ASN1VE Users Guide

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Chapter 1. Introduction

ASN1VE is a graphical editor for ASN.1-encoded data and schemas. Features include:

- Dynamic tree views for quickly navigating encoded data and schemas
- Search tool to find specific items in decoded data
- Type-specific editors to make changing individual data elements easy
- Import/Export data in binary, hexadecimal or Base64 text, and XML formats
- ASN.1 schema editor with syntax highlighting
- Hex editor for low-level manipulation of encoded data

ASN1VE works with a number of different encoding rules:

- Binary encoding rules BER (including DER and CER subsets), PER, UPER, and OER.

  Import and Export to XML (XER) and JSON (JER) textual formats.

It can display any valid message that uses these encoding rules. Some well-known message types that can be viewed/edited include the following:

- 3GPP / LTE protocol messages including NBAP, RANAP, RNSAP, RRC, S1AP, and X2AP
- V2X protocol messages in UPER and OER binary formats such as DSRC Basic Safety Messages (BSM) and MAP/SPAT
- OMA Secure User Plane Location (SUPL) messages
- H.323 protocol signaling messages
- Security-related messages including X.509/PKIX certificates and Cryptographic Message Syntax (CMS). The include messages in Base64 and PEM formatted files.
- Transferred Account Procedure (TAP3) batch files
- Various vendor-specific CDR formats including 3GPP standard CDR files with 32.297 headers

A limited version of ASN1VE can be used for free. This includes the hex editor and a basic data tree view for BER-encoded data. To access advanced features, such as loading and editing schemas, PER, OER, and XML capabilities, and per-element data editing, a license must be purchased.

Chapter 2. Installation

Windows Installation

Minimum Resource Requirements

- Windows 7, 8, or 10 operating system.
- Write access to the Windows Registry, the installation directory, the ProgramData directory, and the Documents directory.

Running the Installation Wizard Program

This section explains how to run the Windows installation wizard setup program.

A distribution setup file containing the complete ASN1VE application should have been provided. This would be an executable file with a name in the following format:

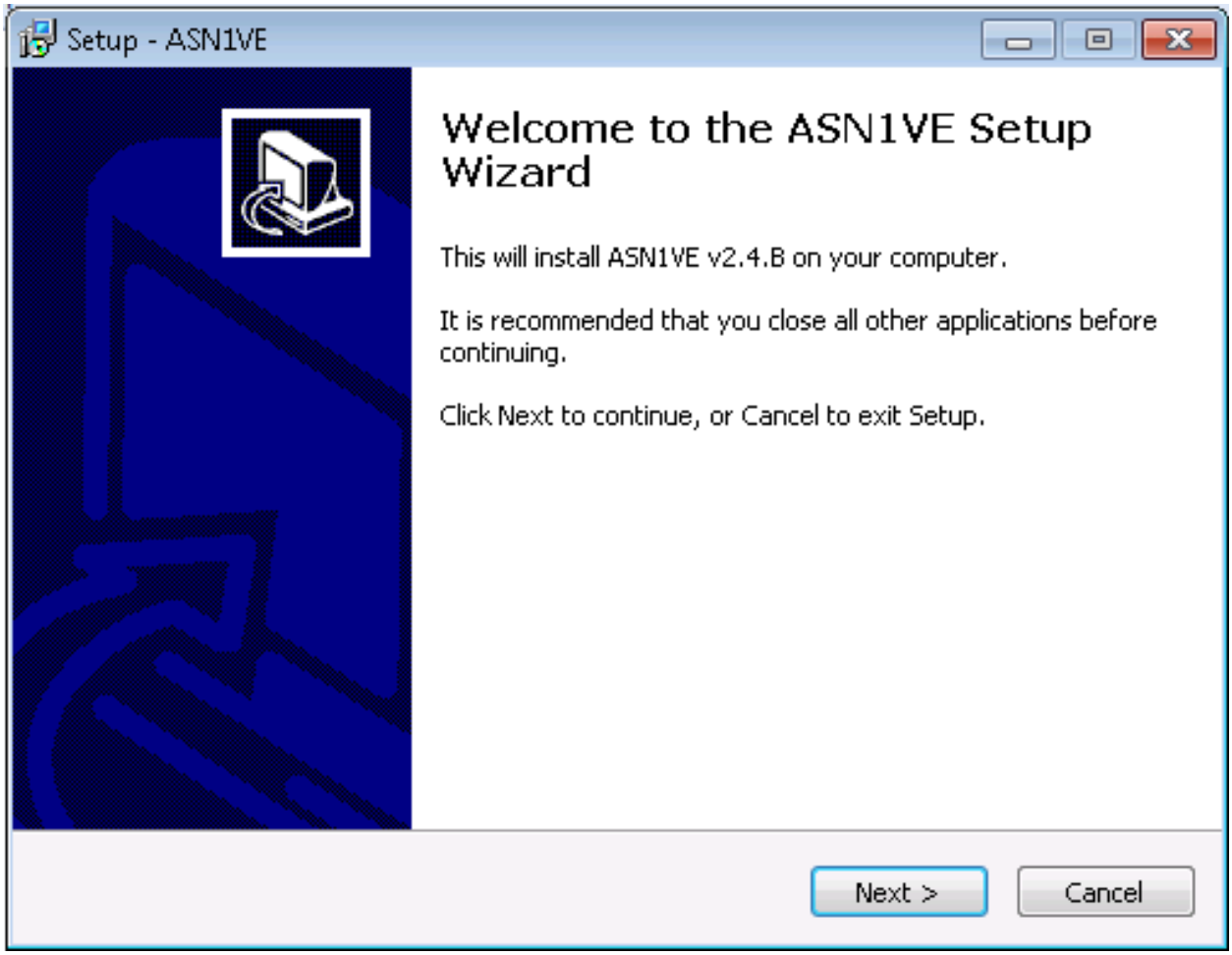
*asn1vev***x64.exe* or

*asn1vev***w32.exe*

where *** would be replaced with the current version number (for example, 280).

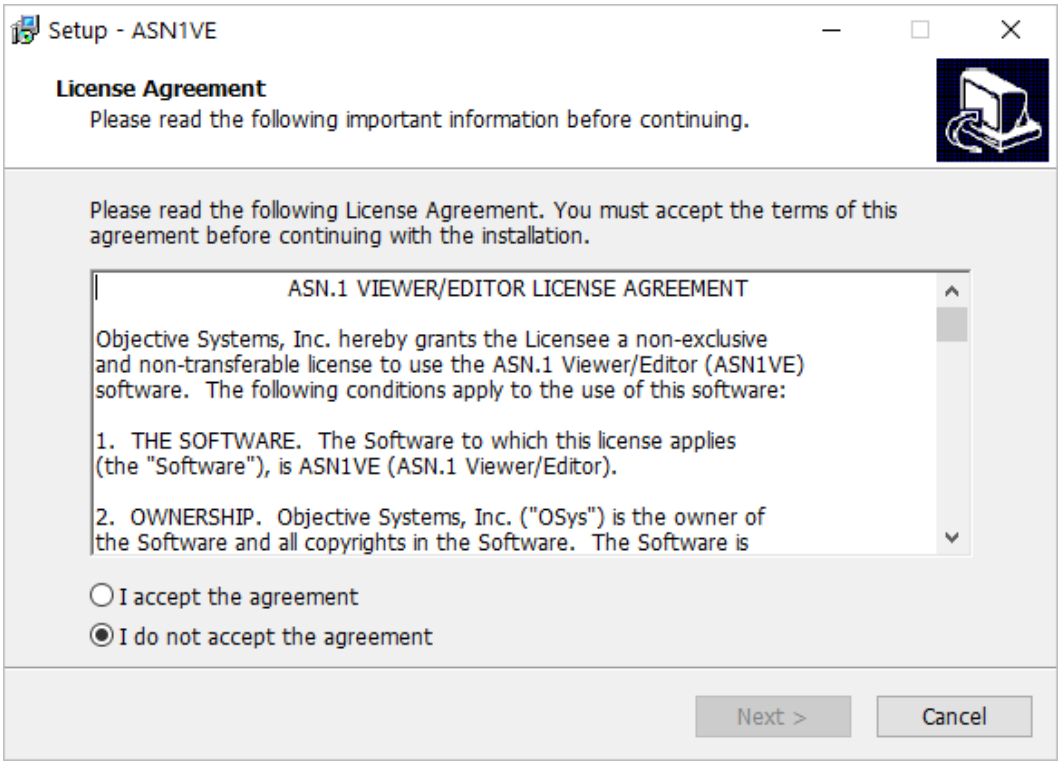
Double-click this file to launch the Wizard. Depending on the version of Windows that is insalled, the first window that appears may be a window asking the user if he wants to allow the application to make changes to the system. If this window appears, *Yes* should be the response.

The next window that appears is a welcome screen:

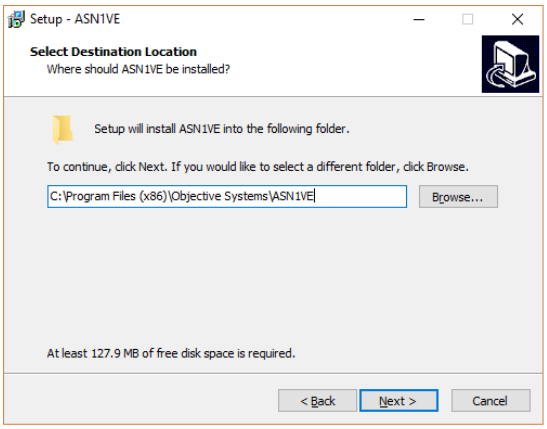


Click *Next* > to move to the next window.

The next window that should appear is the License Agreement screen:



The user should carefully read and understand the license terms. Once this is done, click the "I accept the agreement" radio button to enable the *Next* > button. Click *Next* > to specify where ASN1VE will be installed:

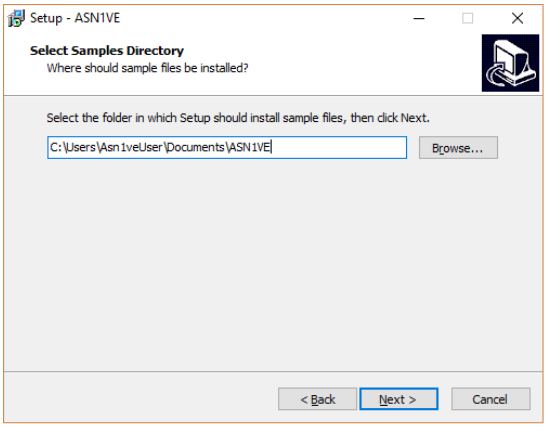


By default, the product is installed in *C:\Program Files \Objective Systems\ASN1VE* (64-bit version) or *C:\Program Files (x86)\Objective Systems\ASN1VE*, (32-bit version) but some users may prefer to install elsewhere. For example, the path could be changed to *C:\Program Files\Objective Systems\ASN1VE_v**** to allow multiple versions to be installed.

In general, it is not a good idea to install a new major release on top of an existing release. The older release should first be uninstalled. For minor patch releases, it should be OK to do this.

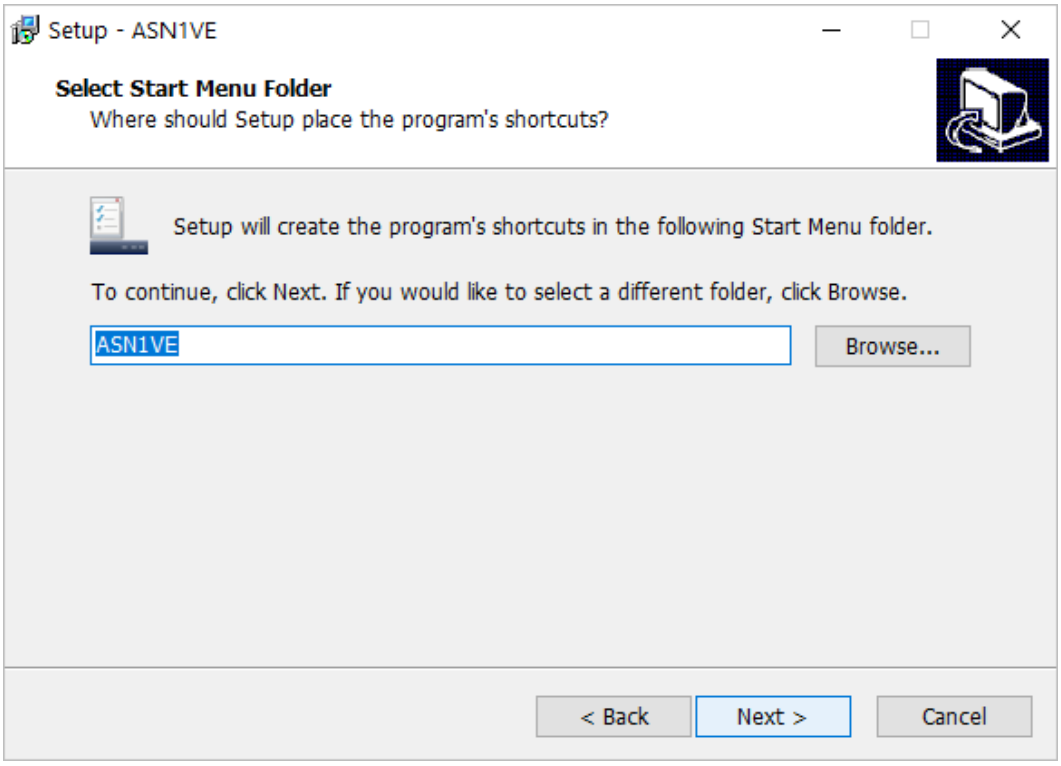
Note that this window also shows the actual amount of disk space required for the product.

Once a location for the software has been selected, click *Next* > to continue. The following screen will be displayed:

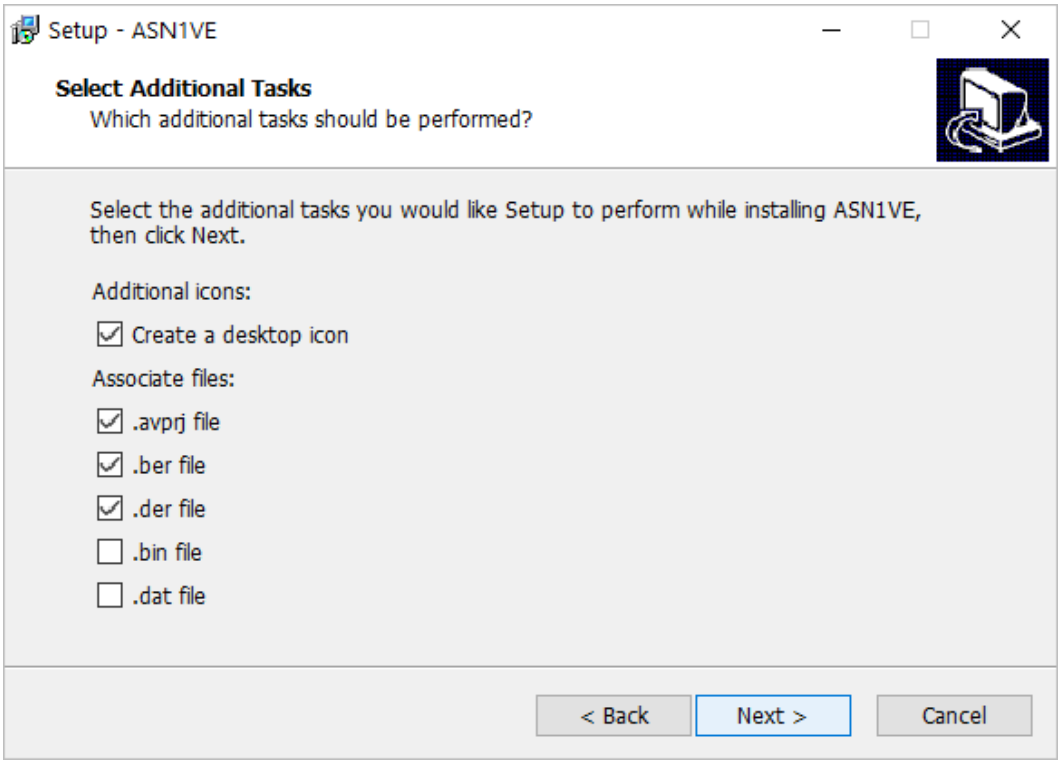


This dialog allows the user to define the folder in which the ASN1VE samples will be installed.

Once a location for the samples has been selected, click *Next* > to continue. The following screen will be displayed:

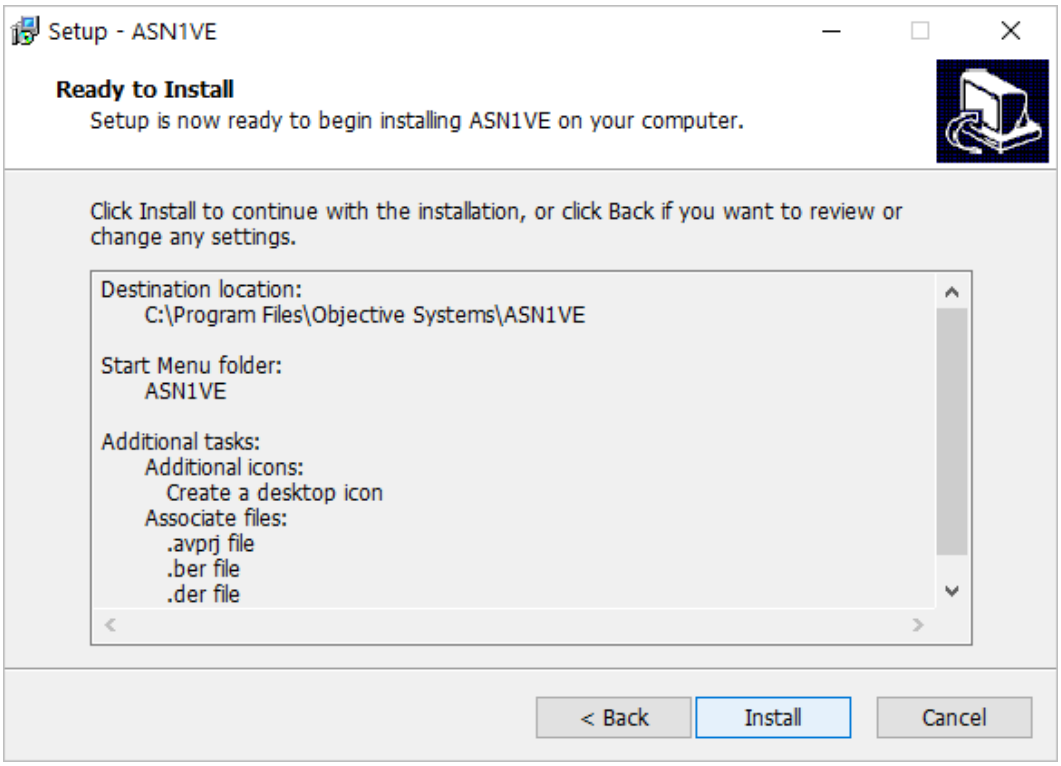


This dialog allows the user to define the folder in which ASN1VE is found on the Windows *Start* menu (accessible when the user clicks the Windows *Start* button). The user can leave this as the default setting or select a different folder. Click *Next* > to continue.



This allows a user to specify creation of a desktop icon as well as file extension associations. Of these associations, the .avproj file association will cause ASN1VE to be launched into project mode to read in all details of the selected project. All other associated files are assumed to be binary files containing ASN.1-encoded data to be loaded. ASN1VE will launch into the Open File dialog upon activation of files with these extensions. Additional associations may be added through the Windows Explorer file extension association feature.

Click *Next* > to continue. The final setup screen provides a summary of all data that has been entered:



Click *Install* to complete the setup procedure. The < *Back* button can be used to go back and modify installation settings.

Linux Installation

Minimum Resource Requirements

- A reasonably current distribution (Ubuntu, Fedora, SUSE, RHEL, et c.)
- Greater than 60 MB of disk space

Installing the Distribution File

ASN1VE is distributed as a platform-independent .tar.gz archive: *asn1ve***lnx.tar.gz*, where *** would be replaced with the current version number (for example, 270).

Installation may be accomplished simply by unpacking the archive; a global installation in */opt* is recommended for multi-user settings. Otherwise a local installation in the user's home directory should be sufficient.

To unpack the archive, run *tar xzf asn1ve***lnx.tar.gz*, noting that *** would be replaced with the current version number. Global installations in */opt* will require super user privileges.

The archive will be unpacked in *asn1ve_v****. The executables and dependent libraries are stored in *asn1ve_v***/bin*.

Mac OSX Installation

Minimum Resource Requirements

- Mac OSX 10.10 or greater
- Write access to the installation directory

Running the Installation Wizard Program

This section explains how to run the Mac OSX installation wizard setup program.

A distribution setup file containing the complete ASN1VE application should have been provided. This would be a disk image file with a name in the following format:

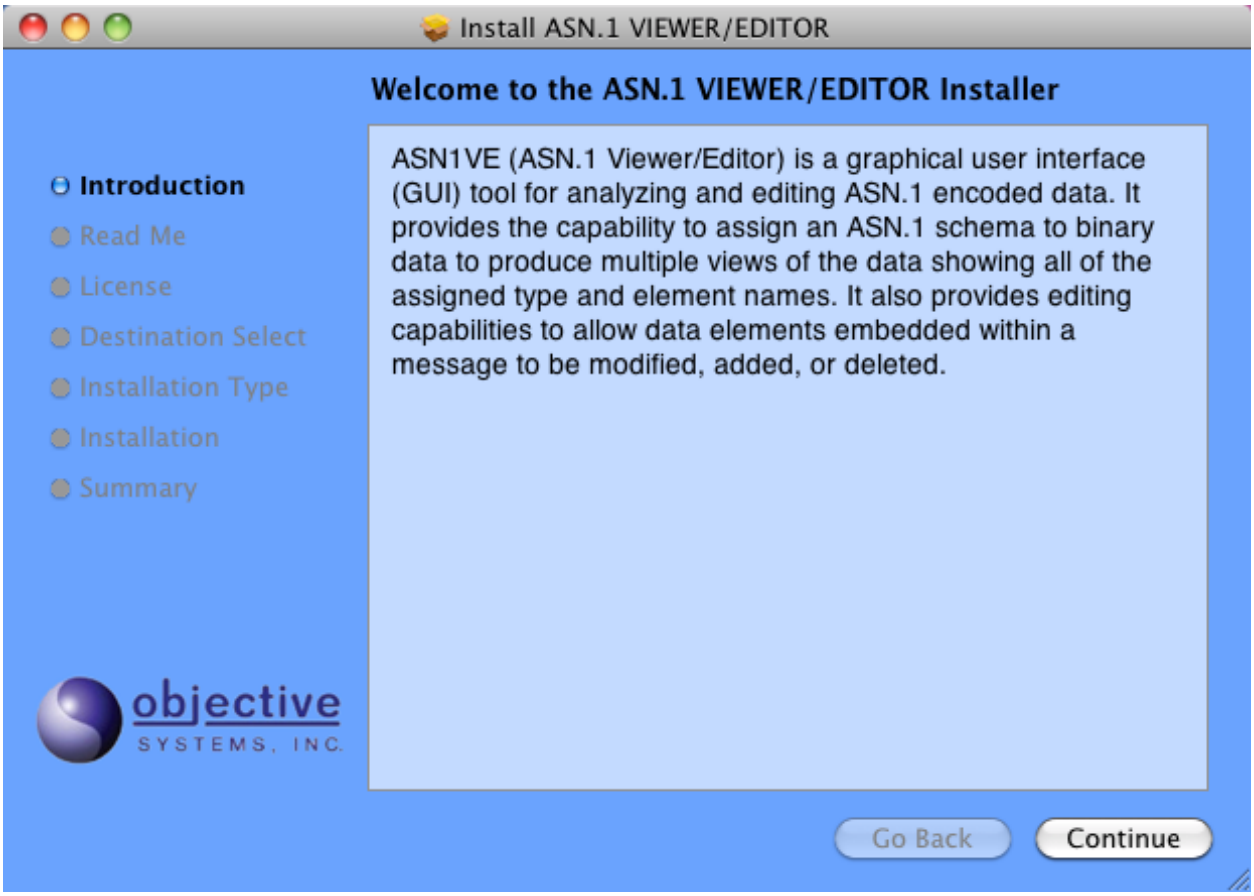
*asn1ve_v***.dmg*

where *** would be replaced with the current version number (for example, 280).

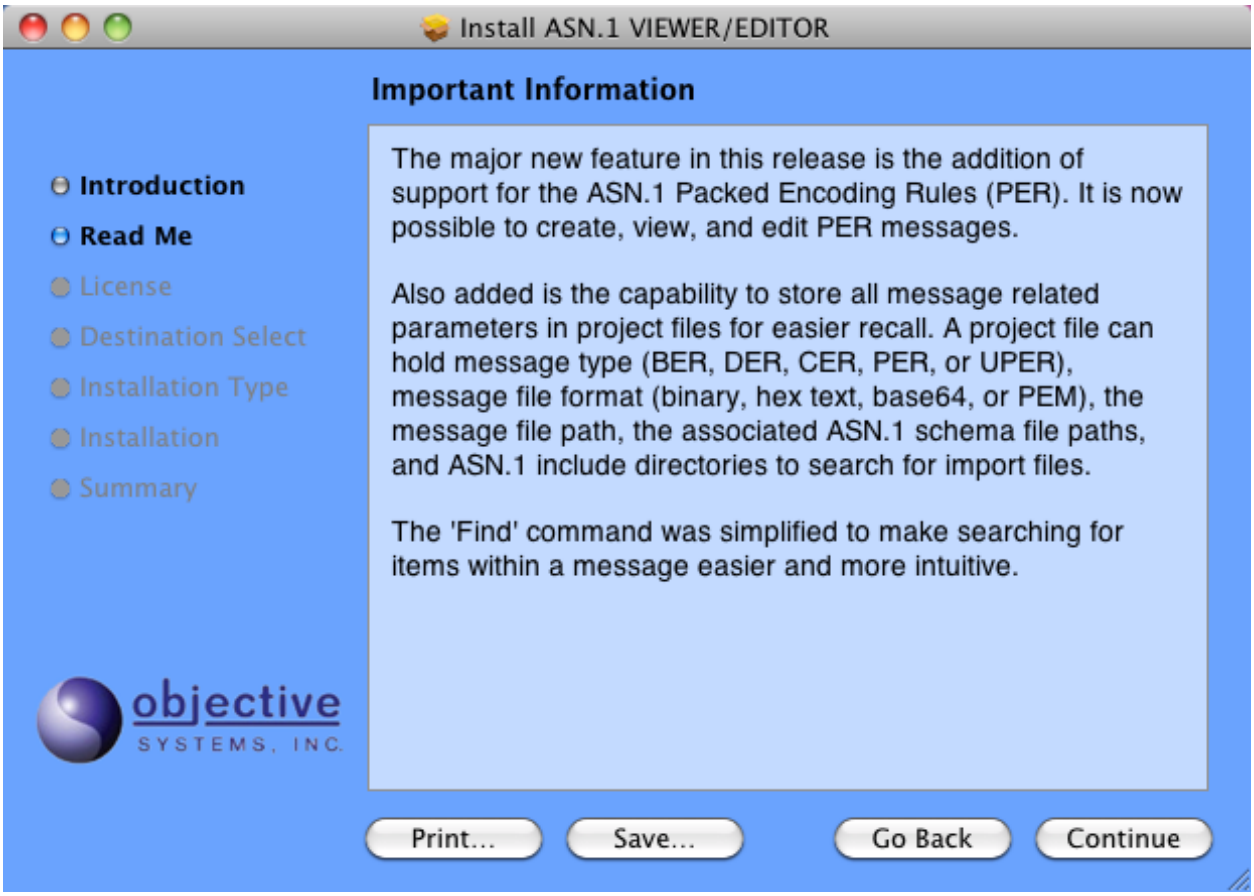
Double-click this file. The first window that should appear is this screen:

This screen displays a *README.html* and two package files: *asn1ve_core.pkg*and *asn1ve_samples.pkg*. Double-click the *asn1ve_core.pkg* file first to install the core ASN1VE software.

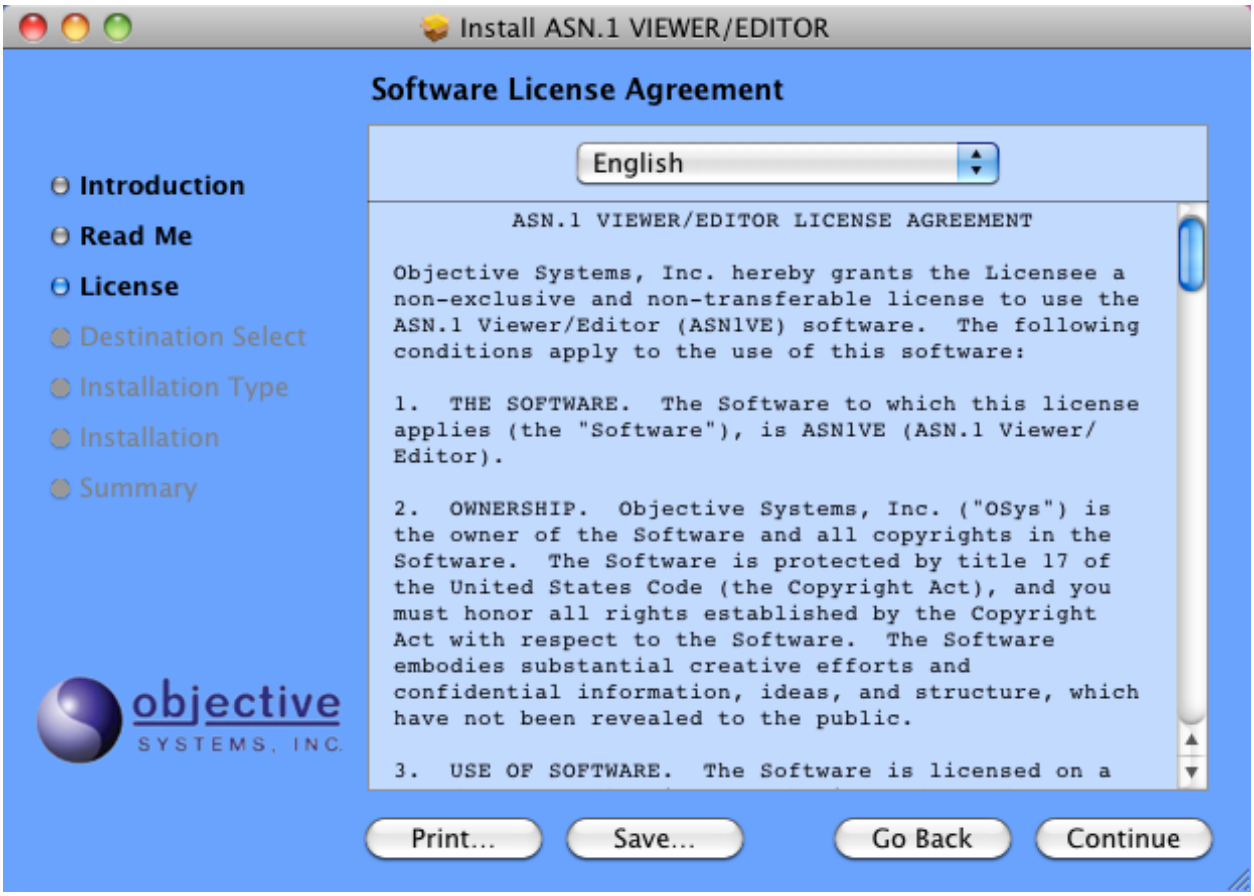
The first screen of the core installation is the Welcome screen:



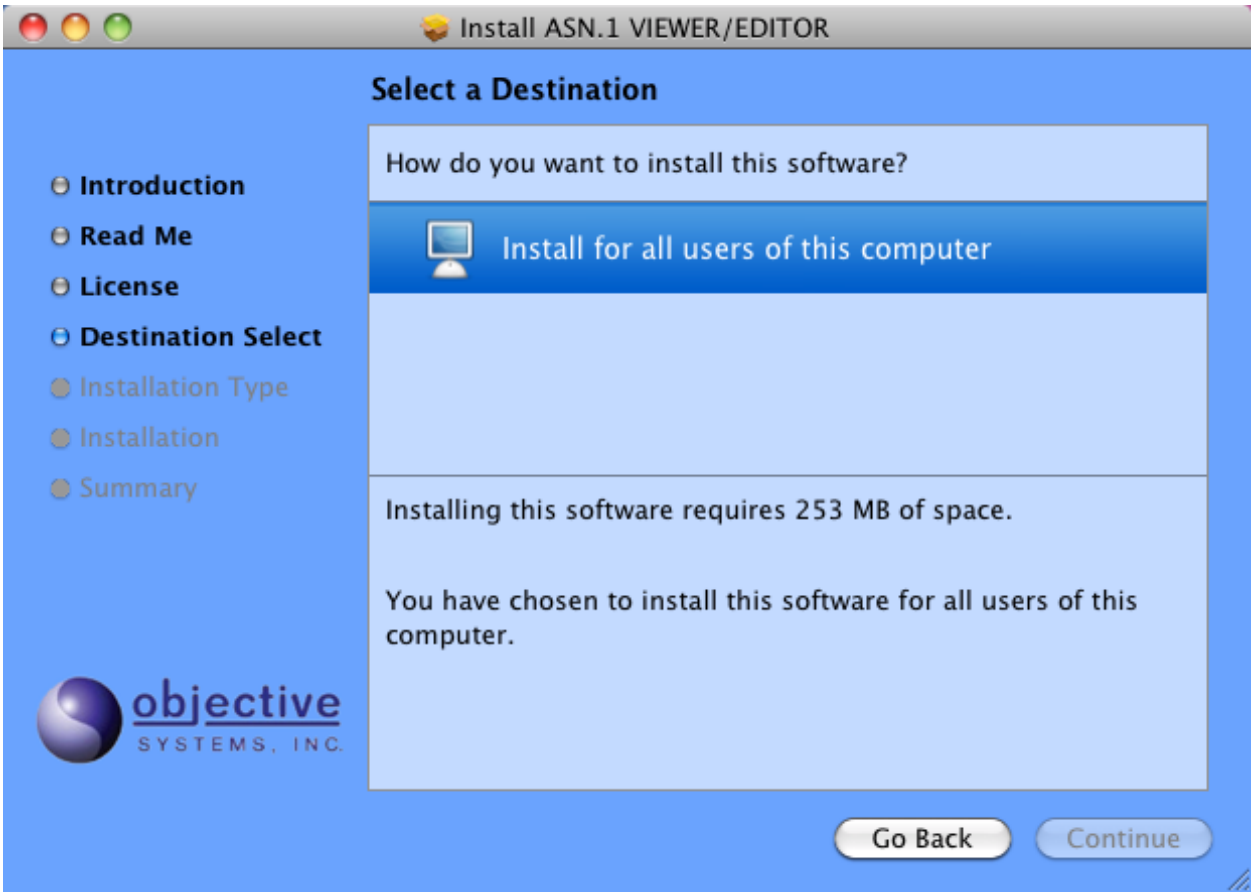
Click *Continue*. The next screen shows a brief synopsis of changes in the current version of the software.



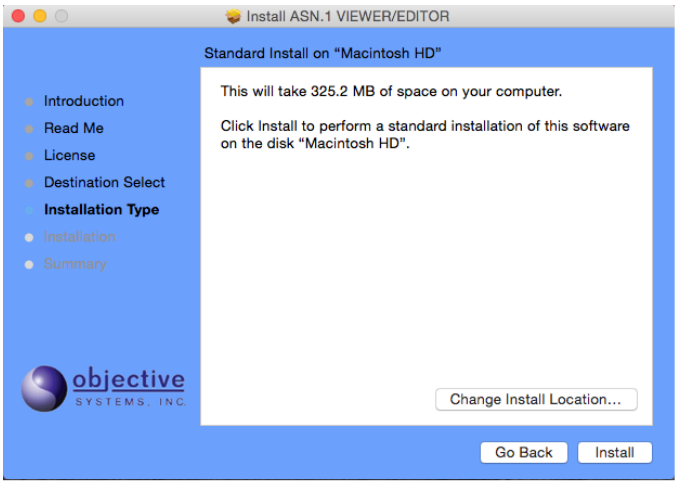
Click *Continue*. The License screen displays the Software License Agreement:



The user should carefully read and understand the license terms. Once this is done, click *Continue*, and then click *Agree*.

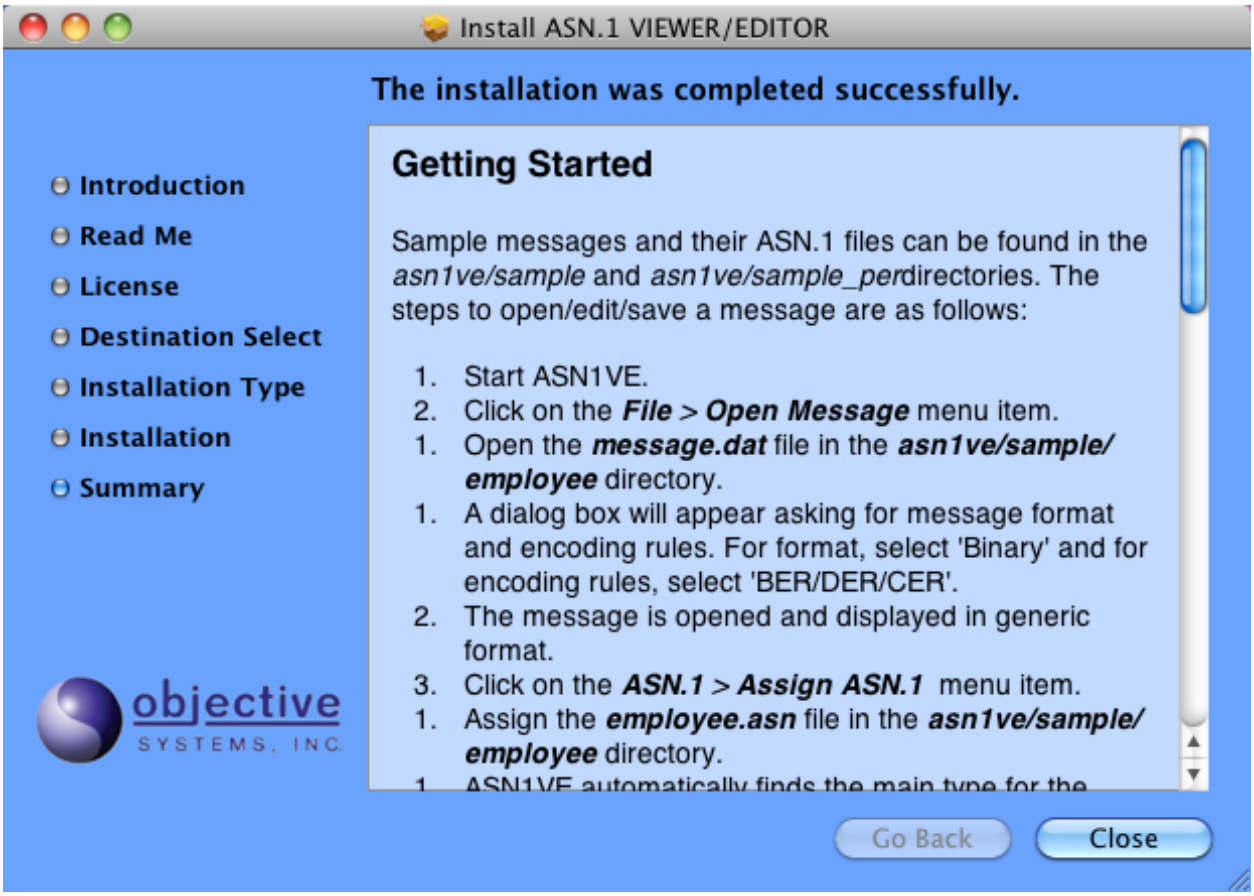


This page, if presented, allows the user to select where to install the software. Select one of the options and click *Continue*.



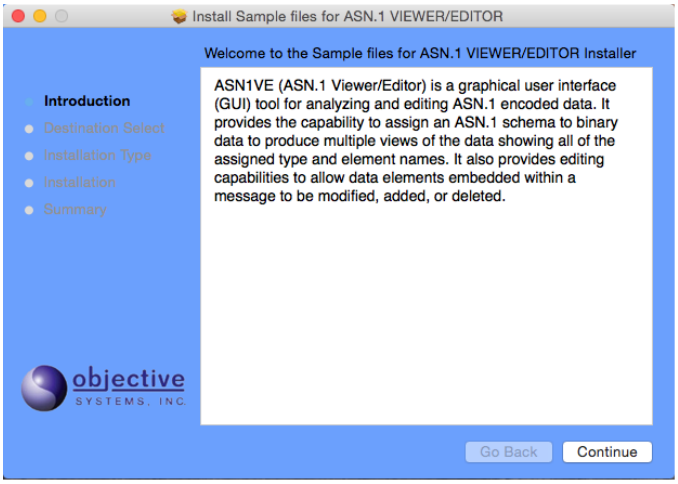
Click *Install* to complete the setup procedure. The *Go Back* button can be used to return to a previous page and change settings before completing installation.

The following page is displayed when the installation is complete.



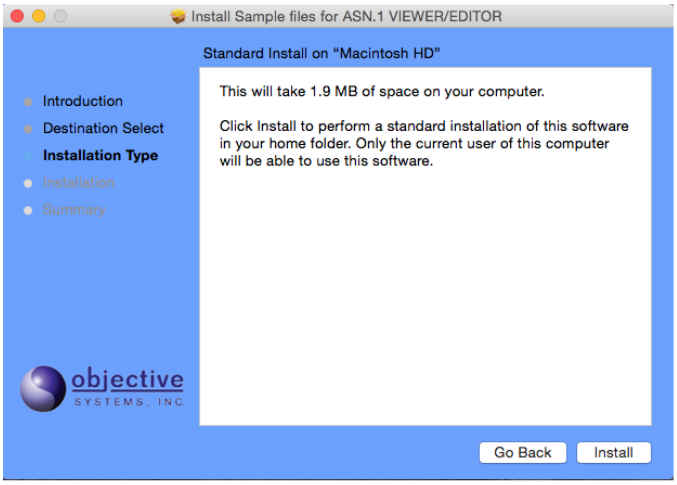
The ASN1VE core application bundle *asn1ve.app* is installed in the *Applications* folder.

After the *asn1ve_core.pkg* is installed, the *asn1ve_samples.pkg* can be installed. The install will create a directory named ASN1VE under the user's home directory and place the samples there. Double-click the *asn1ve_samples.pkg* icon to start the installation of the samples. The first screen is a welcome screen:



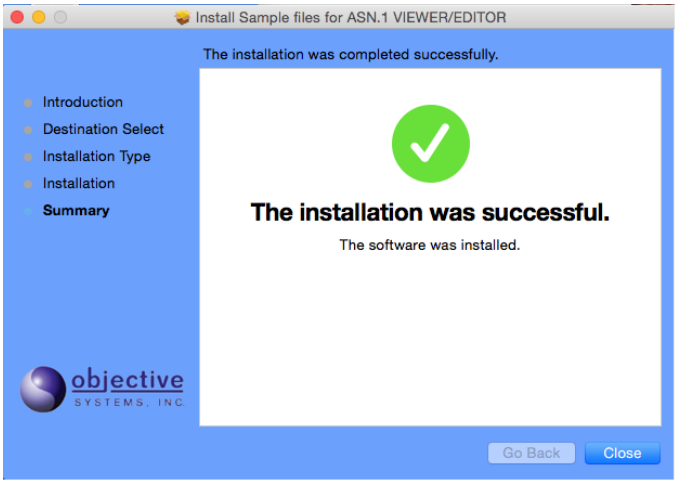
Click *Continue* to advance.

The next screen displays how much disk space will be required:



Click *Install* to begin the installation of the samples.

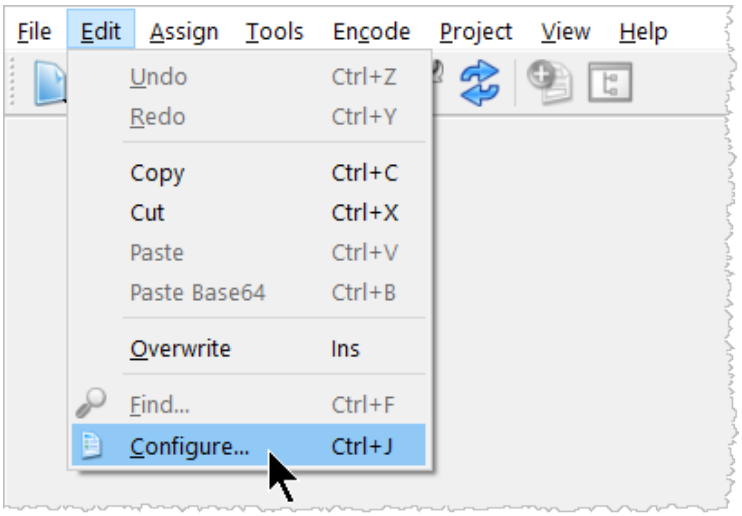
When the installation is complete, this screen will be displayed:



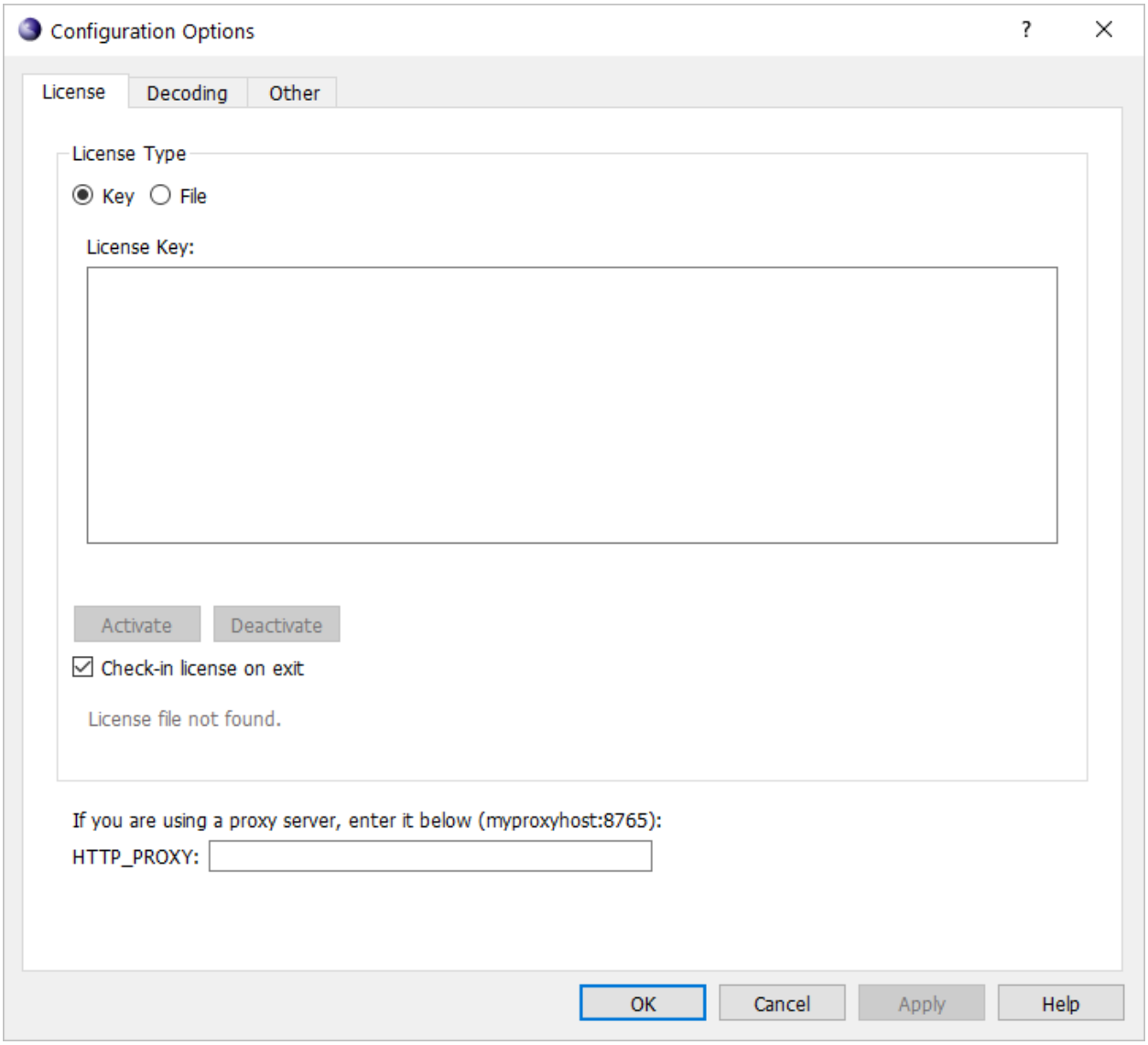
Setting the License Key

To enable advanced functionality within ASN1VE, a license key value must be set. This license key is normally sent by e-mail after a license is purchased (permanent key) or when the user requests an evaluation version (evaluation key).

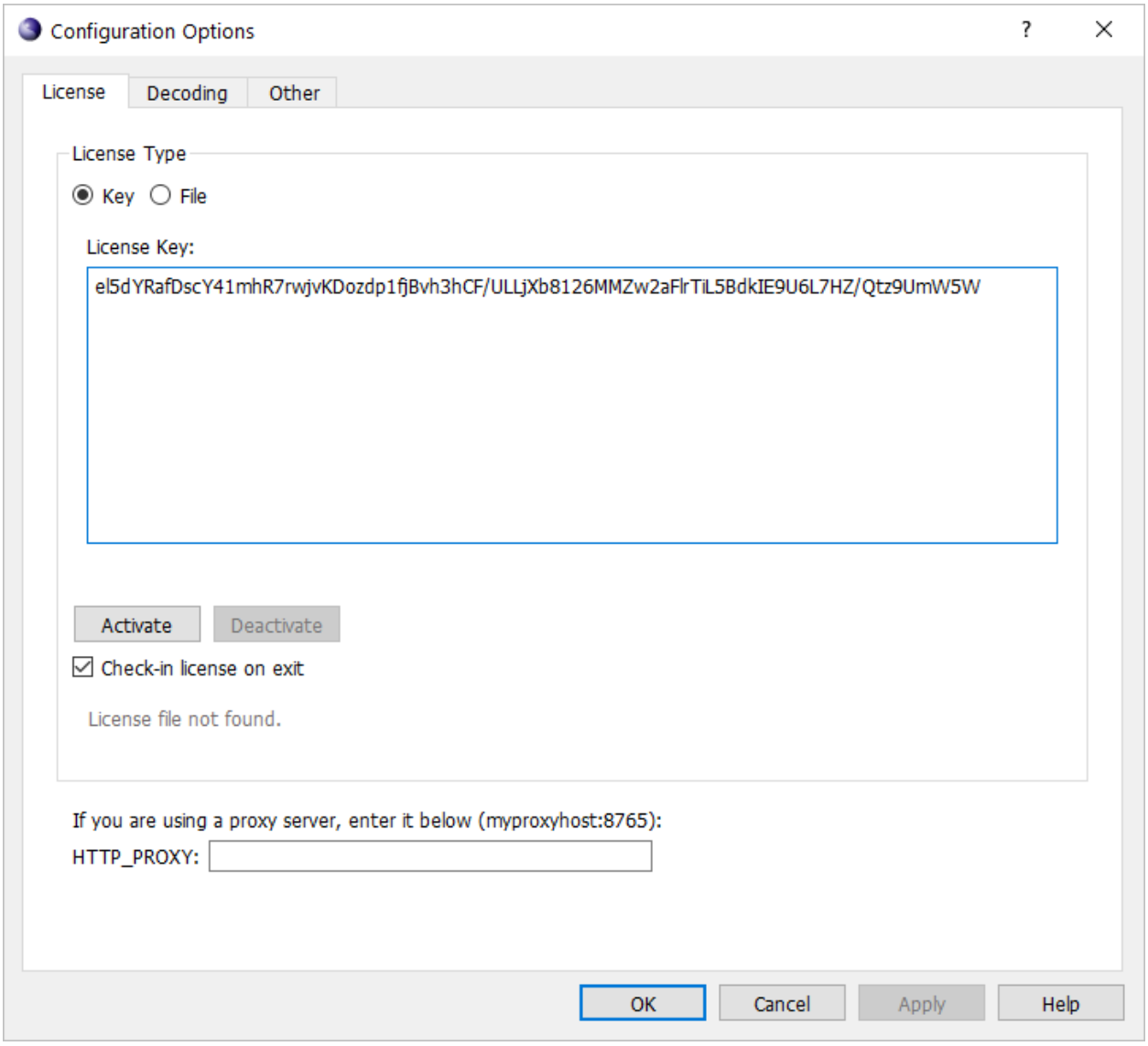
To enter the key value, the *Edit -> Configure* command is used:



This will cause the Configuration Options window to be displayed. The License tab should be displayed. If not, click on it to display the license key entry screen:



The key value can now be either typed in or copied and pasted into the data entry field:

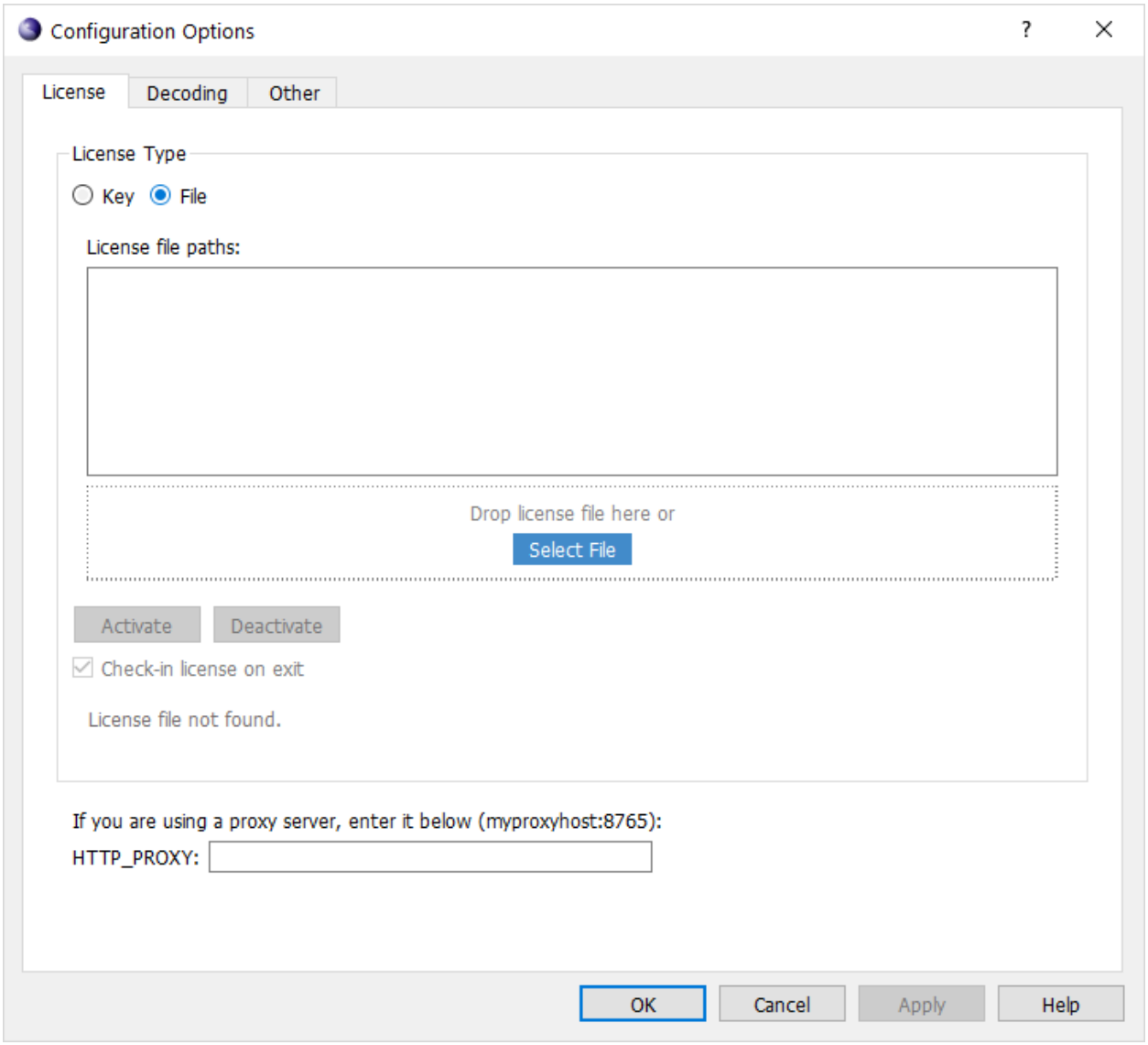


Press *Activate* to activate the license. If you wish to deactivate an existing license to move it to another machine, the *Deactivate* button can be used.

The "Check-in license on exit" check box is used to indicate that the license should be immediately returned to the license pool upon exit making it available for other users on different machines. If not checked, the machine on which it is being used will continue to hold it until it times out (typically in 24 hours). If you will only be using ASN1VE on a single machine most of the time, it is better to keep it unchecked as it will lead to faster startups since the Internet check will not need to be done each time.

The HTTP PROXY box can be used if you are using ASN1VE on a machine that requires Internet requests go through a proxy server.

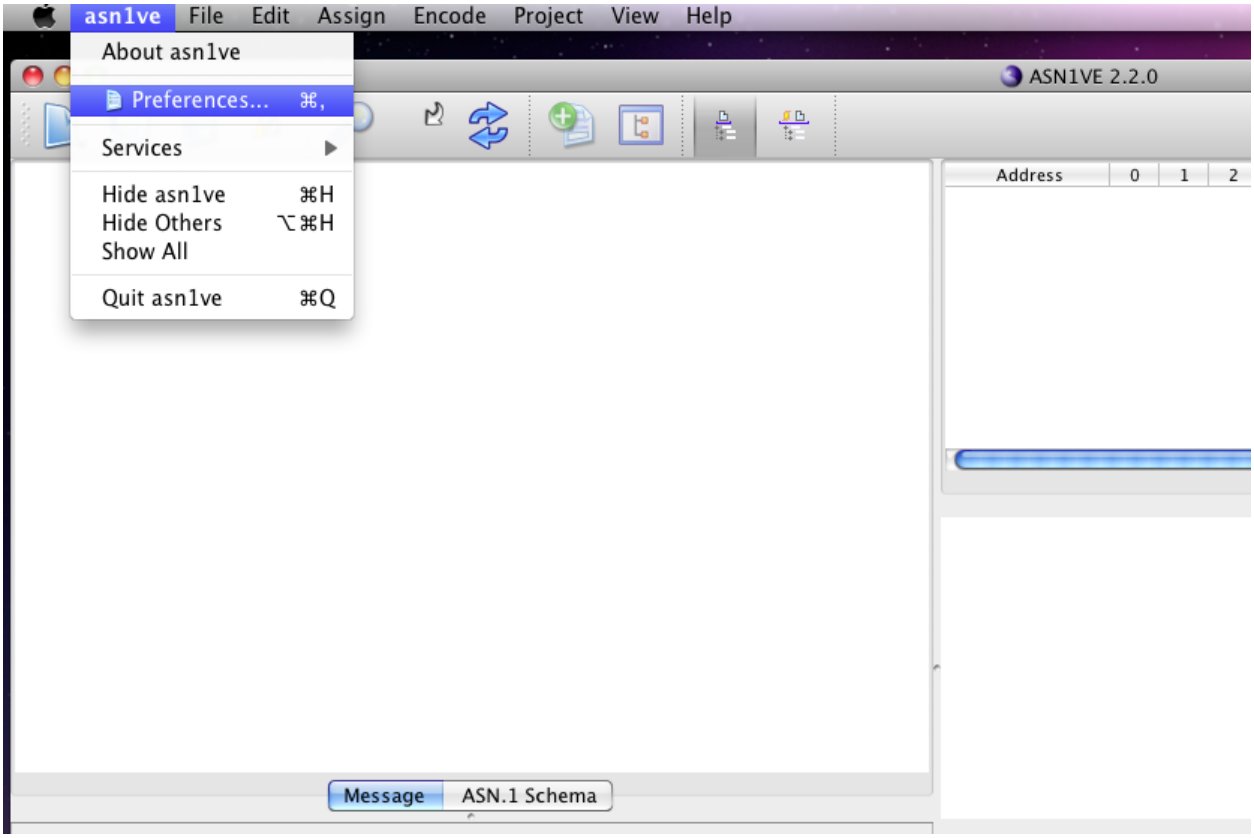
If you have an existing osyslic.txt or RLM license file, the license information can be imported by clicking the File radio button and either dragging and dropping the file into the dialog box or using the Select file dialog:



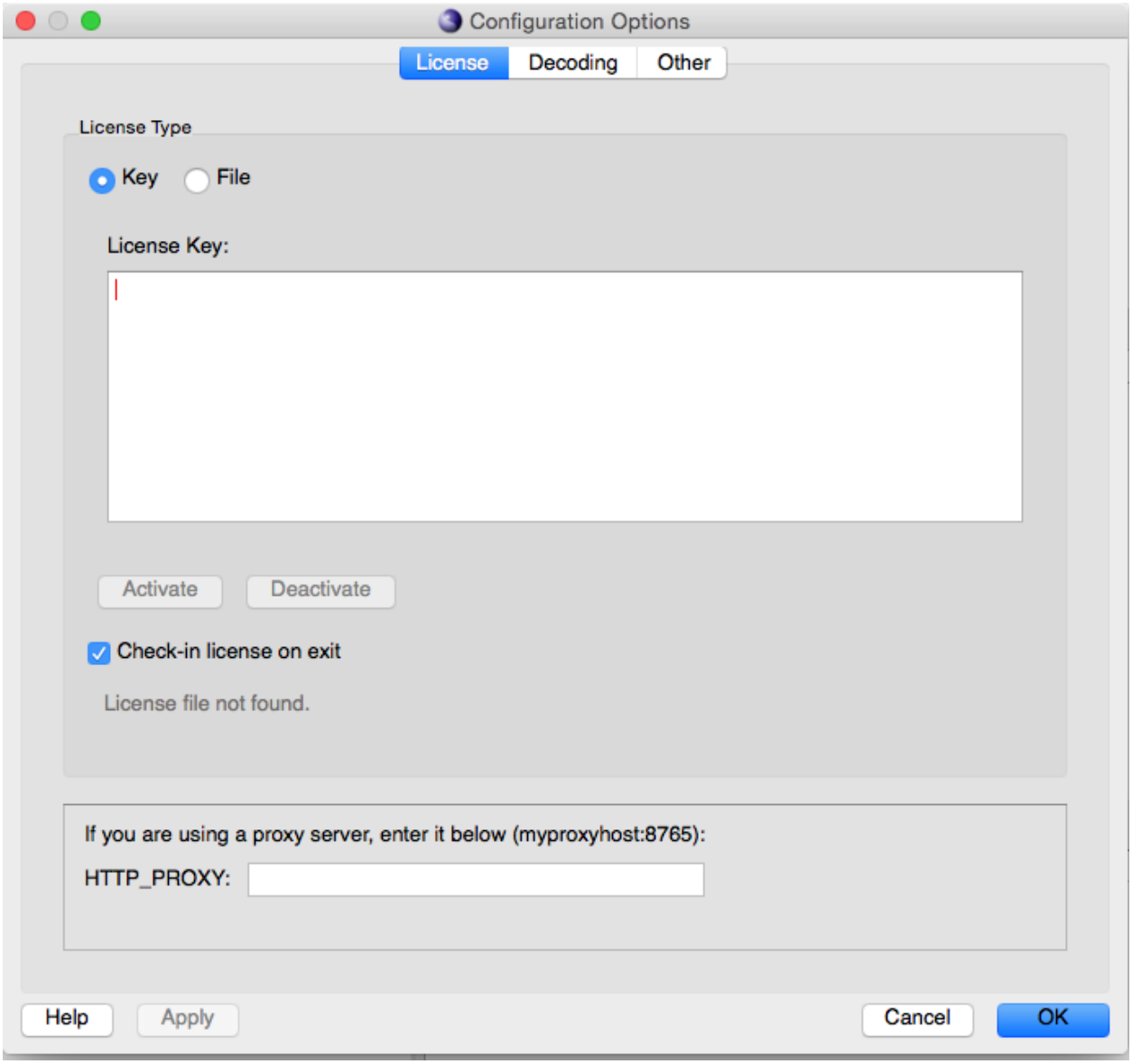
Setting the License Key on Mac OSX

To enable advanced functionality within ASN1VE, a license key value must be set. This license key is normally sent by e-mail after a license is purchased (permanent key) or when the user requests an evaluation version (evaluation key).

To enter the key value, the *asn1ve -> Preferences* command is used:



This will cause the Configuration Options window to be displayed. Click on the License tab at the top of this window to display the license key entry screen:

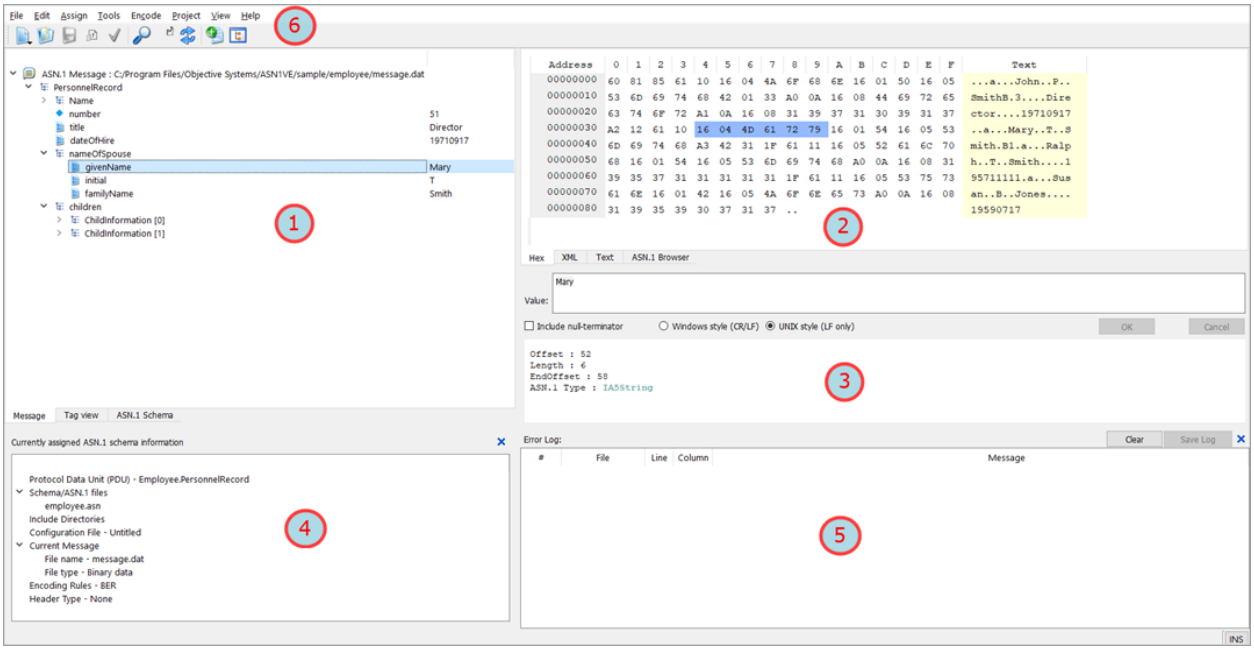


The key value can now be either typed in or copied and pasted into the data entry field. Press *Activate* to activate the license.

If the license is a type that can be deactivated, the *Deactivate* button will be enabled. Pressing this will revoke this license from this machine thus freeing it up for use on a different machine.

Chapter 3. Interface

The ASN1VE main window is divided into several parts, each with a different function.



1. Tree View

The *Tree View* lets the user explore a decoded message file or schema. Clicking on a node in the tree will highlight the data it represents in other views.

2. Document View

This view contains several tabs that show the current message file or schema in various forms.

3. Detail View/Editor

When a node is selected in the *Tree View*, this view shows detailed information about the element. If an ASN.1 schema is used, an editor is also shown here for some elements.

4. Project View

This view shows information about settings currently being used, such as schema file names and encoding rules.

5. Error Log

The *Error Log* shows details about encoding and decoding data and parsing schemas. If a problem occurs in one of these, an error message will be shown here.

6. Menus

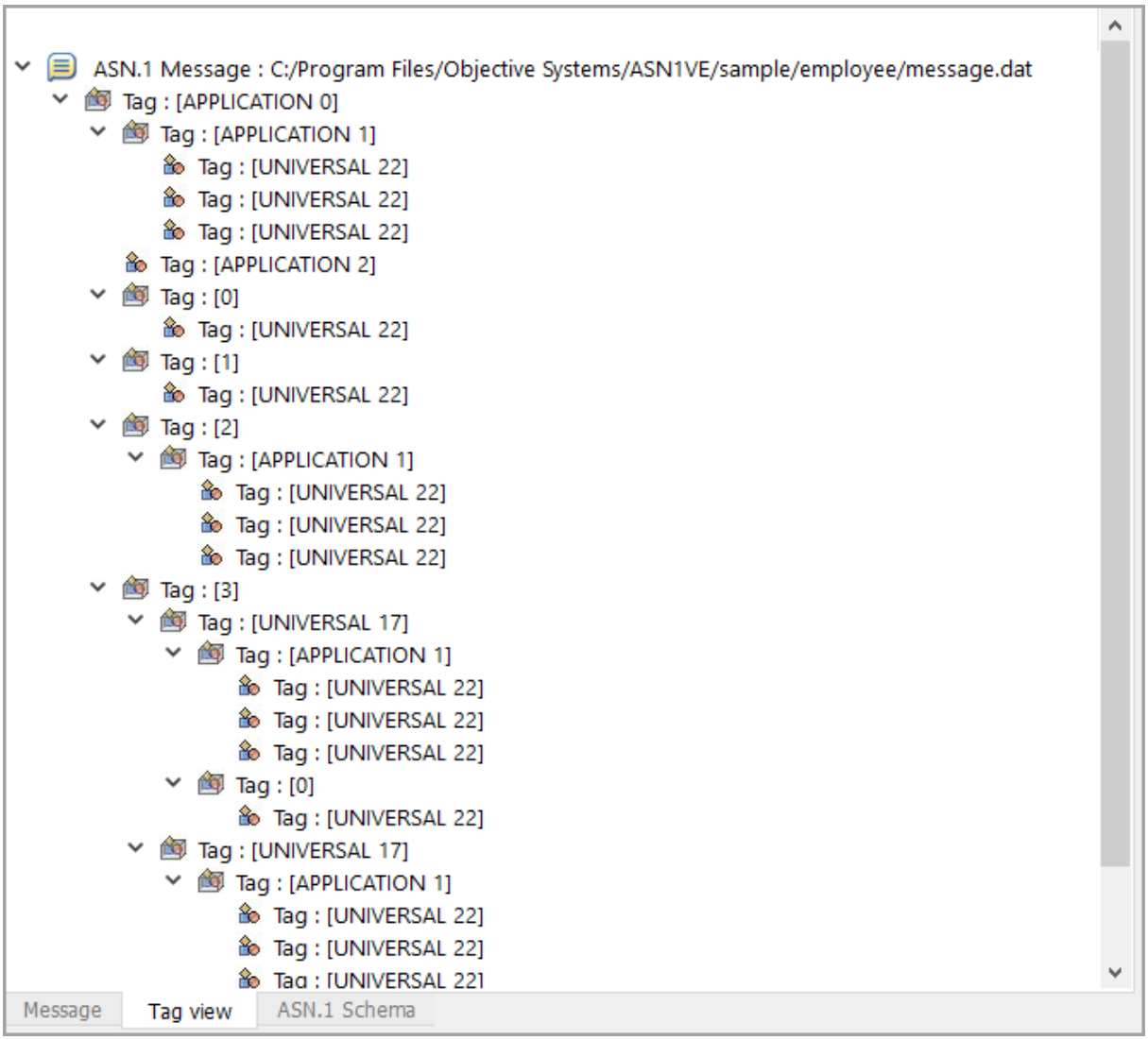
Tree View

The *Tree View* has three tabs, the *Message* tab, which displays the current message in *Element View*, which uses a schema; the *Tag View* tab, which displays the tags and raw data of a BER-encoded message without schema information, and the *ASN.1 Schema* tab, which displays the current schema.

- Tag View
- Element View
- Schema View

Tag View

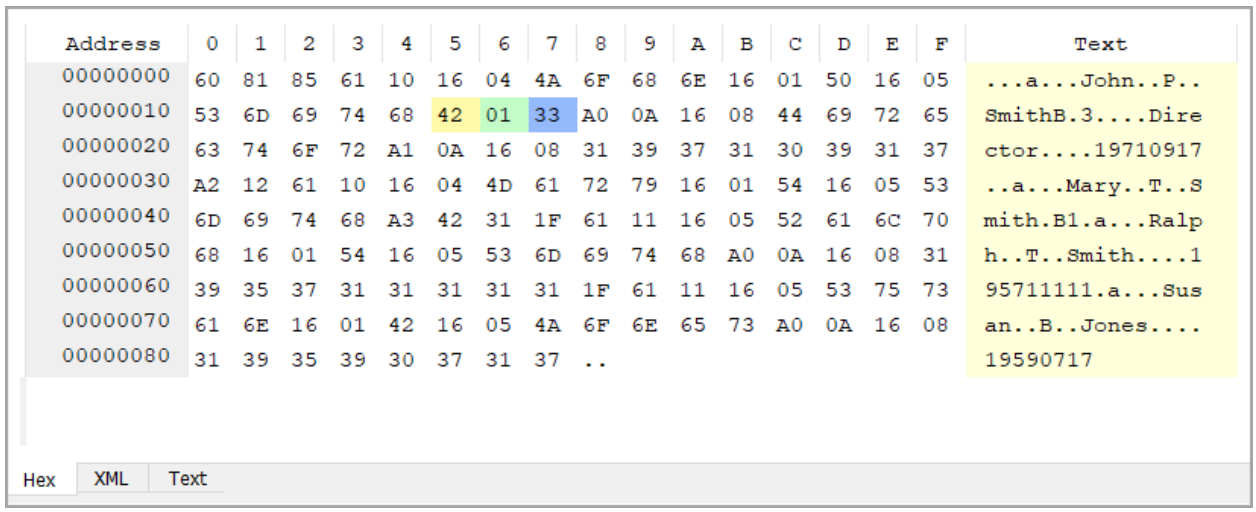
This is the default view for BER/DER/CER messages and is shown when no ASN.1 schema is loaded. This view displays a tree of the tags in the encoded message. *(Note: Tag View is not available for messages using other encoding rules such as PER, OER, or UPER because they cannot be decoded without an ASN.1 schema.)*



The *Tag View* will also show decoded values for elements that have UNIVERSAL tags (for example, if an item is tagged with the UNIVERSAL INTEGER tag, then its contents can be decoded as an integer).

When the *Tag View* is selected, other portions of the interface will change as well.

Hex Tab

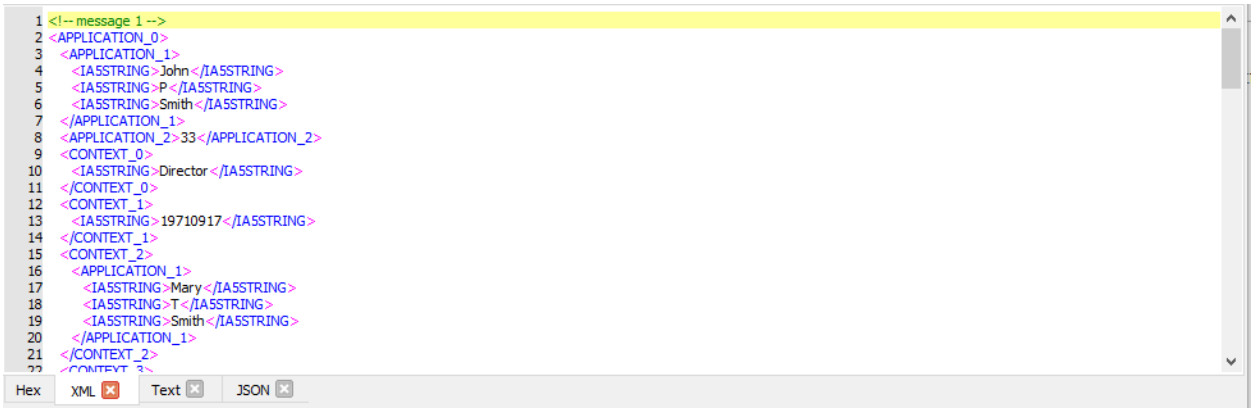


Address	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	Text
00000000	60	81	85	61	10	16	04	4A	6F	68	6E	16	01	50	16	05	...a...John..P..
00000010	53	6D	69	74	68	42	01	33	A0	0A	16	08	44	69	72	65	SmithB.3....Dire
00000020	63	74	6F	72	A1	0A	16	08	31	39	37	31	30	39	31	37	ctor....19710917
00000030	A2	12	61	10	16	04	4D	61	72	79	16	01	54	16	05	53	..a...Mary..T..S
00000040	6D	69	74	68	A3	42	31	1F	61	11	16	05	52	61	6C	70	mith.B1.a...Ralp
00000050	68	16	01	54	16	05	53	6D	69	74	68	A0	0A	16	08	31	h..T..Smith....1
00000060	39	35	37	31	31	31	31	31	1F	61	11	16	05	53	75	73	95711111.a...Sus
00000070	61	6E	16	01	42	16	05	4A	6F	6E	65	73	A0	0A	16	08	an..B..Jones....
00000080	31	39	35	39	30	37	31	37	..								19590717

Hex | XML | Text

When an item is selected in the *Tag View*, its encoded value will be highlighted in the *Hex* tab. The highlighting uses three different colors to indicate the encoded tag, length, and value (yellow, green, and blue, respectively).

XML Tab

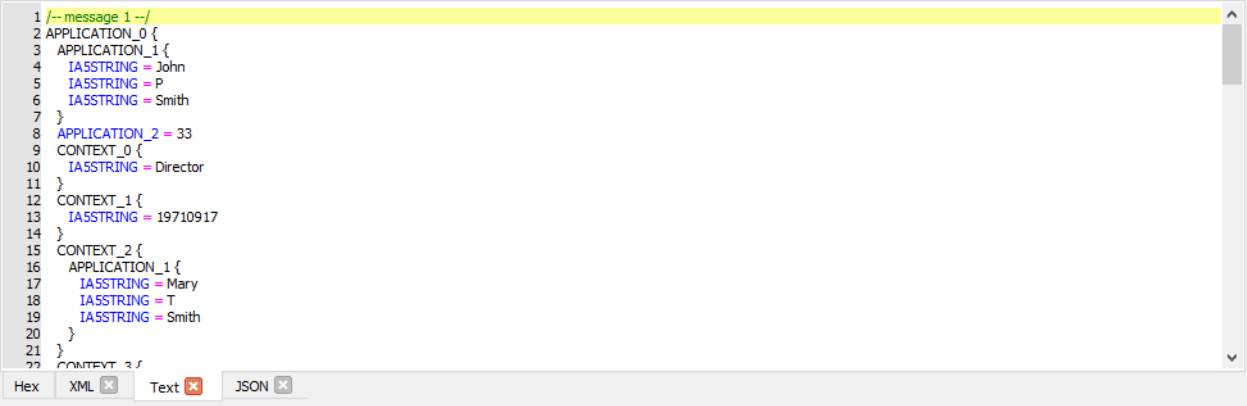


```
1  <!-- message 1 -->
2  <APPLICATION_0>
3    <APPLICATION_1>
4      <IA5STRING>John</IA5STRING>
5      <IA5STRING>P</IA5STRING>
6      <IA5STRING>Smith</IA5STRING>
7    </APPLICATION_1>
8    <APPLICATION_2>33</APPLICATION_2>
9    <CONTEXT_0>
10     <IA5STRING>Director</IA5STRING>
11   </CONTEXT_0>
12   <CONTEXT_1>
13     <IA5STRING>19710917</IA5STRING>
14   </CONTEXT_1>
15   <CONTEXT_2>
16     <APPLICATION_1>
17       <IA5STRING>Mary</IA5STRING>
18       <IA5STRING>T</IA5STRING>
19       <IA5STRING>Smith</IA5STRING>
20     </APPLICATION_1>
21   </CONTEXT_2>
```

Hex | XML | Text | JSON

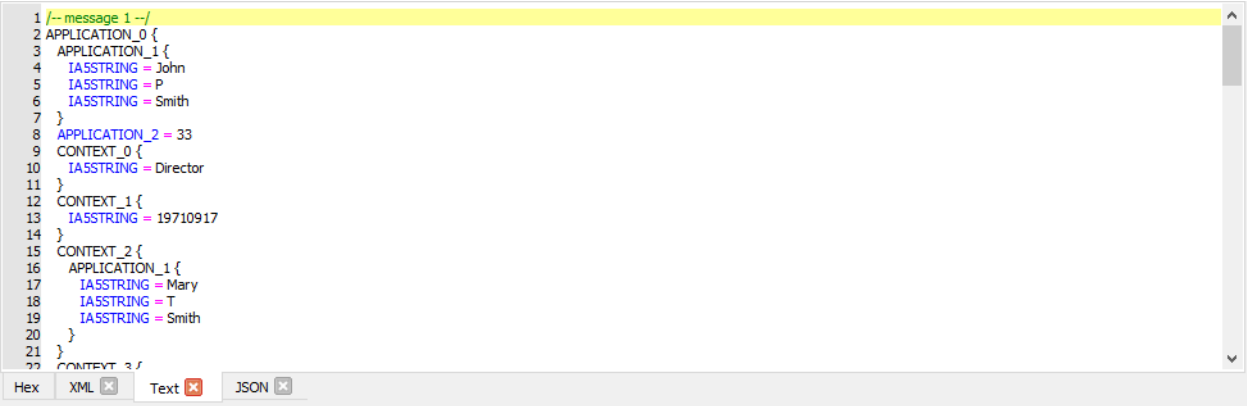
The *XML* tab will display the decoded message as XML, using the decoded tags as XML element names and the decoded values as the XML element values. If the element does not have a UNIVERSAL tag, the value will be shown as undecoded hexadecimal.

Text Tab



The *Text* tab will display the message as "brace-text", using the decoded tags as names.

JSON Tab

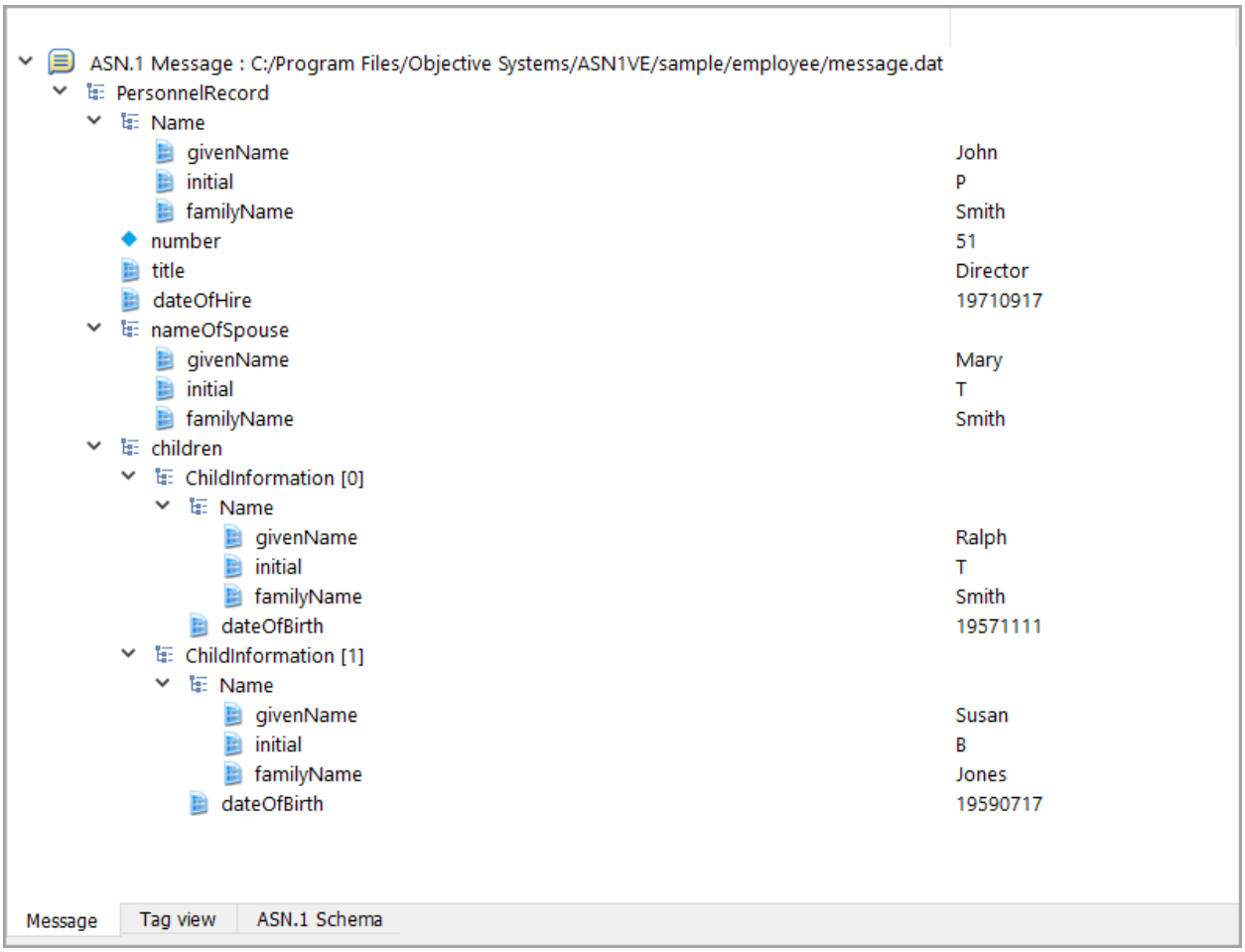


The *JSON* tab will display the message in JSON form, using the decoded tags as names.

Any of these tabs can be removed from the display by clicking the 'x' next to the name or through the 'View' menu. The tab can be restored using the 'View' menu.

Element View

The *Element View* is displayed for messages after an appropriate schema is assigned. In this view, each element of the message is displayed with its name as given in the schema.

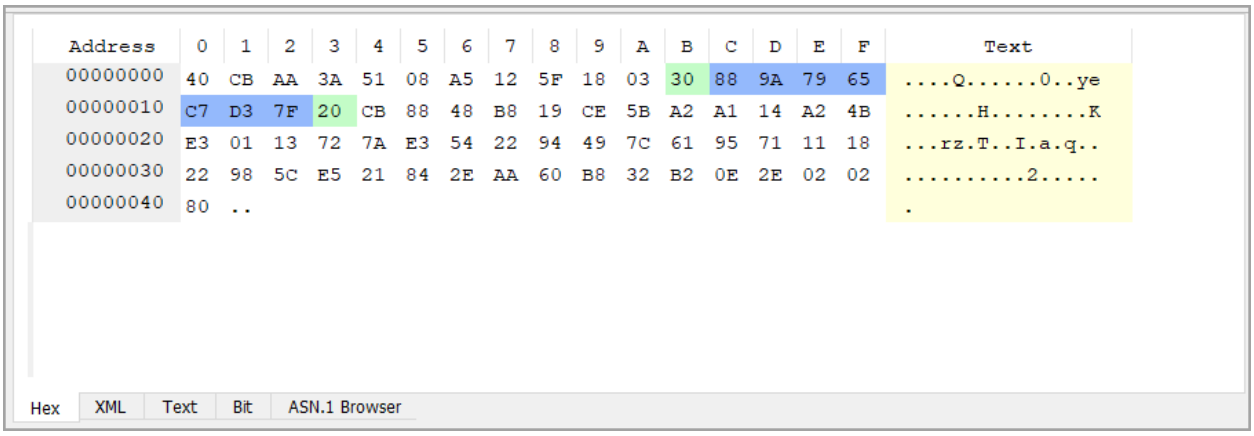


If the message does not match a PDU type within the schema or if decoding otherwise fails, an error message will be displayed in the *Error Log* window.

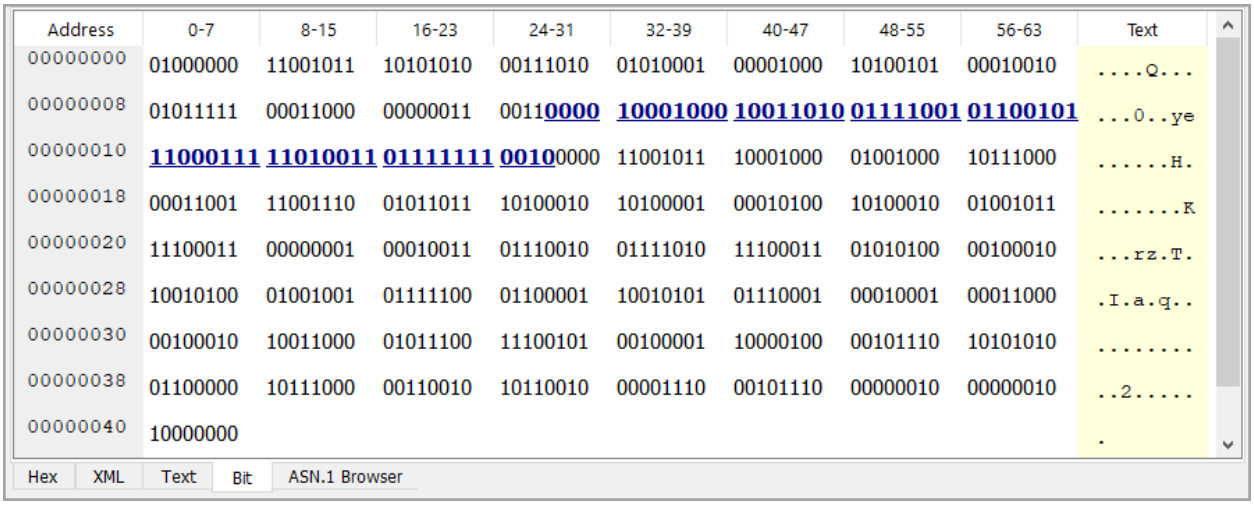
When the *Element View* is selected, other portions of the interface will change as well.

Hex Tab

Selecting an element in the *Element View* will cause its encoded value to be highlighted in the *Hex* tab as usual. However, if the element is not byte-aligned, then partial bytes will be highlighted in green.



In the case of a PER or UPER message, the *Bit* tab is also made available and shows a more granular view of the encoded data.



Address	0-7	8-15	16-23	24-31	32-39	40-47	48-55	56-63	Text
00000000	01000000	11001011	10101010	00111010	01010001	00001000	10100101	00010010	....Q...
00000008	01011111	00011000	00000011	00110000	10001000	10011010	01111001	01100101	...0..ye
00000010	11000111	11010011	01111111	00100000	11001011	10001000	01001000	10111000	......H.
00000018	00011001	11001110	01011011	10100010	10100001	00010100	10100010	01001011	.......K
00000020	11100011	00000001	00010011	01110010	01111010	11100011	01010100	00100010	...rz.T.
00000028	10010100	01001001	01111100	01100001	10010101	01110001	00010001	00011000	.I.a.q..
00000030	00100010	10011000	01011100	11100101	00100001	10000100	00101110	10101010	....
00000038	01100000	10111000	00110010	10110010	00001110	00101110	00000010	00000010	..2.....
00000040	10000000								.

Hex | XML | Text | Bit | ASN.1 Browser

XML Tab

```
<!-- message 1 -->
<PersonnelRecord>
  <name>
    <givenName>John</givenName>
    <initial>P</initial>
    <familyName>Smith</familyName>
  </name>
  <number>51</number>
  <title>Director</title>
  <dateOfHire>19710917</dateOfHire>
  <nameOfSpouse>
    <givenName>Mary</givenName>
    <initial>T</initial>
    <familyName>Smith</familyName>
  </nameOfSpouse>
  <children>
    <ChildInformation>
      <name>
        <givenName>Ralph</givenName>
        <initial>T</initial>
        <familyName>Smith</familyName>
```

Hex | XML | Text | JSON | Bit | ASN.1 Browser

The *XML* tab will display the decoded message as XML, with ASN.1 element names corresponding to XML element names. Values will be displayed in decoded form inside the XML tags.

You can configure ASN1VE to omit parts of the decoded message from the display by choosing "Selected Record" for "XML/Text view mode", in the configuration options. When this is set, "..." will be displayed in place of the parts of the message that are not currently selected in the element view.

Text Tab

The *Text* tab will display the decoded message as "brace-text", using element names from the ASN.1 schema.

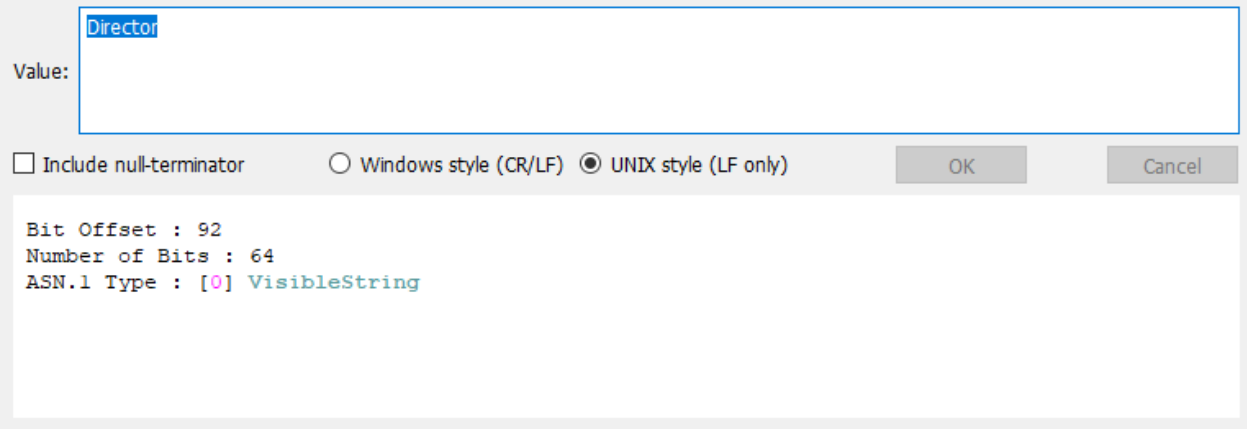
You can configure ASN1VE to omit parts of the decoded message from the display by choosing "Selected Record" for "XML/Text view mode", in the configuration options. When this is set, "..." will be displayed in place of the parts of the message that are not currently selected in the element view.

JSON Tab

The *JSON* tab will display the decoded message in JSON format, using element names from the ASN.1 schema.

You can configure ASN1VE to omit parts of the decoded message from the display by choosing "Selected Record" for "XML/Text view mode", in the configuration options. When this is set, "..." will be displayed in place of the parts of the message that are not currently selected in the element view.

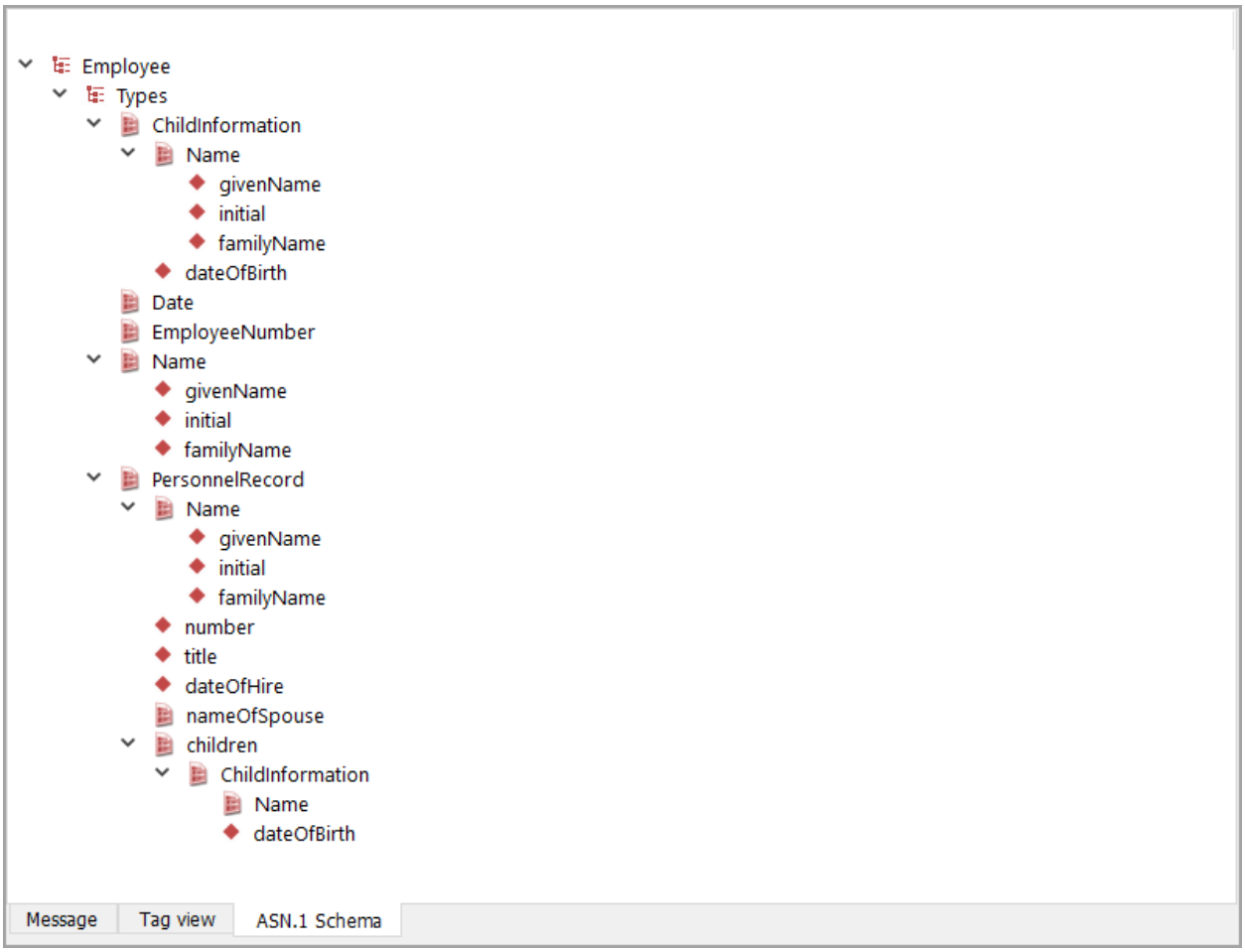
Edit Window/Detail View



When an element is selected in the *Element View*, an editor for that element is displayed in the *Edit* window. The type of editor shown will depend on the type of the element.

In the *Detail View*, the definition of the type of the element will also be shown. If the definition depends on other types defined in the loaded schema, then clicking on the names of these types will cause the *ASN.1 Browser* tab to be displayed above with the corresponding definition in view.

Schema View



When an ASN.1 schema is loaded in ASN1VE, the *Schema View* will show a list of the productions defined in the schema, organized into a tree. Productions are grouped by module. Productions of constructed types can also be expanded to reveal a list of their elements. Clicking any object in the tree will cause the ASN.1 Browser to display the corresponding definition.

Document View

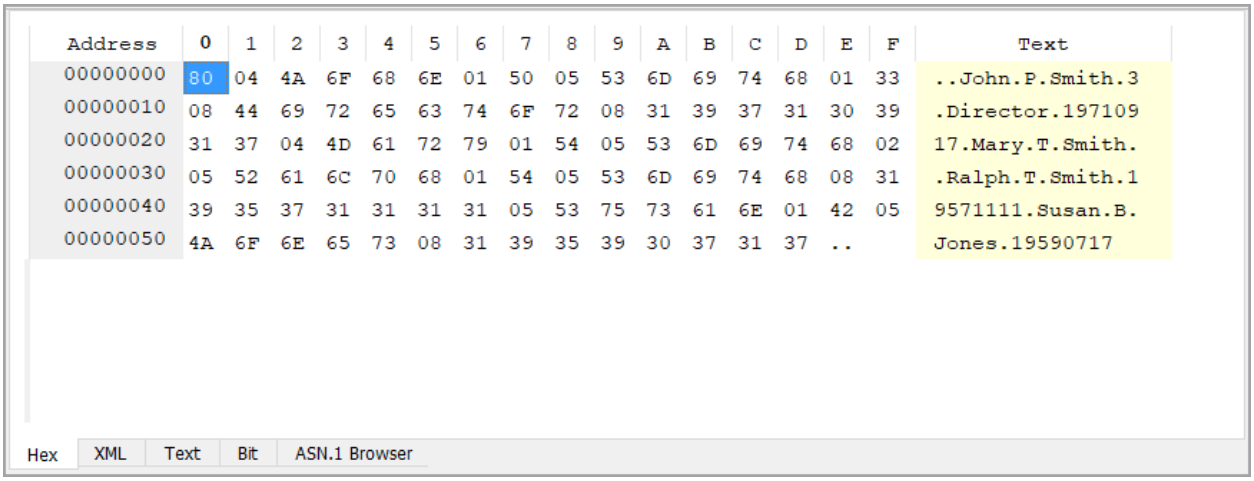
The *Document View* provides a number of tabs with various textual representations of currently loaded data. Two of these tabs, *Hex* and *Editor*, allow editing of the data as well.

- Hex Tab
- Bit Tab
- XML Tab
- Text Tab
- JSON Tab
- ASN.1 Browser Tab

- Editor Tab

Hex Tab

The *Hex* tab is a hex editor for the current message file.



The leftmost column shows the offset of each line within the message. Clicking the column header toggles the representation between *Address*, which shows the offset in hexadecimal, and *Offset*, which shows the value in decimal.

The group of columns in the middle (labeled *0* through *F*) shows the encoded message data in hexadecimal, one byte per column. This also functions as a hex editor.

The rightmost column (labeled *Text*) shows an ASCII representation of the data whenever possible, otherwise showing a "." for each non-ASCII byte.

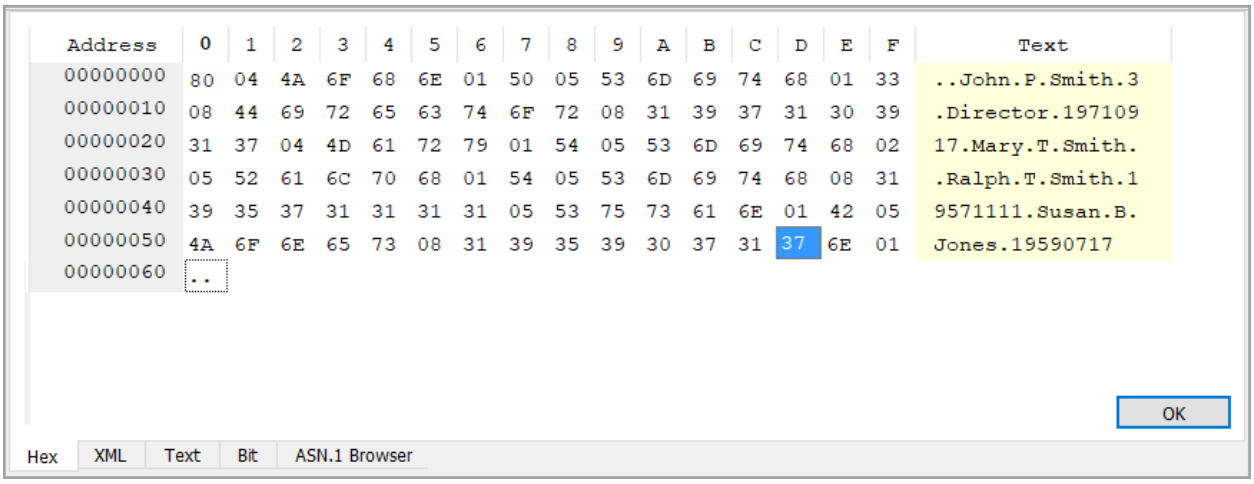
Editing

The simplest way to edit a message is to use the *Element Editor*, but the *Hex* tab also provides advanced users several ways of editing an encoded message directly.

Clicking on a byte will highlight it (drag to highlight multiple bytes). Highlighted portions can be cut or copied. Hexadecimal can also be pasted from the system clipboard. These three functions can be accessed via the *Edit* menu, the context menu (by right-clicking after highlighting), or via keyboard shortcuts Ctrl-X to cut, Ctrl-C to copy, Ctrl-V to paste (Ctrl is replaced by Command on Mac OSX). ASN1VE also provides a *Paste Base64* function, which allows a Base64 formatted string to be pasted from the clipboard as hexadecimal.

Hexadecimal can also be entered directly. Typing a hexadecimal character (0-9A-F, case-insensitive) will insert that value before the most recently selected byte (in *Insert* mode) or will replace the most recently selected byte (in *Overwrite* mode). *Insert*/*Overwrite* modes can be toggled via the *Edit* menu, Insert key on the keyboard, or by clicking the indicator in the lower-right corner.

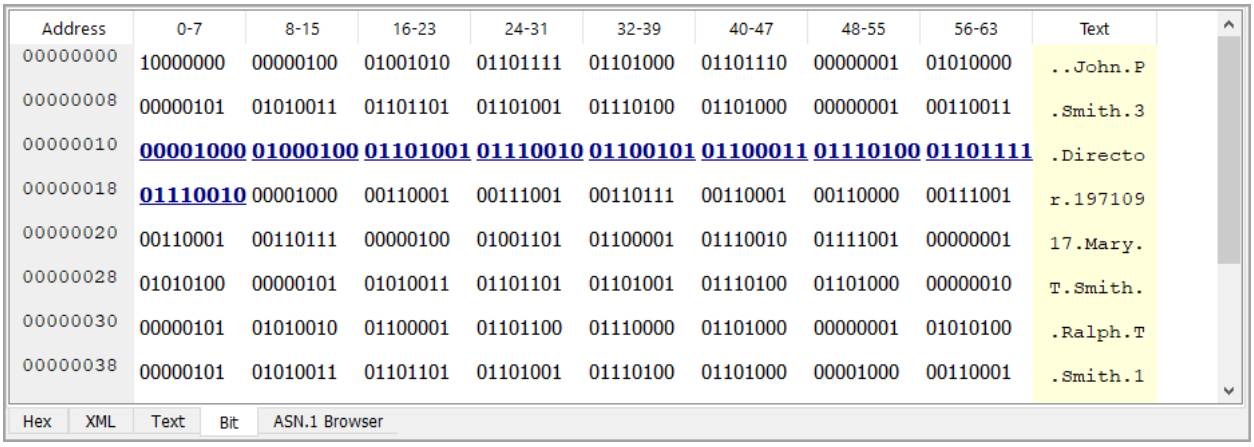
Whenever the *Hex* tab has been edited, an *OK* button is shown at the bottom.



Clicking this button will cause the edited message to be decoded in the *Tree View*.

Bit Tab

The *Bit* tab shows a binary view of the current message. (*Note: This tab is only available for PER or UPER messages*).



The leftmost column (labeled *Address*) shows the offset of each line within the message.

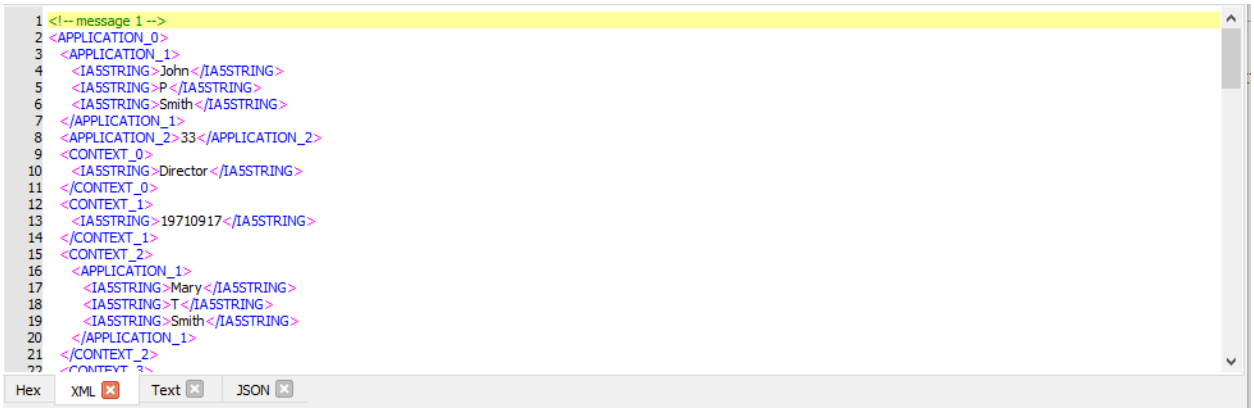
The group of columns in the middle (labeled *0-7* through *56-63*) shows the encoded message data in binary, one byte per column.

The rightmost column (labeled *Text*) shows an ASCII representation of the data whenever possible, otherwise showing a "." for each non-ASCII byte.

XML Tab

The *XML* tab shows the current message in an XML encoding. The XML encoding will either be in Objective Systems standard XML form (or "OSys-XER" as referred to in the ASN1C Compiler User's Manual) or in ASN.1-standard XER form. This can be selected via the *Edit -> Configure* command under the *Other* tab.

The encoding will differ depending on the *Tree View*. If the *Tag View* is currently active, then XML element names will be decoded tags (such as "CONTEXT_14"), except for UNIVERSAL tags, which are named for the type (such as "SEQUENCE"). The value of primitive elements will be a hexadecimal string of the encoded value.



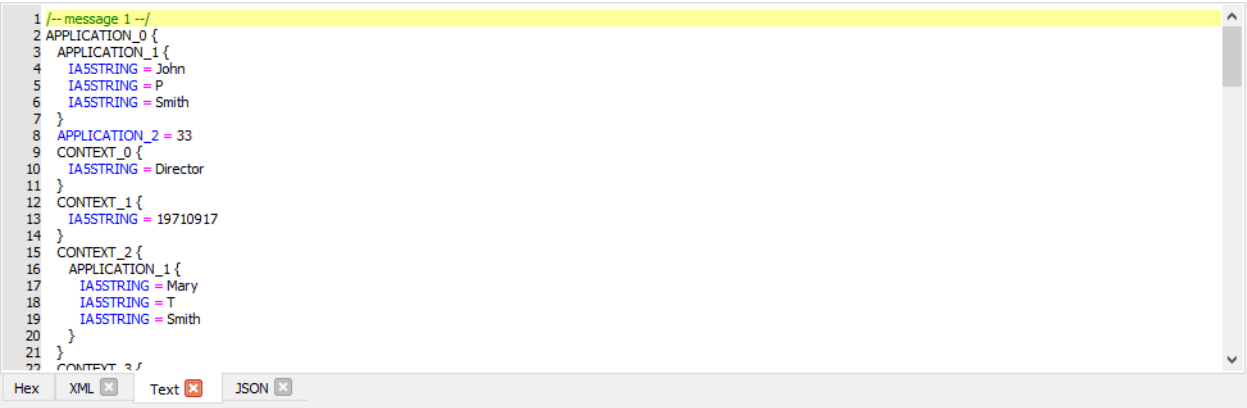
If the *Element View* is active, then XML element names will be the same as shown in the *Element View*. XML values will be the decoded value of the element.

When a node is clicked in the *Tree View*, the corresponding line will be highlighted in the *XML* tab.

Text Tab

The *Text* tab shows the current message in a "brace-text" encoding. In brace-text, constructed elements (i.e., elements that contain other elements) are represented by a name followed by a pair of curly braces containing the representations of its constituent elements. Primitive elements are represented as a name followed by '=', then the decoded value.

The encoding will differ depending on the *Tree View*. If the *Tag View* is currently active, then brace-text element names will be decoded tags (such as "CONTEXT_14"), except for UNIVERSAL tags, which are named for the type (such as "SEQUENCE"). The value of primitive elements will be a hexadecimal string of the encoded value.



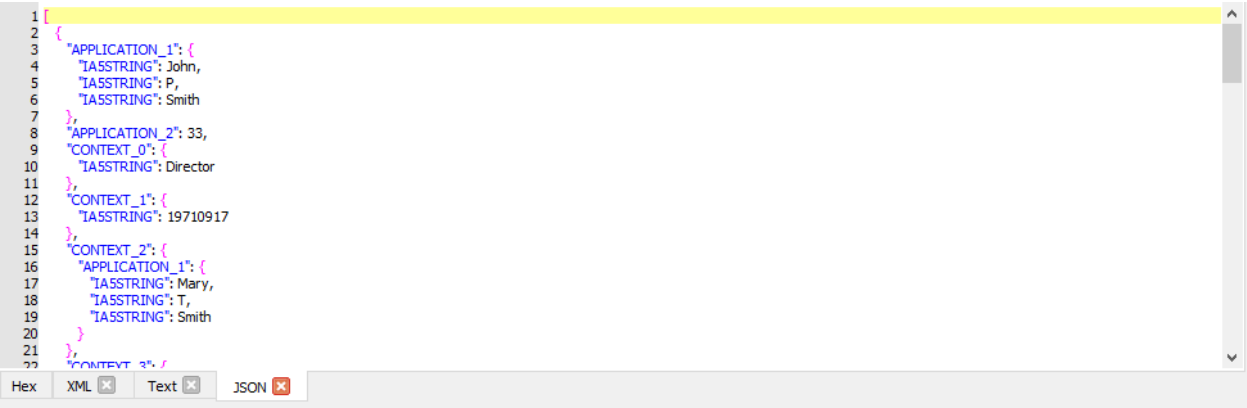
If the *Element View* is active, then brace-text element names will be the same as shown in the *Element View*. Brace-text values will be the decoded value of the element.

When a node is clicked in the *Tree View*, the corresponding line will be highlighted in the *Text* tab.

JSON Tab

The *JSON* tab shows the current message in a "brace-text" encoding. In brace-text, constructed elements (i.e., elements that contain other elements) are represented by a name followed by a pair of curly braces containing the representations of its constituent elements. Primitive elements are represented as a name followed by '=', then the decoded value.

The encoding will differ depending on the *Tree View*. If the *Tag View* is currently active, then brace-text element names will be decoded tags (such as "CONTEXT_14"), except for UNIVERSAL tags, which are named for the type (such as "SEQUENCE"). The value of primitive elements will be a hexadecimal string of the encoded value.

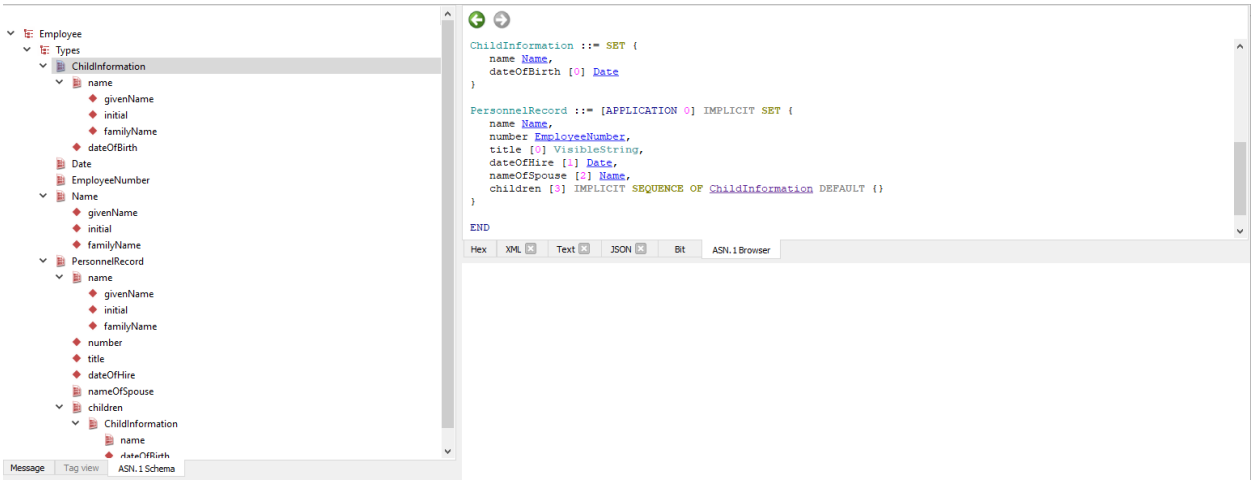


If the *Element View* is active, then brace-text element names will be the same as shown in the *Element View*. Brace-text values will be the decoded value of the element.

When a node is clicked in the *Tree View*, the corresponding line will be highlighted in the *JSON* tab.

ASN.1 Browser Tab

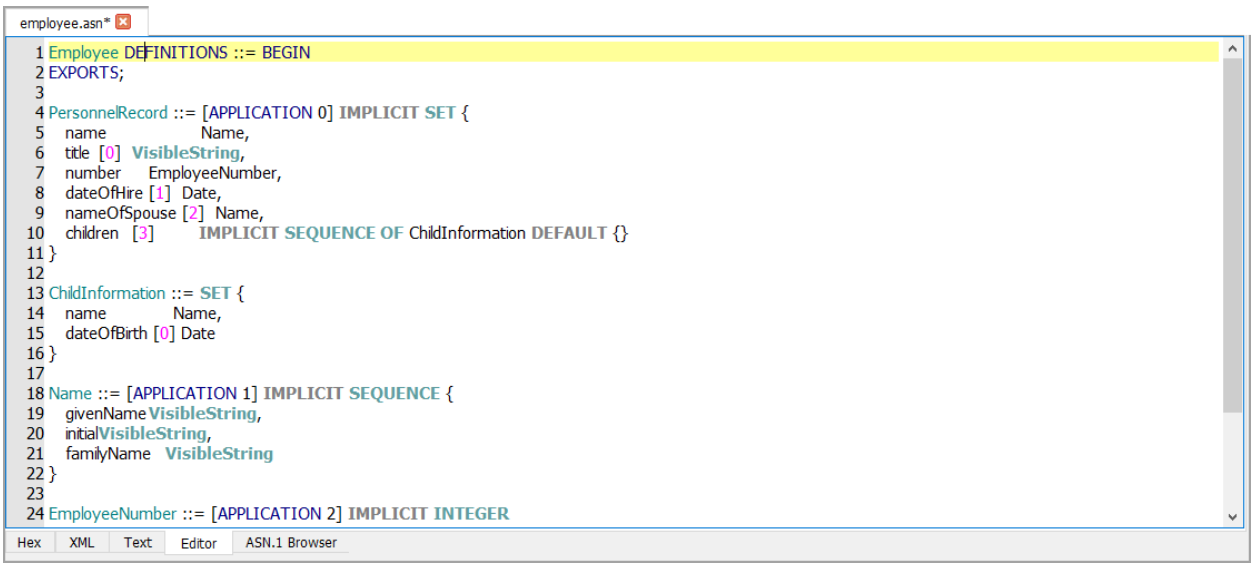
The *ASN.1 Browser* tab provides a hyperlinked view of the loaded ASN.1 schema. Wherever a defined type is referred to by another defined type, clicking its name will cause its definition to be shown in the tab.



Clicking an element in the *Schema View* will also cause the corresponding definition to be shown in the *ASN.1 Browser* tab.

ASN.1 Editor Tab

The *ASN.1 Editor* tab can be used to edit an ASN.1 schema.



The tab itself can contain multiple tabs, one for each schema file being edited. To edit a schema file, either a new schema file must be created (via *New -> Schema...* in the *File* menu), an existing schema file must be opened for editing (via *Open Schema...* in the *File* menu), or by double-clicking a previously loaded schema file in the *Project View*.

Once the schema file has been edited as desired, it can be saved through the *File* menu. In order to use the schema with an ASN.1 data file, it must be validated (using the *Validate schema* option in the *Tools* menu).

Detail View/Editor

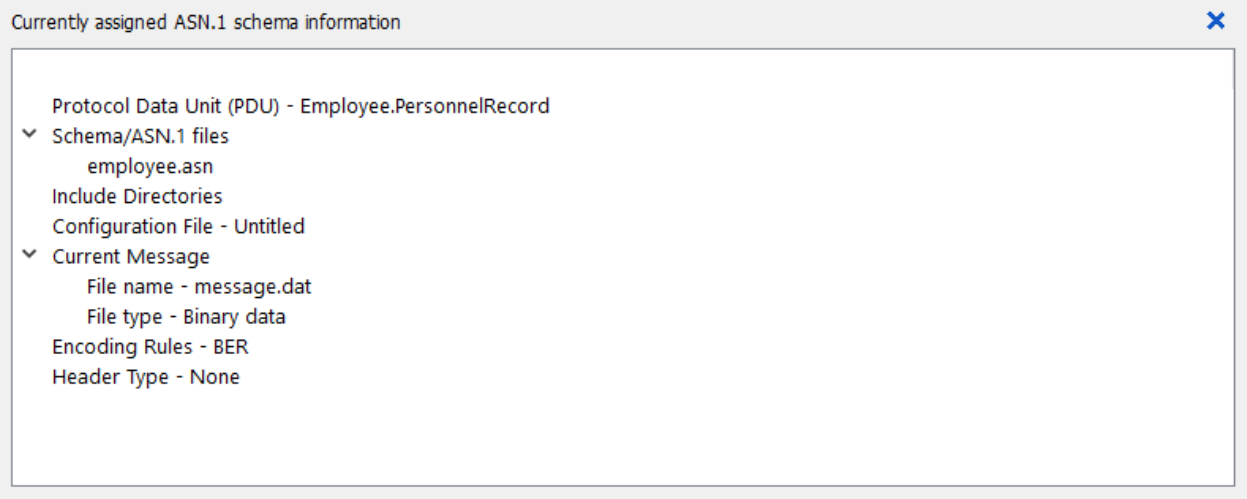
This view shows extra details about the element selected in the tree view. This can include the encoded message offset and length. If the *Element View*is active, the ASN.1 definition and an editor for the element will also be shown.

Depending on the type of the selected element, the editor (shown at the top of the view) will change. When editing an element's value is finished, clicking the *OK* button will commit the edit and re-encode the data.

When the *Element View* is active (as shown), the *Detail View* will include the definition of the selected element's type. If the type depends on other types defined in the ASN.1 schema, the type names will be shown as hyperlinks. Clicking one of these links will open the definition of that type in the *ASN.1 Browser* tab.

Project View

The *Project View* shows project details, including the currently loaded schema file, protocol data unit (PDU) type, and encoding rules. Some options for editing project settings are also provided in the context menu.



The *Project View* can be hidden by clicking the *X* in the upper-right corner, or by unchecking *Show project information* in the *View* menu. The hidden project information can be shown again by checking this option again.

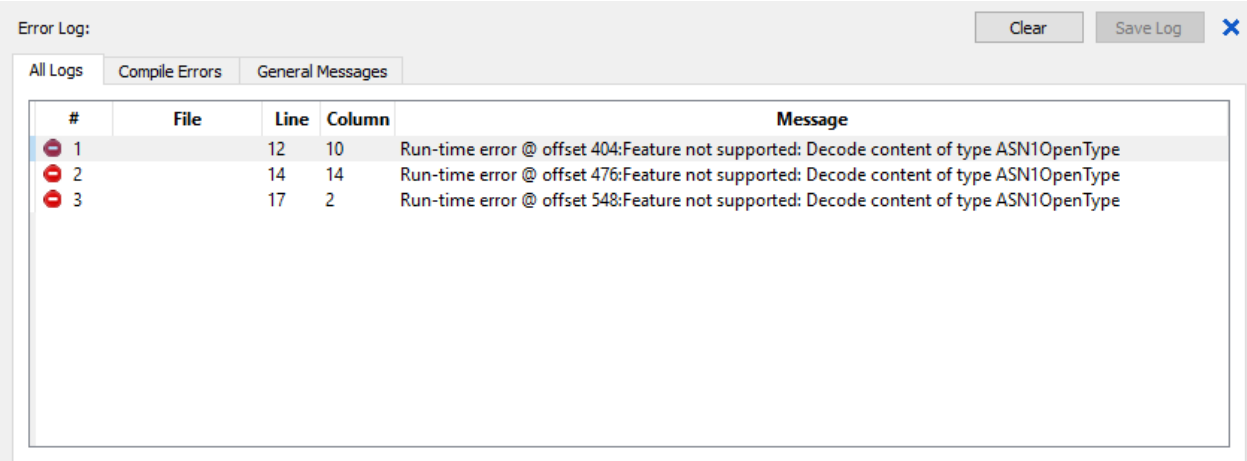
Many of the project settings can be edited directly by right-clicking on them. Project settings can also be edited through the *Edit project...* option in the *Project* menu.

It should be noted that header-specific settings will be shown under *Header Type* depending on its setting. For example, when *Header Type* is set to *Skip*, settings for *Skip Fixed Header* (file header) and *Skip Repeating Header* (message header) will determine the size (in bytes) of each.

Dragging and dropping a project file onto the *Project View* will open the project in ASN1VE.

Error Log

The *Error Log* shows messages related to processing data or schema files in ASN1VE.



Four types of messages may be shown: Error, Warning, Informational, or Debug. Errors indicate a problem that prevents ASN1VE from fully decoding the data or schema file, such as an incorrect encoding. Warnings indicate that the file could be decoded, but suffers from some other issue, such as a constraint violation. Informational messages do not indicate any problems, but rather provide additional details about the decoding process. Debug messages provide a high degree of details regarding the encode or decode process and are normally only used to debug internal problems within the application.

The level of detail shown in the *Error Log* can be adjusted to show Errors only, Errors and Warnings, Errors and Warnings and Informational messages, or all message types. This is done through the *Configure...* item in the *Edit* menu (the option is found under the *Other* tab there).

The *Error Log* can be hidden by clicking the *X* in the upper-right corner or by unchecking the *Show error log window* option in the *View* menu. Messages can be cleared by clicking the *Clear* button.

Tabs at the top of the error log display can be used to show only errors related to a specific operation. The *All Logs* tab shows all log messages. The *Compile* shows only those messages related to ASN.1 compilation. In this case, the File, Line, and Column columns show the specific location within the schema where the error occurred, if known. The *General* tab shows general error messages not related to schema compilation. In this case, the File, Line, and Column columns are hidden.

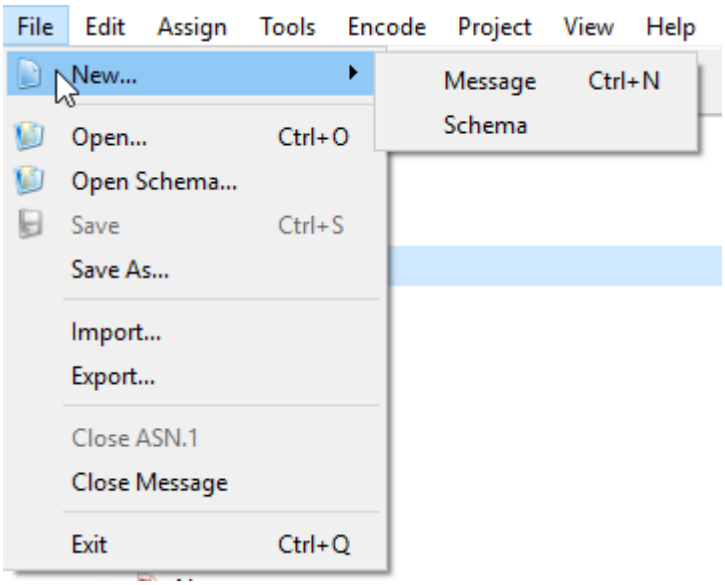
The display can be customized further by right-clicking anywhere in the window. This will cause a context-specific menu to be displayed allowing columns to be displayed or hidden.

Menus

- File Menu
- Edit Menu
- Assign Menu
- Tools Menu
- Encode Menu
- Project Menu
- View Menu

File Menu

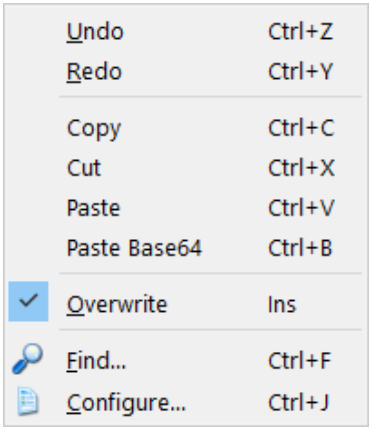
The *File* menu contains file-related actions, such as creating a new message or schema file or importing an XML file.



New...	Create a new file. This may be used to create a new ASN.1 schema or data file or a CDR data file. Depending on the file type selected, ASN1VE will prompt the user for other settings, as required.
Open...	Open an existing message file. This may be used to open a data file or a CDR data file for editing. Depending on the file type selected, ASN1VE will prompt the user for other settings, as required.
Open Schema...	Open an existing ASN.1 schema file for editing.
Save	Save the current file. If the file has not been saved before, ASN1VE will prompt the user for a new filename.
Save as...	Save the current file with a different filename. The original file will remain unchanged. *Save as...* also allows the newly created file to be saved in a different format. For example, a binary-formatted file can be saved as a new hexadecimal text-formatted file.
Import...	Open an existing XML or JSON encoded data file and transform its contents to create a new, binary-encoded file.
Export...	Save the current file as an an XML, brace-text, or JSON file.
Close ASN.1	Unassign ASN.1 schema files from the current message data. file.
Close Message	Close the current message data file.
Exit	Close ASN1VE.

Edit Menu

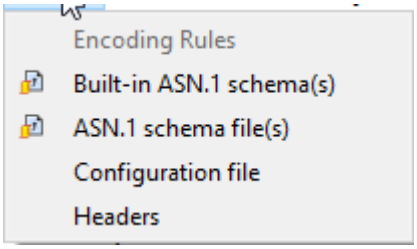
The *Edit* menu provides cut, copy, and paste functionality, search, and application settings.



Undo/Redo	Move backward or forward in the history of edits to the current file.
Cut/Copy/Paste/Paste Base64	The usual cut, copy, and paste actions for the currently selected text. *Paste Base64* provides the ability to paste base64-formatted data into the *Hex* tab.
Overwrite	Toggle the edit mode between Insert (typing pushes back existing content) and Overwrite (typing replaces existing content). The current mode is Overwrite when this item is checked.
Find...	Open the *Search* window for the current message file.
Configure...	Open the *Configuration* dialog to adjust application settings.

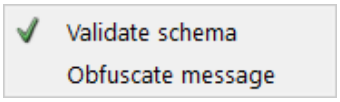
Assign Menu

The *Assign* menu provides the functionality to assign an ASN.1 schema, configuration file, or encoding rules.



Encoding Rules	Set the encoding rules to use for encoding and decoding message data files.
Built-in ASN.1 schema(s)	Choose from the schemas built in to ASN1VE to assign to the current message file.
ASN.1 schema file(s)	Select schema files to use for the current message file.
Configuration file	Select an Objective Systems configuration file to use with the current schema. See Configuration Files for more information.
Headers	This option is used to interpret sections of binary data as headers.

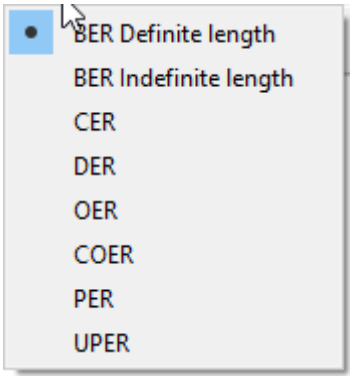
Tools Menu



Validate schema	When an ASN.1 schema file has been edited, this will verify that the file can be used to decode an ASN.1 data file. If the schema file has not been saved since being edited, the file will be saved.
Obfuscate message	This option attempts to change the value of every data element in the current message file to a random value while preserving certain characteristics, such as string lengths, CHOICE values, and presence or absence of OPTIONAL elements.

Encode Menu

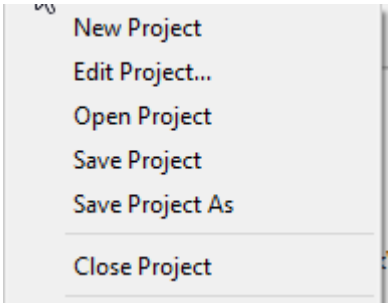
The *Encode* menu provides options for re-encoding a message using different encoding rules.



If none of the items in the *Encode* menu is checked, selecting one will assign those encoding rules to the current data file. If an item in this menu is already checked, then selecting a different item will attempt to re-encode the data in the selected encoding rules.

Project Menu

The *Project* menu provides functionality for working with project files and for editing project settings.



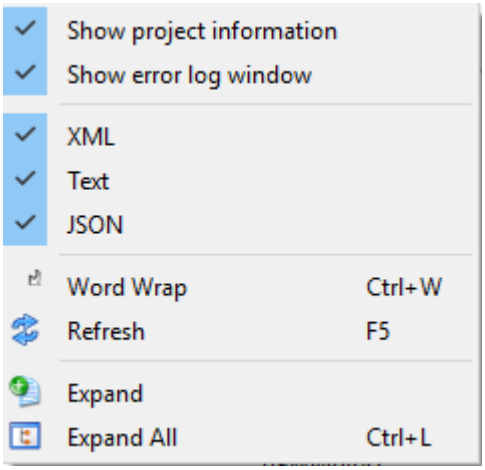
New Project	Create a new project. If an existing project is open, it will be closed and project settings will be cleared.
Edit Project...	Display a dialog to edit an existing project or create a new one. Details on the dialog are available at the following link:

	Project Settings Project details can also be edited directly in the project window by right-clicking the item to be edited.
Open Project	Open an existing project file.
Save Project	Save the current project settings. If the project has been saved before, ASN1VE will prompt the user for a filename.
Save Project As	Save the current project settings in a new file. The current project file, if one exists, will remain unchanged.
Close Project	Close the current project and clear the project settings.

At the end of the *Project* menu are shown a number of recently used project files. These provide a shortcut for selecting *Open Project* and navigating to one of these files.

View Menu

The *View* menu contains user interface-related options.

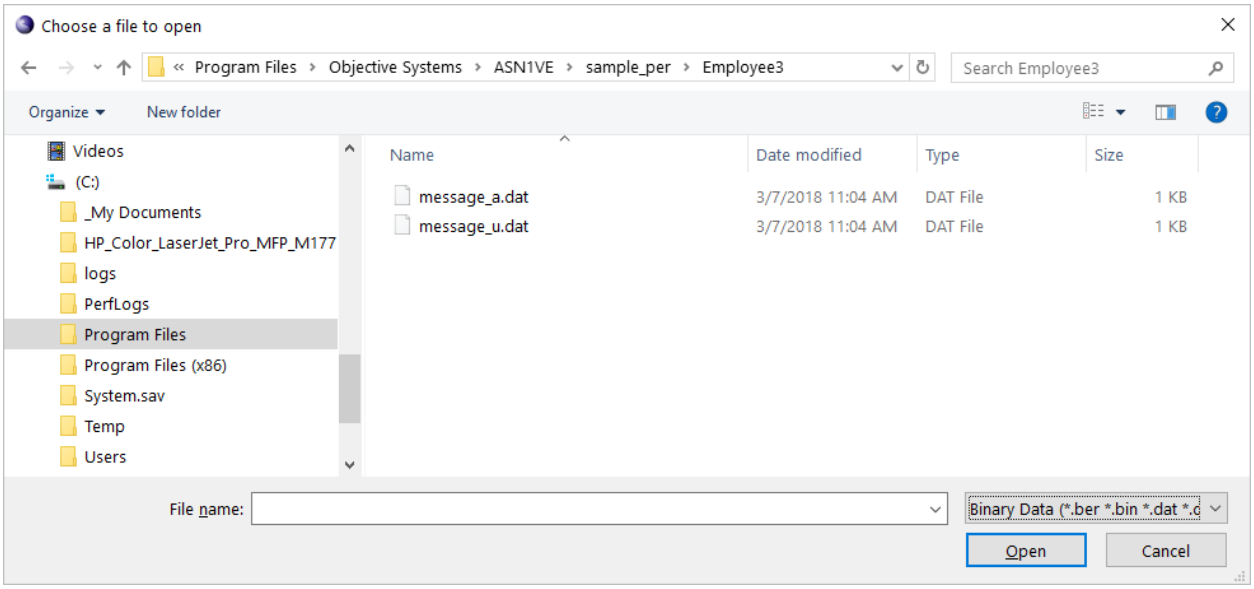


Show project information	Toggle whether to show or hide the *Project View* in the interface.
Show error log window	Toggle whether to show or hide the *Error Log* in the interface.
XML	Toggle whether to show or hide the *XML Tab* in the Document View window.
Text	Toggle whether to show or hide the *Text Tab* in the Document View window.
JSON	Toggle whether to show or hide the *JSON Tab* in the Document View window.
Word Wrap	Toggle wrapping long lines in *XML* and *Text* tabs in the *Document View*.
Refresh	Re-decode the current message data from the encoded data in the *Hex* tab.
Expand/Expand All	Expand the currently selected node (or all nodes) in the *Tree View*.

Chapter 4. Using ASN1VE

Open an Existing Message File

To open an existing message data file in ASN1VE, select the *Open...* option from the *File* menu (or use keyboard shortcut Ctrl-O). This will bring up a dialog box for selecting the file.



Note the dropdown file-type menu at the bottom right. This can be used to filter files by some standard extensions. By default, this is set to *All Files*, meaning all files within a given directory will be displayed as candidates to be opened. Changing this to one of the other options will limit the list of files available for selection.

The current file types that can be filtered are as follows:

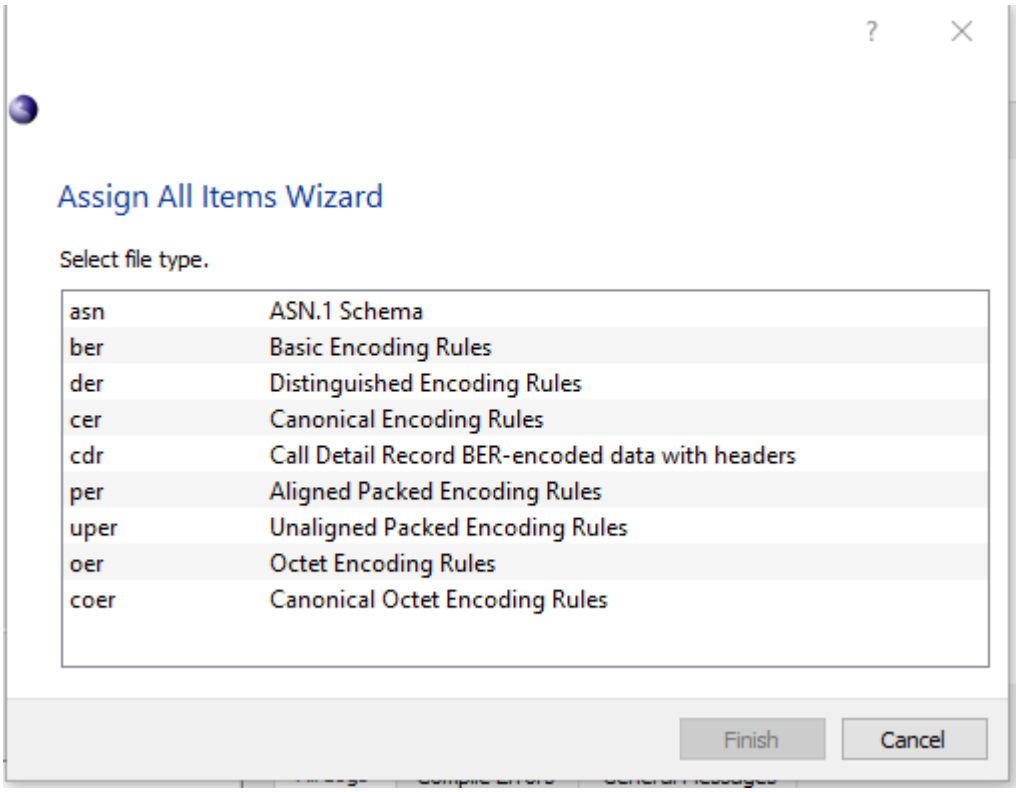
Binary Data	Binary data files are message files with no headers and which require no transformation of input data to binary format upon loading. These files may have generic extensions '.dat' or '.bin' or can have specific encoding rules extensions '.ber', '.der', '.per', or '.uper'. If a file with a specific encoding rule type is selected, the step in the wizard that selects encoding rules is skipped.
Call Detail Records	Call Detail Records are defined to be ASN.1 BER-encoded data files with internal non-ASN.1 headers or block formats.
Certificates	Certificates are binary DER-encoded data files conforming to the X.509 or PKIX standards. Selecting a file using this filter will cause the file to be loaded and the PKIX built-in schema to be automatically assigned. Note that this should not be confused with PEM files (specified below) as these are also commonly used for Certificates but have a different input format (base-64 with a special header and trailer).
Hexadecimal Text	Hexadecimal Text are files containing a textual representation of binary data in hexadecimal form. Message dump files are commonly in this format.
Base64 Text	Like hexadecimal text, this filter describes a textual format that is transformed into binary data when teh message is loaded. This format is common used for

	security-related files, although these files may also be in the PEM format described below.
Privacy Enhanced Email (PEM)	This format is commonly used to represent certificates and other security-related formats. It attempts to create self-contained messages that identify the ASN.1 type in a header line prior to the start of the content. For example, a PEM file that describes an X.509 or PKIX certificate would begin with the line '-----BEGIN CERTIFICATE-----' and end with '-----END CERTIFICATE-----'. Other types may be specified as well. ASN1VE currently supports automatic loading of Certificate and Certification Request (PKCS10) PEM files. Others require the ASN.1 schema be explicitly assigned.

The remainder of this section will assume the user opened the file using the 'All Files' filter and therefore all additional information needs to be specified using the ensuing wizard. Using a filter option will cause some or all of the following items to be skipped.

If existing project information is in place when the message file is opened, the user will be asked if they would like to use the existing project. Clicking 'Yes' will cause existing information to be used and the dialog is terminated. Clicking 'No' will launch the file information wizard.

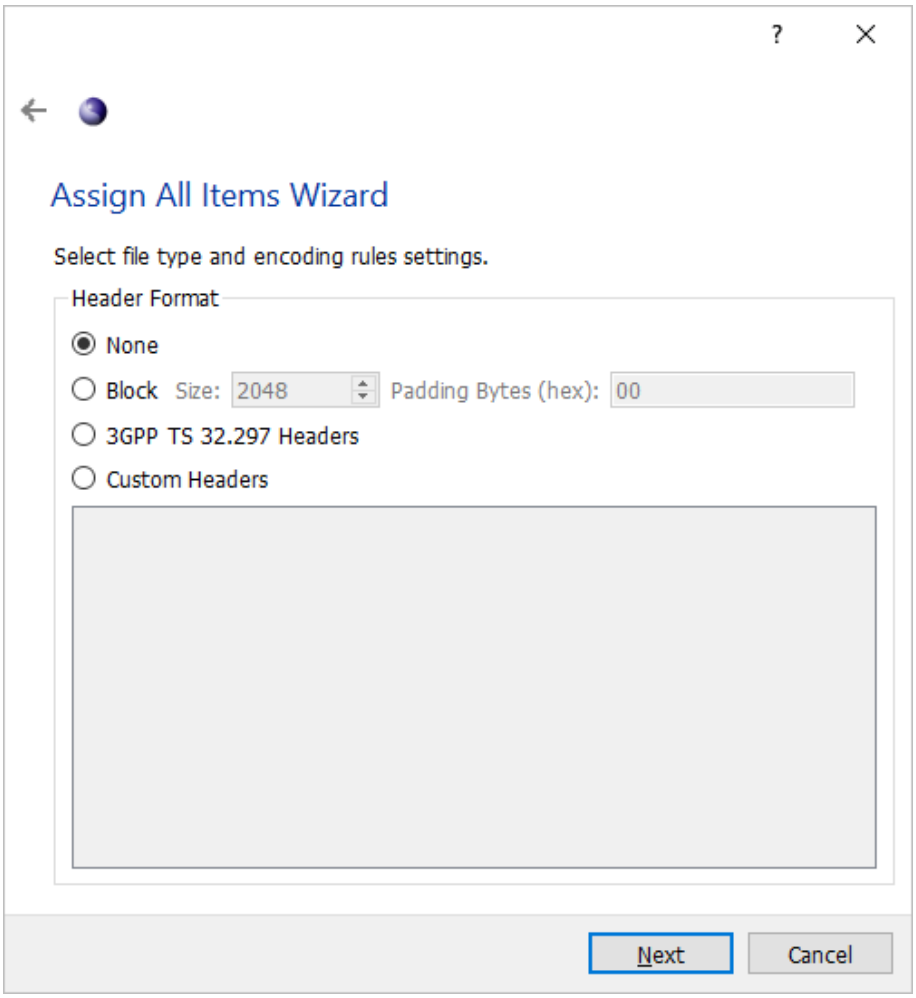
The first screen in the wizard is the 'Select file type' window:



The file types are the same as previously documented under the file filter options. Select one of the options presented and click *Next*.

If "asn" is chosen, a dialog is first presented to allow the user to specify include directories that may be needed to resolve imports in the newly created schema. The user is then placed in the editor where the schema file is opened for editing.

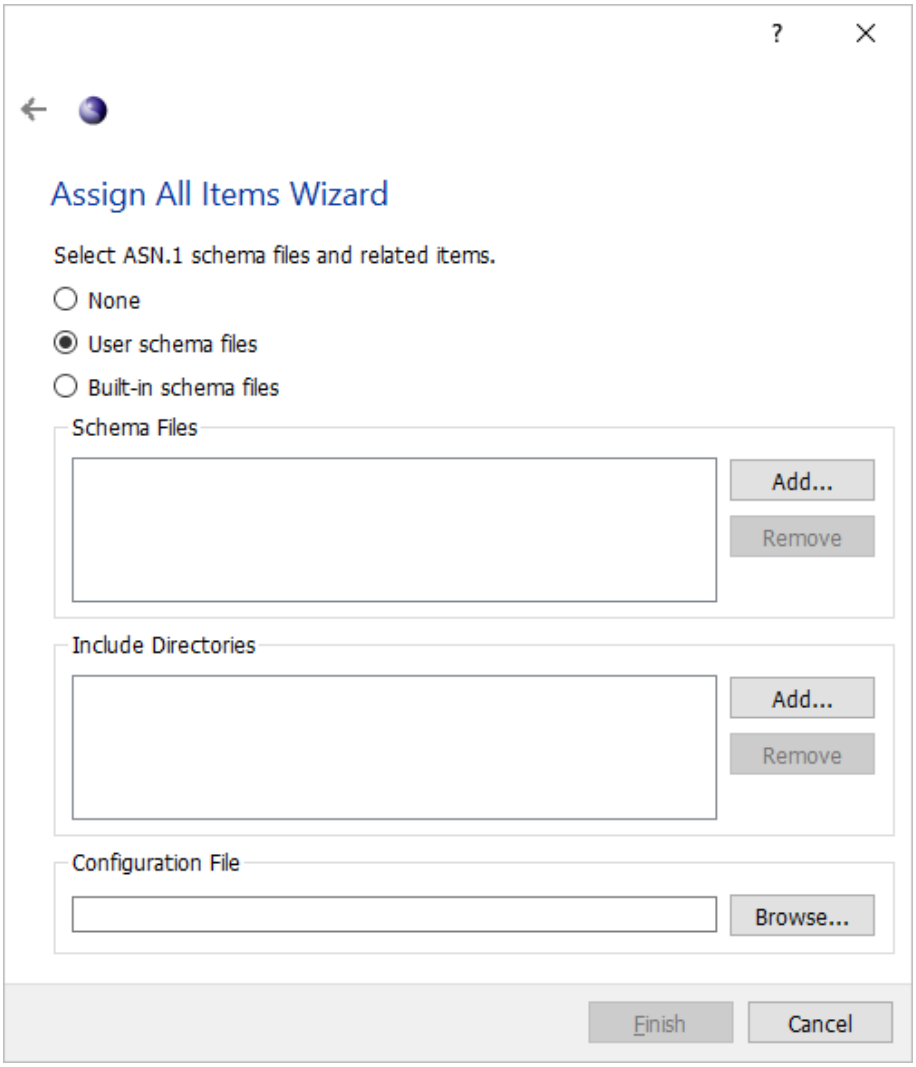
If the 'cdr' option is selected, the user is prompted to enter header and other file format related information in the following window:



The various options are as follows:

None	No headers will be added to the encoded data. This is the same as having selected "ber" in the file type window.
Block	Data will be encoded into blocks of a certain size. If a message would normally be encoded across a block boundary (for a block size of 2048 bytes, this boundary is at offsets 2048, 4096, 8192, ...), the rest of the current block is instead padded out and the message is encoded, starting at the beginning of the next block. Padding bytes are also used to determine whether a block contains more data or is padded out.
3GPP TS 32.297 Headers	Data will be encoded according to the TS 32.297 standard. This includes file and message headers of the standard format.
Custom Headers	Custom headers are fixed-length headers that allow data fields within the headers to be specified. Selecting this option will cause an additional dialog to be opened that allows headers and header fields to be declared: See the section on editing custom headers for details on editing the header format.

After header options are specified for CDR's and for all other message types, the window to enter ASN.1 schema information is presented:



At the top, three options are available, *None*, *User schema files*, and *Built-in schema files*. The *None* option is only available for BER and allows a user to open a message without schema. The *User schema files* option allows the user to select their own ASN.1 schema files. *Built-in schema files* presents a list of available schemas built into ASN1VE.

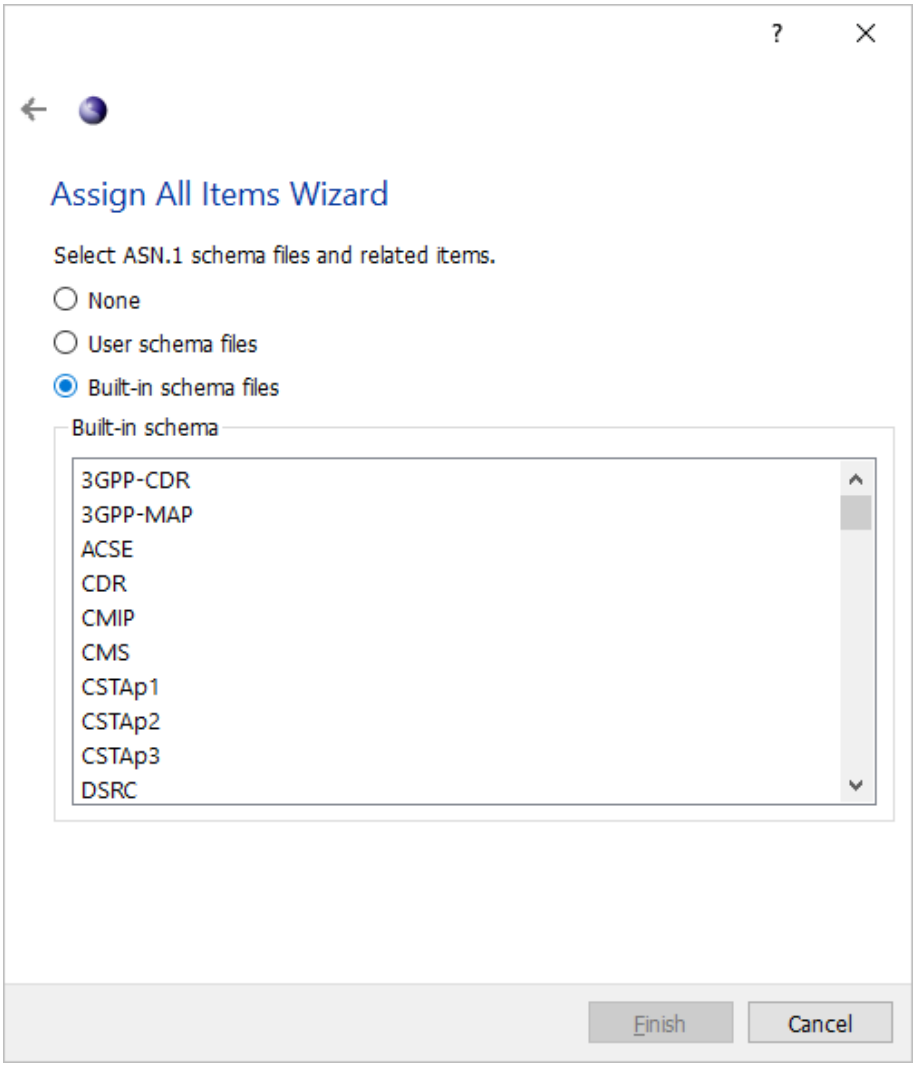
Below the selection options, the wizard shows lists for schema files and include directories. ASN.1 schema files should be added to the list of schema files that define the type of message being created. Include directories are directories to search to resolve import statements within the selected schema files.

Clicking *Add...* next to either list will bring up a file dialog. Navigate to the directory or file(s) to add, highlight them, and click *Open*.

To remove a listed file or directory, highlight it in the list and click the *Remove* button next to the list.

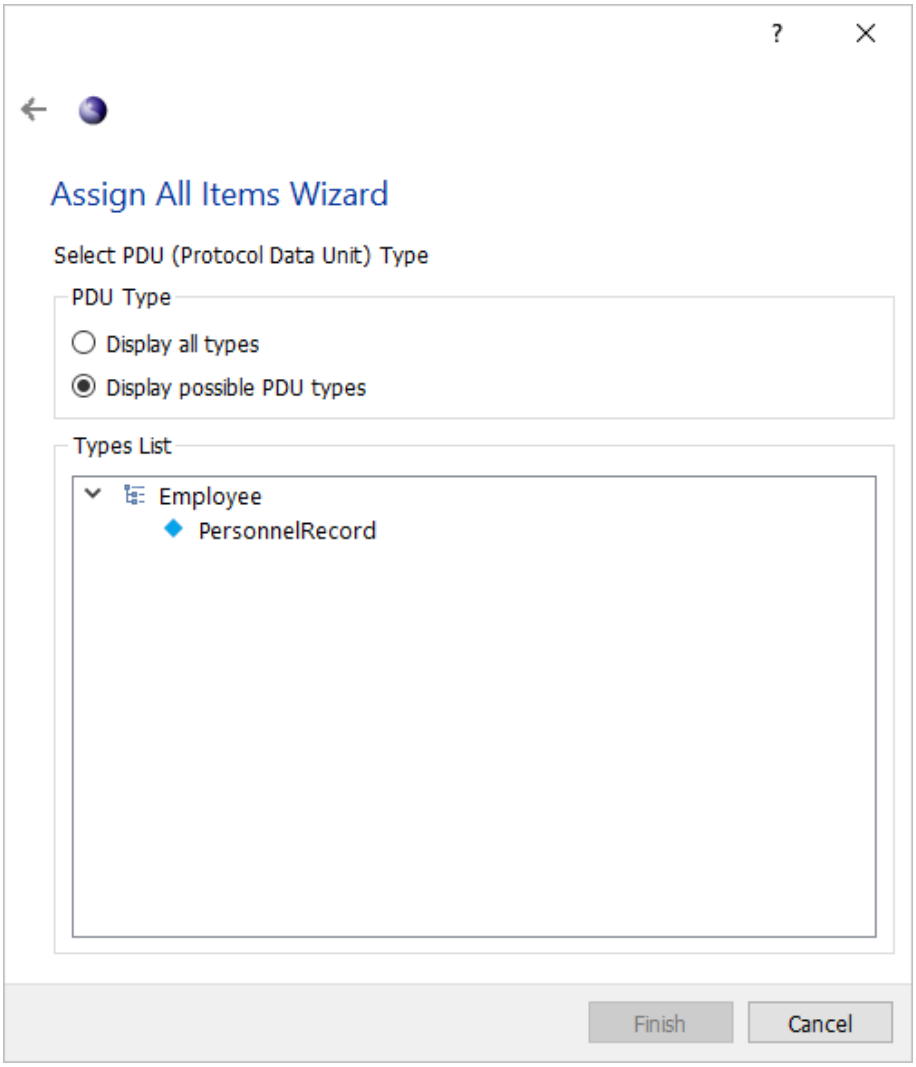
Below the schema files and include directories, *Configuration File* allows the user to apply settings from an Objective Systems configuration file. To select a configuration file, click the *Browse...* button.

If *Built-in schema files* is selected at the top, the wizard will show a list of all the available built-in schemas in ASN1VE as shown in the following image.



Click on a schema entry to select a schema to use.

Once a schema has been selected, click *Next*. The wizard will show a list of types that can be used as the protocol data unit (PDU) for the message.

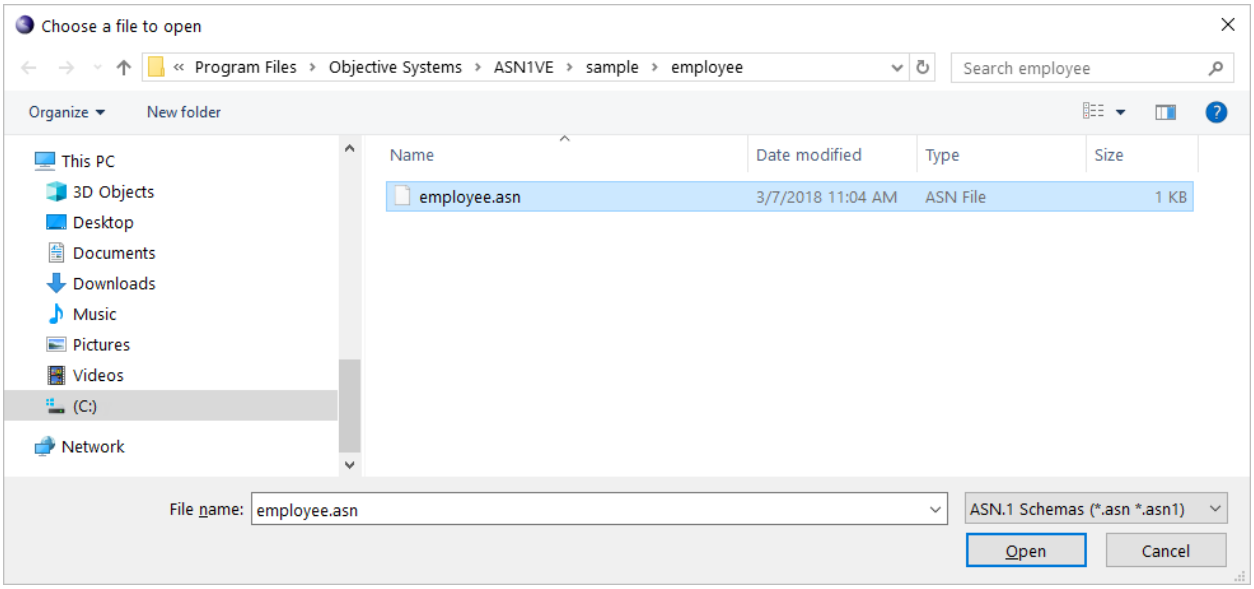


Click a node to select a PDU type. If the type desired is not shown, clicking *Display all types* at the top of the window will display a list of all the types defined in the selected schema. Once a PDU type is selected, click *Finish*.

If opening the file is successful, the *Tree View* will show the top-level data unit in the file, and the *Hex* tab will contain the encoded file data.

Open an ASN.1 schema

To open an ASN.1 schema file for editing, select the *Open Schema...* option from the *File* menu. This will bring up a dialog box for selecting the file.



In the file-type dropdown, select "ASN.1 Schemas (*.asn *.asn1)" and select a file. If the file to be opened has a nonstandard file extension, selecting "All files (*)" will allow the file type (ASN.1 schema, in this case) to be chosen manually.

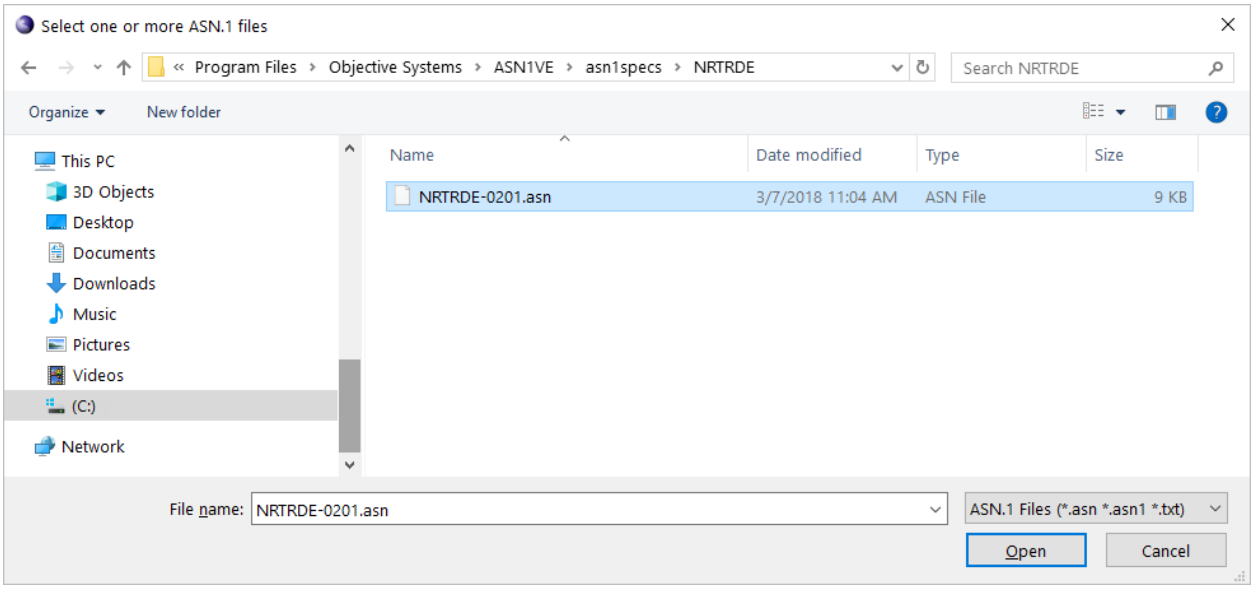
Once the schema file is opened, it is displayed in the Editor Tab in the Document View window. From there, it can be viewed or edited. The schema can also be validated by using the *Validate schema* option in the *Tools* menu. The Validate Schema toolbar button can also be used to do this:

If validation is successful, the schema will be displayed in the ASN.1 Browser Tab as well as the Editor. It will also be shown in the Tree View under the ASN.1 Schema Tab thus allowing for easy navigation to all items within the schema.

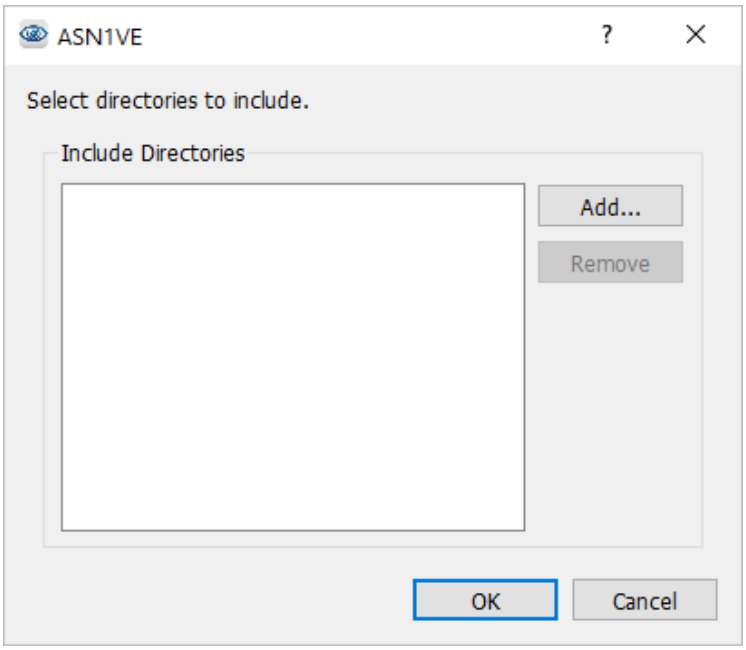
Assign an ASN.1 schema

To assign an ASN.1 schema from a file, select *ASN.1 schema file(s)* from the *Assign* menu. To assign one of ASN1VE's built-in schemas, select *Built-in ASN.1 schema(s)* from the menu.

If assigning from a file, a file dialog will be shown:

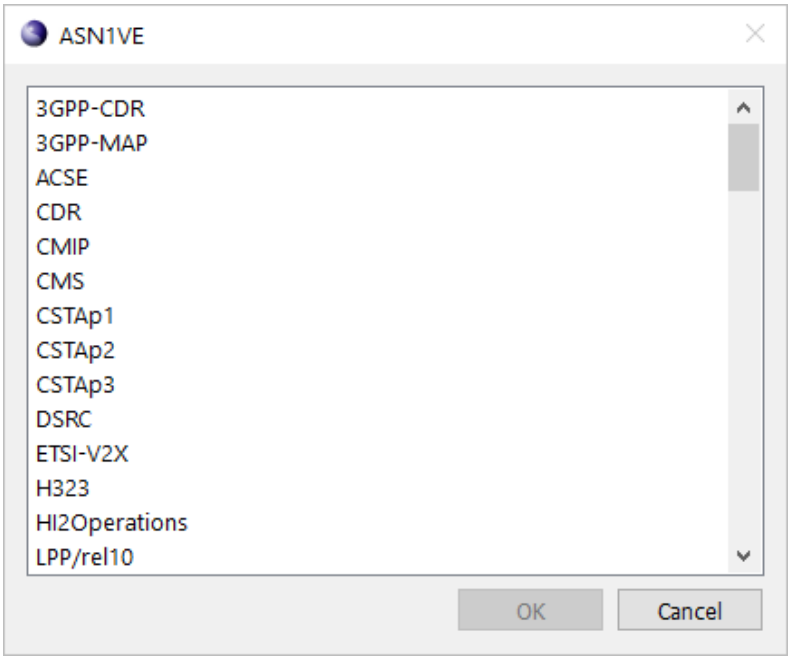


Navigate to and select the schema file(s) to be used and click the *Open* button. A dialog will then be shown which allows Include Directories to be selected:



Include directories are directories that contain other schema files that are referenced in IMPORT statements in the selected ASN.1 schema file(s). Once selection is complete, press OK and the ASN.1 schema files will be assigned to the data.

If assigning a built-in schema, ASN1VE will show a list of available built-in schemas.



Select a schema from the list and click the *OK* button.

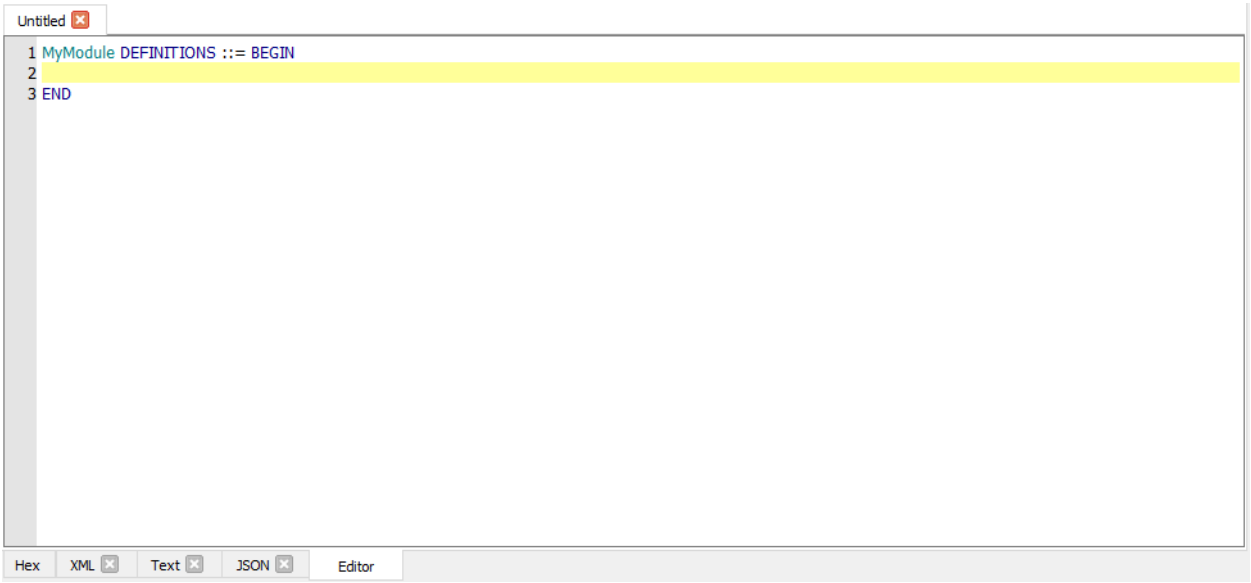
Built-in schemas are schema sets from common standards that use ASN.1. These schemas can sometimes span multiple specifications in import statements. The built-in schemas are configured to automatically resolve these imports by looking in other common directories. The schema files themselves reside in the 'asn1specs' directory within the installation. Each directory normally contains an 'acconfig.xml' file that is automatically read by ASN1VE to find import files or determine the PDU type for the data. A user may add their own schema files to this collection by creating a directory in this space and adding their ASN.1 files. They can also create an acconfig.xml file for specification of configuration items such as import directories or PDU type. ASN1VE will automatically display these newly added schema sets when the Assign Built-in Schemas menu item is selected.

Create a New Message or ASN.1 Schema

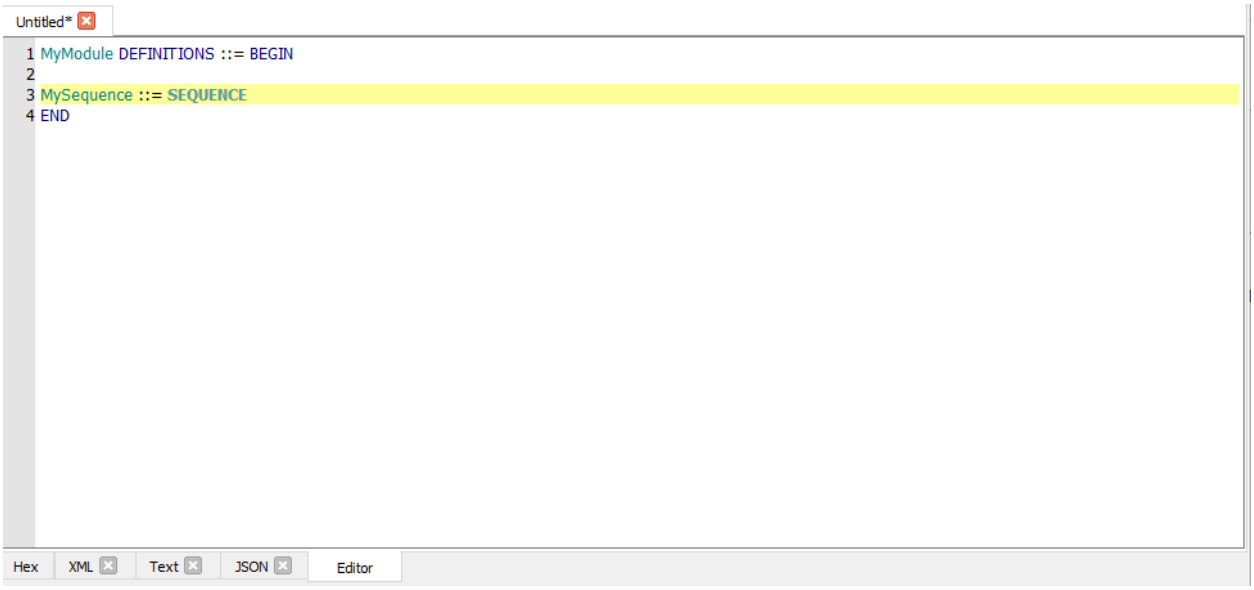
Select *File -> New...* and select either *Message* or *Schema*.

Creating a New ASN.1 Schema File

To create a new ASN.1 schema file, select *File -> New -> Schema* from the *File* menu. This action opens a new ASN.1 schema in the Editor tab:.



ASN.1 definitions can then be added tothe body of the schema. As keywords are recognized, they are highlighted in bold font as follows:



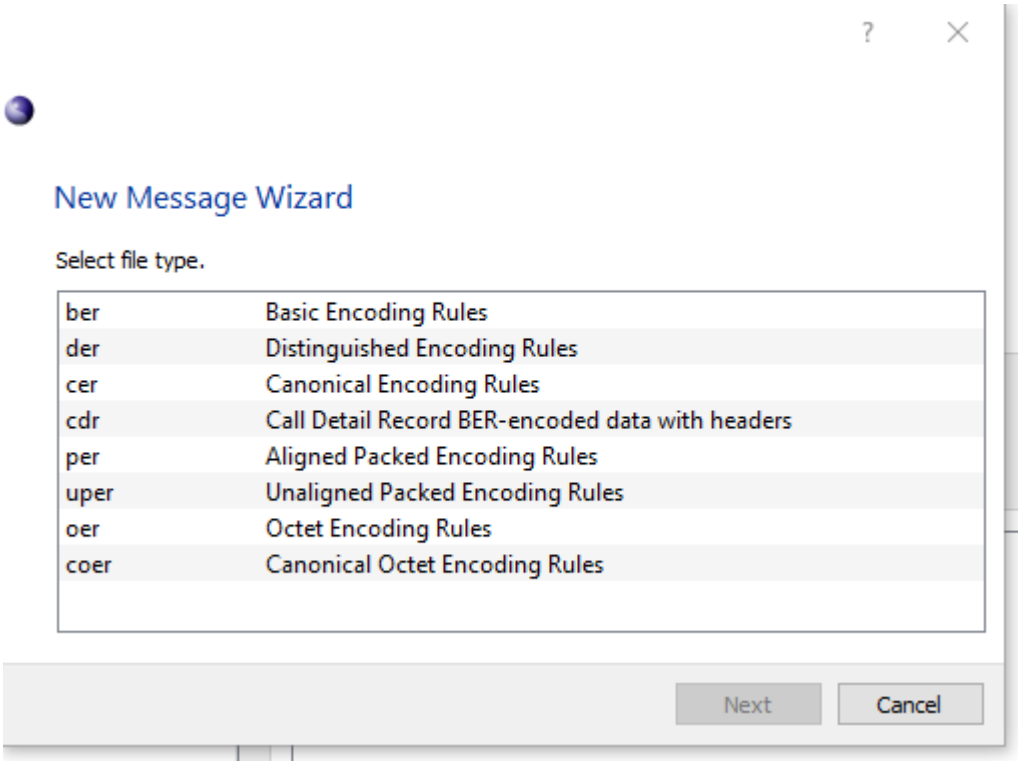
In this example, the SEQUENCE keyword is highlighted.

Additional schema files can be created by executing the New Schema command multiple times. Each invocation will result in a new tab being opened.

The schema files can be saved using the File Save commands. The schema files can be validated using the *Tools -> Validate Schema* menu item, or by pressing the Validate tool button.

Creating a New ASN.1 Data File

To create a new message file, select *File -> New -> Message* from the *File* menu. This will launch the New File Wizard.



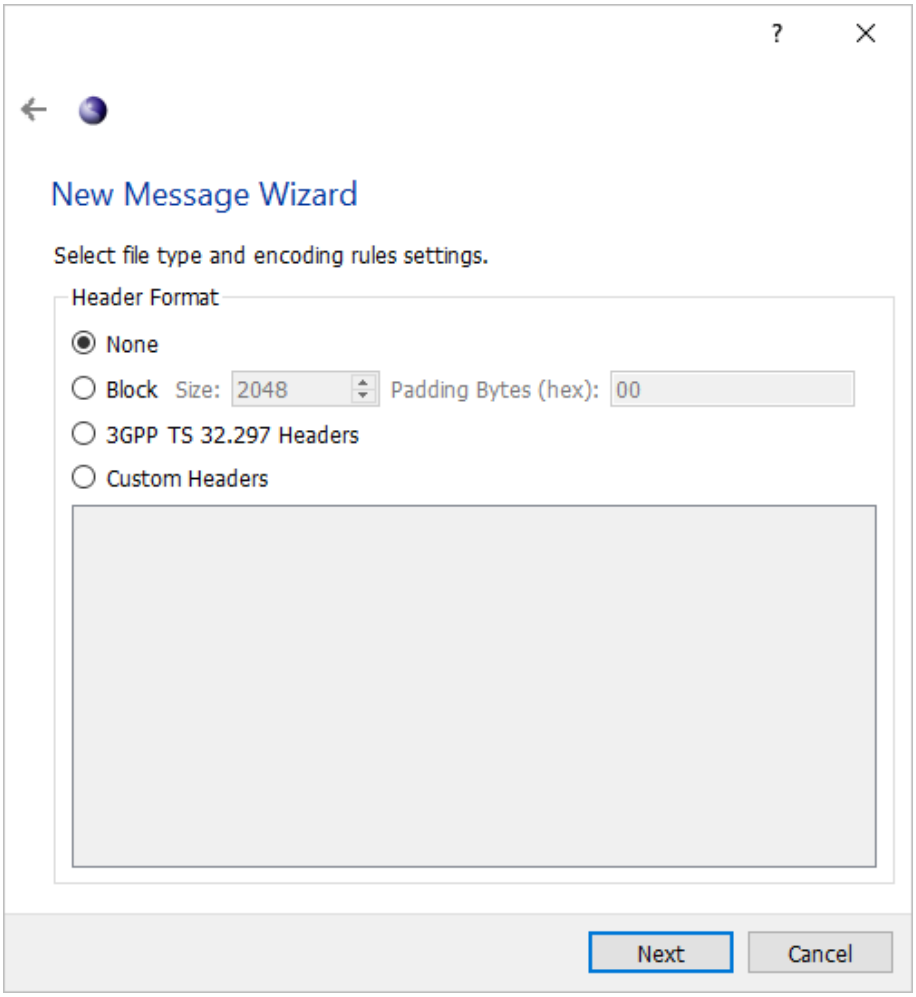
Select one of the options presented and click *Next*.

The *ber*, *der*, *cer*, *oer*, *coer*, *per*, and *uper* options allow a user to create a new ASN.1 data file using one of these encoding rule sets. The *cdr* option is for creating a Call Detail Record (CDR) file that contains additional non-ASN.1 headers.

If *cdr* is chosen, proceed to the next section on specification of CDR headers. Otherwise, jump to the next section on assigning ASN.1 schema information.

Specification of CDR Header Data

After "cdr" is chosen, the "Header Format" dialog is presented:

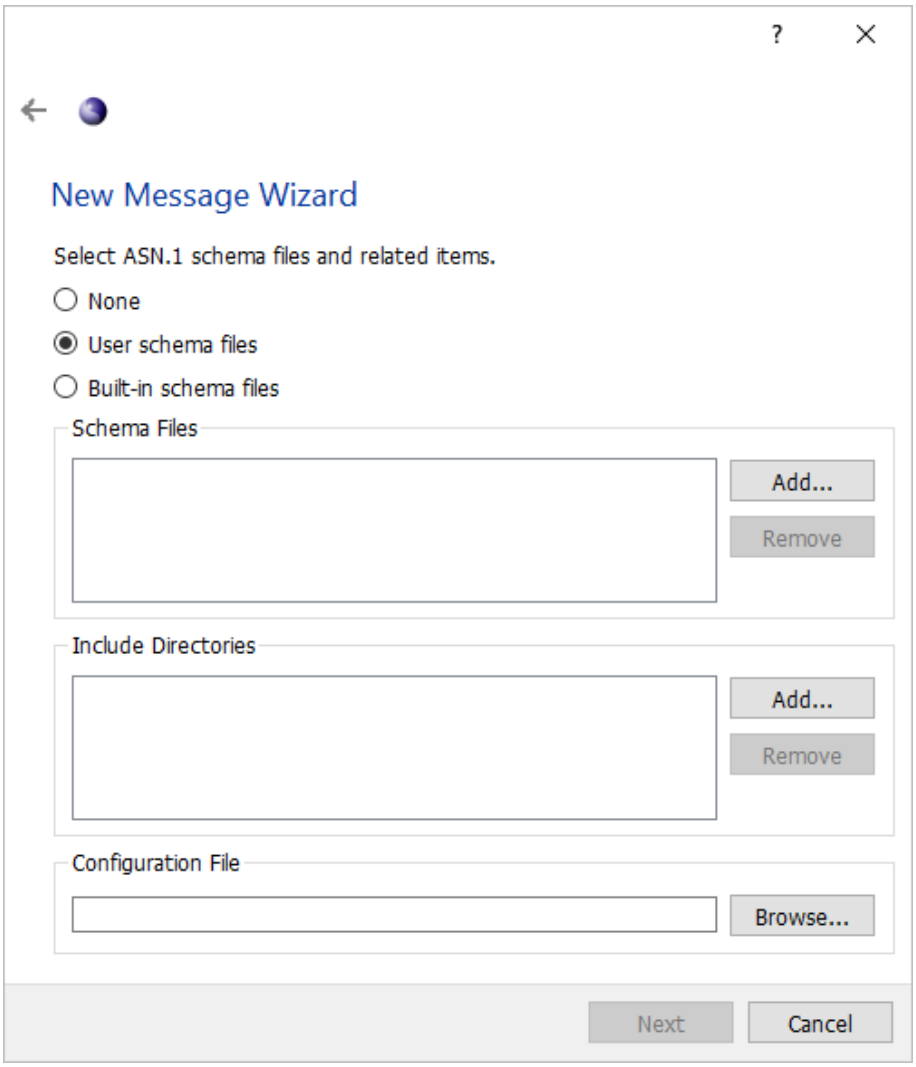


None	No headers will be added to the encoded data. This is the same as having selected "ber" in the previous window.
Block	Data will be encoded into blocks of a certain size. If a message would normally be encoded across a block boundary (for a block size of 2048 bytes, this boundary is at offsets 2048, 4096, 8192, ...), the rest of the current block is instead padded out and the message is encoded, starting at the beginning of the next block. Padding bytes are also used to determine whether a block contains more data or is padded out.
3GPP TS 32.297 Headers	Data will be encoded according to the TS 32.297 standard. This includes file and message headers of the standard format.
Custom Headers	Custom headers are fixed-length headers that allow data fields within the headers to be specified. Selecting this option will cause an additional dialog to be opened that allows headers and header fields to be declared. See the section on editing custom headers for details on editing the header format.

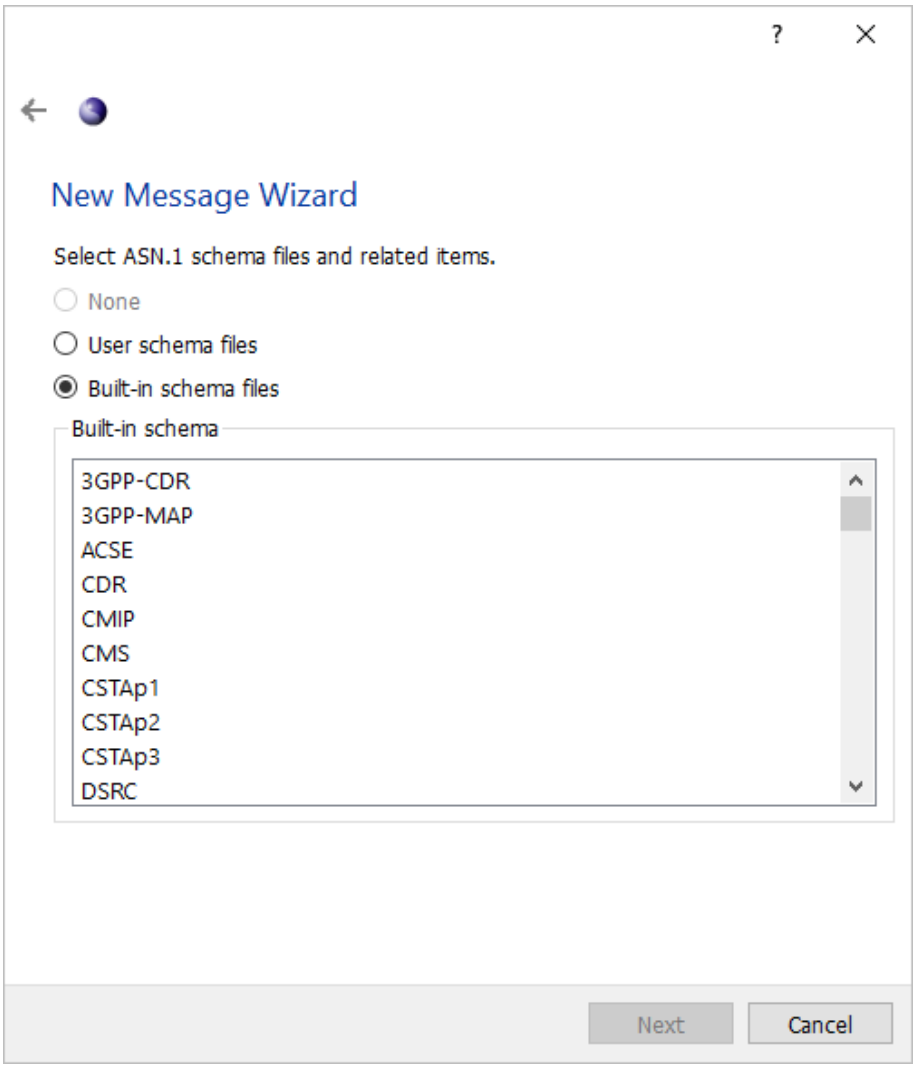
Once the header type has been selected, click *Next*.

Assignment of ASN.1 Schema Files

The next page of the wizard prompts for a schema to use. This would be the first page displayed after a file type other than *cdr* is selected.



At the top, three options are available, *None*, *User schema files*, and *Built-in schema files*. The *None* option is only available for BER and allows a user to define a message without schema using hex data. The *User schema files* option allows the user to select their own ASN.1 schema files. *Built-in schema files* presents a list of available schemas built into ASN1VE.



Below the selection options, the wizard shows lists for schema files and include directories. ASN.1 schema files should be added to the list of schema files that define the type of message being created. Include directories are directories to search to resolve import statements within the selected schema files.

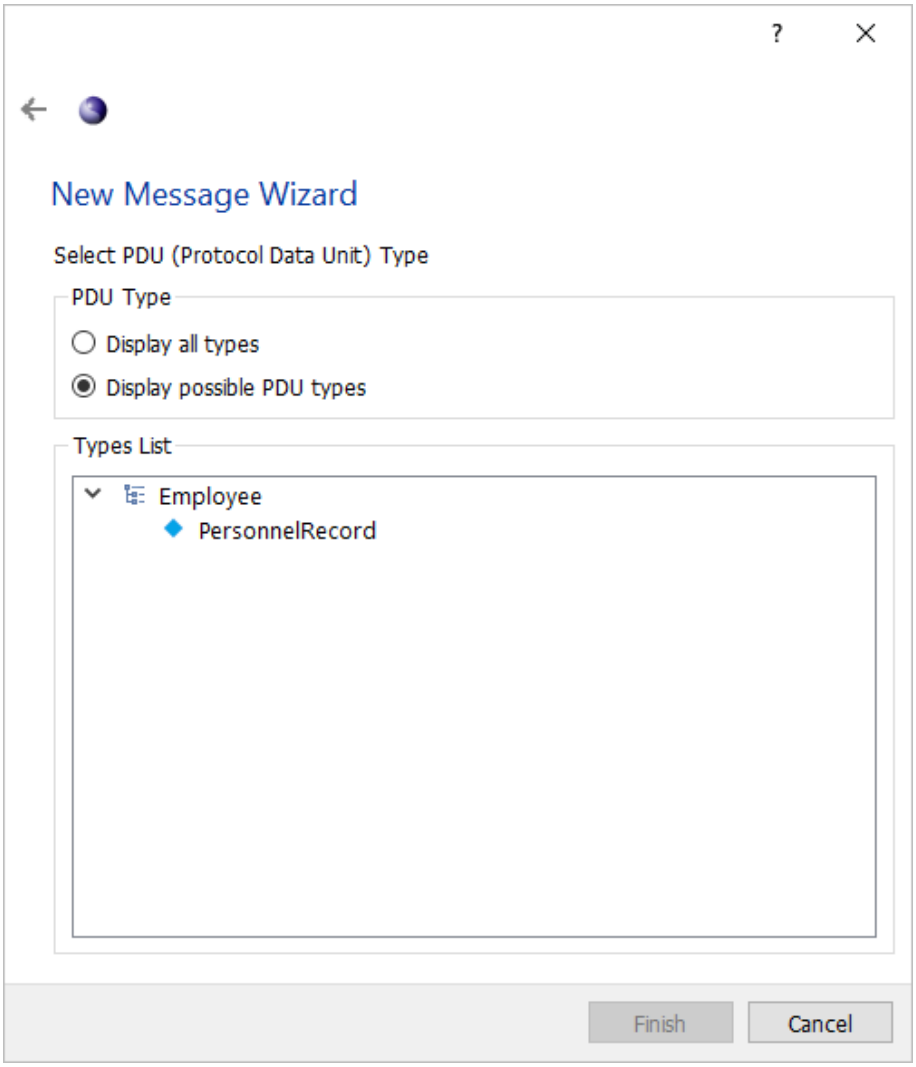
Clicking *Add...* next to either list will bring up a file dialog. Navigate to the directory or file(s) to add, highlight them, and click *Open*.

To remove a listed file or directory, highlight it in the list and click the *Remove* button next to the list.

Below the schema files and include directories, *Configuration File* allows the user to apply settings from an Objective Systems configuration file. To select a configuration file, click the *Browse...* button. See the Configuration Files section for more information.

If *Built-in schema files* is selected at the top, the wizard will show a list of all the available built-in schemas in ASN1VE. Click to select a schema to use.

Once a schema has been selected, click *Next*. The wizard will show a list of types that can be used as the protocol data unit (PDU) for the message.



Click a node to select a PDU type. If the type desired is not shown, clicking *Display all types* at the top of the window will display a list of all the types defined in the selected schema. Once a PDU type is selected, click *Finish*.

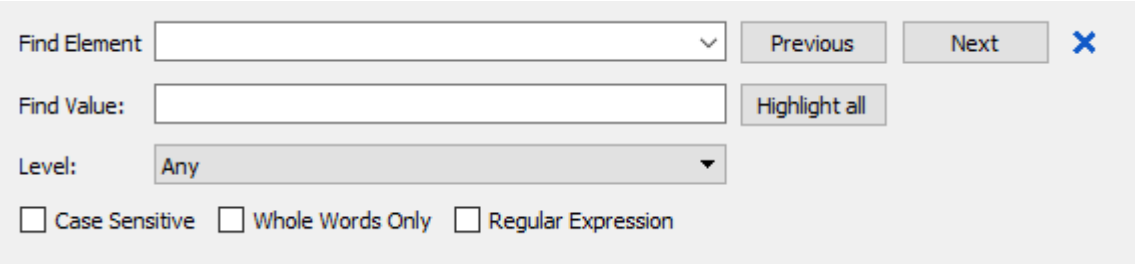
If on the first page "cdr" was chosen, ASN1VE will prompt the user for a number of records to generate. Otherwise (or after choosing how many records to create), the newly-created message will be shown in the *Element View* and encoded in the *Hex* tab.

Find an element in a message

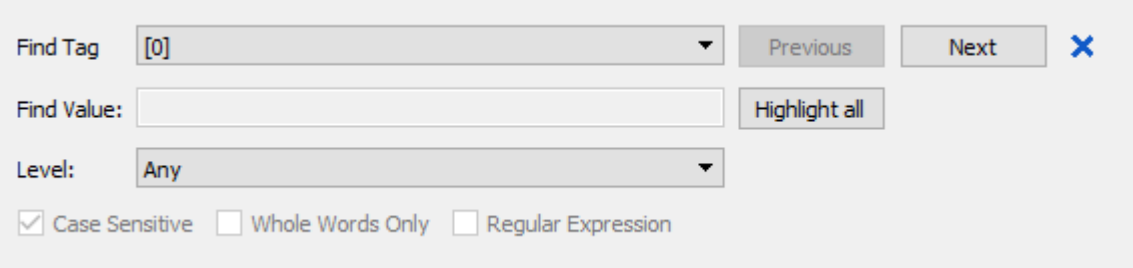
To find a specific data item in a message file, the *Find* command can be used. When enabled by selecting *Find...* in the *Edit* menu, the *Find* widget is shown in the lower left-hand corner, below the *Project View*. (It can also be shown or hidden using the button in the toolbar or the keyboard shortcut Ctrl+F.)

It is also possible to search a specific branch in the tree for an item by right-clicking on a node and selecting the *Find In* option.

If a schema is assigned to the message, the find dialog is as follows:



If no schema is assigned, the Find dialog looks like this:



The first field is *Find Element* (or *Find Tag* when the *Tag View* is active), and can be used to search for an element or tag by its name. In both cases, a dropdown menu for the field provides a list of tag or element names within the current context (children of the currently selected element, or the entire file if no element is selected). Selecting from the list or entering a name manually and clicking *Next* or *Previous* will search the current context for elements with that name.

Find Value allows searching the current context for elements with the given value, across all types. For example, entering "123" in the *Find Value* field would match an INTEGER element with a value of 123, and it would match a BMPString with value "123." (Note that values should be entered in decoded form, rather than as encoded in ASN.1.)

Level allows searching for the element name and/or value combination or tag at a given level in the message. The choices for this field are 'Any' which will search the entire message of 'Current' which will search within the currently selected block in the tree view. In the case of 'Tag', it is also possible to select a specific level by number to search.

If search criteria are entered in both the *Find Element* and *Find Value* fields, then only elements matching both name and value are returned as search results. In the case of *Find Tag*, it is only possible to seach for the tag, not the value.

Besides the *Next*and *Previous* buttons, clicking the *Highlight All* button will highlight every element in the current context that matches the search criteria.

The *Find* tool provides several options for matching values, as well.

The following additional options are available for the message with assigned schema case:

- *Case Sensitive* makes *Find Value* search terms case-sensitive (this is off, by default).
- The *Whole Words Only* option matches search terms as complete words. For example, a search for "moose" with *Whole Words Only* unchecked would match the phrases "I saw a moose over there" and "These moosetracks are fresh," but with *Whole Words Only* checked, only the phrase "I saw a moose over there" would match.
- *Regular Expression* indicates that the text in the value field is a regular expression.

The search starts from the last item that was selected in a message. To ensure a search starts from the top, the user should select the root item in the *Tree View*.

Edit a message

Once a data file is open in ASN1VE, it can be edited in various ways.

Tree View

To edit a particular element, first the *Tree View* must be showing the *Element View*. For this, an ASN.1 schema must be assigned. Expand the tree to expose the element to be edited. Right-clicking on the element will bring up a context menu with varying options for the selected element.

For repeating elements (such as elements of a SEQUENCE OF) and top-level nodes (representing a complete message or record), options *Insert before* and *Insert after* will create a new, empty element of the same type before or after the selected element. The *Copy element* and *Paste element* options can be used to copy the contents of one element and then paste this data into a new element. The *Delete* option will delete the currently selected element.

For Open (ANY) type elements, the *Decode as...* option allows a type to be selected for the current element. Once a type is selected, the element will be re-decoded as if it were the selected type. Note that this does not actually change the encoded message. To replace an Open type element with another, see the type-specific element editor for Open type elements.

Detail View

Clicking on an element in the *Tree View* will cause the *Detail View* to show a type-specific editor for the element. For details about specific type editors, see Element editors.

Hex Tab

Message data can also be edited directly via the *Hex* tab in the *Document View*. Clicking on a byte highlights it, and entering hexadecimal characters, two for each byte, inserts the new byte before the selected one. To overwrite the current byte instead of inserting before it, click the INS button in the lower right-hand corner to change it to OVR. Once editing is complete, clicking the *OK* button in the *Hex* tab will reload the message in the *Tree View*.

Note that attempting to edit hex data directly can be problematic if the message contains embedded lengths upstream from the location where the editing is being done. These will not be updated automatically if hex contents are changed in the editor, so a user can very easily make a message invalid by trying to edit it this way. It is better to use one of the other methods except for the simplest cases>

Encode Menu

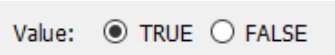
Finally, message data can also be re-encoded using a different set of ASN.1 encoding rules. To do this, select from the *Encode* menu the encoding rule set to re-encode as.

Element editors

INTEGER

To edit an INTEGER type, change the number in the box and click *Update*. If any named values are present in the schema, they can be selected from the dropdown menu.

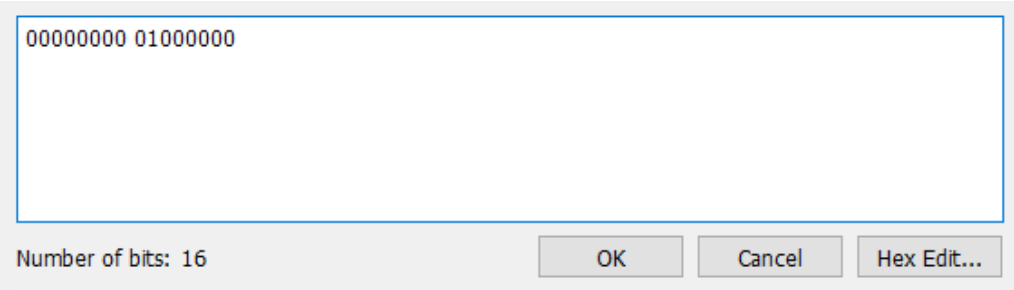
BOOLEAN



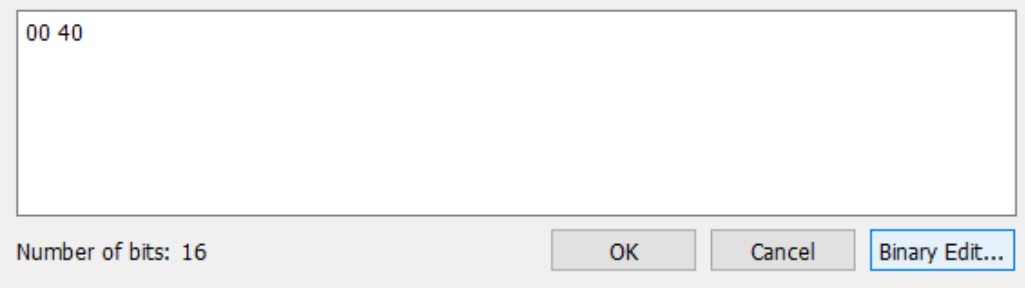
Selecting an element with a BOOLEAN type will show radio buttons *True* and *False* in the editor. Selecting either one will change the element's value accordingly.

BIT STRING

This type of value can be edited using the following dialog displayed in the edit window. It will accept only 1 or 0 bits values. Other values will be marked as invalid values.

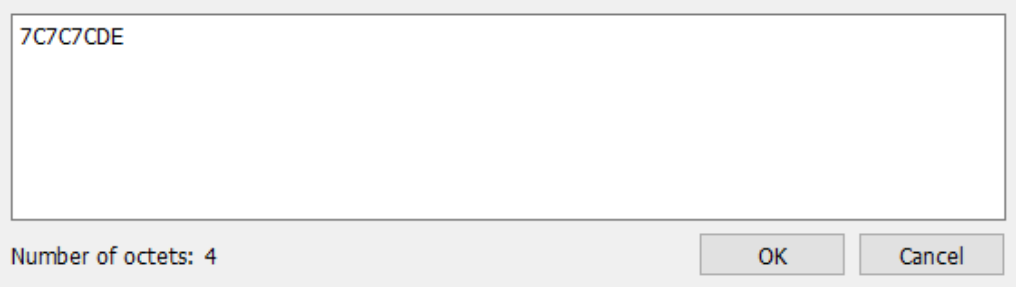


Clicking the *Hex Edit...* button will toggle the editor to hexadecimal mode.



Clicking the *Binary Edit...* button will subsequently toggle the editor back to binary mode. Click *OK* to change the element's value to that of the edited string.

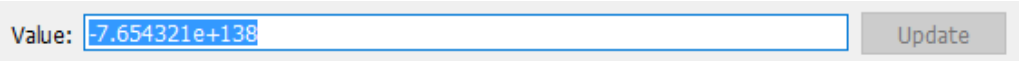
OCTET STRING



Similarly, OCTET STRING types are edited using the editor shown above. Each pair of hexadecimal characters represents a single byte. Click the *OK* button to set the element's value.

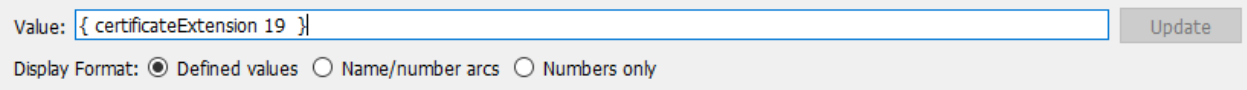
It is possible to alter how OCTET STRING's are displayed using the <displayFormat> configuration variable. For example, OCTET STRING's can be configured to be displayed as IP addresses, TBCD strings, or textual strings. If an OCTET STRING is configured to be displayed in an alternate format, its editor will also be adjusted to allow values to be entered in that format.

REAL



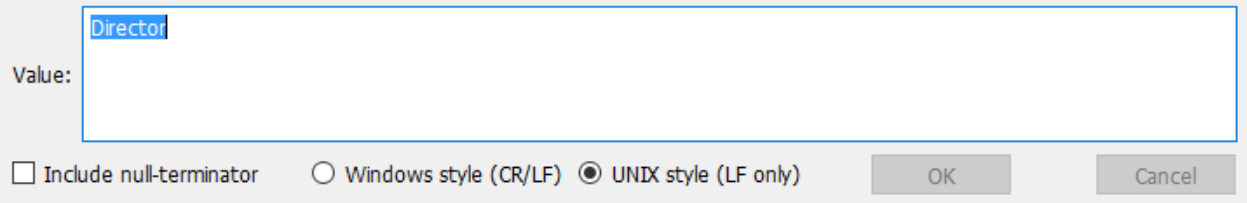
In the editor for elements of type REAL, values can be entered in typical floating-point format. Clicking *Update* sets the value of the element.

OBJECT IDENTIFIER



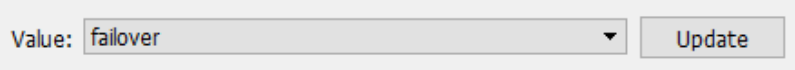
This type of value is edited as a string. When present in the schema, *Defined values* can show the current value relative to a named value, and *Name/number arcs* shows each branch number in parentheses following the branch name.

CHARACTER STRING



CHARACTER STRING types, including restricted string types such as BMPString and UTF8String, use the above editor. Selecting *Windows style (CR/LF)* or *Unix style (LF only)* will determine how newlines are represented in the encoded string. Checking *Include null-terminator* will make sure the encoded string ends with a zero byte.

ENUMERATED



ENUMERATED types are edited by selecting from the choices available in the dropdown menu. Clicking *Update* will set the value of the element.

UTCTime and GeneralizedTime

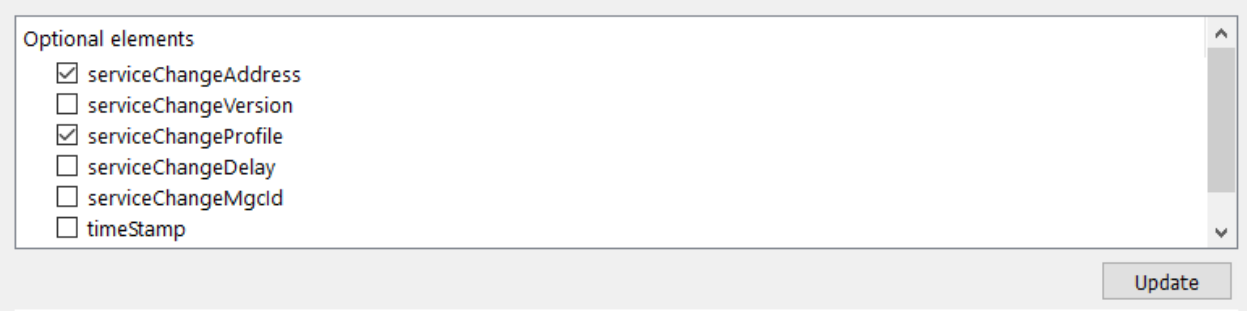
UTCTime and GeneralizedTime values are edited as shown above. The *Raw Value* field is for information only and cannot be edited directly. The values must be set using the data entry fields in the top row. Date and time can either

be entered directly or the spin box controls used. To do this, highlight a portion of the time (such as the month) and use the up and down arrows on the right to change the value of that portion. The *fractional seconds* (GeneralizedTime only) setting allows for editing fractions of seconds to arbitrary precision. *Time Zone* allows the time zone to be set as its difference from UTC.

Once the time has been adjusted, clicking *Update* will set the time in the current element.

For convenience, the *Set Current* button is provided as a shortcut to set the current time.

SEQUENCE and SET



The editor for elements of types SEQUENCE and SET provides a list of elements of the selected SEQUENCE or SET which are OPTIONAL in the schema. If an OPTIONAL element is checked, it will be present in the resulting SEQUENCE or SET, whereas if it is unchecked, it will be removed. Once changes have been made, clicking the *Update* button will cause only the OPTIONAL elements that are checked to be enabled.

It is also possible to add/remove optional elements by right-clicking them and selecting Enable or Delete from the context-specific menu.

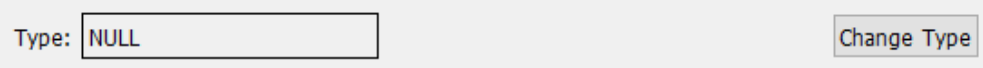
SEQUENCE OF and SET OF

The editor for elements of types SEQUENCE OF and SET OF is similar to the INTEGER editor. Changing the value shown and clicking *Update* will cause the specified number of elements to be encoded. If this number is greater than the previous number, new elements will be created; if it is less than the previous number, elements will be removed from the end.

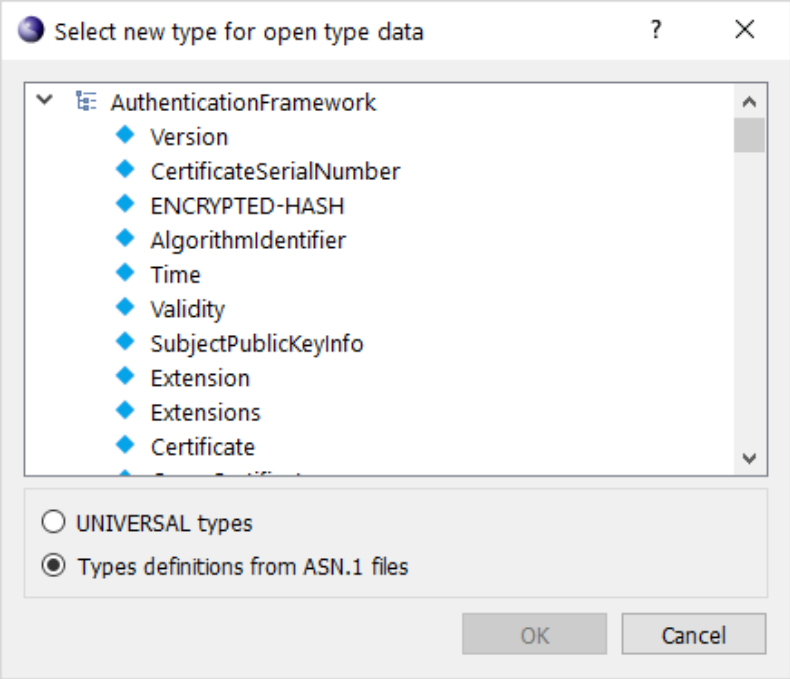
CHOICE

CHOICE elements can be edited similarly to ENUMERATED elements. A dropdown menu provides a list of possibilities. Select one from the list and click *Update* to replace the existing CHOICE element with one of the selected type.

Open



The editor for Open (ANY) type elements shows a box at the left denoting the type used to decode the element. If no type could be determined, or if Open type decoding is disabled, the box will be empty. To set or change the type of value the element contains, click the *Change Type* button. Note that this is an editing operation and will almost certainly change the encoded value. To attempt to decode the existing element as a different type, the right-click context menu in the *Element View* provides a *Decode as...* option.

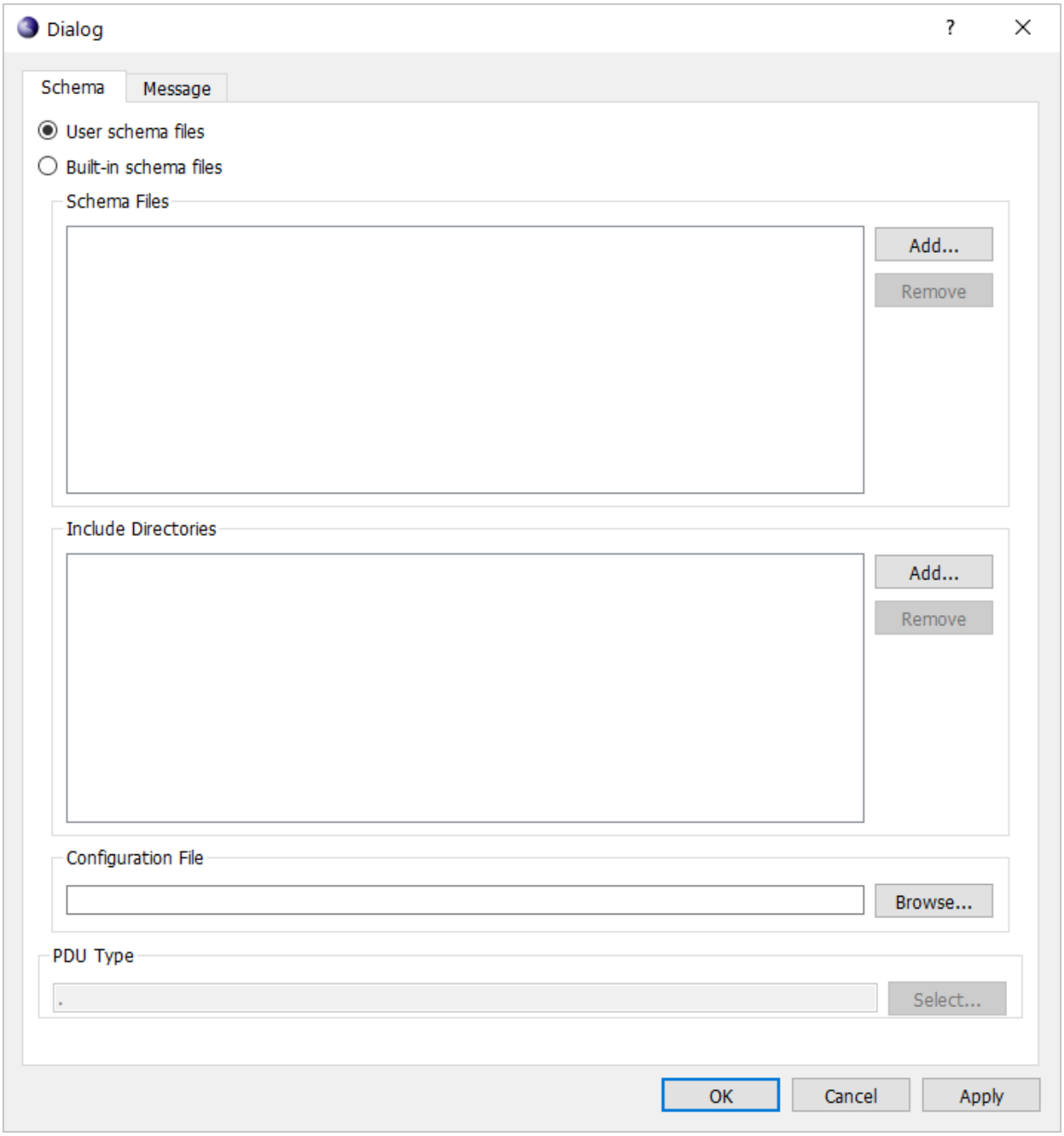


The window also provides a list of UNIVERSAL types to choose from, accessible by clicking *UNIVERSAL types*. To change the type of the element, select a type from the list and click *OK*.

Edit a project

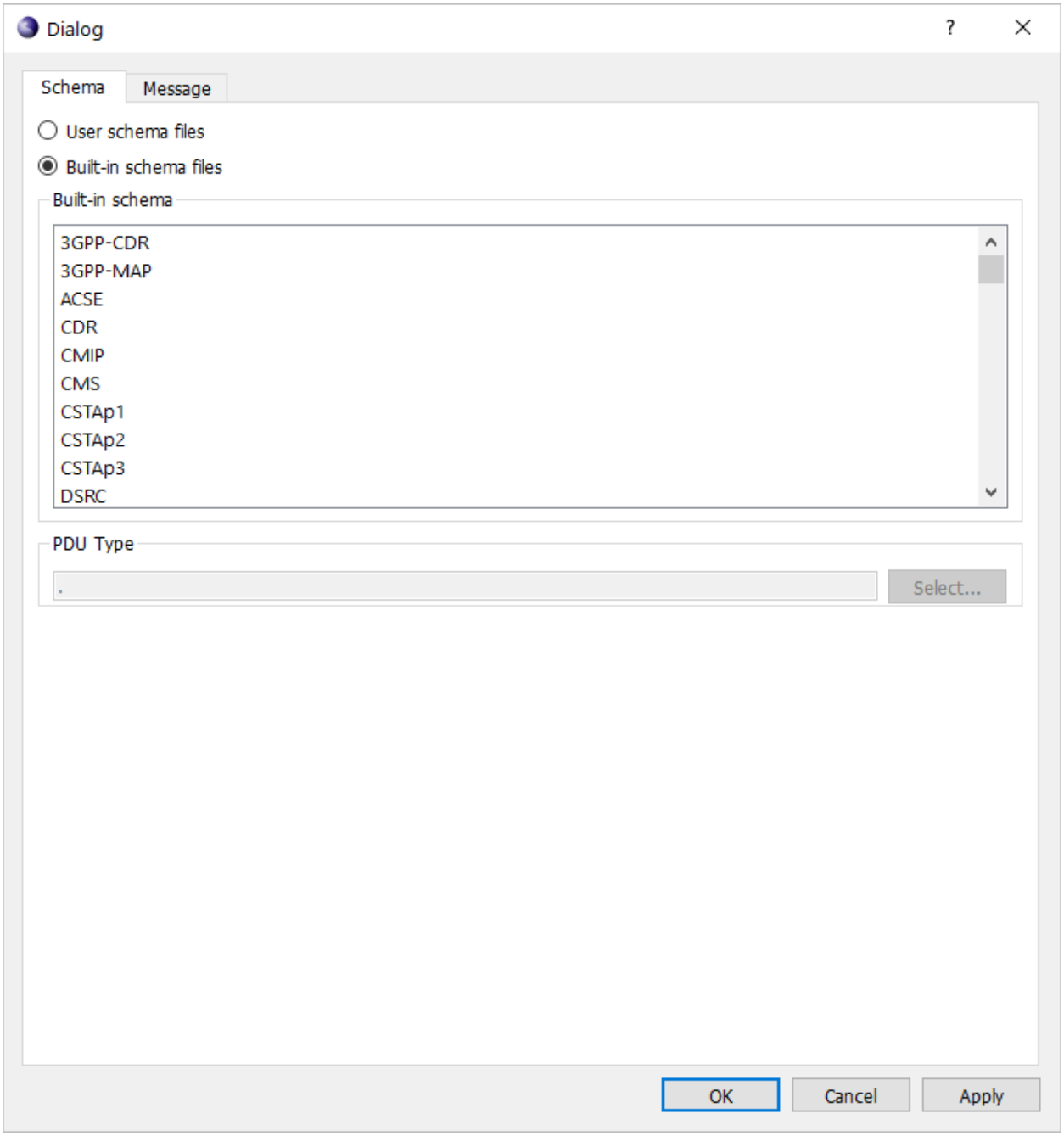
ASN1VE provides two different methods of editing project settings. First a project may be edited via the *Project View* by right-clicking on the various settings.

The second method can be accessed by selecting *Edit project...* from the *Project* menu.



The resulting window has two tabs, *Schema* and *Message* The *Schema* tab allows for adjusting schema-related settings, while the *Message* tab manages settings specific to the data file.

At the top of the *Schema* tab, two options are available, *User schema files* and *Built-in schema files*. *User schema files* allows the user to select their own ASN.1 schema files. *Built-in schema files* presents a list of available schemas built in to ASN1VE.



If *User schema files* is selected, the window shows lists for schema files and include directories. ASN.1 schema files should be added to the list of schema files that define the type of message being created or opened. Include directories are directories that the parser will look in for additional schema files needed to resolve import statements.

Clicking *Add...* next to either list will bring up a file dialog. Navigate to the directory or file(s) to add, highlight them, and click *Open*.

To remove a listed file or directory, highlight it in the list and click the *Remove* button next to the list.

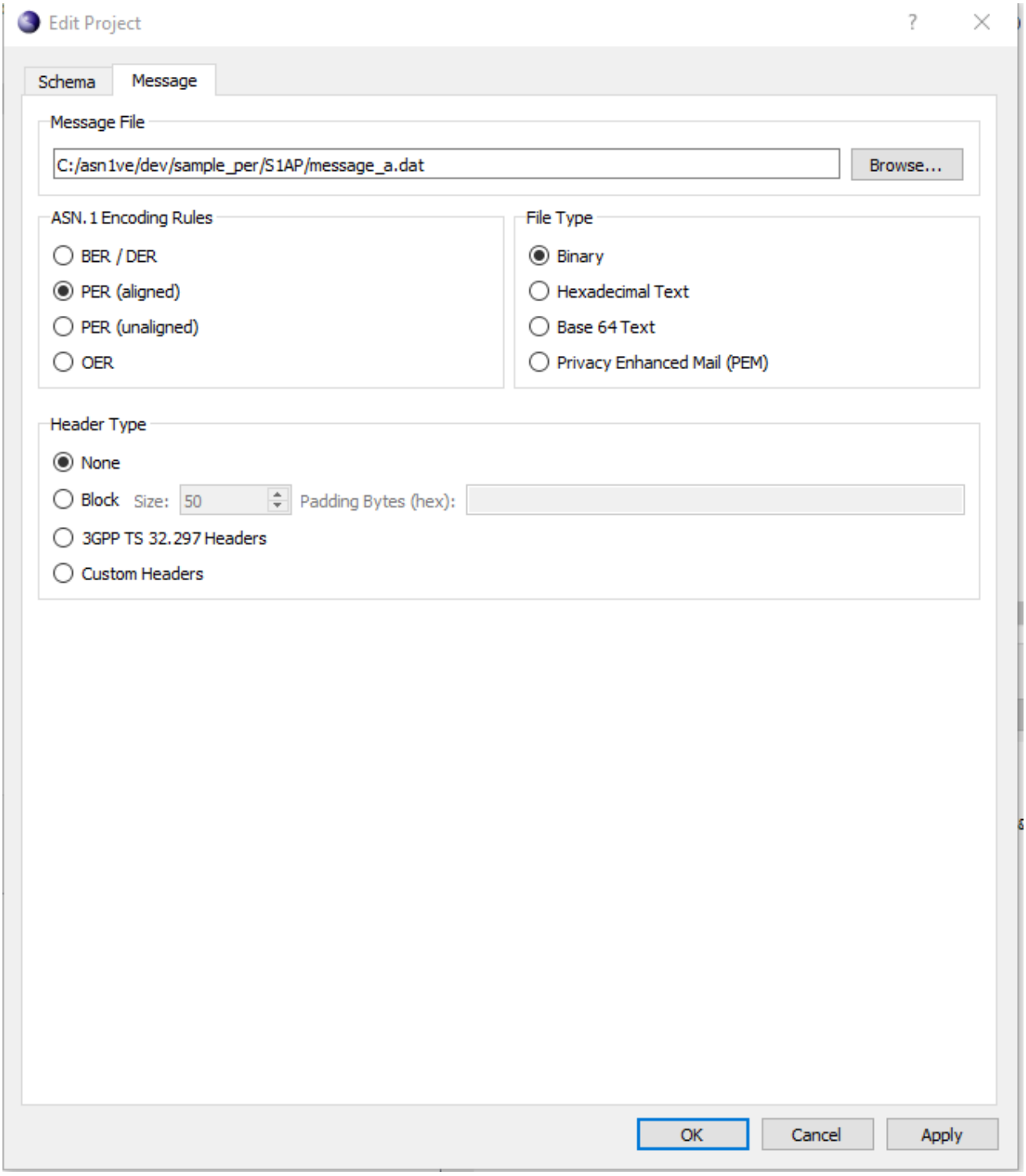
Below the schema files and include directories, *Configuration File* allows the user to apply settings from an Objective Systems configuration file. To select a configuration file, click the *Browse...* button.

At the bottom, *PDU Type* allows the user to specify a PDU type for the message data. Clicking *Select...* will open a PDU selection window.

If *Built-in schema files* is selected at the top, the window will show a list of all the available built-in schemas in ASN1VE. Click to select a schema to use.

The *Built-in schema files* option also includes a section for selecting the PDU type at the bottom.

The *Message* tab shows message-related settings:



At the top, *Message File* is the name of the message data file. Clicking *Browse...* opens a file dialog to select a message file.

ASN.1 Encoding Rules determines the encoding rules used to decode the message file.

File Type selects whether the message file being used is encoded as a binary file or as either hexadecimal or base64 text. The *Privacy Enhanced Mail (PEM)* setting provides special handling for PEM files (a special, base64 text format).

Header Type describes the type of headers used by the encoded message. In standard ASN.1 encodings where no header is encoded, *None* should be checked.

For block-encoded data files (i.e., messages are encoded within blocks of a certain size and do not cross boundaries between blocks), *Block* should be checked. In this case, both the size of the blocks and the padding bytes (used as a buffer between the last message in a block and the end of the block) can be set. Padding bytes should be comma-separated, hexadecimal values. If no padding bytes are given, zero is assumed.

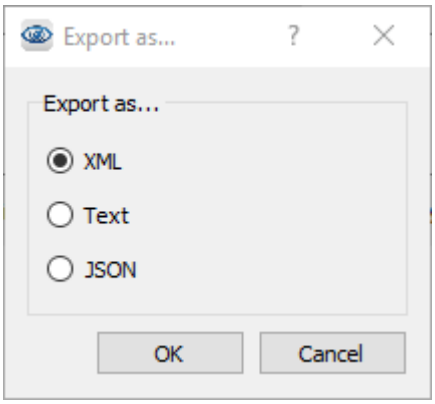
For data files using headers of fixed length, *Fixed-length Headers* should be selected, and the sizes for file and message headers should be set. The file header occurs only once at the beginning of the file, and the message header occurs at the beginning of each record or message in the file.

3GPP TS 32.297 Headers provides handling for files encoded using the TS 32.297 standard.

Once project editing is complete, click *OK* to apply the chosen settings and exit the window. Clicking *Apply* will apply the chosen settings without exiting the project settings window.

Export a Message as XML, Text, or JSON

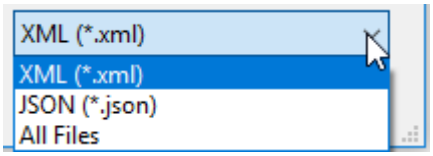
To export a loaded message data file as XML, JSON, or brace-text, select *Export...* from the *File* menu. The following dialog will be displayed:



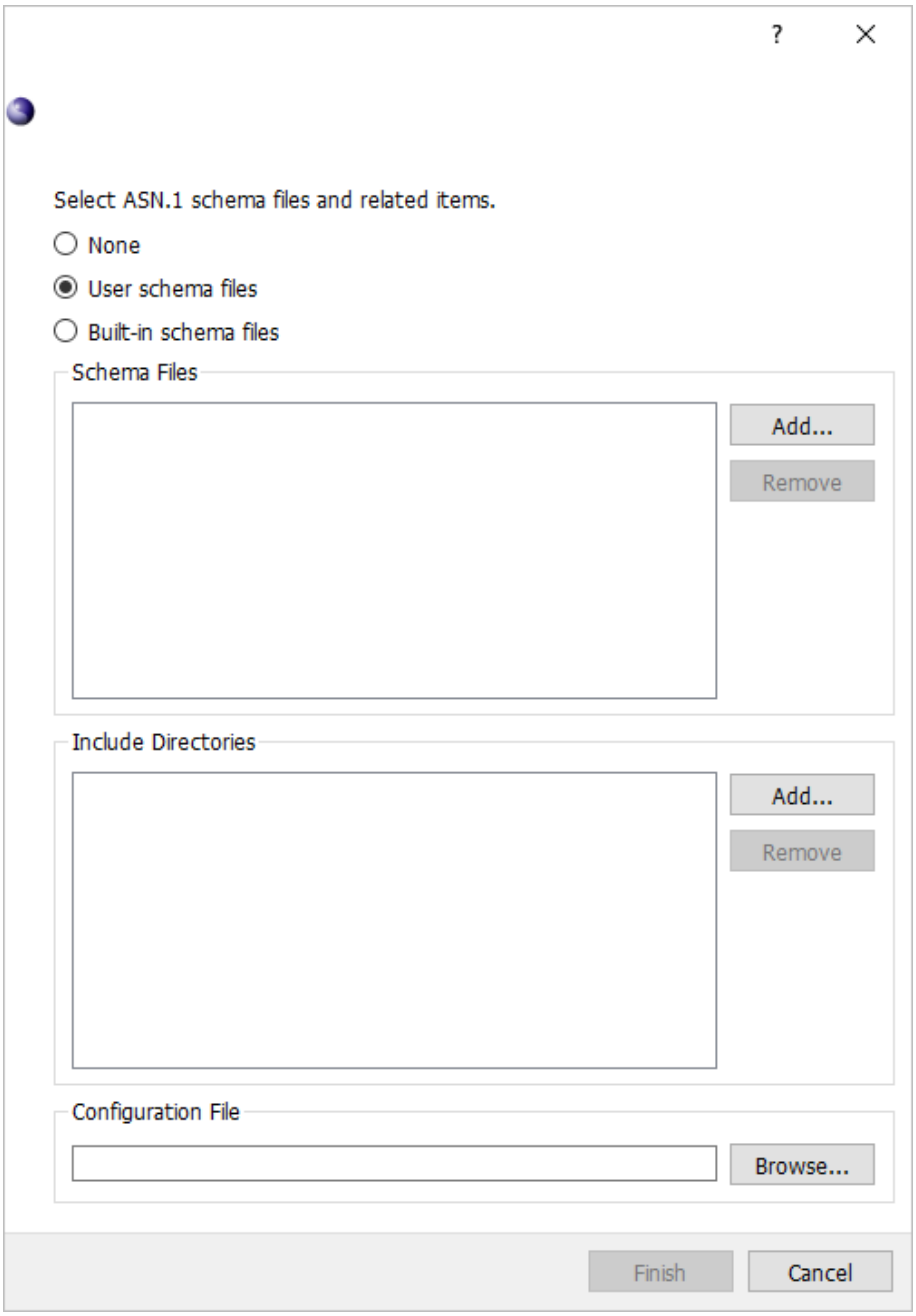
Choose *XML*, *Text*, or *JSON* in the dialog box and click *OK*. ASN1VE will then show a file dialog. Navigate to the directory in which the resulting file will be saved and enter a name for the new file. Click *Save* to complete the export procedure.

Import an XML or JSON file

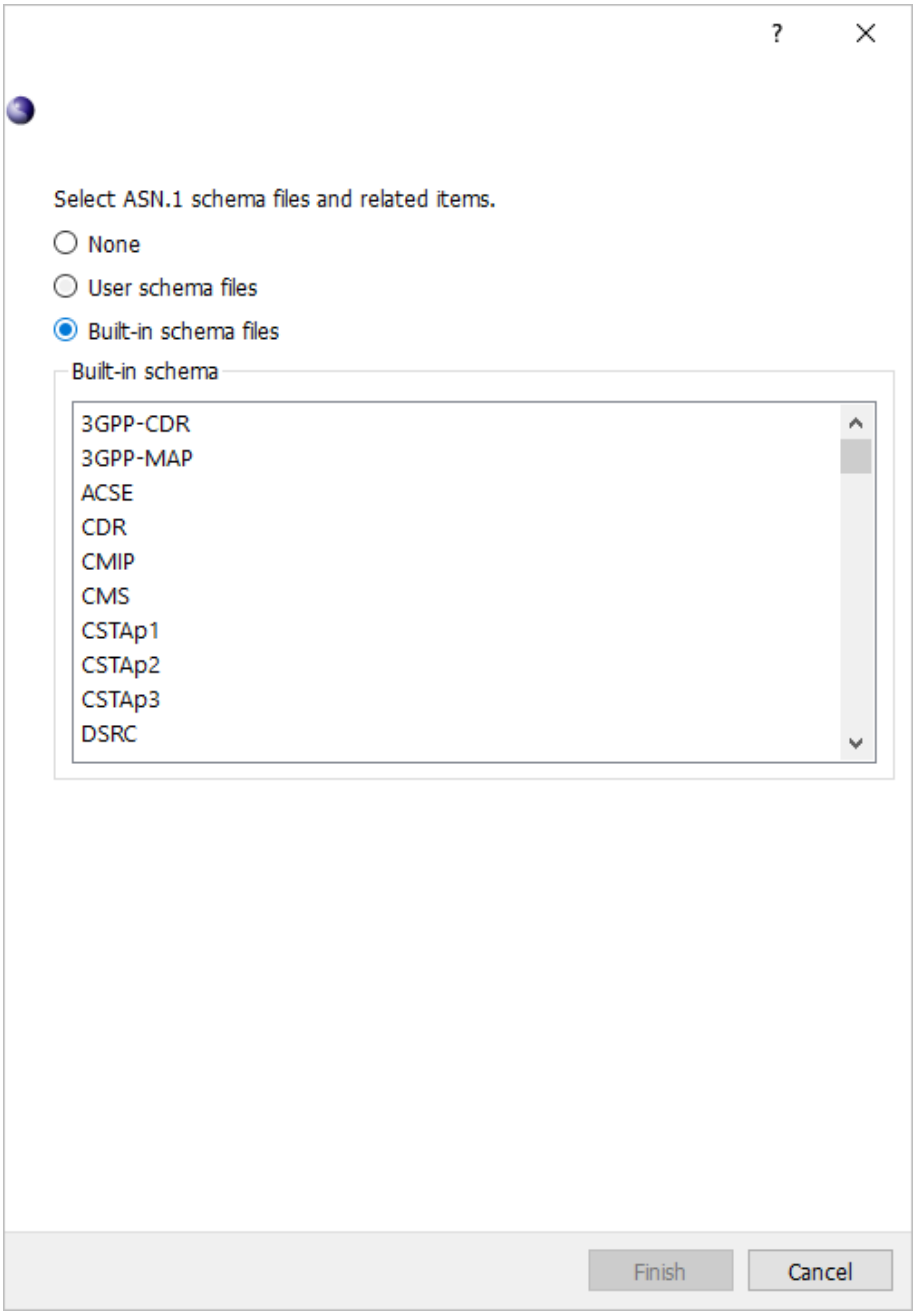
To import an XML or JSON file and convert it to a binary encoding, select the *Import...* option from the *File* menu. A file dialog will be shown. The file import filter in the lower right corner will allow either an XML or JSON file to be chosen based on extension:



Navigate to and select an XML or JSON file to import and click *Open*. If an existing project is currently in use, ASN1VE will ask the user if they want to use existing project information. If yes, the import is done and the dialog is complete. If no, or no project is active at the time, ASN1VE will prompt for encoding rules. These determine the binary encoding that the imported file will be converted to. Choose an option and click *OK*. ASN1VE will then provide a wizard for selecting an ASN.1 schema to use.



At the top, two options are available, *User schema files* and *Built-in schema files*. *User schema files* allows the user to select their own ASN.1 schema files. *Built-in schema files* presents a list of available schemas built in to ASN1VE.



If *User schema files* is selected, the wizard shows lists for schema files and include directories. ASN.1 schema files should be added to the list of schema files that define the type of message being created. Include directories can contain additional schema files that define types used by the schema.

Clicking *Add...* next to either list will bring up a file dialog. Navigate to the directory or file(s) to add, highlight them, and click *Open*.

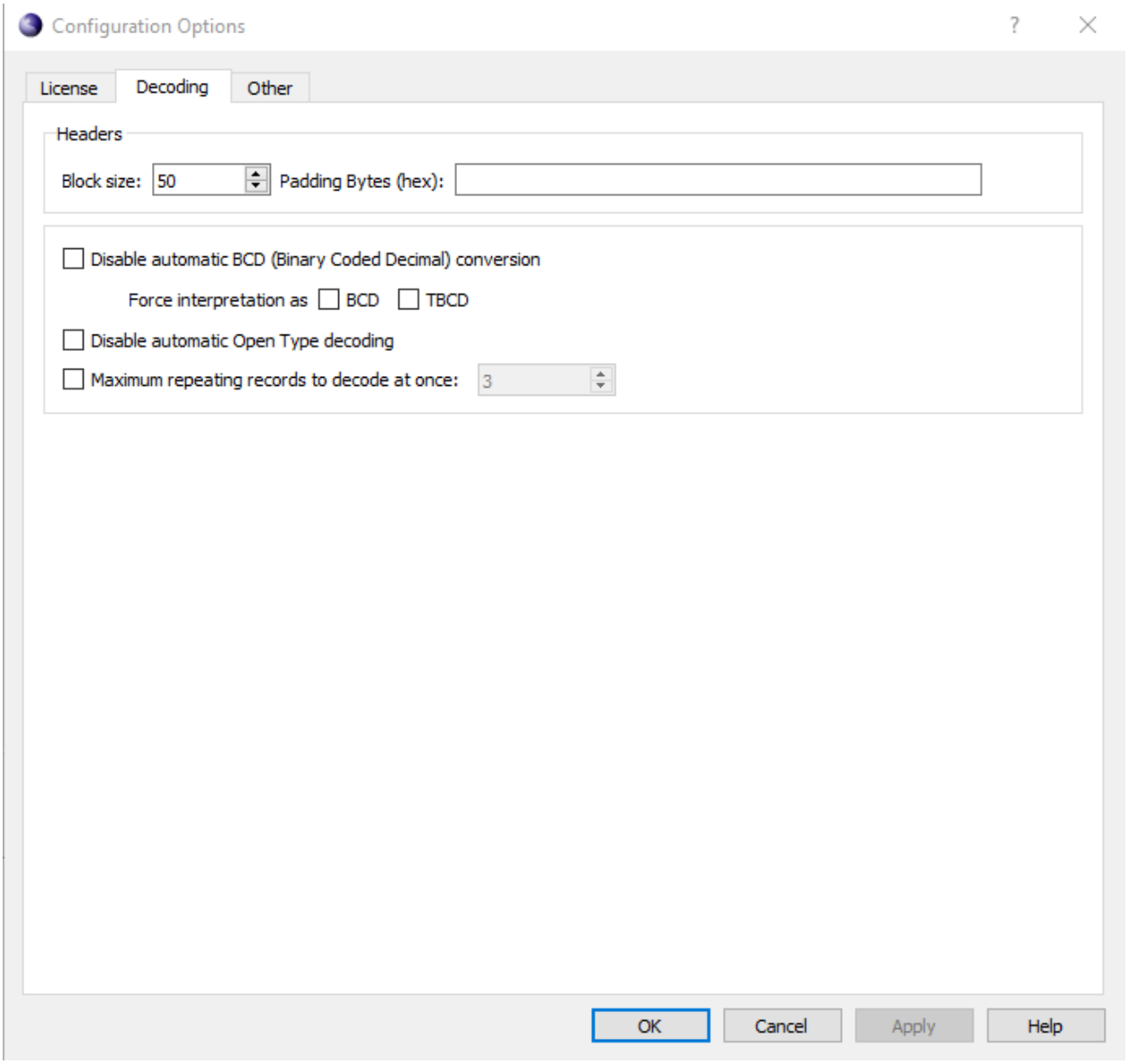
To remove a listed file or directory, highlight it in the list and click the *Remove* button next to the list.

Below the schema files and include directories, *Configuration File* allows the user to apply settings from an Objective Systems configuration file. To select a configuration file, click the *Browse...* button. See the Configuration Files section for more information.

If *Built-in schema files* is selected at the top, the wizard will show a list of all the available built-in schemas in ASN1VE. Click to select a schema to use.

Set ASN1VE options

Options for ASN1VE itself can be found in the *Configure...* item in the *Edit* menu. Selecting this will bring up a window with several tabs.



The *Decoding* tab contains a number of options for default settings during message data decoding. Many of these settings are overridden by session-specific or project-specific settings and would only come into effect when no project settings are defined.

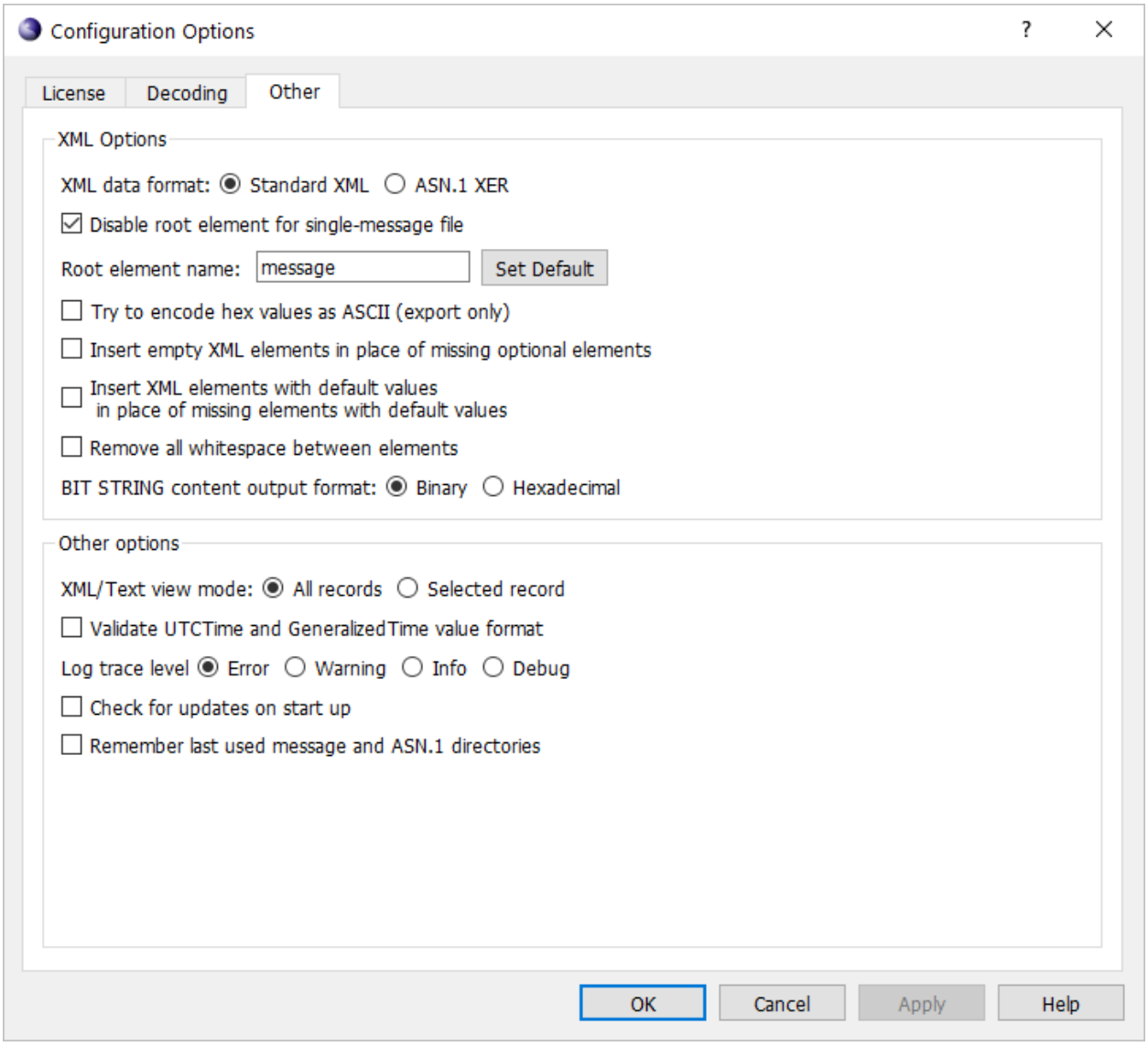
The *Headers* set of options describe the header format that may apply to certain file types. This is mostly applicable to Call Detail Record (CDR) types, but may apply to others as well.

The *Block* option is for selecting a file with fixed-sized blocks and padding bytes to fill out the block. *Size of Block* determines the number of bytes expected in each block. The *Padding Bytes (hex)* section specifies the hex code of bytes used to fill out the block. Padding bytes are specified using hexadecimal notation (0xnn) and separated by commas.

At the bottom are several miscellaneous options. By default, ASN1VE detects OCTET STRING types named "BCDString" and displays them as such, rather than as hexadecimal. *Disable BCD (Binary Coded Decimal) conversion* disables this feature. If this is unchecked, then the options below it allow the user to force all OCTET STRING types to be decoded as either BCD or TBCD (Telephony Binary Coded Decimal).

Disable automatic Open Type decoding prevents ASN1VE from attempting to determine the types of Open Type elements and to decode them.

The last option, when checked, limits the number of repeating records that ASN1VE will decode at a time. This limit affects top-level messages as well as elements of SEQUENCE OF and SET OF types. When the limit is reached, the *Tree View* will show a node at the end with the text "More...". Clicking on this node will cause ASN1VE to decode the next number of records.



The *Other* tab has two sections; *XML Options* allows for XML output (i.e., the *XML* tab in the *Document View* and XML export) to be configured, while *Other options* provides miscellaneous settings for ASN1VE.

XML data format allows the user to select between ASN.1 XER and a simplified XML representation of message data.

When *Disable root element for single message file* is checked, a message data file with only one message will produce XML without an extra tag surrounding it. When unchecked and for files containing multiple messages, the contents of the file will be surrounded by a single, top-level tag to produce a valid XML encoding. The tag used will be the value of *Root element name*.

Try to encode hex values as ASCII (export only) causes the application to scan through elements of type OCTET STRING that would normally contain binary data and examine each byte to determine if it falls within the range of an ASCII character. If all bytes are found to do so, the contents will be presented as an ASCII string rather than as hex bytes.

Insert empty XML elements in place of missing optional elements and *Insert XML elements with default values in place of missing elements with default values* will cause elements missing in the original message to be encoded in the XML as empty elements if they are optional or as their default value where one is provided, respectively.

When *Remove all whitespace between elements* is checked, XML will be produced without any extraneous formatting, such as indentation or newlines.

BIT STRING content output format determines whether elements of type BIT STRING will be encoded in XML as binary or hexadecimal.

In *Other options*, *XML/Text view mode* determines the contents of the *XML* and *Text* tabs in the *Document View*. If *All records* is selected, the entire file will be shown. If *Selected record* is selected, then only the message currently selected in the *Tree View* will be shown.

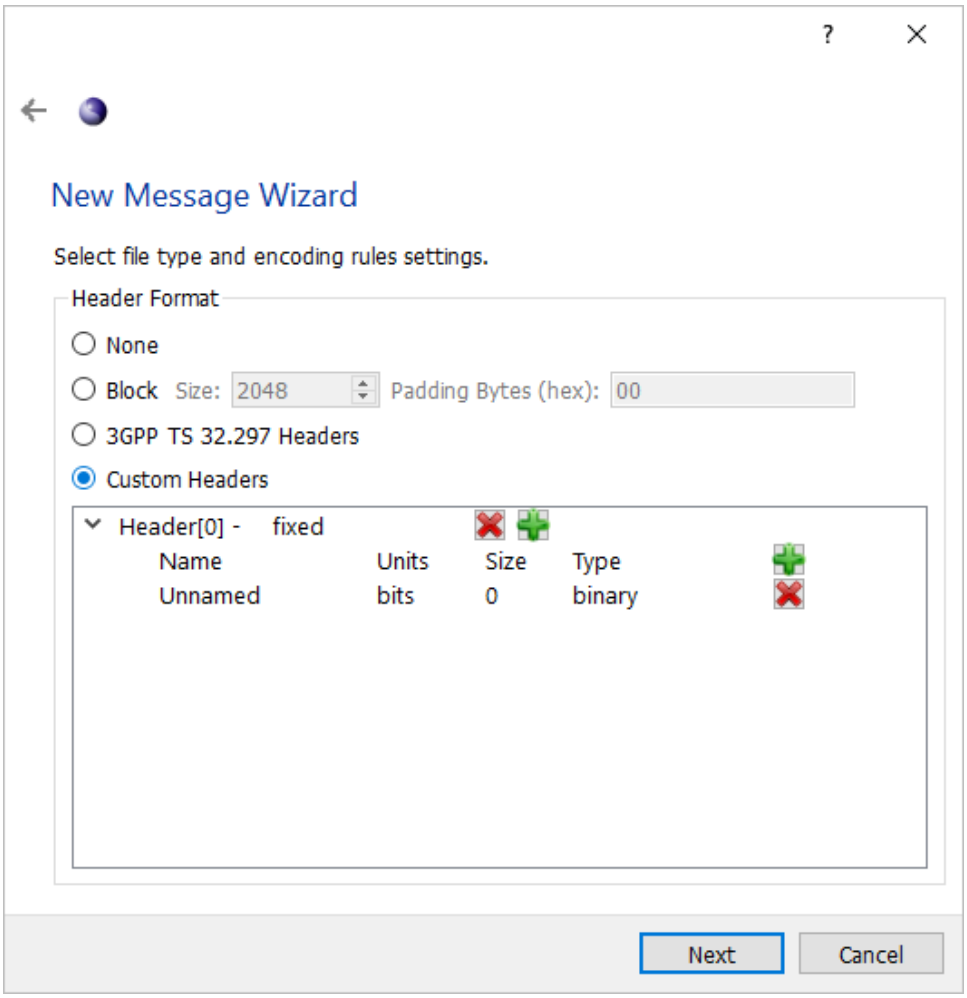
Validate UTCTime and GeneralizedTime value format will cause validation of the format of the time values contained within elements of these types to be done. In most observed cases, the time values do not strictly adhere to the specified formats, so this is off by default to prevent annoying errors from popping up. It can be turned on to have values of these types strictly checked for conformance.

Log trace level determines the level of detail provided in the *Error Log*.

Check for updates on start up will cause ASN1VE to do a check with the Internet host to determine if a newer version of ASN1VE is available for download. This is the same as manually selecting the 'Help -> Check for updates...' command.

Edit custom headers

In the New Message Dialog and in the Project View Window, the option exists to create or modify custom headers. Invoking this option brings up a dialog similar to the following:



When creating a new message, the dialog expands to allow the initial header to be created. The cursor can be placed within the header field definition area and then the field items edited. The following items can be specified for a header field:

Name Name of the header.

Units Units of the field (bits or bytes).

Size Size field of the field in Units.

Type Type of the field. The types currently supported are binary, integer (big-endian), and character (UTF-8).

Additional fields can be appended by clicking on the green + control next to the fields header line. Fields can be inserted by right-clicking either on the fields header or a field entry. This will cause a new field definition entry to be inserted immediately after the entry.

Additional headers can be added by either clicking on the green + control next to the header entry or by right-clicking on the header and selecting the 'Add Header' option. Headers can be removed by either clicking the red x control next to the header or by right-clicking on the header and selecting 'Remove Header.'

A header can be declared to either be 'fixed' or 'repeating.' A 'fixed' header appears only once at the start of a message. A 'repeating' header would appear before each record in a repeating collection of records.

Configuration Files

Configuration files are XML files that can be used to apply specific options to specific items within a schema. These options can be applied to specific modules, productions, and elements as well as globally.

A configuration file would target an item to which a directive is to be applied by specifying module, production, and element in an XML hierarchy. An example that targets an element to be displayed in an alternate format is as follows:

```
<asn1config>
  <module name=”MEDIA-GATEWAY-CONTROL”>
    <production name=”IP4Address”>
      <element name=”address”>
        <displayFormat>ipv4</displayFormat>
      </element>
    </production>
  </module>
</asn1config>
```

This indicates the element 'address' in the production 'IP4Address' in the module 'MEDIA-GATEWAY-CONTROL' should be displayed in the form of an IP version 4 address rather than in the default format for the type (which for OCTET STRING is hex bytes).

At the outer level of the markup is the `<asn1config> </asn1config>` tag pair. Within this tag pair, the specification of global items and modules can be made. Global items are applied to all items in all modules. An example would be the `<includedir>` qualifier. This specifies an include directory to search for modules specified in import statements. It is not something that is associated with an individual module or production.

The specification of a module is done using the `<module></module>` tag pair. This tag pair can only be nested within the top-level `<asn1config>` section. The module is identified by using the required `<name></name>` tag pair or by specifying the name as an attribute (for example, `<module name="MyModule">`). Other attributes specified within the `<module>` section apply only to that module and not to other modules specified within the specification. A complete list of all module attributes is provided in the table at the end of this section.

The specification of an individual production is done using the `<production></production>` tag pair. This tag pair can only be nested within a `<module>` section. The production is identified by using the required <name></name> tag pair or by specifying the name as an attribute (for example, `<production name="MyProd">`). Other attributes within the production section apply only to the referenced production and nothing else. A complete list of attributes that can be applied to individual productions is provided in the table at the end of this section.

The following tables specify the list of attributes that can be applied at all of the different levels: global, module, and individual production. Only the attributes applicable to ASN1VE are shown.

Global Level

These attributes can be applied at the global level by including them within the `<asn1config>` section:

Name	Values	Description
<includedir></includedir>	<Include directory>	This configuration item is used to specify a directory that will be searched for IMPORT files.

Module Level

These attributes can be applied at the module level by including them within a `<module>` section:

Name	Values	Description
<name> </name>	module name	This attribute identifies the module to which this section applies. Either this or the <oid> element/attribute is required.
<oid>	module OID (object identifier)	This attribute provides for an alternate form of module identification for the case when module name is not unique. For example, a given ASN.1 module may have multiple versions. A unique version of the module can be identified using the OID value.
<include types="names" values="names"/>	ASN.1 type or value names are specified as an attribute list	By default, all types and values within a specification are included for display within ASN1VE. This item allows ASN.1 types and/or values to be explicitly specified for inclusion in the set of items to be displayed. This allows the size of what is loaded to be reduced. This can be useful in the case of large schemas which import items from many different schemas to reduce the number of schema files that need to be imported.
<exclude types="names" values="names"/>	ASN.1 type or values names are specified as an attribute list	This item allows a list of ASN.1 types and/or values to be excluded from the set of schema items to be displayed. By default, all types and values from within a specification are included. If an attempt is made to exclude a type or value referenced by another item, the directive will be ignored.
<noPDU/>	n/a	Indicates that this module contains no PDU definitions. This is normally true in modules that are imported to get common type definitions. This will prevent any types from being displayed from this module as possible PDU types.

Production Level

These attributes can be applied at the production level by including them within a `<production>` section:

Name	Values	Description
<name> </name>	production name	This attribute identifies the production (type) to which this section applies. It is required.
<displayFormat>	lower, upper, ipv4, ipv6, imei, imsi, tbcd	This is used to specify an alternate stringified representation for binary data. It is only applicable to OCTET STRING types. By default, OCTET STRING data is displayed in hexadecimal text format. The *lower* and *upper* qualifiers also result in hexadecimal text format, but force lower or upper case characters to be used. The *ipv4* and *ipv6* qualifiers cause the date to be formatted as an IP address. The *imei*, *imsi*, and *tbcd* qualifiers treat the data as being encoded in TBCD format with slight differences in each format type.
<isPDU/>	n/a	This item is used to indicate that this production represents a Protocol Data Unit (PDU). This indicates that this production should be included in the list of possible PDU types when the schema is assigned.
<isTBCDString/>	n/a	This item is used to indicate that this production is to be encoded and decoded as a telephony binary coded string (TBCD). This is type is not part of the ASN.1 standards

Name	Values	Description
		but is a widely used encoding format in telephony applications.

Element Level

These attributes can be applied at the element level by including them within an `<element>` section:

Name	Values	Description
<name> </name>	element name	This attribute identifies the element within a SEQUENCE, SET, or CHOICE construct to which this section applies. It is required.
<displayFormat>	lower, upper, ipv4, ipv6, imei, imsi, tbcd	This is used to specify an alternate stringified representation for binary data. It is only applicable to OCTET STRING types. By default, OCTET STRING data is displayed in hexadecimal text format. The *lower* and *upper* qualifiers also result in hexadecimal text format, but force lower or upper case characters to be used. The *ipv4* and *ipv6* qualifiers cause the date to be formatted as an IP address. The *imei*, *imsi*, and *tbcd* qualifiers treat the data as being encoded in TBCD format with slight differences in each format type.

Chapter 5. Technical Support

Report problems you encounter by sending E-mail to support@obj-sys.com [mailto:support@obj-sys.com]. Please provide a project file and all related message and ASN.1 schema files required to reproduce the issue.

If you have any further questions or comments on what you would like to see in the product or what is difficult to use or understand, please communicate them to us. Your feedback is important to us.