if any).
Delimiter	Displayed for `delim` Node Type only. Once delimiters are specified, the value field displays the delimiter characters (read only).
Begin Delimiter	Once begin delimiters are specified, the value field displays the delimiter characters (read only).
Begin Delimiter Detached	Specifies whether the begin delimiter is anchored or detached. The default value is `false` (unchecked box), indicating an anchored delimiter.
Array Delimiter	Displayed for `array` Node Type only. Once delimiters are specified, the value field displays the delimiter characters (read only).
Fixed Length	Displayed for `fixedLength` Node Type only. The options are: ■ `regular` specifies a fixed-length field whose length is measured from the beginning of the message. ■ `encoded` specifies a fixed-length field whose length is the sum of the encoded field length and an offset, measured from either the zero position or the current parsing position. ■ `determined by regex match` specifies a fixed-length field whose length is determined by a regular expression at runtime. ■ `deducted from end` specifies a fixed-length field whose length is measured from the end of the message.
Length	Displayed only for `fixedLength` Node Type with the `regular` option. Specifies the length of the field in terms of bytes (as a positive integer). The default value is `0`.

TABLE 3 Leaf Node Properties *(Continued)*

Name	Description
Offset	Displayed only for `fixedLength` Node Type with the `regular` option. Specifies the offset of the field in terms of bytes (as a positive long integer) from the zero position where the first sibling starts. The default value is `0`.
Encoded Field Length	Displayed only for `fixedLength` Node Type with the `encoded` option, and specification is required. Specifies the length of the encoded field in terms of bytes (as a positive integer). The default value is `0`.
Encoded Field Offset	Displayed only for `fixedLength` Node Type with the `encoded` option, and specification is optional. Specifies the offset in terms of bytes (as a positive long integer) from the position where the first sibling starts.
Encoded Field Position	Displayed only for `fixedLength` Node Type with the `encoded` option, and specification is required. Specifies the offset in terms of bytes (as a positive long integer) between the current parsing position and the position from which the Encoded Field Length is defined.
Length From End	Displayed only for `fixedLength` Node Type with the `deducted from end` option.

Node Type Default Values

The basic default value for the nodeType property is `delimited`. If, however, the node is the child of a parent node whose Node Type is `fixedLength` or `transient`, then the child takes on the same Node Type as the parent. See the following table for additional information.

Note – This rule does not apply to Choice Element nodes.

TABLE 4 Node Type Default Values

Parent	Child
array	delimited
delimited	delimited
fixed	fixed
group	delimited
transient	transient

Order Property

To illustrate how the `order` property works, consider the simple tree structure shown in the following diagram, where **a** is an element node, **b** is a non-repeating field node, and **c** is a repeating field node. The value set for the `order` property allows the field nodes to appear as shown in following table.

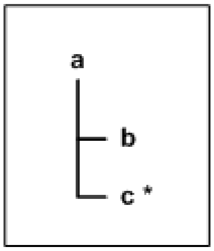


FIGURE 3 Order Property Example

TABLE 5 Order Property Example

Value	Allowed Node Order
sequence	b, c1, c2
any	b, c1, c2, **or** c1, c2, b
mixed	b, c1, c2, **or** c1, c2, b, **or** c1, b, c2

Data Encoding

For GlassFish ESB to correctly handle data in byte-oriented protocol, the encoding method for inbound and outbound Encoders and the native code used for parsing must be specified in the Encoding properties. If you do not specify otherwise, UTF-8 is assumed to be the encoding method in each case.

Supporting UTF-8 by default allows the use of the Unicode character set in both ASCII and non-ASCII based environments without further specification. GlassFish ESB also supports ASCII for English, Japanese, and Korean locales, and the localized country-specific encoding methods shown in the following table.

The data encoding you specify when configuring the Encoding properties modifies the Java methods used for encoding and decoding. The encoding and decoding processes differ from one another depending upon which Java method you use, and whether you are encoding to or decoding from bytes or strings. The diagrams shown in “About Data Parsing and Serialization” on page 43 illustrate these differences.

The encoding options available to you depend on the locale specified by your version of GlassFish ESB. UTF-8 is the default in all locales.

TABLE 6 Partial Listing of Supported Encoding Options According to Locale

English	Japanese	Korean	Simplified Chinese	Traditional Chinese
UTF-8	UTF-8	UTF-8	UTF-8	UTF-8
ASCII	ASCII	ASCII	GB2312	Big5
EBCDIC	EUC-JP	EUC-KR		
UTF-16	SJIS	MS949		
	MS932			

Matching Data Patterns

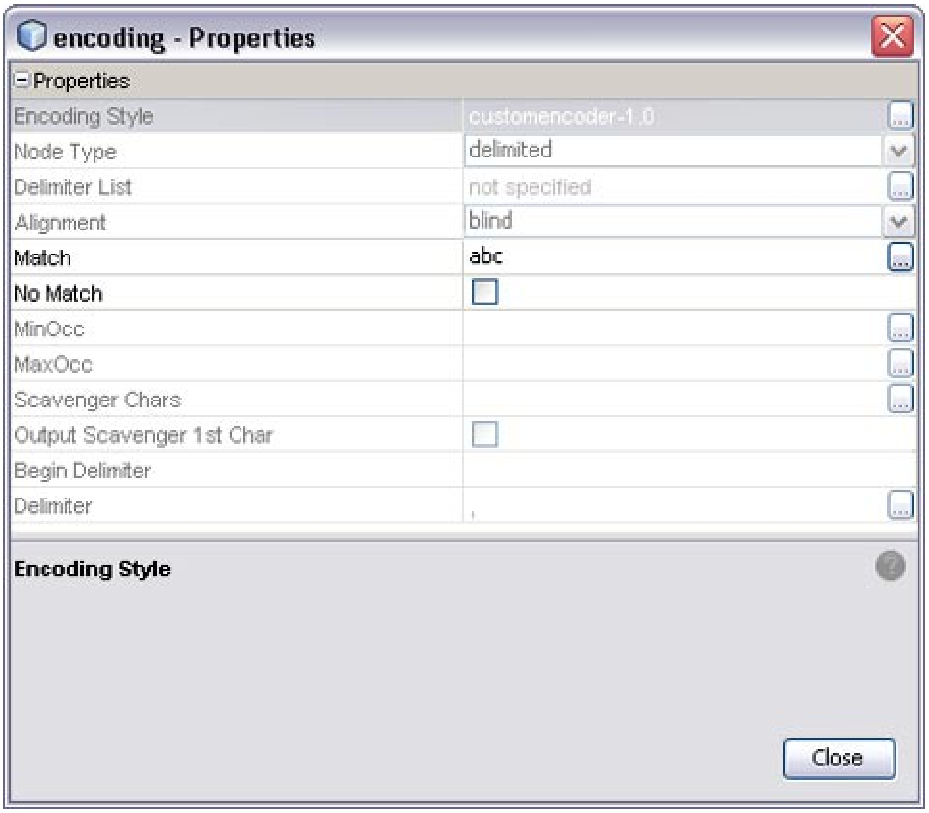
One of the parsing techniques that can be applied to the decoding of an input data stream is that of matching a specific byte pattern within a data sequence. You can accomplish this in a Custom Encoder by using the `Match` and `Align` field-node properties, when the `Node Type` is either `delimited` or `fixedLength`. During the decode operation, a field is successfully matched if it complies with the value of the `Match` property, interpreted according to the value of the `Align` property, as set for that field.

Defining Byte Patterns

The value you enter for the `Match` property defines the byte pattern for the data you want to match. As an example, a value of `abc` has been entered into the value field shown in the following figure. This provides a reference for the `Alignment` property, as shown in the next section.

If the `Node Type` property is set to `fixedLength`, and the `Fixed Length Type` property is specified as `determined by regex match`, the `Alignment` property is automatically set to `regex` and the regular expression (regex) must be entered into the `Match` value field.

Selecting the `No Match` check box reverses the situation, resulting in a match if the field contents (data) are *not equal to* the byte pattern entered in the `Match` field.


encoding - Properties

Properties

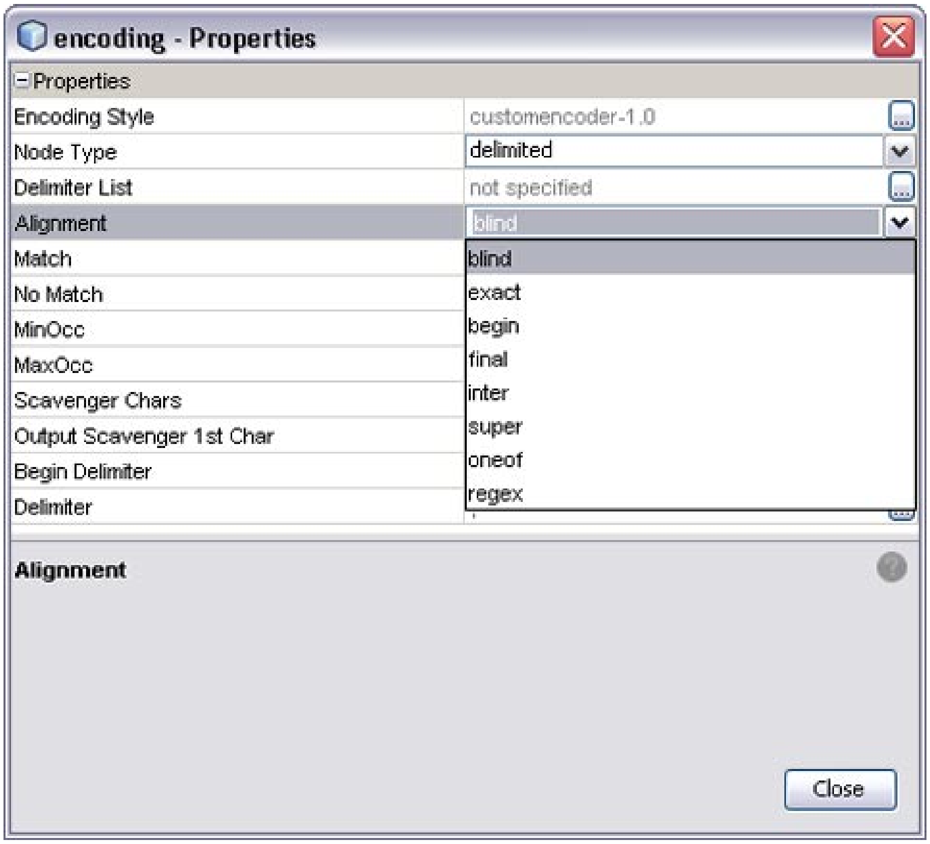
Encoding Style	customencoder-1.0
Node Type	delimited
Delimiter List	not specified
Alignment	blind
Match	abc
No Match	☐
MinOcc	
MaxOcc	
Scavenger Chars	
Output Scavenger 1st Char	☐
Begin Delimiter	
Delimiter	,

Encoding Style

FIGURE 4 Match Property

Specifying Pattern Alignment

The `align` property supplements the `match` property, specifying criteria on which to base the match. The default value is `blind`; if this is specified, the match property has no meaning.


encoding - Properties

Properties

Encoding Style	customencoder-1.0
Node Type	delimited
Delimiter List	not specified
Alignment	blind
Match	
No Match	
MinOcc	
MaxOcc	
Scavenger Chars	
Output Scavenger 1st Char	
Begin Delimiter	
Delimiter	

FIGURE 5 Align Property Menu

TABLE 7 Align Parameter Options

Option	Description
blind	Always performs a match (pass-through). Any value set for the `Match` property is ignored. This is the default value.
exact	When an input byte sequence exactly matches the specified byte pattern (for example, `[abc]`), the decode method matches the field to the input byte sequence.
begin	When the leading bytes of an input byte sequence match the value set for the `Match` property (for example, `[abc......]`), the decode method matches the field to the input byte sequence.
final	When the trailing bytes of an input byte sequence match the value set for the `Match` property (for example, `[......abc]`), the decode method matches the field to the input byte sequence.

TABLE 7 Align Parameter Options *(Continued)*

Option	Description
inter	When the input byte sequence contains a byte pattern that includes the value set for the `Match` property, (for example, [`...abc...`]), the decode method matches the field to the input byte sequence.
super	When an input byte sequence is a subsequence of the value set for the `Match` property (for example, [`bc`]), the decode method matches the field to the input byte sequence.
oneof	If the value set for the `Match` property is a repeating pattern of the form `<separator><value>...` (for example, [`\mon\wed\fri`]), and the input byte sequence contains a byte pattern that matches one of the `<value>` entries (for example, [`wed`]), the decode method matches the field to the input byte sequence.
regex	When an input byte sequence exactly matches the regular expression specified in the `Match` property, the decode method matches the field to the input byte sequence. The `Alignment` property is automatically set to `regex` when the `Fixed Length Type` property is specified as `determined by regex match`.

Note – The value entered for the `match` property is interpreted as a `Latin1` string, rather than following the specified encoding.

Specifying Delimiters

Delimiter List

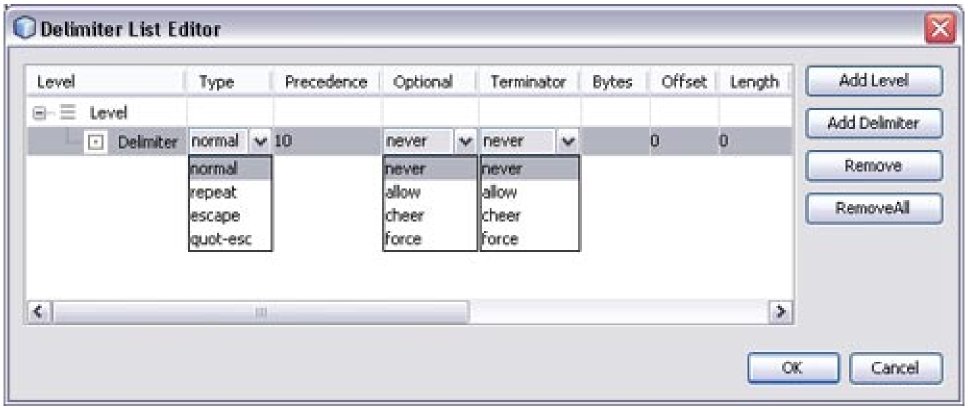
You can define a set of delimiters — a *delimiter list* — for any node in the hierarchical data structure. This delimiter list is used in the external data representation for that node and its descendents. A delimiter list defined for any non-root node overrides the effect of any ancestor node's delimiter list on both the node itself and its descendents.

Delimiters are defined using the Delimiter List Editor, as illustrated in the following figure. The editor is invoked by clicking the `delim` property value field in the node's property dialog box and clicking the ellipsis (…) button, or by double-clicking the field. See "Defining a Delimiter List" on page 34 for additional information.

Clicking within a field in the Delimiter List Editor enables the field for editing. After typing a value into a field, you must press `Enter` to set the value. Clicking the drop-down menu button in one of the following three fields displays its menu, as illustrated in the following figure.

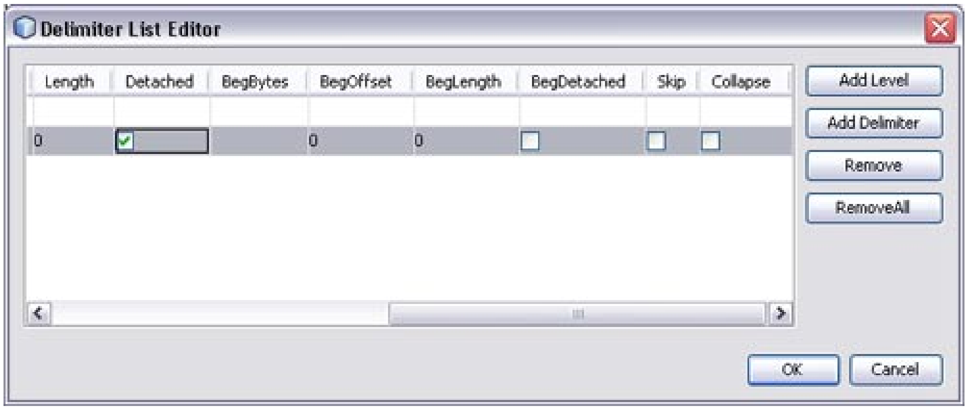
- Type

- Optional
- Terminator



Level	Type	Precedence	Optional	Terminator	Bytes	Offset	Length
Level							
Delimiter	normal	10	never	never		0	0

FIGURE 6 Delimiter List Editor: Left Side



Length	Detached	BegBytes	BegOffset	BegLength	BegDetached	Skip	Collapse
0	✓		0	0	☐	☐	☐

FIGURE 7 Delimiter List Editor: Right Side

TABLE 8 Delimiter List Editor Command Buttons

Command	Action
Add Level	Adds a new level after the selected level.
Add Delimiter	Adds a new delimiter after the selected delimiter, or to the bottom of list under the selected level.

TABLE 8 Delimiter List Editor Command Buttons *(Continued)*

Command	Action
Remove	Deletes the selected line item (level or delimiter) from the list.
Remove All	Deletes all items (levels and delimiters) from the list.
OK	Saves your entries and closes the editor.
Cancel	Discards your entries and closes the editor.

Delimiter Properties

TABLE 9 Delimiter Properties

Property	Description
Level	Assigns consecutive sets of delimiter parameters to delimited nodes in the Encoder node hierarchy. See "Delimiter Levels" on page 24 for additional information.
Type	Specifies how the delimiter is used. See "Delimiter Type" on page 26 for additional information.
Precedence	Indicates the priority of a certain delimiter, relative to other delimiters. See "Precedence" on page 28 for additional information.
Optional	Specifies how delimiters for optional nodes are to be handled when the nodes are absent from the input instance or when their fields are empty. See "Optional" on page 29 for additional information. **Note –** Does not apply to children of *choice element* nodes.
Terminator	Specifies how delimiters are to be handled for a specific terminator node in the Encoder tree. See "Terminator" on page 31 for additional information.
Bytes	Specifies the characters (bytes) to use to end the delimited data for the specified level. Delimiters can have begin bytes, end bytes, or both. The term "bytes" (by itself) always indicates end bytes. See "Delimiter Characters (Bytes)" on page 32 for additional information.
Offset	Offset of the delimited data field in bytes from the beginning of the data stream (byte 0). Value must be a non-negative integer; the default is `0`.
Length	Length of the data field in bytes, if it is of fixed length. Value must be positive integer. Entering a value clears the `Bytes` field
Detached	When checked, indicates that the specified delimiter is a detached, or non-anchored, delimiter, and does not have to appear at a fixed position.

TABLE 9 Delimiter Properties *(Continued)*

Property	Description
BegBytes	Specifies the characters (bytes) to use to begin the delimited data for the specified level. Delimiters can have begin bytes, end bytes, or both. See "Delimiter Characters (Bytes)" on page 32 for additional information.
BegOffset	Offset of the fixed-length data field in bytes from the beginning of the data stream (byte 0). Value must be a non-negative integer; the default is `0`.
BegLength	Length of the data field in bytes, if it is of fixed length and has a beginning delimiter. Value must be positive integer. Entering a value clears the `Bytes` field
BegDetached	When checked, indicates that the specified delimiter is a detached (non-anchored) beginning delimiter, and does not have to appear at a fixed position.
Skip	When checked, skips identical leading delimiters. The delimiters may be defined either as begin bytes or end bytes. The purpose of this flag is to facilitate parsing tabular data.
Collapse	When checked, collapses identical, consecutive end delimiters into a single delimiter. As with the `Skip` flag, the purpose of this flag is to facilitate parsing tabular data.

Delimiter Levels

Delimiter levels are assigned in order to those hierarchical levels of an Encoder that contain at least one node that is specified as being delimited. If none of the nodes at a particular hierarchical level is delimited, that hierarchical level is skipped in assigning delimiter levels.

Delimiter lists are typically specified on the root node, so that the list applies to the entire Encoder. The root node itself is typically not delimited, so that *Level 1* would apply to those nodes that are children of the root node. See the following figure and example.

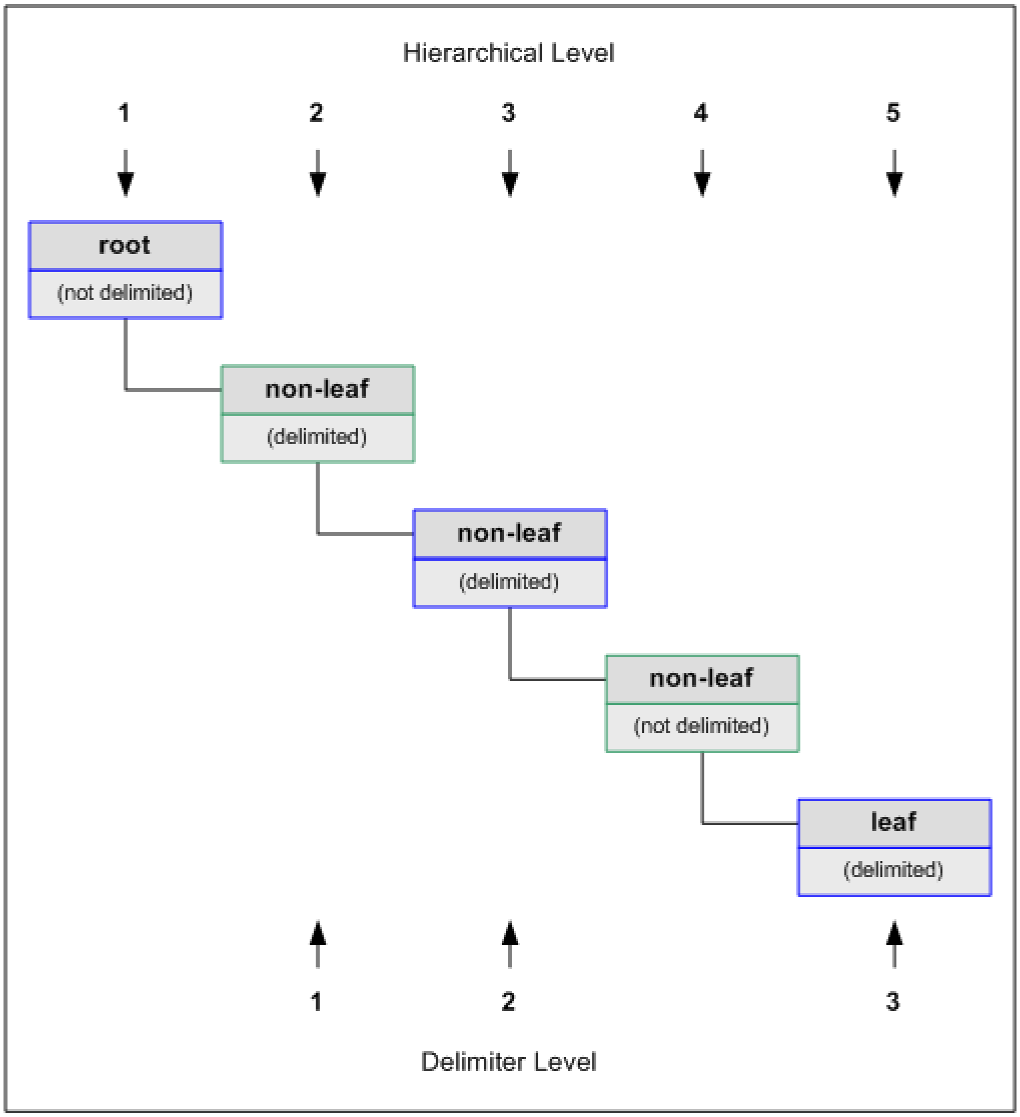


FIGURE 8 Encoder Hierarchical and Delimiter Levels

For example, if you want to parse the following data:

```
a^b|c^d|e
```

you might create a Custom Encoder as follows:

- root
  - element_1
    - field_1
    - field_2
  - element_2
    - field_3
    - field_4
  - field_5

In this example, the delimiter list is specified on the *root* node, which is not delimited; therefore, the list has two levels:

- Level 1
  - Delimiter |
- Level 2
  - Delimiter ^

The *Level 1* delimiter (|) applies to element_1, element_2, and field_5. The *Level 2* delimiter (^) applies to field_1 - field_4.

If the root node is set to be delimited, the *Level 1* delimiters will then apply to it. Using the above example, the *Level 2* delimiter (^) would then apply to element_1, element_2, and field_5, and a new *Level 3* delimiter would apply to field_1 - field_4.

Delimiter lists can be much more complex than this very simple example. For instance, you can create multiple delimiters of different types at any given level, and you can specify a delimiter list on any node within the Encoder— not only the root node as shown in the example. See "Defining a Delimiter List" on page 34 for a step-by-step description of the procedure for creating a Delimiter List.

Delimiter Type

The *Delimiter Type* property specifies whether the delimiter is a terminator at the end of the byte sequence (`normal`), a separator between byte sequences in an array (`repeat`) or an escape sequence.

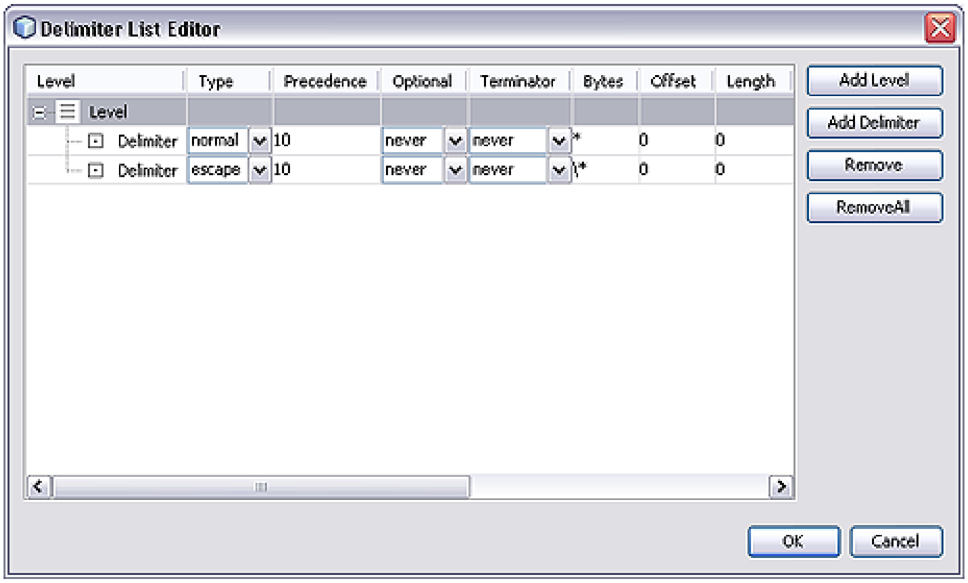
TABLE 10 Delimiter Type Options

Option	Description
normal	Indicates the delimiter is a normal delimiter.
repeat	Indicates the delimiter is a delimiter that delimits repetitive fields (nodes). If a node is defined to be repetitive, then a repeat delimiter can be used to delimit the repetitive occurrences, while a normal delimiter terminates the repitition. For example, `a^b^c1~c2~c3~c4~c5^` where '~' is a delimiter that delimits repetitive nodes and '^' is a normal delimiter that terminates repetitive nodes.
escape	Indicates the delimiter is an escape delimiter. The purpose of escape delimiter is to escape special bytes , such as delimiters, using predefined escape sequences. Once the bytes of the escape delimiter are matched, no action is taken except that the search is continued at the position immediately following the delimiter bytes.
quot-esc	The quot-esc delimiter is used to escape special bytes using quotation style escaping, that is, whatever appears within the (double) quotes is escaped. For example, assume that ',' (comma) is a normal delimiter. To escape ',' in the data, either we can use an escape sequence such as `<data>\,<data>` or we can use quotation marks such as `"<data>,<data>"`. The bytes defined in the quot-escape delimiter represent the quotation marks.

Escape Option

An *escape* delimiter is simply a sequence that is recognized and ignored during parsing. Its purpose is to allow the use of escape sequences to embed byte sequences in data that would otherwise be seen as delimiter occurrences.

For example, if there is a normal delimiter "+" at a given level, and we define an escape delimiter "\+" as shown in the following figure, then `aaa+b\+c+ddd` will parse as three fields: `aaa`, `b\+c`, and `ddd`. If the escape delimiter were not defined, the sequence would then parse as four fields: `aaa`, `b\`, `c`, and `ddd`.



Level	Type	Precedence	Optional	Terminator	Bytes	Offset	Length
Level							
Delimiter	normal	10	never	never	*	0	0
Delimiter	escape	10	never	never	*	0	0

FIGURE 9 Delimiter Type - Escape

If there is *only* an escape delimiter on a given level, however, it presents a *no delimiter defined* situation for `delim` and `array` nodes.

Precedence

Precedence indicates the priority of a certain delimiter, relative to the other delimiters. Precedence is used to resolve delimiter conflicts when one delimiter is a copy or prefix of another. In case of equal precedence, the innermost prevails.

By default, all delimiters are at precedence 10, which means they are all considered the same; fixed fields are hard-coded at precedence 10. Delimiters on parent nodes are not considered when parsing the child fields; only the child's delimiter (or if it is a fixed field, its length). The range of valid precedence values is from 1 to 100, inclusive. The higher the value, the higher the precedence. Delimiters with higher precedence have a greater chance to be matched.

Changing the precedence of a delimiter will cause it to be applied to the input data-stream in different ways. For example:

- root
  - element (type delim, delimiter = "^", repeat)
  - field_1 (type fixed, length = 5)
  - field_2 (type fixed, length = 8, optional)

Although this will parse "abcde12345678^zyxvuABCDEFGH', it will *not* parse the text "abcde^zyxvuABCDEFGH' even though the second fixed field is optional. The reason is that the element's delimiter is ignored within the fixed field because they have the same precedence. If you want the element's delimiter to be examined within the fixed field data, you must change its precedence, for example:

root

- element (type delim, delimiter = "^", repeat, **precedence = 11**)
- field_1 (type fixed, length = 5)
- field_2 (type fixed, length = 8, optional)

  This will successfully parse the text "abcde^zyxvuABCDEFGH'.

  A similar argument can be applied to delimited child nodes. The parser normally attempts to match the child delimiter— setting the precedence to 11 forces the parser to match the parent delimiter first.

Optional

The *Optional* property specifies how delimiters for optional nodes are to be handled when the nodes are absent from the input instance or when their fields are empty.

TABLE 11 Optional Mode Options

Option	Rule
never	If the node is absent, the delimiter is not allowed in either input or output.
allow	If the node is absent, the delimiter is allowed in input but will not be emitted in output.
cheer	If the node is absent, the delimiter is allowed in input and will also be emitted in output.
force	If the node is absent, the delimiter must appear in input and will be emitted in output. **Note –** Only this option allows trailing delimiters for a sequence of absent optional nodes.

As illustrative examples, consider the tree structures shown in the following figure and table, where the node **a** has a caret (^) as its delimiter, and the child nodes **b**, **c**, and **d** all have asterisks (*) as their delimiters.

- **Example 1:** Child node **c** is *optional.* (Child nodes **c** and **d** must have different values for the *match* parameter.)

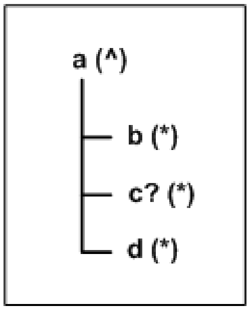


FIGURE 10 Optional Mode Property (Example 1)

Option	Input	Output
never	**b***d**^	**b***d**^
allow	**b****d**^	**b***d**^
cheer	**b****d**^	**b****d**^
force	**b****d**^	**b****d**^

- **Example 2:** Child nodes **c** and **d** are both *optional.*

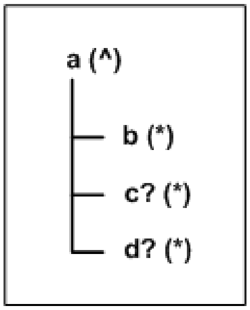


FIGURE 11 Optional Mode Property (Example 2)

Option	Input	Output
never	**b**^	**b**^
allow	**b**^, **b***^, or **b****^	**b**^
cheer	**b**^, **b***^, or **b****^	**b****^
force	**b****^	**b****^

Terminator

The *Terminator* property specifies whether or not the delimiter should appear for the last node of current level. For example, it determines whether data should look like "`a,b,|`" or "`a,b|`" assuming "`,`" (comma) is the current level delimiter and "`|`" (pipe) is the parent level delimiter.

The delimiter that terminates the last child of the level in question is referred to as the *terminator*.

TABLE 12 Terminator Mode Options

Option	Rule
never	Specifies that the delimiter is not allowed to be a terminator in input and will not be emitted as terminator in output.
allow	Specifies that the delimiter is allowed to be a terminator in input but will not be emitted as terminator in output.
cheer	Specifies that the delimiter is allowed to be a terminator in input and will be emitted as terminator in output.
force	Specifies that the delimiter must appear as a terminator in input and will also be emitted as terminator in output.

Consider the tree structure shown in the following figure, where the node **a** has a caret (^) as its delimiter, and its child nodes **b** and **c** have asterisks (*) as their delimiters.

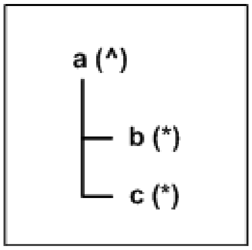


FIGURE 12 Terminator Mode Property Example

Option	Input	Output
never	**c**^	**c**^
allow	**c**^ or **c***^	**c**^
cheer	**c**^ or **c***^	**c***^

Option	Input	Output
force	**c***^	**c***^

Delimiter Characters (Bytes)

Note – There is essentially no limitation on what characters you can use as delimiters; however, you obviously want to avoid characters that can be confused with data or interfere with escape sequences, as described in "Escape Option" on page 27. The backslash (\) is normally used as an escape character; for example, the HL7 protocol uses a double backslash as part of an escape sequence that provides special text formatting instructions. Additionally, a colon (:) is used as a literal in system-generated time strings. This can interfere with recovery procedures, for example following a Domain shutdown.

Escape Sequences

Use a backslash (\) to escape special characters. The following table lists the currently supported escape sequences.

TABLE 13 Escape Sequences

Sequence		Description
\	\	Backslash
\	b	Backspace
\	f	Linefeed
\	n	Newline
\	r	Carriage return
\	t	Tab
\	ddd	Octal number*
\	xdd	Hexadecimal number**

*For octal values, the leading variable `d` can only be `0` - `3` (inclusive), while the other two can be `0` - `7` (inclusive). The maximum value is `\377`.

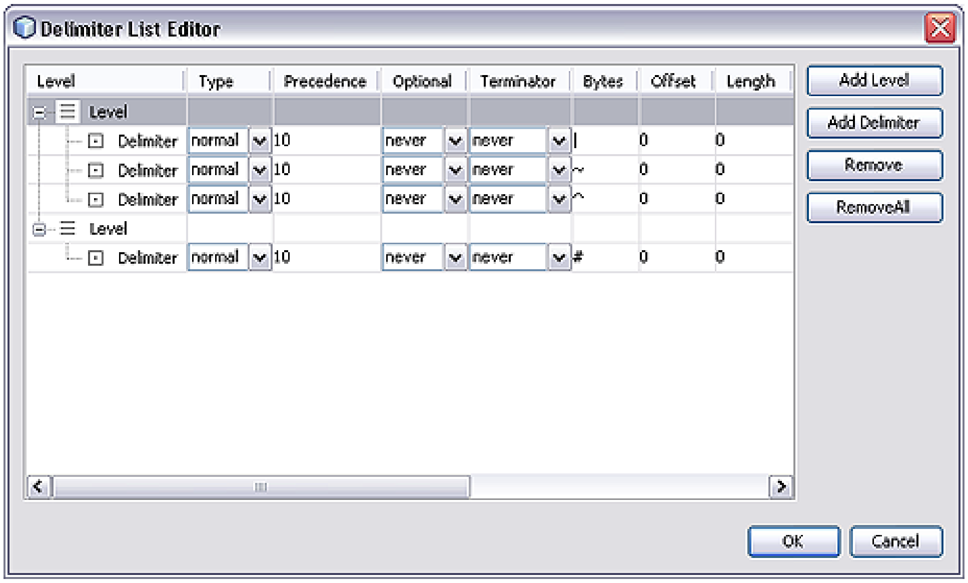
**For hexadecimal values, the variable `d` can be `0` - `9` (inclusive) and `A` - `F` (inclusive, either upper or lower case). The maximum value is `\xFF`.

Multiple Delimiters

You can specify multiple delimiters at a given level; for example, if you specify `|`, ~, and ^ as delimiters for a specific level, the parser will accept any of these delimiters:

- root
  - element (delimiters = "`|`", "~", "^")
  - field_1 (delimiter = "#")
  - field_2 (delimiters = "`|`", "~", "^")

    This will successfully parse the data `abc|def`, `abc~def`, and `abc^def`.



Level	Type	Precedence	Optional	Terminator	Bytes	Offset	Length
Level							
Delimiter	normal	10	never	never	|	0	0
Delimiter	normal	10	never	never	~	0	0
Delimiter	normal	10	never	never	^	0	0
Level							
Delimiter	normal	10	never	never	#	0	0

FIGURE 13 Multiple Delimiter Example

Anchored and Detached Delimiters

Anchored delimiters must be the starting and ending characters of the specified element.

Begin and End Delimiters

Begin delimiters mark the beginning of a fixed-length field, whereas end delimiters mark the end of a field. Usually, the term "delimiter" by itself refers to an end delimiter. We use the term "end delimiters" for clarification when begin delimiters are also present.

Begin delimiters are used to signify the beginning of a fixed-length data field. Since the data field is of fixed length, no delimiter is required to mark the end of the field. Use the `Begin Delimiter` or `Begin Delimiter Detached` property to specify it.

Constant and Embedded Delimiters

Constant delimiters remain unchanged at runtime. Embedded delimiters are embedded in the data, and thus are determined dynamically at runtime. Standard embedded delimiters are specified by the `Offset` and `Length` delimiter properties, while embedded begin delimiters are specified by the `BegOffset` and `BegLength` delimiter properties.

Defining a Delimiter List

As an example, we shall create a delimiter list for the simple Encoder structure shown in the following figure.

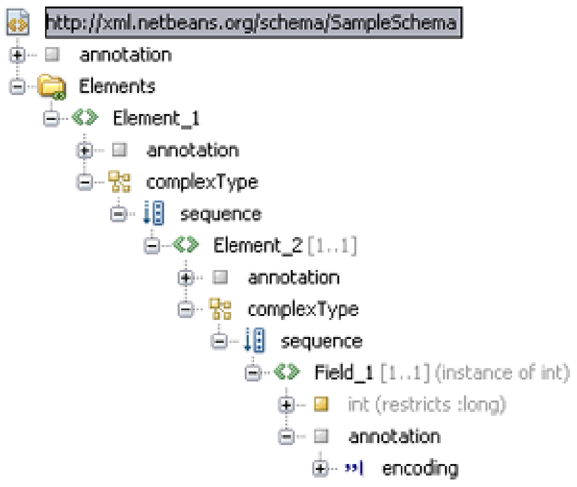


FIGURE 14 Sample Encoder Tree

▼ To create a delimiter list

1 **In the XSD Editor, select the node for which you want to define a set of delimiters (this example uses the *root* node, which is designated Element_1). By default, the value for the `Node Type` property is set to `delimited` and the value for the `Delimiter List` property appears as `not specified`.**

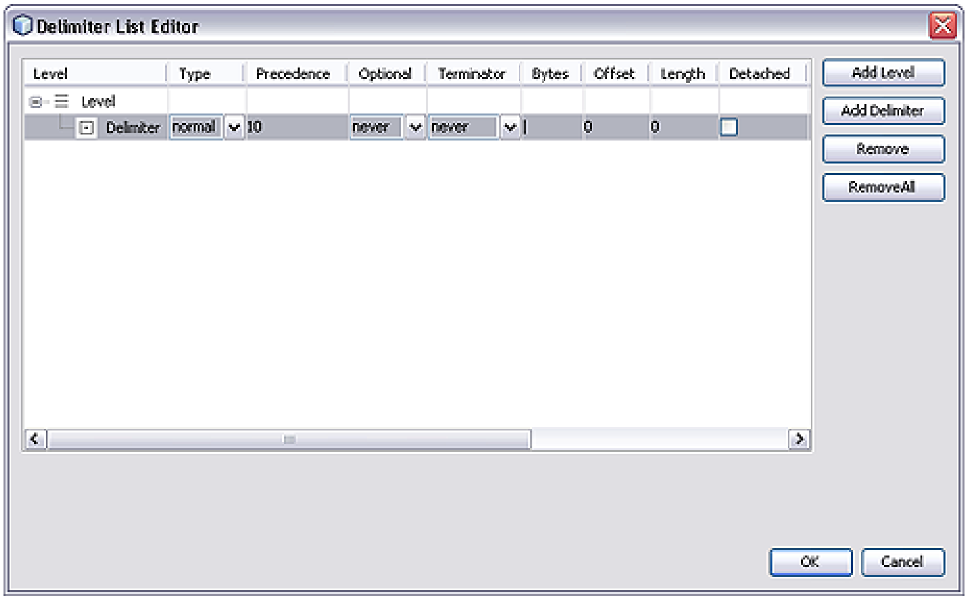
Note – The `Node Type` values for elements and fields also are `delimited` by default, so they automatically pick up the delimiters specified for their ancestors unless you define new delimiter lists for them.

---

2 **Click the ellipsis (…) button in the `Delimiter List` value field to display the Delimiter List Editor, which is initially blank.**

3 **Click `Add Level` to add a level to the delimiter list, then click `Add Delimiter` to add a delimiter to the selected level. Click in the `Bytes` field to activate it for editing and type in the delimiter characters.**

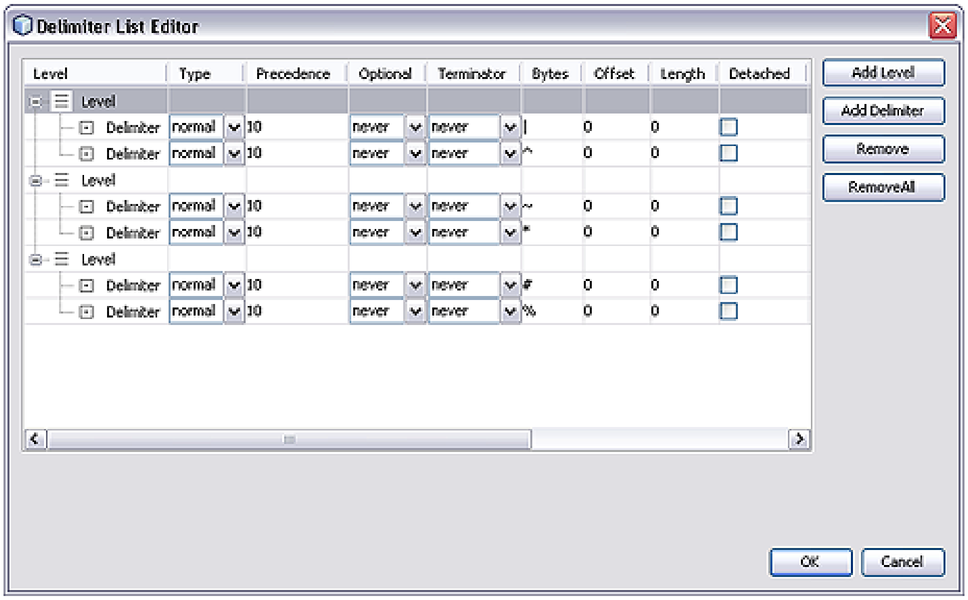
4 **Press `Enter` to set the delimiter value. The list should appear as shown in the following figure.**



Level	Type	Precedence	Optional	Terminator	Bytes	Offset	Length	Detached
Level								
Delimiter	normal	10	never	never		0	0	☐

FIGURE 15 Delimiter List Editor - Add Delimiter

5 **Continue adding levels and delimiters as required, as shown in the following figure.**



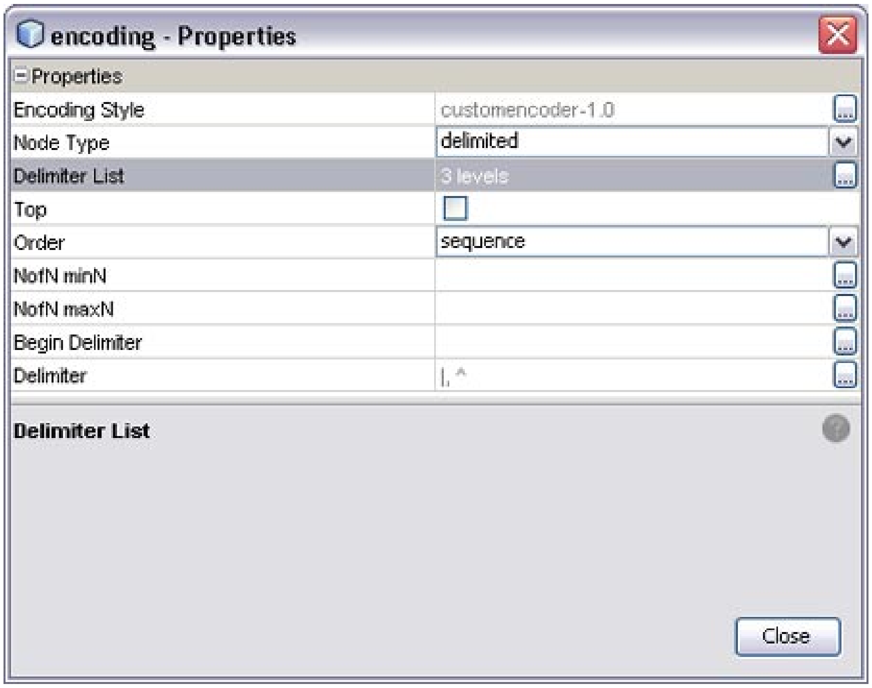
Delimiter List Editor

Level	Type	Precedence	Optional	Terminator	Bytes	Offset	Length	Detached
Level								
Delimiter	normal	10	never	never	|	0	0	☐
Delimiter	normal	10	never	never	^	0	0	☐
Level								
Delimiter	normal	10	never	never	~	0	0	☐
Delimiter	normal	10	never	never	*	0	0	☐
Level								
Delimiter	normal	10	never	never	#	0	0	☐
Delimiter	normal	10	never	never	%	0	0	☐

FIGURE 16 Delimiter List Editor - Add Levels and Delimiters

6 **Click** OK **to close the editor and save your work.**

7 **The value for the** `Delimiter List` **property will now indicate the number of delimiter levels that are specified, as shown in the following figure.**



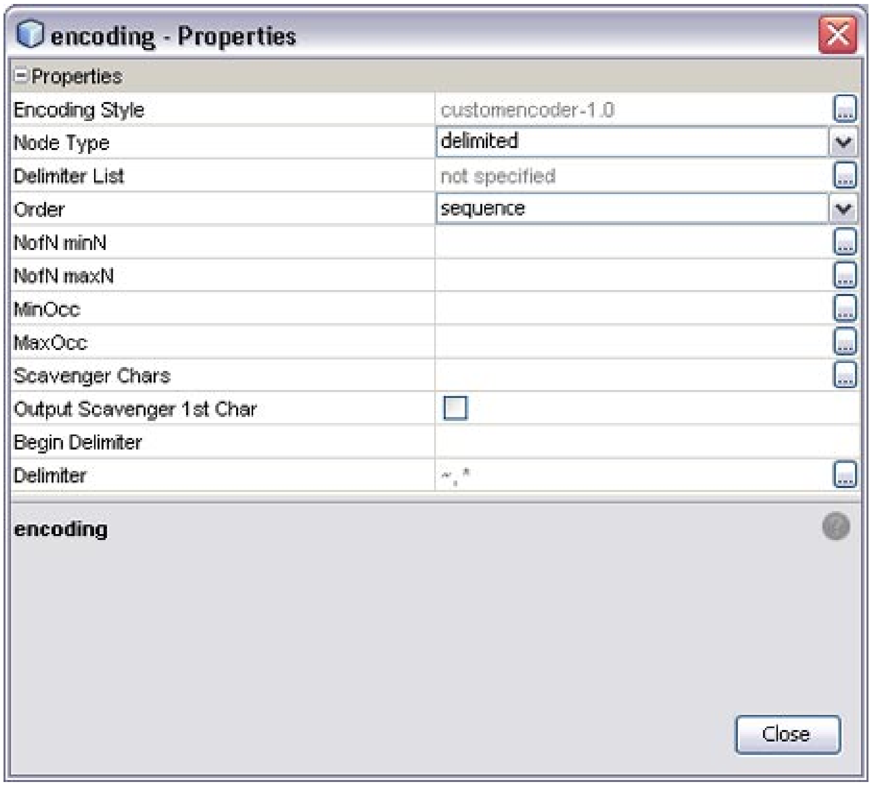
Properties

Encoding Style	customencoder-1.0
Node Type	delimited
Delimiter List	3 levels
Top	☐
Order	sequence
NofN minN	
NofN maxN	
Begin Delimiter	
Delimiter	|, ^

Delimiter List

FIGURE 17 Element_1 - Delimiters Specified

8 **The properties for Element_2 are displayed in the following figure. It automatically picks up the delimiters for *Level 2*, since the existing delimiter list is defined for Element_1. Defining another delimiter list here would override the existing list.**

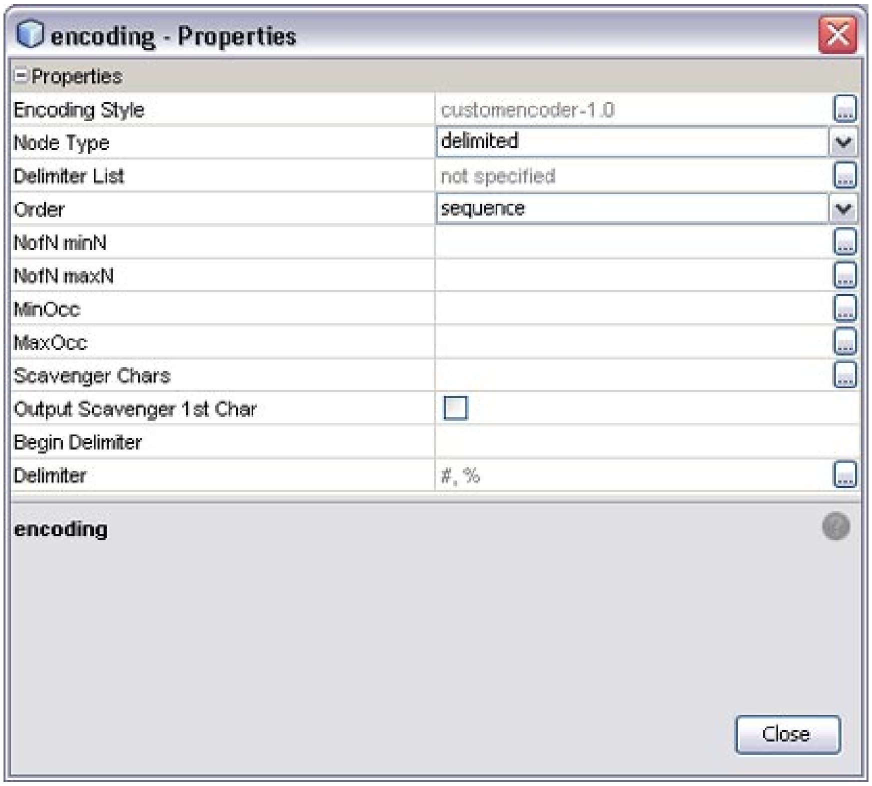


Encoding Style	customencoder-1.0
Node Type	delimited
Delimiter List	not specified
Order	sequence
NofN minN	
NofN maxN	
MinOcc	
MaxOcc	
Scavenger Chars	
Output Scavenger 1st Char	☐
Begin Delimiter	
Delimiter	~,*

encoding

FIGURE 18 Element_2 Properties

9 **Leave the** `Node Type` **property for Field_1 set to** `delimited`**; it automatically picks up the delimiters for** *Level 3* **from the list defined for Element_1, as displayed in the following figure. Again, the** `Delimiter List` **property remains** `not specified`**.**


encoding - Properties

Properties

Encoding Style	customencoder-1.0
Node Type	delimited
Delimiter List	not specified
Order	sequence
NofN minN	
NofN maxN	
MinOcc	
MaxOcc	
Scavenger Chars	
Output Scavenger 1st Char	☐
Begin Delimiter	
Delimiter	#, %

encoding

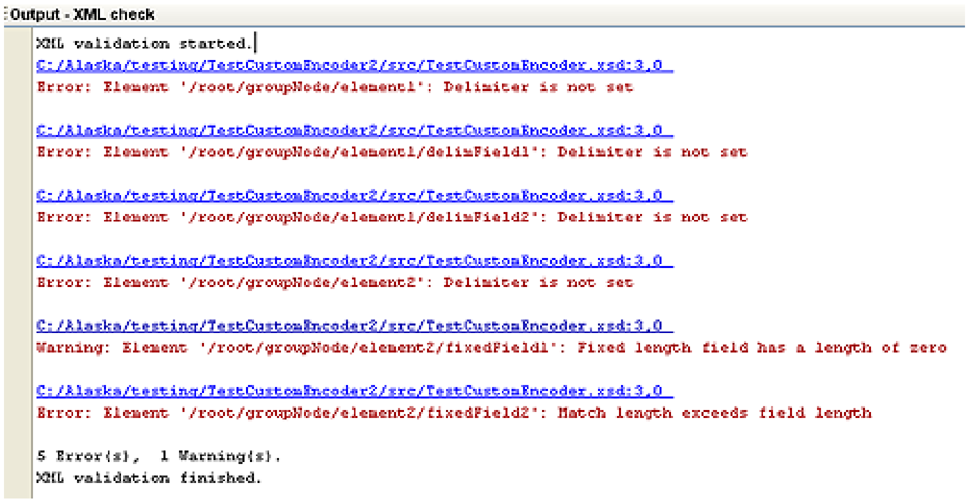
FIGURE 19 Field_1 Properties

10 **Once you have defined your delimiter list, you should test the Encoder to verify that it parses correctly.**

Validating and Testing the Custom Message Definition

Validating the Custom Message Definition

You can validate the encoding rules, along with the message definition in XML format, by clicking the validation button in the XSD Editor. If encoding rules are present, they are validated following validation of the XML grammar and semantics. An example output showing multiple errors is shown in the following figure.



```
Output - XML check
XML validation started.
C:/Alaska/testing/TestCustomEncoder2/src/TestCustomEncoder.xsd:3,0
Error: Element '/root/groupNode/element1': Delimiter is not set

C:/Alaska/testing/TestCustomEncoder2/src/TestCustomEncoder.xsd:3,0
Error: Element '/root/groupNode/element1/delimField1': Delimiter is not set

C:/Alaska/testing/TestCustomEncoder2/src/TestCustomEncoder.xsd:3,0
Error: Element '/root/groupNode/element1/delimField2': Delimiter is not set

C:/Alaska/testing/TestCustomEncoder2/src/TestCustomEncoder.xsd:3,0
Error: Element '/root/groupNode/element2': Delimiter is not set

C:/Alaska/testing/TestCustomEncoder2/src/TestCustomEncoder.xsd:3,0
Warning: Element '/root/groupNode/element2/fixedField1': Fixed length field has a length of zero

C:/Alaska/testing/TestCustomEncoder2/src/TestCustomEncoder.xsd:3,0
Error: Element '/root/groupNode/element2/fixedField2': Match length exceeds field length

5 Error(s),  1 Warning(s).
XML validation finished.
```

FIGURE 20 Example Validation Result

Testing the Encoder Runtime Behavior

The Encoder Tester allows you to test the Encoder's runtime behavior at design time. To display the tester dialog, right-click the XSD file to display its context menu and select `Encoder` > `Test`, as shown in the following figure.

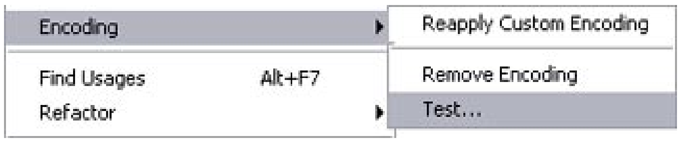
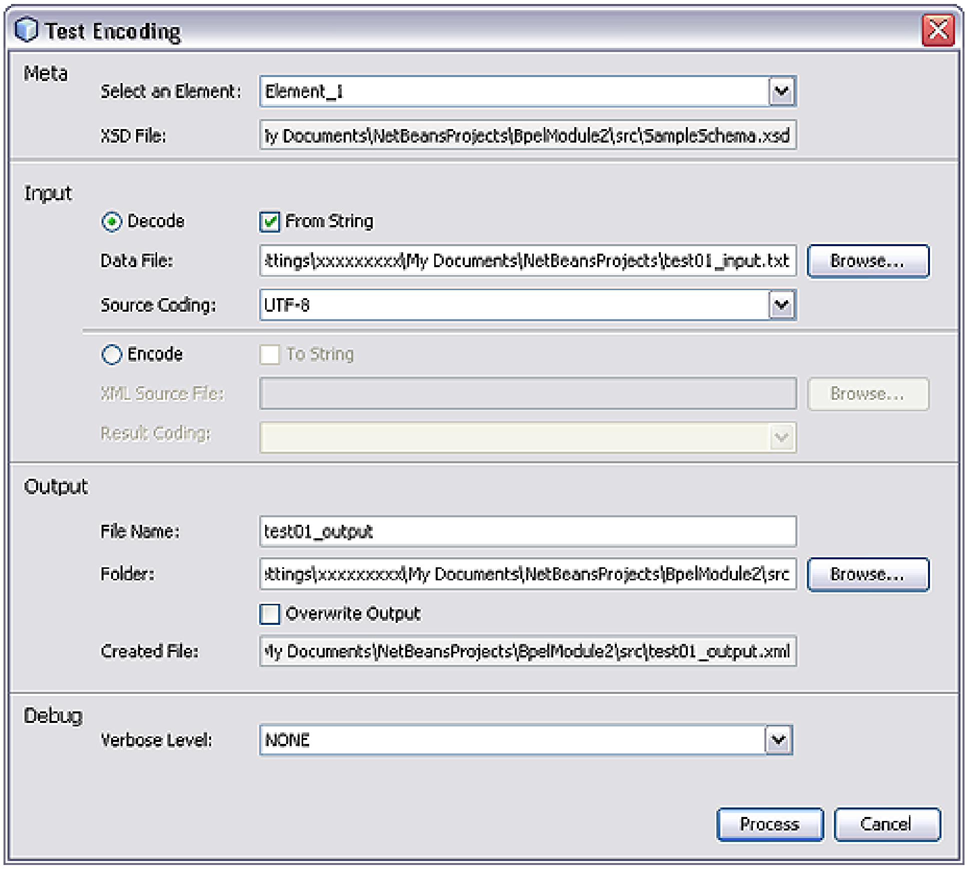


FIGURE 21 Starting the Encoder Tester

The Test Encoding dialog is shown in the following figure. The various fields are described briefly in the table following the figure. After the Decode test is complete, the result is placed in an XML file inside the current project. This file can then be validated as described in the preceding section. There is no automatic method for validating the Encode result, however.


Test Encoding

Meta

Select an Element: Element_1

XSD File: ly Documents\NetBeansProjects\BpelModule2\src\SampleSchema.xsd

Input

Decode [✓ From String]

Data File: ttings\xxxxxxxxx\My Documents\NetBeansProjects\test01_input.txt

Source Coding: UTF-8

Encode [ ] To String

XML Source File:

Result Coding:

Output

File Name: test01_output

Folder: ttings\xxxxxxxxx\My Documents\NetBeansProjects\BpelModule2\src

[ ] Overwrite Output

Created File: My Documents\NetBeansProjects\BpelModule2\src\test01_output.xml

Debug

Verbose Level: NONE

FIGURE 22 Test Encoding Dialog

TABLE 14 Test Encoding Dialog Fields

Section	Field Caption	Description
Meta	Select an Element	Specifies the top-level element whose structure you want to test.
	XSD File	Identifies the XSD file you have selected for testing.

TABLE 14 Test Encoding Dialog Fields *(Continued)*

Section	Field Caption	Description
Input	Decode/Encode	Option buttons to select the direction of data flow for the test. Specifies whether encoding or decoding behavior is being tested.
	From/To String	Specifies that the input or output data is in string format. If not checked, byte format is assumed.
	Data File	Specifies the data file to use in the Decode test.
	XML Source File	Specifies the source file to use in the Encode test.
	Source/Result Coding	Specifies the encoding of the serialized data. See "Data Encoding" on page 17
Output	File Name	Specifies the file name to use for the test result.
	Folder	Specifies the folder in which you want the output file to be placed.
	Overwrite Output	Specifies whether or not you want to overwrite any existing output file having the same name.
	Created File	Confirms that the output file has been created, along with the location.
Debug	Verbose Level	Specifies the level of detail contained in the log file. The options are: ■ `None` ■ `Info` ■ `Fine` ■ `Finer` ■ `Finest`

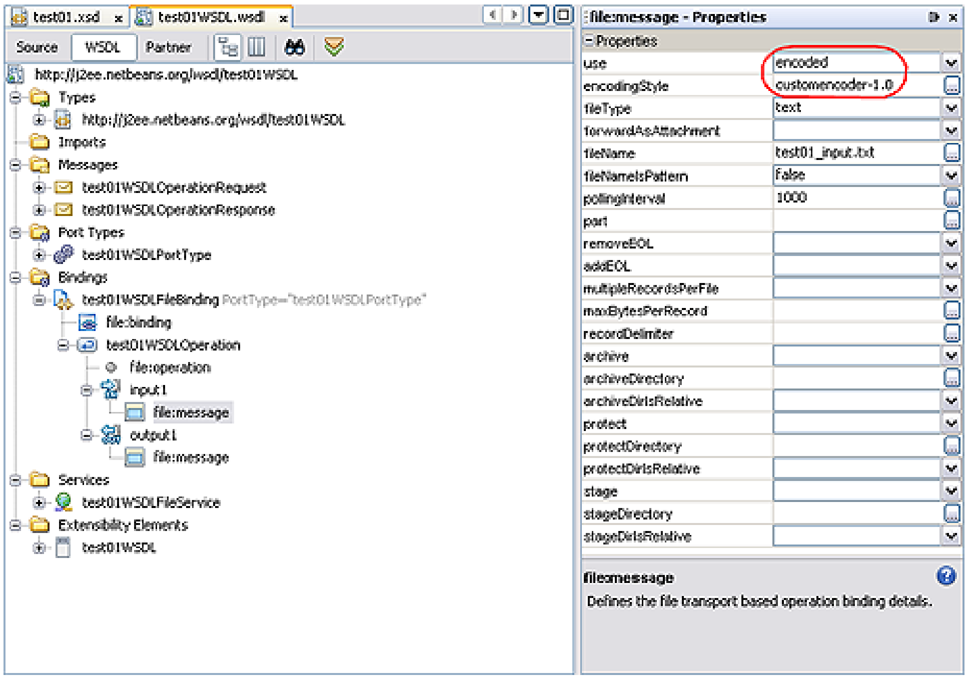
Using Custom Encoders in JBI Projects

Using a Custom Encoder in a JBI Project is described in the following procedure.

▼ To Use a Custom Encoder in a JBI Project

1 **Import the XSD into a WSDL using the WSDL context menu.**

2 **Configure the individual binding component's inbound or outbound message type as** `encoded` **and set the encoding style to** `customencoder-1.0`**. See the following figure as an example.**



```
http://j2ee.netbeans.org/wsdl/test01WSDL
  Types
    http://j2ee.netbeans.org/wsdl/test01WSDL
  Imports
  Messages
    test01WSDLOperationRequest
    test01WSDLOperationResponse
  Port Types
    test01WSDLPortType
  Bindings
    test01WSDLFileBinding PortType="test01WSDLPortType"
      file:binding
      test01WSDLOperation
        file:operation
        input1
          file:message
        output1
          file:message
  Services
    test01WSDLFileService
  Extensibility Elements
    test01WSDL
```

Properties

use	encoded
encodingStyle	customencoder-1.0
fileType	text
forwardAsAttachment	
fileName	test01_input.txt
fileNameIsPattern	false
pollingInterval	1000
part	
removeEOL	
addEOL	
multipleRecordsPerFile	
maxBytesPerRecord	
recordDelimiter	
archive	
archiveDirectory	
archiveDirIsRelative	
protect	
protectDirectory	
protectDirIsRelative	
stage	
stageDirectory	
stageDirIsRelative	

file:message
Defines the file transport based operation binding details.

FIGURE 23 File Message Property Configuration

About Data Parsing and Serialization

The parsing and serializing operations require data to be in byte-array form, so different methods for encoding and decoding data must be used to accommodate different input and output data formats. These different methods incorporate various stages of character conversion using specific character sets.

Encoding Process

Internally, the encoder requires the data input and output to be in bytes. The encoding process uses the `serializing charset`, as illustrated in the following figure.

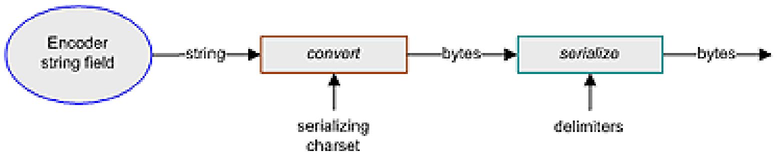


FIGURE 24 Encoding Process

encodeToString() Method

The `encodeToString()` method requires conversion to produce an output string after encoding from a byte[] field. This method also requires conversion when encoding from a string field, since the parser requires the data in bytes, and conversion again to produce an output string. The `encodeToString()` process uses the `serializing charset`, as illustrated in the following figure.

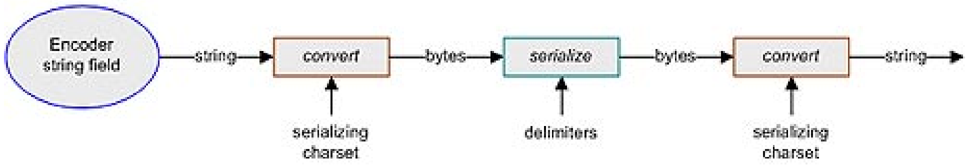


FIGURE 25 encodeToString()

encodeToBytes() Method

The `encodeToBytes()` method requires conversion to produce bytes after encoding from a string field. Following serialization, this method also requires conversion to produce an output (in bytes) having a different format from that used by the parser. If the same format is desired, then the `output charset` is left undefined, the `serializing charset` property is substituted by default, and the double conversion is bypassed. The `encodeToBytes()` process uses both the `serializing charset` and the `output charset`, as illustrated in the following figure.

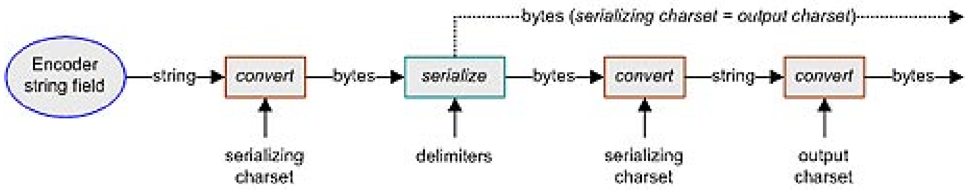


FIGURE 26 encodeToBytes()

encodeToStream() Method

Encodes an XML representation of a message into an OutputStream object, encoded in custom format.

encodeToWriter() Method

Encodes an XML representation of a message into a Writer object, encoded in custom format.

Decoding Process

Internally, the decoding process requires conversion when decoding to a string field, since the input is in bytes as required by the parser. The decoding process uses the `parsing charset`, as illustrated in the following figure.

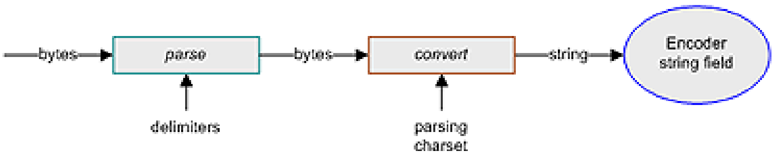


FIGURE 27 Decoding Process

decodeFromString() Method

The `decodeFromString()` method requires conversion of the input string, since the parser requires the data in bytes. This method requires a second conversion when decoding to a string field. The `decodeFromString()` process uses the `parsing charset`, as illustrated in the following figure.

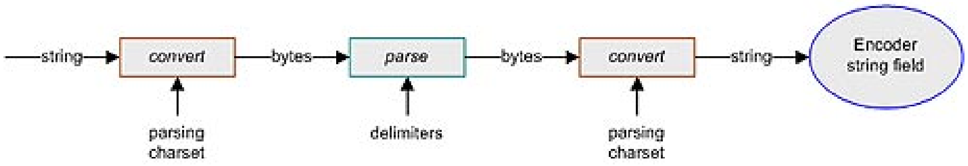


FIGURE 28 decodeFromString()

decodeFromBytes() Method

The `decodeFromBytes()` method requires conversion if the input data has a different byte format from that used by the parser. If the same format is desired, then the `input charset` is left undefined, the `parsing charset` is substituted by default, and the double conversion is bypassed. After parsing, this method requires further conversion if decoding to a string field. The `decodeFromBytes()` process uses both the `input charset` and the `parsing charset`, as illustrated in the following figure.

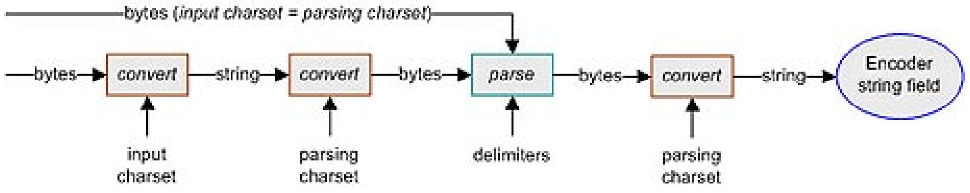


FIGURE 29 decodeFromBytes()

decodeFromStream() Method

Decodes an InputStream object encoded in custom format into an XML-encoded message.

decodeFromReader() Method

Decodes a Reader object encoded in custom format into an XML-encoded message.

Setting Delimiters

The following figure illustrates how the delimiter gets set and passed into the parser.

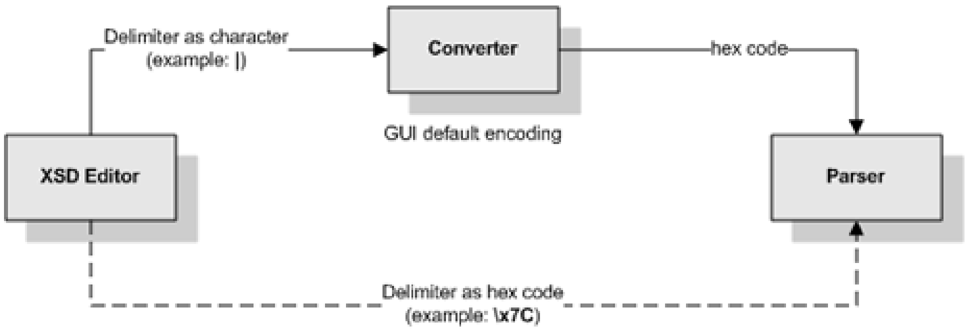


FIGURE 30 Setting Delimiters

As an example, if you select a delimiter in the XSD Editor by hex code (such as **\x7C**), it is passed directly into the parser. If you type the delimiter in as a pipe (**|**), however, then the pipe character is first converted to hex code, using the GUI's encoding, and then sent to the parser.