



The Workflow Management Coalition Specification

**Workflow Management Coalition
Workflow Standard - Interoperability
Internet e-mail MIME Binding**

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Character	Refers to the character in the encoding being used. In single-byte encoding, a character corresponds to a byte. In multi-byte encoding, a character may correspond to one or more bytes.
Dialog or Conversation	The exchange of a set of messages that occurs between two workflow engines to effect a complete interoperation relating to the enactment of two designated process instances.
Message	A request for another workflow engine to perform one or more operations on behalf of the source workflow engine or a response to such a request informing the recipient of the outcome of performing one or more requested operations.
Operation	An interoperability function that can be used as part of a conversation. Operations are defined in section 11 below.
Source workflow engine	An engine that requests an enactment of a process from another workflow engine. The source workflow engine always starts its dialog by issuing a StartConversation and concludes with a StopConversation. This engine is sometimes called the initiating engine.
Target workflow engine	The workflow engine that receives the request from the source workflow engine. An engine that accepts a StartConversation assumes the role of target workflow engine. The process running on this engine is sometimes called the enacted sub-process instance.
Receiving workflow engine	The engine that is processing the incoming message.
Sending workflow engine	The engine that is making the request or that is creating the outbound message.
Protocol	The way messages are interchanged between the source workflow engine and the target workflow engine The protocol specifies how these workflow engines deal with the idiosyncrasies arising from the mail system, including lost, duplicated, and out-of-sequence messages.
Protocol data	The part of the message that contains the information the workflow engine interprets

7 MIME Message

This specification is based on MIME (Multipurpose Internet Mail Extension - RFC-2045 to RFC-2049). It uses either a text/plain content type or a multipart MIME message in which the first part must be text/plain.

The content type of the message is either multipart/mixed or text/plain, depending on whether attachments are used. When using attachments, the content type must be multipart/mixed. A simple example of the MIME header is:

Content-type: multipart/mixed

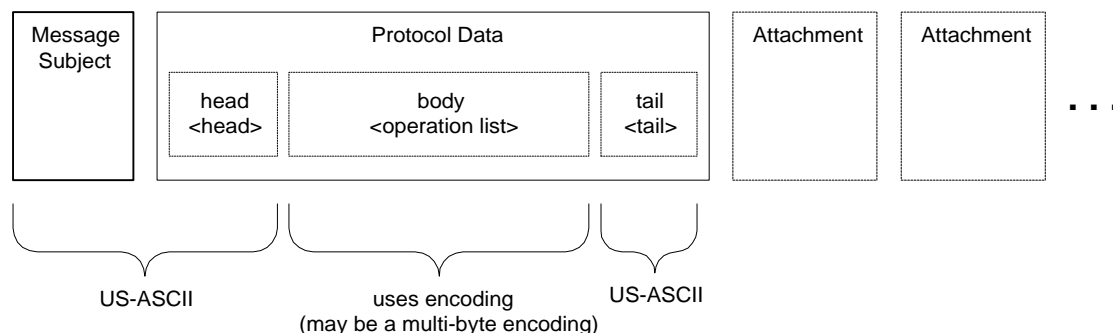
The preamble and epilogue in a multipart message are ignored.

If attachments are not used, the content type should be text/plain. A simple example of the MIME header, in this case is:

Content-type: text/plain

Details on the structure of a MIME header are described in the Multipurpose Internet Mail Extension - RFC-2045.

The rest of this section describes how interoperability information is placed in an electronic mail message. MIME messages have the following parts which are described below:



7.1 Message subject

The subject of a message implementing this specification conforms to the following BNF-like (Backus, Naur Form) syntax:

```

<message Subject> ::= <message type> <sequence> <conversation id> "&&"
<message type>   ::= "wfmc-if4-request"
                  | "wfmc-if4-response"
                  | "wfmc-if4-error"   "(" <message error> ")"
<sequence>       ::= "[" <message id> "]"
  
```

Where <conversation id>, <message error>, and <message id> are described in the next section. The message subject is always encoded in US-ASCII.

Messages with a subject that does not start with a valid <message type> and <sequence> must be ignored by the receiving engine.

It is possible that some electronic mail systems will truncate the message subject. A message subject without the "&&" at the end is considered truncated. Truncated messages can still be processed by the receiving engine, by using the message body as described in the next section, as long as it has a valid <message type> and <sequence>. The subject <message type> and <sequence> in a truncate message must match the <message type> and <sequence> in the protocol data <head> (see section 7.2.1 Head). The subject <conversation id> of a truncated message must be discarded by the receiving engine, the <conversation id> of the protocol data <head> must be used instead.

Example:

```
wfmc-if4-request[12]495+AB010DFF&&
```

The initial request, the one with the StartConversation operation on it, must have zero for <message id>, and it must have a partial <conversation id> (without the TargetConversationID part, see section 9.2.4 Conversation id), as shown below:

```
wfmc-if4-request[0]123ABCD+&&
```

7.1.1 Message Type

There are three distinct messages that an engine can send. The <message type> indicates the kind of message the electronic mail contains.

Messages must contain operations or responses (see section 11 Operations), but not both. Therefore, the two main message types are request and response.

7.1.2 Request or Notification Messages

A message containing operations to be performed by another workflow engine must have a message type of wfmc-if4-request.

A source workflow engine uses operations to request work from a target workflow engine. A target workflow engine uses operations to notify the source workflow engine of its progress. In both cases, a wfmc-if4-request is used.

A wfmc-if4-request may contain several operations. The order of the operations indicates the order in which the sending engine expects the receiving engine to process the operations.

7.1.3 Response Messages

A message containing responses to operations must have a message type of wfmc-if4-response.

Response messages are used by source and target engines to respond to operations they receive. All the operations in the request message must be attempted in the order they appear in the request message.

The wfmc-if4-response must contain the same number of responses, as there were operations in the wfmc-if4-request message, which is being answered. The order of the responses, in the message, must follow the order of the operations in the request or notification.

7.1.4 Error Messages

Message interchange errors must have a message type of wfmc-if4-error.

Message interchange errors are those in which the receiving engine is unable to process the operations or responses in the message, because the message does not conform to a valid message. Corrupted and invalid messages fall into this category.

The protocol data of a wfmc-if4-error message must contain an empty operation list (see `<operation list>` in section 7.2 Protocol Data). In this case, the message body is limited to the `<head>` and the `<tail>` of the protocol data (see `<head>` and `<tail>` in section 7.2 Protocol Data).

7.2 Protocol Data

In a multipart message, the first part must be of content type `text/plain` and contain the protocol data. The rest of the MIME parts are considered attachments. In a single-part message, the only part present is of content type `text/plain` and it contains the protocol data.

The body of the first part contains one or more operation requests/responses with appropriate fields, encoded using the concepts defined by the CGI (Common Gateway Interface) and the URL encoding scheme [RFC-1738].

Each operation starts with the operation name which is terminated by a “?” character. The fields are defined as name-value pairs and are separated by the “&” character. No positionality of fields is assumed. The operation ends with “&&”.

Extended attributes in the form of name-value pairs separated by the “&” character can be appended at the end of the line, after the following marker “&extended&”. Extended attributes may be used by workflow engines to extend the number of fields supporting an operation. The receiving workflow engine may ignore the extended attribute. Extended attributes are optional and workflow engines must not depend on them to be present.

The following BNF-like (Backus, Naur Form) syntax formally describes the body of the first part of the message. Non-terminal tokens enclosed in quotes must be spelled exactly as defined.

<message Body>	::=	<head> <operation list> <tail>
<head>	::=	<message type> <sequence> <conversation id> "&" <timestamp> <encoding> <terminator>
<message type>	::=	"wfmc-if4-request" | "wfmc-if4-response" | "wfmc-if4-error" "(" <message error> ")"
<sequence>	::=	"[" <message id> "]"
<conversation id>	::=	<source conversation id> "+" <source conversation id> "+" <target conversation id>
<encoding>	::=	"," "encoding" "=" <encoding name> | <empty>
<operation list>	::=	<op> | <op> <operation list> | <empty>
<op>	::=	<operation> "?" <name-value list> <extended> <terminator>
<extended>	::=	"&extended&" <name-value list> | <empty>
<name-value list>	::=	<name> "=" <value> | <name> "=" <value> "&" <name-value list>
<terminator>	::=	"&&"
<tail>	::=	"end" "(" <checksum> ")"

Where:

<checksum>	This is the message checksum from the first byte of this part (always a "w" of either wfmc-if4-request, wfmc-if4-response, or wfmc-if4-error) to the last byte before the "(" (always the "d" of "end"). See section 7.2.2 Tail. This is a string representation of an integer value.
<empty>	This is a syntactical placeholder, which indicates no input.
<encoding name>	Implementations may recognize several encodings, including Unicode and JIS. This is a US-ASCII string value. The encoding name values are case insensitive. For Unicode (ISO/IEC 10646) use the following values: UTF-8 UTF-16 ISO-10646-UCS-2 ISO-10646-UCS-4 For JIS X-0208-1997 use the following values: ISO-2022-JP Shift_JIS EUC-JP

	US-ASCII and the ISO-8859 family should not be used as encoding values because they are part of the text/plain charset
<message error>	<p>A message interchange error. Used to tell the remote engine that a sent message was not processed because of a message interchange error. This is an US-ASCII string representation of an integer value.</p> <p>wfmc-if4-error indicates an interchange error relating to either a wfmc-if4-request or wfmc-if4-response. The <message id> of the wfmc-if4-error must be the same as the <message id> of the message in error. The <operation list> must be empty (a wfmc-if4-error message only contains <head> and <tail>).</p> <p>Valid values are:</p> <ul style="list-style-type: none">201 -- Truncated message202 -- Modified Message (Bad Checksum)203 -- Invalid or unsupported encoding204 -- Expired Message205 -- Invalid Message206 -- Invalid ConversationID207 -- Invalid Sequence208 -- Invalid Timestamp209 -- Invalid Escape Sequence
<message id>	<p>Message number. This is a string representation of an integer value. See section 9.2.6 Message Id.</p>
<name>	<p>This is the name of a parameter, as defined in the operation, or the name of an extended attribute (if it appears after “&extended&”). The name values are case insensitive.</p> <p>Valid values are:</p> <ul style="list-style-type: none">ActivityIDAErrorCodeContractIDErrorCodeErrorTextLanguageMessageIDNameNumberOpIDProcessDefinitionIDProcessIDProductIDProfileRootPIDSourceAIDSourceBDefNameSourceNodeIDSourcePIDSourceRoleIDSourceConversationIDSourceUserIDState

	TargetNodeID TargetBDefName TargetPID TargetRoleID TargetConversationID TargetUserID Timestamp Type Value Version
<operation>	This is the name of an operation as described in section 11 Operations. The operation values are case insensitive. Valid values are: ChangeProcessInstanceState CreateProcessInstance GetProcessInstanceAttribute GetProcessInstanceState ProcessInstanceAttributeChanged ProcessInstanceStateChanged SetProcessInstanceAttributes StartConversation StopConversation
<sequence>	There are two variants of <sequence>, one with a range and one without. Request messages do not use the range variant. The range variant is only used by response messages in which not all the operations are being responded in a single message.
<source conversation Id>	Identifies the source engine on this conversation. This is a string value. See section 9.2.4 Conversation id. The maximum length for the source conversation id is 128 bytes, and the minimum length is 1 byte. Note that “+” and “&” must not appear in <conversation id>. If they are necessary, they must be escaped.
<target conversation Id>	Identifies the target engine on this conversation. This is a string value. See section 9.2.4 Conversation id. The maximum length for the target conversation id is 128 bytes, and the minimum length is 1 byte. Note that “+” and “&” must not appear in <conversation id>. If they are necessary, they must be escaped.
<timestamp>	Time stamp of the message. It must use a UTC time value. See section 9.1.4.3 DateTime Format (WMTDateTime).
<value>	This is the value of the field or attribute. The type of the value is predefined by the operation.

Note that <encoding name>, <name>, and <operation> are case insensitive. For example: ErrorCode, errorcode, errorCODE, and ERRORcode are all valid <name>s.

7.2.1 Head

The head, as described above, is always encoded in US-ASCII. Any other encoding starts immediately after the head terminator (“&&”). When using a particular encoding, the non-terminal tokens enclosed in quotes in the grammar must be encoded. Therefore, the “?”, token used after the <operation>, uses one byte in US-ASCII, but two in a double byte encoding.

For example, if Unicode (a double-byte encoding) is used, the head will still be US-ASCII as follows:

```
wfmc-if4-request[4]ABC+123&1998-04-25T04:25:39Z,encoding=UTF-16&&
```

The rest of the message will be encoded in UTF-16. This convention allows the receiving engine to recognize the encoding.

7.2.2 Tail

The tail contains the word “end” followed by a checksum in parenthesis. The tail must be encoded in US-ASCII. This allows the receiving engine to detect message modification. The mechanism does not detect all modification, but it is useful to detect those introduced by the mail system (for example: extra blanks or extra carriage returns). The tail follows the encoding defined in the head. For example:

```
end(40388)
```

If the tail is not present or does not finish in “)”, then the message is considered truncated. Truncated messages must be reported as errors to the transmitting engine. If the checksum calculated by the receiving engine is different from the checksum in the tail, then the message is considered modified. Modified messages must be reported as errors to the transmitting engine. Truncated or modified messages must not be processed by the receiving engine.

The checksum is calculated from the first byte (always a “w” of either wfmc-if4-request or wfmc-if4-response) to the last byte before the checksum in parenthesis (always the “d” of “end”). The following C code implements the variant of the Fletcher checksum algorithm [Fletcher82] used in this specification:

```
unsigned int checksum(const unsigned char *s)
/* Calculates the WfMC message checksum.
 * s is a null terminated string containing the first part of the message.
 * for example: s = "wfmc-if4-request . . . &&end";
 */
{
    unsigned int a, b;

    /* the first byte of the message is always the 'w' in "wfmc-if4-" */
    assert('w' == *s);
    a = b = 0;
    while(*s)
    {
        a = (a + *s++) % 255;
        b = (a + b) % 255;
    }
    /* the last byte is the 'd' in "end" */
    assert('d' == *(--s));
    return (a * 256) + b;
}
```

7.2.3 Special Characters

The MIME text/plain content type, used in this protocol, uses US-ASCII as the default character set, but it also supports the ISO 8859 family (8859-1 Latin 1 (West European), 8859-2 Latin2 (East European), 8859-3 Latin3 (South European), 8859-4 Latin4 (North European), 8859-5 Cyrillic, 8859-6 Arabic, 8859-7 Greek, 8859-8 Hebrew, and 8859-9 Latin5 (Turkish)). US-ASCII characters from 0 to 127 (hexadecimal 00 to 7F) are the same in all of these character sets.

The first part of the message (protocol data) is sent using the set of bytes {10, 13, 32 to 126} (hexadecimal {0A, 0D, 20 to 7E}). This is achieved by escaping bytes that are outside this set. Escaping has two objectives:

- It guarantees that only bytes in the set {10, 13, 32 to 126} are included in the protocol data.
- It guarantees that bytes in the set {10 (line feed), 13 (carriage return), 37 (%), 38 (&)} (hexadecimal {0A, 0D, 25, 26}) are used according to the protocol. These bytes have specific functions within the protocol data and any other appearance must be escaped.

Escaping depends on the byte encoding (<encoding name>). Single-byte encodings, such as US-ASCII and UTF-8 are escaped in one pass. Multi-byte encodings must be escaped in two passes.

7.2.3.1 Escaping Single-Byte Encoding

In single-byte encoding, bytes are encoded based on the following table:

Dec	hex	Comment
0-31	00-1F	Always escaped
32-36	20-24	Clear (not escaped)
37	25	Used by the protocol to escape bytes, otherwise escaped.
38	26	Used by the protocol to indicate the end of a field value, otherwise escaped.
39-126	27-7E	Clear (not escaped)
127-255	7F-FF	Always escaped

Escaping is achieved by replacing the byte with its hexadecimal representation. The percent sign (%) is used to identify byte escaping. It must be followed by:

- The pair of hexadecimal digits representing the byte being escaped. For example, “K” can be escaped as %4B.
- Another “%” when the character being escaped is the percent sign. Therefore, a % in the message is escaped as %%.
- A “[” followed by a series of hexadecimal pairs and closed by a “]” to escape a block of bytes. This modality is useful to escape binary fields. For example, the string “WfMC” can be escaped as “[57664D43]”.

Any other use of the “%” byte results in an invalid escape sequence (error code 209).

Examples

%7E	Tilde “~”
%7K	Invalid escape sequence. K is not a hexadecimal digit.
%7	Invalid escape sequence. There is only one digit after the “%”.
%%	Percent sign “%”
\$\$	Invalid escape sequence. “\$” is not an hexadecimal digit.
%[55]	Capital letter “U”
%[676F6F64]	String “good”
%[555]	Invalid escape sequence. Missing one hexadecimal digit.

7.2.3.2 Escaping Multi-Byte Encoding

Multi-byte encoding must be escaped in two steps. The first step is called character escaping, because it is done using the characters of the encoding. The second step is to apply a byte escaping to the encoded message.

7.2.3.2.1 Multi-Byte Character Escaping

Character escaping is used to escape the characters “%” and “&”, when they appear in a field value (<value>). These characters are used as markers by the protocol, and so must be escaped in the field value to avoid confusion. Character escaping must be done when placing field values in the message. The following table shows how these characters are escaped:

Character	Encoded as	Comments
%	%%	Four bytes in a double byte encoding.
&	%26	Six bytes in a double byte encoding.

For example, the following segment of a SetProcessInstanceAttributes:

```
name=exp&type=WMTText&value=23 && ( foo % 2 )&
```

is wrong, because the && and % within the value must be encoded. The correct segment is:

```
name=exp&type=WMTText&value=23 %26%26 ( foo %% 2 )&
```

7.2.3.2.2 Multi-Byte Byte Escaping

After all the operations (<operation list>) has been placed in the message, byte escaping is conducted. The byte escaping consists of escaping each byte that is in the set {0-31, 37, 127-255}. This process is conducted as specified in 7.2.3.1 Escaping Single-Byte Encoding.

In some encodings, it maybe practical to escape the whole <operation list> in between “[” and “]”.

Note that this procedure will encode all occurrences of the percent sign (%) byte. In some encodings, this will result in a double escaping of the percent sign. That is an intended effect.

7.2.4 Lines

Following the MIME’s text media type conventions, a line is terminated by a carriage return (CR) followed by a line feed (LF). This specification does not rely on the use of lines; however, the email systems processing plain/text do need lines. Although the plain/text MIME specification allows lines of up to 988 bytes, this specification uses lines with a maximum length of 60 bytes (similar to UUENCODE).

A line that exceeds 60 bytes must be broken, by inserting a carriage return (CR) and line feed (LF), in that order. Therefore, in this specification a line does not exceed 62 bytes (60 bytes plus carriage return and line feed). The carriage return (CR) and line feed (LF) must be removed by the receiving engine before processing the message.

Line breaking must be done after character encoding and byte encoding.

Neither the sender nor the receiver should add any extra bytes around the carriage return (CR) and line feed (LF), so that the reconstructed message is identical to the original message (“messCRLFage” becomes “message”). Note, that any CR or LF inside the message must be escaped to %0D or %0A, as any other special byte.

Example:

The following two fragments, are exactly the same (with exception of the checksum, which is calculated including the CRLFs):

```
wfmc-if4-request[0]K1234+&1998-04-25T04:25:39Z&&  
StartConversation?ContractID=Nice Group&Version=1.1&  
SourceNodeID=xyz@wfmc.org&RootPID=24&  
ProductID=MagicWorkflow/5.0&OpID=1&  
SourcePID=24&SourceConversationID=K1234&&  
CreateProcessInstance?ProcessDefinitionID=Open Account&  
Profile=chain&OpID=2&&  
SetProcessInstanceAttributes?OpID=3&Number=2&  
Name=copies&Type=WMTINT8&Value=3&  
NAME=description&TYPE=WMTTEXT&VALUE=Two lines of text, thi  
s is the first line%0D%0AThis is the second line.&&  
ChangeProcessInstanceState?OpID=4&State=open.running&&  
StopConversation?OpID=5&&  
end(38341)
```

It is the same as:

```
wfmc-if4-request[0]K1234+&1998-04-25T04:25:39Z&&StartConvers  
ation?ContractID=Nice Group&Version=1.1&SourceNodeID=xyz@wfm  
c.org&RootPID=24&ProductID=MagicWorkflow/5.0&OpID=1&SourcePI  
D=24&SourceConversationID=K1234&&CreateProcessInstance?Proce  
ssDefinitionID=Open Account&Profile=chain&OpID=2&&SetProcess  
InstanceAttributes?OpID=3&Number=2&Name=copies&Type=WMTINT8&  
Value=3&NAME=description&TYPE=WMTTEXT&VALUE=Two lines of tex  
t, this is the first line%[0D0A]This is the second line.&&Cha  
ngeProcessInstanceState?OpID=4&State=open.running&&StopConve  
rsation?OpID=5&&end(14814)
```

7.3 Assembling the Protocol Data

The order in which the first part (protocol data) is assembled into the message is important. In order for character escaping, multi-byte encoding, line breaking, truncation, and modification detection to work, the protocol data must be assembled in the following order:

1. Add the operations with all relevant fields and values, using the encoding that will be used by the message (<encoding name>). If the encoding is a multi byte encoding, each character may use multiple bytes.
2. In a single byte encoding, the escaping of single byte encodings must be applied (section 7.2.3.1).
3. In multi-byte encoding, when adding field values, the multi-byte character escaping must be applied as described in section 7.2.3.2.1.
4. In multi-byte encoding, after all the operations and fields had been added, the multi-byte byte escaping must be applied (section 7.2.3.2.2). Note that only the characters '%' and '&' are escaped in this step.
5. Prefix the message with the <head> in US-ASCII (section 7.2.1).
6. Append the message with the "end" of <tail> in US-ASCII (section 7.2.2). It is preferable to add a new line (CRLF) before the "end" token, this prevent the last line from exceeding the 62 bytes (section 7.2.4) when the checksum is added.
7. Break the message into lines of no more than 60 bytes (section 7.2.4). Use CRLF to break the lines.
8. Calculate the checksum (section 7.2.2).
9. Append the checksum enclosed in parenthesis to the end of the message (as specified in <tail>) (section 7.2.2).
10. Verify that last line does not exceed 60 bytes. If the last line exceed the 60 bytes limit, then remove the <tail>, add a new line (CRLF), add the "end" token, and repeat steps 8 and 9.

The receiving engine should disassemble the message in the following order:

1. Verify that the message is not expired or already processed. If it is, then ignore the message. Note that only US-ASCII is required for this check.

2. Verify that <head> matches the message subject (allowing for possible truncation), otherwise issue an invalid message (error code 205). Note that only US-ASCII is required for this check.
3. Verify the message is not truncated, otherwise issue truncated message (error code 201). The message must contain the “)” of <tail>. Note that only US-ASCII is required for this check.
4. Verify the message checksum by recalculating the checksum. If checksum is not identical issue modified message (error code 202). Note that only US-ASCII is required for this check.
5. Verify that this engine support the encoding specified in the <head> of the message. If the engine does not support the encoding then issue invalid or unsupported encoding (error code 203). Note that only US-ASCII is required for this check.
6. Strip the message of all the CRLFs.
7. In a multi-byte encoding, undo the byte escaping. If an invalid escaping sequence is encountered, then report it (error code 209).
8. In multi-byte encoding, when extracting the value of each field, undo the character escaping. If an invalid escaping sequence is encountered, then report it (error code 209).
9. In a single-byte encoding, undo the byte encoding while tokens are extracted.

7.4 Attachments

Attachments can be used to pass files between workflow engines. When using attachments, the MIME content type must be multipart/mixed and the first part must be text/plain. The first part contains the protocol data, as defined above, the other parts are considered attachments.

Attachments may be referenced by part number or, optionally, a filename. The use of filenames may be supported by workflow engines with access to an electronic mail system that implements content disposition [RFC-2183]. The interoperability contract must specify which kind of attachment referencing is supported.

Each part of the multipart message is assigned a part number. The preamble is assigned zero, the text/plain part that contains the protocol data is assigned one, and any other attachments get progressively higher numbers. An attachment may be referenced by using the part number.

To reference an attachment by a filename, the Content-Disposition header field must be provided for that part of the message. The sending workflow engine must ensure that all filenames it sends out in a particular message are unique. A sample Content-Disposition header is:

```
Content-Disposition: attachment; filename="i4prop2.doc"
```

Note that checksum does not apply to attachments. This protocol does not address the handling of truncated or modified attachments.

7.5 Examples

This section shows two examples of the MIME messages. The first requires some attachments, so it is a multipart message. The second does not require attachments, so it is considered a simple message.

7.5.1 Multipart Message

When attachments are used, a multipart/mixed context type message must be used. The following example shows this case:

```
From: Workflow Engine X <xyz@wfmc.org>  
To: Workflow Engine Y <y@wfmc2.org>  
Subject: wfmc-if4-request[0]K1234+&  
MIME-Version: 1.0  
Content-type: multipart/mixed; boundary="simple boundary"
```

This is the preamble. It is part Zero, and it is ignored.

```
--simple boundary
Content-type: text/plain
wfmc-if4-request[0]K1234+&1998-04-25T04:25:39Z&&
StartConversation?ContractID=Nice Group&Version=1.1&
SourceNodeID=xyz@wfmc.org&RootPID=24&OpID=1&
ProductID=MagicWorkflow/5.0&
SourcePID=24&SourceConversationID=K1234&&
CreateProcessInstance?ProcessDefinitionID=Open Account&
Profile=chain&OpID=2&&
SetProcessInstanceAttributes?OpID=3&Number=4&
Name=copies&Type=WMTINT8&Value=3&
NAME=description&TYPE=WMTTEXT&VALUE=Two lines of text, thi
s is the first line%0D%0AThis is the second line.&
name=file1&type=WMTAttachment&value=2&
name=file2&type=WMTATTACHMENT&value=3&&
ChangeProcessInstanceState?OpID=4&State=open.running&&
StopConversation?OpID=5&&
end(7224)
--simple boundary
Content-type: text/plain; charset=us-ascii
```

This is an attachment. It is attachment number two (name=file1&).
The attachment could be any context type, but in this case it is text/plain.

```
--simple boundary
Content-type: text/plain; charset=us-ascii
```

This is another attachment. It is attachment number three (name=file3&).
This attachment could be any context type, but in this case it is text/plain.

```
--simple boundary-
```

This is the epilogue. It is part four, and it is also ignored.

7.5.2 Simple Message

If attachments are not required, then a text/plain context type message must be used. The following example shows such a message:

```
From: Workflow Engine X <x@wfmc1.org>
To: Workflow Engine Y <y@wfmc2.org>
Subject: wfmc-if4-response[1]K1234+ABC&&
MIME-Version: 1.0
Content-type: text/plain
wfmc-if4-response[1]K1234+ABC&1998-04-25T05:00:33Z&&
StartConversation?ErrorCode=0&SourceConversationID=K1234&
TargetConversationID= ABC&TargetNodeID=abc@wfmc.org&
Version=1.1&ProductID=BetterMagicWorkflow/8.1&OpID=1&&
CreateProcessInstance?ErrorCode=0&OpID=2&
TargetPID=32&state=open.notRunning.NotStarted&&
SetProcessInstanceAttributes?ErrorCode=0&OpID=3&
Number=4&name=copies&name=description&
Name=file1&name=file2&&
ChangeProcessInstanceState?ErrorCode=0&state=open.running&OpID=4&&
StopConversation?ErrorCode=0&OpID=5&&
end(27234)
```

8 Protocol for Reliability

This interoperability protocol is accomplished over electronic mail, which is an unreliable communication channel. In this specification, each workflow engine is uniquely identified by the mailbox to which it "listens" (i.e. its mail address). Each message that one workflow engine sends to another is numbered. Moreover, each workflow engine uniquely identifies a message by its type (request, response, or error) and by its place in the sequence of messages that constitute the complete dialog.

Even with these precautions, several problems can occur on an unreliable communication channel. This protocol accounts for messages that are:

- Out of sequence
- Duplicate
- Lost
- Truncated
- Modified

The protocol provides for out of sequence and duplicate messages by establishing a conversation in which all messages are enumerated. This specification includes a retransmission strategy that recovers lost messages. The checksum mechanism, described in the previous section, manages truncated and modified messages. This section addresses the following issues:

- Retransmission
- Handling duplicate messages
- Conversation establishment and termination
- Flow control
- Crash recovery
- Error processing

8.1 Flow Control

This specification assumes that there is no limit on the number of messages a workflow engine can receive, and it does not consider mail overflow.

Incoming mail, within a conversation, must be processed in the order specified by the message-id (see 9.2.6 Message Id). Each message is numbered as follows:

Message	Numeration (message-id)
Request messages originating from the source workflow engine	- Start with 0 (StartConversation) - Last message number sent + 4
Response messages originating from the target workflow engine	- Received message number + 1
Request messages originating from the target workflow engine	- Start with 2 - Last message number sent + 4
Response messages originating from the source workflow engine	- Received message number + 1

Within each request message, individual operations are numbered starting from 1, so that they can be accounted for. This is accomplished by using an operation-id (see 9.2.9 Operation Id).

A receiving engine is always expecting one of the following message-ids (from a particular node-id within a conversation-id) to arrive:

- A wfmc-if4-request with a message-id that is four more than the last request from the other engine
 The first message from the other engine is either zero (during conversation establishment), or two, which is the first target engine notification (wfmc-if4-request) message.
- A wfmc-if4-response with a message-id that is one more than the request this (receiving) engine just sent
- A wfmc-if4-error with the same message-id as the last message sent by this (receiving) engine.

A received message that does not comply with the expected message-id is duplicated or out-of-sequence or it has an invalid message-id. Duplicate messages are treated as specified in 8.3 Duplication Detection. An

invalid message-id is one that does not comply with the sequencing rules as specified in 9.2.6 Message Id. An invalid message-id must be answered with a wfmc-if4-error.

An engine receiving an out-of-sequence message must not process that message until it has successfully received and processed all preceding messages.

8.2 Retransmission Strategy

The retransmission strategy handles lost messages. A timer is associated with each message sent. If the timer expires before the response is received, the request must be sent again.

The parties of a business agreement assign an arbitrary timer value that is large enough to allow a message round trip (the time that elapses between sending an operation and receiving its response). The timer granularity must be large (several hours or days) to avoid clock synchronization problems.

The sending engine resends a request if the timer (specified in the business agreement) expires before it receives the response. The receiving engine must ignore messages for which the <timestamp> plus the timer value is less than the current UTC (Coordinated Universal Time) time, because they are expired messages.

The sending engine must retry lost messages as many times as specified in its business contract. The sending engine must notify a human administrator if it is unable to contact the other engine after the specified number of retries.

Timers solve the problem of a duplicated and delayed StartConversation, as described in the next section.

8.2.1 Resending Messages

The workflow engines must keep copies of the messages they send out, so that if the message is lost it can be resent. These copies must be kept until the workflow engine receives a new message from the other engine on the same conversation. The StopConversation or its response must be kept for at least double of the timer period.

The workflow engine must update the timestamp of a message before it is resent, otherwise the receiving engine will ignore the message, because it will have expired.

8.3 Duplication Detection

A message from a particular node-id (see 9.2.8 Node Id) that has the conversation-id (see 9.2.4 Conversation id) and the message-id (see 9.2.6 Message Id) of a message already processed is a duplicated message. Duplicated messages occur in two situations:

- During the current conversation.
- After the conversation finished. In particular, a duplicated start conversation message that arrives days after the conversation completed must be handled correctly.

8.3.1 Duplicate Within the Same Conversation

In this case, the receiving engine receives a message that has an active conversation-id, but the message-id has been used, in one of the following ways:

- Message-id is the same as the last message-id received, in which case the receiver must assume that its last message was lost and, therefore, must resend all messages after that message
- Message-id is less than the last processed message-id, in which case, the receiver should ignore the message.

8.3.2 Duplicate Outside the Conversation

Most of the time, an invalid conversation-id exposes out-of-conversation message. However, a delayed and duplicate start conversation presents a special problem, because it looks like as a valid message to the receiving engine. It looks like a valid message because, it has a conversation-id that is not in use, it has a message-id of zero, and it contains a start conversation.

The retransmission timer value solves this problem. If the message has expired (expiration time is calculated by adding the timer value to the message <timestamp>) the receiving engine must ignore it.

8.4 Conversation Establishment and Termination

StartConversation marks the beginning of a message interchange between two workflow engines. After the StartConversation, any number of operations and electronic mail messages may be exchanged by the workflow engines. Enactment of a workflow and all the electronic mail interchange required between the source and the target workflow engines must occur within a single conversation.

StopConversation marks the end of the message interchange. StopConversation does not force the workflow engine to terminate its process; rather, it just indicates that the source engine wants to stop the message interchange. It tells the target workflow engine that:

1. It should release all the data structures that pertain to the conversation.
2. It must not send notification (wfmc-if4-request) messages concerning that particular process enactment to the source engine.
3. The process enacted may continue execution, but the source workflow engine has no further interest in it.

After the StopConversation, the conversation-id (source or target) is invalid. After the StopConversation, both workflow engines are free to reassign the process-id (source or target), but conversation-ids must not be reassigned. Process-ids are not guaranteed across conversation boundaries.

8.5 Crash Recovery

This specification assumes that operations are transactional and atomic.

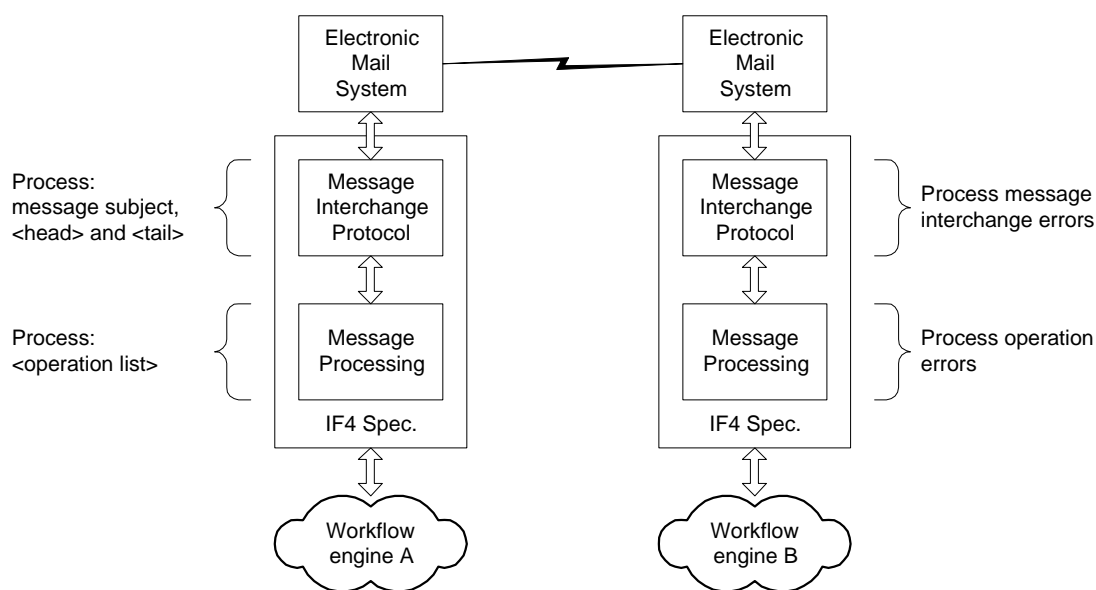
Messages must always be sent after the workflow transaction is committed. Otherwise, they may be received as false messages.

The sending engine must handle the case in which it sends a message, then fails. Whether the message is a request or a response, it must be sent after the workflow transaction is committed. If the engine fails after committing the transaction, but before sending the message, the message is just lost. In a reply, if the engine fails before committing the transaction, the original request message becomes lost. A lost message is preferable to a false message.

Workflow engines implementing this specification may operate at operation granularity or at message granularity. Engines operating at operation granularity will perform each operation in the message in a separate transaction. Engines that operate at message granularity will perform all the operations in the message in a single transaction. Engines operating at message granularity may replace error code 0 (Success) by error code 254 (operation was rollback) if the operation was rollback (see section 9.2.14).

8.6 Error Processing

There are two kinds of errors, that a receiving workflow engine must expect: message interchange errors (section 7.1.4) and operation errors (section 9.2.14). They are modeled based on the following stack implementation:



9 Data Types & Declaratives

9.1 Basic Attribute Types

The following table describes all the basic types used in this specification. Type names are case insensitive.

Type	C type	Comments
WMTAttachment		See Attachments Values below for details
WMTBinary		See Binary Values below for details
WMTBoolean	char	See Boolean Values below for details
WMTDate		See Date and Time Values below for details
WMTDateTime		See Date and Time Values below for details
WMTDouble	double	See Numerical Values below for details
WMTFloat	float	See Numerical Values below for details
WMTInt16	short	See Numerical Values below for details
WMTInt32	long	See Numerical Values below for details
WMTInt8	char	See Numerical Values below for details
WMTText	char*	See Numerical Values below for details
WMTTime		See Date and Time Values below for details
WMTUInt16	unsigned short	See Numerical Values below for details
WMTUInt32	unsigned long	See Numerical Values below for details
WMTUInt8	unsigned char	See Numerical Values below for details

9.1.1 Attachments Values

The value placed in the operation is a reference to the MIME attachment. Attachments are only present in multipart MIME messages. Each part of a multipart message is enumerated for purposes of this protocol. The preamble is assigned the number zero, the first part (the protocol) is assigned number one, and so on. For example, the following segment of a SetProcessInstanceAttributes refers to the first attachment (part number two):

```
name=attach1&type=WMTAttachment&value=2&
```

Alternatively, the use of filenames may be supported by workflow engines with access to an electronic mail system that implements content disposition [RFC-2183]. For example, the following segment of a SetProcessInstanceAttributes refers to the file called proposal.doc:

```
name=attach2&type=WMTAttachment&value=proposal.doc&
```

Note that the interoperability contract must specify which kind of attachment referencing is supported.

9.1.2 Boolean Values

Boolean values passed between workflow engines in messages are as follows:

Boolean Value	use
True	1
False	0

For example:

```
name=boolField&type=WMTBoolean&value=1&
```

9.1.3 Binary Values

Binary values are placed in the message byte by byte independent of the encoding. A byte in a binary value represents an octet independent of the encoding and independent of the character set being used.

For example, the following binary field:

Binary	hexadecimal
0000 0000 1111 1111 1001 0110 0011 1100	00 FF 96 3C
0101 1010 1010 1010 1111 0000 0111 1110	5A AA F0 7E

Is placed in the operation, independent of the encoding and independent of the character set, as:

```
name=binaryBlock&type=WMTBinary&value=%[00FF963C5AAAF07E]&
```

9.1.4 Date and Time Values

Valid values for the date and time types are a subset of the ISO 8601 date/time representations. The subset is based on the complete representation of the date and time formats.

Using 8:25:39p.m (twenty-five minutes and thirty-nine seconds after eight o'clock in the evening) of April 24, 1998 in California (Pacific Standard Time) as an example, we obtain the following table of valid date and time formats.

WMTDate	WMTTime	WMTDateTime
1998-04-24	20:25:39	1998-04-24T20:25:39
	04:25:39Z	1998-04-25T04:25:39Z

9.1.4.1 Calendar Date Format (WMTDate)

Use the following format: YYYY-MM-DD, where YYYY is the year in the Gregorian calendar; MM is the month of the year, from 01 (January) to 12 (December); and DD is the day of the month, from 01 to 31.

9.1.4.2 Time Format (WMTTime)

The following formats are permissible: HH:MM:SS or HH:MM:SSZ where HH is the hours, from 00 to 24; MM is the minutes, from 00 to 59; SS is the seconds, from 00 to 59; and “Z” is the symbol that indicates Coordinated Universal Time (UTC). Midnight may be expressed as 00:00:00 or 24:00:00.

Time in the format HH:MM:SS (without “Z”) is considered local. Use of local time is discouraged, because there is no guarantee that two interoperating workflow engines are in the same time zone.

Time in the format HH:MM:SSZ is represented in Coordinated Universal Time (UTC). For practical purposes (when fractions of a second are not important), UTC is the same as Greenwich Mean Time (GMT), i.e., the local time at the Greenwich meridian (zero degrees longitude).

9.1.4.3 DateTime Format (WMTDateTime)

The symbol “T” separates the date and time part of a time-stamp format. The date and time components must follow the formats given above. The use of UTC time may, depending on the time of day, affect the date in a combined format.

9.1.5 Numerical Values

Numerical values are placed in the message using a string representation of the value. This specification uses the ANSI-C printf/scanf conversions as follows:

Type	C type	ANSI-C printf/scanf format specification
WMTDouble	double	%lf
WMTFloat	float	%f
WMTInt16	short	%hd
WMTInt32	long	%ld
WMTInt8	char	%d
WMTUInt16	unsigned short	%hu
WMTUInt32	unsigned long	%lh
WMTUInt8	unsigned char	%u

The decimal separator for WMTDouble and WMTFloat must be a period (“.”). Note that some ANSI-C implementations will use the locale specification to determine the decimal separator. Independent of the locale specification, the sending engine must guarantee the separator to be a period, and the receiving engine must accept period as separator.

9.2 Operation Fields

Fields are defined as name-value pairs, separated by the “&” character. There is no positionality of fields in the operations (unless it is specifically stated). A field passed with no given value (null field) passes as the field name only, viz:

```
nullparameter=&
```

This forces the receiving engine to set the field to null.

Optional fields may be omitted from the message. When an optional field is not present, the receiving engine may use a default value or null at its discretion. Default values must be agreed as part of the interoperability contract.

Operation field names are case insensitive, so contractid, ContractID, and CONTRACTid are all valid and equivalent spellings.

9.2.1 Activity Id

Name	Type	Variations
ActivityID	WMTText	SourceAID

An activity-id identifies a process step. An activity is defined in [WfMC1011] as “a piece of work that forms one logical step within a process”.

The source activity-id (SourceAID) variation is used when notifying the source engine of changes in attribute values or state. In this case, it must contain the same value as that received in the StartConversation’s ActivityID. If the StartConversation’s ActivityID was not present or it was null, then this field becomes optional; otherwise, it must contain the appropriate activity-id.

Example:

```
ActivityID=1.2.3&
```

9.2.2 Business Process Definition Name

Name	Type	Variations
BusinessPName	WMTText	SourceBDefName TargetBDefName

This describes the business name of the process definition. The business name maybe different from the process definition-id. This is an optional field, used for auditing purposes.

Example:

```
SourceBDefName=Credit Verification Process&
```

9.2.3 Contract Id

Name	Type	Variations
ContractID	WMTText	

When workflow engines interoperate, they do so based on a business agreement. This specification identifies the business agreement by a ContractID. It is an identifier, of type WMTText, which has been agreed upon by the administrators of both workflow engines. This allows the target workflow engine to check the ContractID against a list of business agreements that it is willing to honor. (This specification does not define the mechanism by which administrators define business agreements).

The initiating (source) workflow engine sends a ContractID with which the target workflow engine agrees. The source engine may maintain a list of valid business agreements for each workflow engine that is used as a target. The target workflow engine checks the ContractID against a list of valid business agreements

for the source engine. It reject the message if it finds no match. The ContractID allows the target workflow engine to implement several business agreement polices. For example, it accept requests that are:

- Independent of the SourceNodeID and the ContractID
- From “SourceNodeID=x@wfmc.org”, independent of the ContractID
- From “SourceNodeID=x@wfmc.org” that has “ContractID=Contract1234”
- With “ContractID=Charity” independent of the SourceNodeID

It is the responsibility of the target engine to verify that the source engine is adhering to the contract policy. The target workflow engine must return “not authorized” error when the source workflow engine fails to adhere to the contract.

Example:

```
ContractID=equipment suppliers AB12&
```

9.2.4 Conversation id

Name	Type	Variations
ConversationID	WMTText	SourceConversationID TargetConversationID <conversation id> <source conversation id> <target conversation id>

Each conversation has a two-part conversation identifier. Each engine in the conversation assigns an arbitrary but unique identifier for its part of the conversation. The initiating workflow engine assigns a SourceConversationID and the target workflow engine (the one with which the initiating workflow engine wishes to start a conversation) assigns a TargetConversationID.

Note that, If the source engine alone sets the conversation-id, there is a remote possibility that a target workflow engine working with multiple source engines will receive the same conversation-id from more than one source. Similarly, if the target engine alone sets the conversation-id, a source workflow engine, working with multiple targets, could receive back the same conversation-id from more than one engine. To overcome this problem, a unique conversation-id can be achieved by having both engines provide a conversation-id component that is unique to each. The combined source/target pairing of conversation ids is then likely to be unique for both engines.

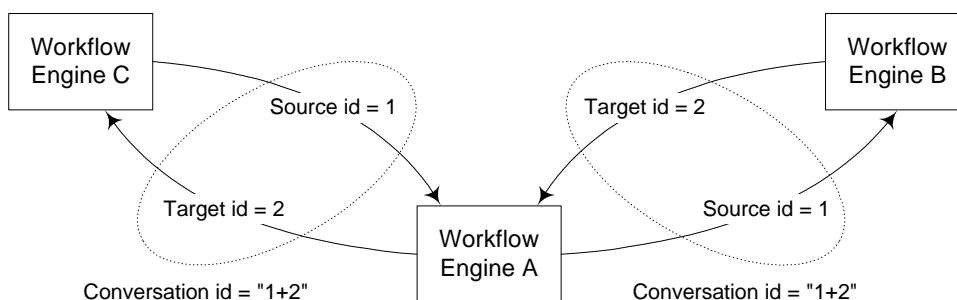
ConversationID is a field composed of two variants. It is defined as SourceConversationID “+” TargetConversationID. The character “+” is used in ConversationID to separate the source and the target conversation ids. For example:

```
SourceConversationID=210&
and TargetConversationID=1AB01234&
then ConversationID=210+1AB01234&
```

Note that “+” is not a valid character for either SourceConversationID nor TargetConversationID, because it is used as a separator in ConversationID.

The maximum length for SourceConversationID 128 characters, and the minimum length is one byte. The maximum length for TargetConversationID is 128 characters, and the minimum length is one byte. Therefore, the maximum length for ConversationID is 257 bytes (128 bytes for each of source and target conversation id, plus the “+” separator), and the minimum length is three bytes.

Implementations should avoid the use of a monotonically increasing integer as the sole component of a conversation id. The following example shows three workflow engines, each one assigning a sequential conversation id (implemented by a monotonically increasing integer) starting with one. The example shows that under those circumstances, a workflow engine can end with two identical conversation ids for different conversation.



In the example, each engine creates the source and target conversation ids starting on one and adding one for each new conversation. Under those circumstances, workflow engine A may have two "1+2" conversation ids.

9.2.5 Language

Name	Type	Variations
Language	WMTText	

The language uses the two-character ISO 639-1 code. It indicates which language the source workflow engine is using to communicate with the end user. The target workflow engine may use the same language to set the ErrorText.

Note that language does not specify the encoding. It is only used to specify the language preference for error description (ErrorText).

Language is an optional field in StartConversation, in which case the language of the target engine is assumed.

Example:
 Language=en&

9.2.6 Message Id

Name	Type	Variations
MessageID	WMTInt32	<message id>

Messages within a conversation are uniquely numbered. This allows the workflow engines to protect against messages being lost, duplicated, or delivered out of sequence. The receiving workflow engine must be able to identify:

- Messages it has received and acted on
- Messages received out-of-sequence, thus they are not yet eligible for processing
- Messages not received (e.g., if only messages 0, 4 and 16 have been received, it is possible to deduce that messages 8 and 12 are missing).

The semantic of the message number is either *"Message n I have sent to engine X during conversation S"* or *"Message n I have received from engine X during conversation S"*. To allow each engine to distinguish messages it has sent and messages it has received, both engines number the messages they send to the other engine in increments of four. Responses to request/notification (wfmc-if4-request) messages are numbered by adding 1 to the request/notification message number.

The source workflow engine starts its requests (wfmc-if4-request messages) with message-id zero that corresponds to the StartConversation. The target workflow engine replies (wfmc-if4-response) with message-id one (zero plus one). The next source workflow engine message is four (zero plus four), to which the target workflow engine responds with five (four plus one).

This specification provides two notification operations: ProcessInstanceAttributeChanged and ProcessInstanceStateChanged. These two notification operations are initiated by the target workflow engine by using a wfmc-if4-request message.

The target workflow engine starts its notifications (wfmc-if4-request messages) with message-id two. The source workflow engine responds (wfmc-if4-response message) with a message-id of three (received message-id plus one).

Interchange error messages (wfmc-if4-error) use the message-id of the bad message, so that the sequencing is not disturbed. An interchange error message may be caused by either a wfmc-if4-request or a wfmc-if4-response.

Example:

Source			Target		
wfmc-if4-request	Wfmc-if4-response	Wfmc-if4-error	wfmc-if4-request	Wfmc-if4-response	Wfmc-if4-error
0				1	
4				5	
8					8
8				9	
		9		9	
			2		
	3		6		
	7				
12				13	

Note that:

- Each request has an even message-id.
- Each response has an odd message-id.
- The message-id of a request coming from the source is divisible by four.
- The message-id of a request coming from the target is not divisible by four (it minus two is divisible by four).

Using the above concepts, it is possible to guarantee that:

- In an environment where there may be many workflow engines conducting interoperability conversations with each other, every conversation is uniquely identifiable
- Within such an environment, every message is uniquely identifiable.

An engine receiving a message may need to determine its role in the conversation. Using the message-id the engine can find out its role in a conversation, as follows:

- If the message type is wfmc-if4-request and the message-id is zero or divisible by four then the receiving engine is the target workflow engine
- If the message type is wfmc-if4-response and the message-id plus one is divisible by four then the receiving engine is the target workflow engine.

- If the message type is wfmc-if4-error and the message-id minus one is divisible by four then the receiving engine is the target workflow engine.
- Otherwise the receiving engine is the source workflow engine..

9.2.7 Name-Type-Value Group

Name	Type	Variations
Number	WMTInt16	
Name	WMTText	
Type	WMTText	
Value		

The name-type-value group is used when a list of attributes is required. The name-type-value group is always preceded by number. Number indicates how many name-type-value groups are present in the operation. This is the only case in which field position is important within an operation.

Example:

`number=2&name=first&type=WMTInt8&value=2&name=second&type=WMTText&value=test&`

9.2.8 Node Id

Name	Type	Variations
NodeID	WMTText	SourceNodeID TargetNodeID

The node-id is the electronic mail address of a workflow engine. The receiving engine always ignores the return email address, and instead, uses the node-id to address the other engine (except in the case of message interchange errors).

The node-id in conjunction with the contract-id will be used by the receiving engine to authenticate against its contract information.

Example:

`NodeID=xyz@wfmc.org&`

9.2.9 Operation Id

Name	Type	Variations
OpID	WMTUInt16	<operation id>

The operation-id is an enumeration of operations within a request message. Each request message starts with operation-id number =1. The operations in a response message have operation-ids that correspond to the operation-id of the request operation.

Example:

`OpID=2&`

9.2.10 Process Definition Id

Name	Type	Variations
ProcessDefinitionID	WMTText	

Process definition-id is the name of a workflow process that can be executed in a target engine by using a CreateProcessInstance operation. It often corresponds to the name of a business process, for example, expense report.

Example:

`ProcessDefinitionID=expense report&`

9.2.11 Process Id

Name	Type	Variations
ProcessID	WMTText	RootPID SourcePID TargetPID

The process-id is a unique identifier for a process instance being executed. This arbitrary and unique identifier is assigned by the workflow engine that enact the process. The source workflow engine is executing a process instance and so, allocates it. A CreateProcessInstance operation causes enactment of a process instance by a target workflow engine which allocates the process instance a process-id.

The RootPID is the process-id of the top-level process. Several levels of process enactment may occur when a top-level process creates a sub-process instance, that in turn creates another sub-process instance. In this case, it is important to know which was the original process-id (process-id of the top-level process).

If the process establishing a conversation has a RootPID, then it should pass it as the RootPID of the conversation. If the process establishing the conversation does not have a RootPID (if it has been enacted locally in the source workflow engine), then the RootPID will be the same as the SourcePID.

9.2.12 Product Id

Name	Type	Variations
ProductID	WMTText	

The product-id identifies the product making the request. This allows the other engine to know which product implements the other end of the conversation. Based on that information, the engines may use extended attributes. Product-id is of the form: <product name>/<version number>.

Example:

ProductID=MagicWorkflow/5.1&

9.2.13 Profile

Name	Type	Variations
Profile	WMTText	

The profile allows the source workflow engine to indicate what kind of conformance profile it is intended to engage with the target workflow engine. See conformance profiles for details on each profile.

Profile can take one of the following, case insensitive, values:

chain	Simple chains
nested	Nested sub-process

Example:

Profile=chain&

9.2.14 Return Error Codes

Name	Type	Variations
ErrorCode	WMTInt16	AErrorCode
ErrorText	WMTText	

Request and notification (wfmc-if4-request) messages sent by one workflow engine to another are answered by a response message which tells the sending workflow engine what happened on the receiving workflow engine as a result of the message being sent. Each wfmc-if4-request message contains one or more operations. There are five possible outcomes for each operation:

- The operation was not attempted due to an error in a preceding operation. This is indicated with error code 255 ().
- The operation was not processed by the receiving workflow engine because the required functionality was not supported or not implemented. This is indicated with error code 1 (implemented).

The operation was processed successfully. This is indicated with error code 0 ().

- The operation was processed successfully, but the operation was rollback by the processing workflow engine because a failure in a subsequent operation (see section). This is indicated with error code 254 ().
- An error occurred in the processing of the roperation. This is indicated with an error code from the table below.

response message.

Error codes in the range 0 to 255 are used by this specification. Unassigned values in the range 0 to 255 are

ErrorCode	Description
	Success
1	
2	Not authorized
	Unknown ProcessID
4	
5	Invalid or unknown attribute name
	Invalid state transition
7	
8	Attribute value does not correspond to attribute type
	Required Attribute not set
10	
11	Invalid or unsupported language
	Invalid or unsupported MIME version
20	
30	Operation failed see AErrorCode for details
	Invalid ProcessDefinitionID
41	
201	Truncated message
	Modified Message (Bad Checksum)
203	
204	Expired Message
	Invalid Message

206	Invalid ConversationID
207	Invalid Sequence
208	Invalid Timestamp
209	Invalid Escape Sequence
254	Operation was rollback. This code is used when a subsequent operation (in the same message) fails and previous operations are rollback by the workflow engine (see section 8.5).
255	Operation not performed. This code is used when a preceding operation (in the same message) fails
256 to 32767	Failure. Implementation specific error code.

The ErrorText field allows for a short explanatory message that explains the error code to be passed back (this is an optional field). When possible, it should use the StartConversation language argument to decide which language to use for the error message. The StartConversation language field indicates which language the source workflow engine is using to interact with the end user. This scheme allows the target workflow engine the possibility of returning a meaningful value for the failure state, which might convey to the source workflow engine what went wrong, rather than just the fact that something went wrong. The values for Failure may be workflow engine-specific or they may be the result of an agreement between the designers of the two interoperating workflow definitions.

In a message with several operations, if one operation fails, the rest of the operations are not attempted (including the StopConversation). Their error code is set to 255 (operation not performed). The following message segment illustrates that case:

```
StartConversation?ErrorCode=0&SourceConversationID=K1234&
TargetConversationID= ABC&TargetNodeID=abc@wfm.org&
Version=1.1&ProductID=BetterMagicWorkflow/8.1&OpID=1&&
CreateProcessInstance?ErrorCode=40&OpID=2&&
SetProcessInstanceAttributes?ErrorCode=255&OpID=3&&
ChangeProcessInstanceState?ErrorCode=255&OpID=4&&
StopConversation?ErrorCode=255&OpID=5&&
```

9.2.15 Role Id

Name	Type	Variations
RoleID	WMTText	SourceRoleID TargetRoleID

A role is defined in [WfMC1011] as “A group of participants exhibiting a specific set of attributes, qualifications and/or skills” and it is normally associated with security privileges. The use of roles is optional in this specification and caution is recommended when sending role information to third party organizations.

Example:

```
RoleID=FinaceClerk&
```

9.2.16 State

Name	Type	Variations
State	WMTText	

States are organized into several levels of granularity, lower level states refining higher-level ones. An implementation might choose to support states on any level of granularity, omit states and add additional states to the list defined below. A state is identified by its name that includes its super-state parents using dot-delimited notation.

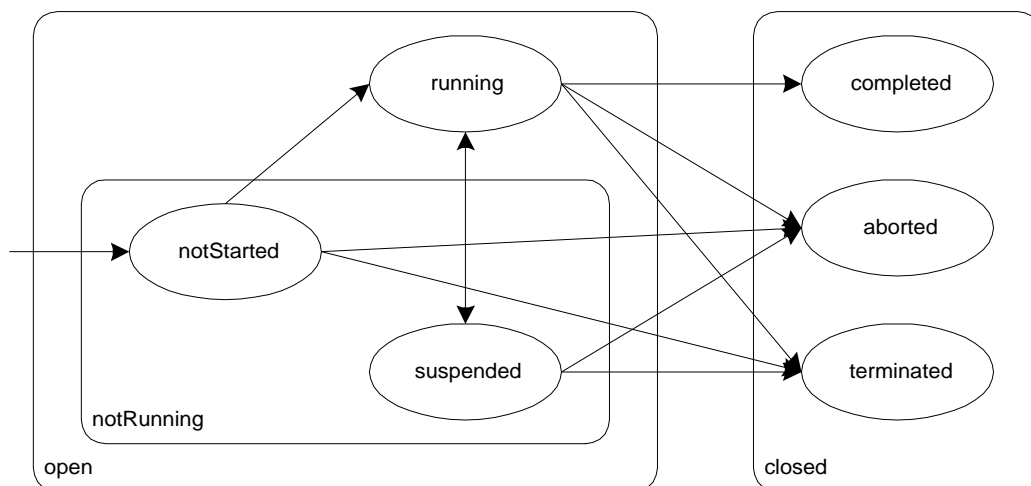
The top level of states for a Process Instance distinguishes two states, *open* and *closed* two sub-states, *running* and *notRunning*; *notRunning* in turn has two sub-states, *suspended* and *notStarted*.

State	Description
<i>open.running</i>	The Process Instance is enacted
<i>open.notRunning</i>	The Process Instance is temporarily not executing
<i>open.notRunning.suspended</i>	The Process Instance has been created, but was not started yet
<i>closed</i>	Enactment of the Process Instance has been finished
<i>closed.aborted</i>	Enactment of the Process Instance has been aborted. It is an abnormal termination with no attempt to terminate sub-processes. It is catastrophic circumstances where nothing except clearing the process away can be done.
<i>closed.terminated</i>	Enactment of the Process Instance has been terminated. It is an abnormal but graceful termination, in which an attempt to terminate all running sub-processes has been made.
<i>closed.completed</i>	Enactment of the Process Instance has completed normally.

states; valid sets of states include for example:

- *open.notRunning*, *open.running* and *closed*
- *open.notStarted*, *open.running*, *open.suspended* and *closed.terminated*
- ...

bottom-level states only, transitions between the higher-level states can be deduced from that easily; e.g., there is a transition from *open* to *closed* via *notRunning* to *closed*, but no transition backwards in both cases.



Note that:

- State names are case insensitive.

- Transitions can be made from *notRunning* states to the *running* state; transitions from the *running* to the *notRunning* super-state can be made to the *suspended* sub-state only.
- When enactment of a Process Instance is finished, its state will take one of the flavors of the *closed* state, depending on the way of ending enactment (normally *completed*, *terminated* or *aborted*). The *completed* state can only be reached from the *running* state since it represents normal completion of the Process Instance; the other *closed* sub-states are reached via the *WMAbrtProcessInstance* or *WMTerminateProcessInstance* operations.
- The *closed* state is a final state, i.e., there is no transition from a *closed* state to an *open* state.

Example:

State=open.running&

9.2.17 Timestamp

Name	Type	Variations
Timestamp	WMTDateTime	<timestamp>

The timestamp when the message was sent. The time stamp used for <timestamp> must use Coordinated Universal Time (UTC).

9.2.18 User Id

Name	Type	Variations
UserID	WMTText	SourceUserID TargetUserID

A user (participant) is defined in [WfMC1011] as “A resource which performs the work represented by a workflow activity instance” and it is normally associated with security privileges. The use of users is optional in this specification and caution is recommended when sending user information to third party organizations.

Example:

UserID=jdoe&

9.2.19 Version

Name	Type	Variations
Version	WMTText	

The version of the MIME binding used to construct messages. For this specification, it must contain the value: 2

Example:

version=2&

10 Conformance

A vendor can claim conformance to this or any other WfMC specification only when specifically authorized to make that claim by the WfMC. A vendor of a workflow engine who claims conformance with this interface shall clearly indicate:

- Mechanism/binding required to effect interoperability e.g., Internet e-mail MIME version 1.1.
- the style of interoperability dialogue supported:
 - atomic
 - batched
 - both
- Style of dialogue supported:
 - half duplex
 - full duplex
- Conformance profile supported:
 - Chained
 - Nested
- Audit data implementation:
 - WfMC audit data
 - Product specific audit data
 - No audit data

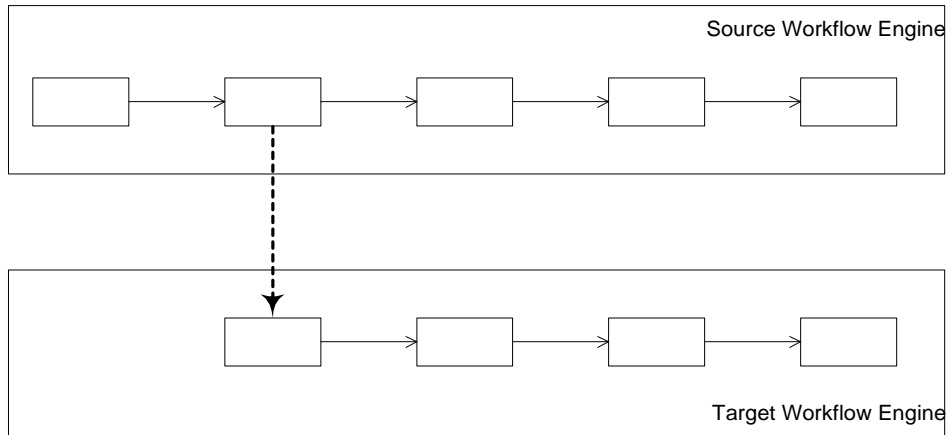
If the implementation uses the WfMC audit data, this document indicates the information that a conforming workflow engine must be able to present, in relation to the status and history of interoperation with other workflow engines, relating to enactment of a process instance. It is not intended as a specification of how or where that information is stored and maintained.

It should be noted that workflow engine interoperability implies more than just the ability to have one workflow engine do things at the behest of another. It requires that both workflow engines are capable of doing things at the behest of the other. Ideally the set of things that each can do for the other will coincide.

10.1 Conformance Profiles

This version of the MIME Binding supports implementation of interoperability scenarios characterised by the conformance profiles given below. More complex interoperability scenarios may be achievable, but are not defined here as they are the subject of ongoing work by the Workflow Management Coalition.

10.1.1 Simple Chains



10.1.1.1 Intended Use

The simple chains conformance profile is typified by the ability of: one workflow engine to

- Create and instantiate a process instance created on another given the appropriate process identifier and permissions;
- Cause enactment of an identified, instantiated process instance on another workflow engine.

10.1.1.2 Operations

Source Workflow Engine

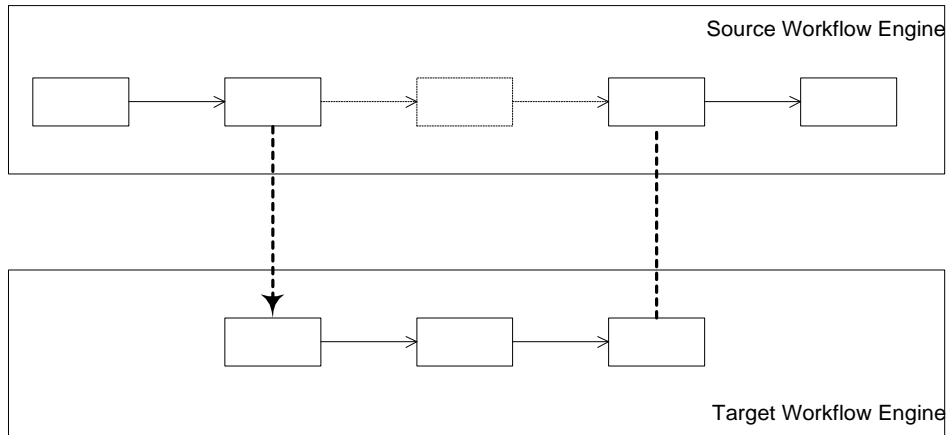
StartConversation
StopConversation
CreateProcessInstance
SetProcessInstanceAttributes
ChangeProcessInstanceState (open.running)

Target Workflow Engine

There is no presumed ordering of operations beyond the requirement that the interoperation must begin with a StartConversation and finish with a StopConversation. However, if the process instance on the target workflow engine is to be created, the first operation following StartConversation must be CreateProcessInstance (you cannot set attribute values or initiate enactment for a process instance that does not exist).

Permission to interoperate with a designated process instance on another workflow engine is established through authentication of the request messages according to rules in the prevailing interoperability contract.

10.1.2 Nested Sub-process



10.1.2.1 Intended Use

Nested sub-process is characterised by the ability of

- One workflow engine to create and instantiate a process instance created on another given the appropriate process identifier and permissions;
- One workflow engine to cause enactment of an identified, instantiated process instance on another workflow engine
- The source workflow engine to know when the sub-process has completed and optionally to take back resulting attribute values to be used in the ongoing enactment of the parent process instance.

10.1.2.2 Operations

Source Workflow Engine

StartConversation
StopConversation
CreateProcessInstance
SetProcessInstanceAttributes
ChangeProcessInstanceState (open.running)
ChangeProcessInstanceState (closed.aborted)
ChangeProcessInstanceState (closed.terminated)
ProcessInstanceStateChanged (closed.aborted)
ProcessInstanceStateChanged (closed.terminated)

GetProcessInstanceAttribute
GetProcessInstanceState

Target Workflow Engine

ProcessInstanceStateChanged (open.running)
ProcessInstanceStateChanged (closed.aborted)
ProcessInstanceStateChanged (close.terminated)
ProcessInstanceStateChanged (closed.completed)
ProcessInstanceAttributeChanged

There is no presumed ordering of operations beyond the requirement that the interoperation must begin with a StartConversation and finish with a StopConversation. However, if the process instance on the target workflow engine is to be created, the first operation following StartConversation must be CreateProcessInstance (you cannot set attribute values or initiate enactment for a process instance that does not exist). Similarly, the target workflow engine cannot notify the source workflow engine of changes in the values of designated process instance attributes or of the state of the sub-process instance before enactment of the sub-process instance has commenced.

Permission to interoperate with a designated process instance on another workflow engine is established through authentication of the request messages according to rules in the prevailing interoperability contract.

A source engine, conforming to this profile that is enacting a process instance to be terminated, must terminate all nested sub-processes by sending them a `ChangeProcessInstanceState` (`closed.terminated`). The “terminate” succeeds only if the sub-processes are terminated, otherwise it fails.

A source engine, conforming to this profile that is enacting a process instance to be aborted may do one of the following:

- Attempt to abort all nested sub-processes by sending them a `ChangeProcessInstanceState` (`closed.abort`).
- Notify all nested sub-processes of its state change by sending them a `ProcessInstanceStateChanged` (`closed.abort`).

The aborting source engine may not wait for the responses from the sub-processes, to complete its abort.

11 Operations

In the following text, the function specifications define operations required to effect interoperability between two (or more) workflow engines. The message specifications define information that must be passed between two workflow engines in order to effect the operations described.

The position of fields within an operation is arbitrary. Therefore, there is, in general, no field positionality. The only exception being the name-type-value groups used in operations dealing with process instance attributes, which must appear in the order given.

The position of operations within the message is critical. The receiving workflow engine must execute operations in the order designated in the message. Both messages, the request and the response must have the same number of operations and they should be placed in the message in the same order.

There are situations in which a required operation parameter (e.g. ProcessID) is the result of a previous operation successfully being performed (e.g. CreateProcessInstance). In order to place both operations in a single message, the source workflow engine delegates setting of a value for the parameter field to the target workflow engine.

For example, in the following message fragment, ProcessID (required in SetProcessInstanceAttributes and in ChangeProcessInstanceState) is the result of CreateProcessInstance. In this fragment, the source workflow engine did not include the unknown ProcessID field in the message sent, so the target engine is required to use the ProcessID resulting from the CreateProcessInstance.

```
CreateProcessInstance?OpID=2&ProcessDefinitionID=Open Account&Profile=chain&&  
SetProcessInstanceAttributes?OpID=3&Number=1&Name=copies&Type=WMTINT8&Value=3&&  
ChangeProcessInstanceState?OpID=4&State=open.running&&
```

In this specification, the operation and field names are case insensitive. Most of the values defined in this specification are also case insensitive. The few exceptions to this:

1. Non-terminal tokens enclosed in quotes in the BNF grammar, which must be spelled exactly as defined, i.e., they are case sensitive.
2. Values supplied by a workflow engine must be considered case sensitive. These are the values supplied in between the “=” and “&” in a field assignment, i.e., ConversationID, SessionID, etc. are case sensitive.
3. Values defined as part of an interoperability contract must be considered case sensitive, i.e., ContractID, ProcessDefinitionID, etc. are case sensitive.

11.1 Change Process Instance State

`ChangeProcessInstanceState`

Description Change the state of the designated process instance. For example, from suspended to resumed or vice versa.

The receiving workflow engine creates a Process/Sub-process audit record, as specified in [WfMC015], to record that enactment of the suspended process instance was resumed or vice versa.

Rationale It is an operational requirement of users of interoperating workflow systems that it be possible to suspend and resume enactment of sub-process.

Direction This message is always sent from *Source* Engine to *Target* Engine

Request Fields

Field	Comments
ActivityID	The activity on the source workflow engine requesting the change. This field is optional.
OpID	The operation-id of this operation within the message.
SourceRoleID	RoleID responsible for request. This field is optional.
SourceUserID	UserID responsible for request. This field is optional.
State	The state to which the designated process instance is to be changed
TargetPID	Process-id of process that must be changed. If this operation is in the same message as the StartConversation, this field must be omitted and the target workflow engine will use the TargetPID on the StartConversation reply.
TargetRoleID	RoleID responsible for process instance on target workflow engine. This field is optional.
TargetUserID	UserID responsible for process instance on target workflow engine. This field is optional.

Example of a wfmc-if4-request message:

```
ChangeProcessInstanceState?OpID=2&TargetPID=24&State=closed.aborted&&
```

Response Fields

Field	Comments
ActivityID	The ID of the current activity in the target workflow engine at the time the state change occurred. This field is optional.
ErrorCode	
ErrorText	Optional
OpID	The operation-id of this operation within the message.
State	State of the process instance in the target workflow engine. Note that this state maybe different that the requested state. For example, requesting an abort, may result in a termination. If ErrorCode is zero, this field must be present; otherwise, it is optional.

TargetRoleID Role assumed by primary user. This field is optional.
TargetUserID UserID of primary user. This field is optional.

Error Codes

0 Success
1 Operation not implemented
2 Not authorized
3 Unknown ProcessID (TargetPID)
4 Invalid state
6 Invalid state transition
254 Operation was rollback, because of a failure of a subsequent operation.in the message
255 Operation not performed, because of a failure by an earlier operation.

Example of a wfmc-if4-response message:

`ChangeProcessInstanceState?OpID=2&ErrorCode=0&state=closed.aborted&&`

11.2 Create Process Instance

CreateProcessInstance

- Description** Identify a process definition that the receiving workflow engine is required to enact.
- Rationale** A workflow engine must be able to communicate the identity of a process definition to another workflow engine in order for the latter to enact it.
- Direction** This message is always sent from *Source Engine* to *Target Engine*

Request Fields

Field	Comments
OpID	The operation-id of this operation within the message.
ProcessDefinitionID	Identifier of the process definition that the target workflow engine is required to use to create the process instance
Profile	Indicates the type of dialog to be conducted with the created process.
SourceBDefName	Business Definition Process Name for source process instance. This field is optional.
SourceRoleID	RoleID responsible for request. This field is optional.
SourceUserID	UserID responsible for request. This field is optional.
TargetRoleID	RoleID responsible for process instance on target workflow engine. This field is optional.
TargetUserID	UserID responsible for process instance on target workflow engine. This field is optional.

Example of a wfmc-if4-request message:

```
CreateProcessInstance?OpID=2&ProcessDefinitionID=Open Account&
Profile=chain&&
```

Response Fields

Field	Comments
ErrorCode	
ErrorText	Optional
OpID	The operation-id of this operation within the message.
TargetPID	ID of newly created process instance. If ErrorCode is zero, this field must be present; otherwise, it is optional.
State	State of new process instance. If ErrorCode is zero, this field must be present; otherwise, it is optional.
TargetBDefName	Business Definition Process Name for target process instance. This field is optional.
TargetRoleID	Role assumed by primary user. This field is optional.
TargetUserID	UserID of primary user. This field is optional.

Error Codes

- 0 Success
- 1 Operation not implemented
- 2 Not authorized
- 40 Invalid ProcessDefinitionID
- 41 Invalid or not implemented profile
- 254 Operation was rollback, because of a failure of a subsequent operation.in the message
- 255 Operation not performed, because of a failure by an earlier operation.

Example of a wfmc-if4-response message:

```
CreateProcessInstance?OpID=2&ErrorCode=0&  
TargetPID=32&state=open.notRunning.notStarted&&
```

11.3 Get Process Instance Attributes

`GetProcessInstanceAttributes`

- Description** Return the value(s) of the requested process instance attributes (process relevant data).
- Rationale** Checking values of process relevant data is one way in which a workflow engine can check on the progress of a workflow being enacted on another workflow engine.
- Direction** This message is always sent from *Source Engine* to *Target Engine*

Request Fields

Field	Comments
ActivityID	Identifies the current activity on the source workflow engine. This field is optional.
OpID	The operation-id of this operation within the message.
TargetPID	The PID of the process instance on the target workflow engine from which attribute values are being requested.
SourceBDefName	Business Definition Process Name for source process instance. This field is optional.
SourceRoleID	RoleID responsible for request. This field is optional.
SourceUserID	UserID responsible for request. This field is optional.
TargetRoleID	RoleID responsible for process instance on target workflow engine. This field is optional.
TargetUserID	UserID responsible for process instance on target workflow engine. This field is optional.
Number	The number of Attributes for which values are being requested.
Name ¹	Attribute identifier
...	...

Example of a wfmc-if4-request message:

```
GetProcessInstanceAttributes?OpID=2&TargetPID=32&
Number=1&Name=copies&&
```

Response Fields

Field	Comments
ErrorCode	
ErrorText	Optional
OpID	The operation-id of this operation within the message.
Number	The number of Attributes for which values have been supplied. This field may be zero in which case Name, Type, and Value must be omitted.

¹ Information repeated for each attribute value requested.

Name ²	attribute identifier
Type	new attribute type
Value	new attribute value
...	...

Error Codes

0	Success
1	Operation not implemented
2	Not authorized
3	Unknown ProcessID
5	Invalid or unknown attribute name
254	Operation was rollback, because of a failure of a subsequent operation.in the message
255	Operation not performed, because of a failure by an earlier operation.

Example of a wfmc-if4-response message:

```
GetProcessInstanceAttributes?OpID=2&ErrorCode=0&
Number=1&Name=copies&Type=WMTINT8&Value=3&&
```

² Information repeated for each attribute value to be set.

11.4 Get Process Instance State

`GetProcessInstanceState`

Description Get the status of a process instance that another workflow engine is enacting.

Rationale For a long-term sub-process with a life beyond that of the conversation during which it was created, it is important that the invoking workflow engine be able to check that the invoked sub-process is alive and well or that it has completed.

Direction This message is always sent from *Source* Engine to *Target* Engine

Request Fields

Field	Comment
OpID	The operation-id of this operation within the message.
TargetPID	PID of process instance on target workflow engine for which state information is requested

Example of a wfmc-if4-request message:

```
GetProcessInstanceState?OpID=2&TargetPID=48&&
```

Response Fields

Field	Comment
ErrorCode	
ErrorText	Optional
OpID	The operation-id of this operation within the message.
State	State of process instance. If ErrorCode is zero, this field must be present; otherwise, it is optional.

Error Codes

0	Success
1	Operation not implemented
2	Not authorized
3	Unknown ProcessID
254	Operation was rollback, because of a failure of a subsequent operation.in the message
255	Operation not performed, because of a failure by an earlier operation.

Example of a wfmc-if4-response message:

```
GetProcessInstanceState?OpID=2&ErrorCode=0&state=open.running&&
```

11.5 Process Instance Attributes Changed

<code>ProcessInstanceAttributeChanged</code>
--

- Description** Notify the source workflow engine of a change in the (sub) process instance attributes (process relevant data).
- Rationale** This operation is provided so that a workflow engine that is enacting a sub-process can notify the source workflow engine that the value of a set of elements of workflow-relevant data has been changed. This allows tracking of milestones in the management of workflows enacted in a multi-engine contract.
- Direction** This message is normally sent from *Target* Engine to *Source* Engine; however, during some scenarios (see conformance profiles), it may be sent from the *Source* engine to the *Target* engine.

Notification Fields

Field	Comment
OpID	The operation-id of this operation within the message.
ProcessID	The ProcessID of the process instance sending the notification.
SourceAID	The ID of the activity instance within the source workflow engine that is to be notified that the attribute value has changed. This field may be optional.
SourceRoleID	RoleID responsible for the process instance that caused the notification request. This field is optional.
SourceUserID	UserID responsible for the process instance that caused the notification request. This field is optional.
TargetRoleID	RoleID responsible for the process instance on the target workflow engine which caused the newly started process instance to be created. This field is optional.
TargetUserID	UserID responsible for the process instance on the target workflow engine which caused the newly started process instance to be created. This field is optional.
Number	Number of attributes that have changed.
Name ³	attribute identifier
Type	attribute type
Value	new attribute value
...	...

Example of a wfmc-if4-request message:

```
ProcessInstanceAttributeChanged?OpID=2&TargetPID=24&
Number=1&Name=copies&Type=WMTINT8&Value=3&&
```

Response Fields

Field	Comment
-------	---------

³ Information repeated for each attribute value to be set.

ErrorCode	
ErrorText	Optional
OpID	The operation-id of this operation within the message.

Error Codes

0	Success
1	Operation not implemented
2	Not authorized
3	Unknown ProcessID (TargetPID)
5	Invalid or unknown attribute name
7	Invalid attribute type for this attribute
8	Attribute value does not corresponds to attribute type
254	Operation was rollback, because of a failure of a subsequent operation.in the message
255	Operation not performed, because of a failure by an earlier operation.

Example of a wfmc-if4-response message:

ProcessInstanceAttributeChanged?OpID=2&ErrorCode=0&&

11.6 Process Instance State Changed

`ProcessInstanceStateChanged`

- Description** Notify the source workflow engine of a state change in the (sub).
- Rationale** When the invoking process instance hangs while waiting for the enacted sub-process to complete, the workflow engine enacting the sub-process must have a means of communicating the completion to the invoking engine.
- Direction** This message is normally sent from *Target* Engine to *Source* Engine; however, during some scenarios (see conformance profiles), it may be sent from the *Source* engine to the *Target* engine.

Notification Fields

Field	Comment
ProcessID	The Process-id of the process instance that changed state.
ActivityID	The ID of the activity instance that is to be notified that the attribute value has changed. This field may be optional.
OpID	The operation-id of this operation within the message.
SourceRoleID	Optional
SourceUserID	Optional
State	New state of process instance
TargetRoleID	Optional
TargetUserID	Optional

Example of a wfmc-if4-request message:

```
ProcessInstanceStateChanged?OpID=2&ProcessID=24&state=closed.completed&&
```

Response Fields

Field	Comment
ErrorCode	
ErrorText	Optional
OpID	The operation-id of this operation within the message.

Error Codes

0	Success
1	Operation not implemented
2	Not authorized
3	Unknown ProcessID
4	Invalid state
9	Required attribute not set
254	Operation was rollback, because of a failure of a subsequent operation.in the message
255	Operation not performed, because of a failure by an earlier operation.

Example of a wfmc-if4-response message:

ProcessInstanceStateChanged?OpID=2&ErrorCode=0&&

11.7 Set Process Instance Attributes

SetProcessInstanceAttributes

Description Set the value(s) of process instance attributes (process relevant data) in a selected process definition.

The attribute list sent to target workflow engine contains value specifications for one or more process instance attributes to be set. The target workflow engine attempts to set attribute values in the order in which they occur in the list. It returns a response message containing a list of those attributes for which the set operation was successful. In the event that part way through enacting a list of attribute values an error occurs, the attribute for which it was unable to set a value is not contained in the response message and the return code value indicates a failure. The target workflow engine does not enact the list of attribute values beyond the point at which a failure occurs.

Rationale Process definitions are only partial and must be fully (or sufficiently) instantiated before enactment may commence.

Direction This message is normally sent from *Source* Engine to *Target* Engine; however, during some scenarios (see conformance profiles), it may be sent from the *Target* engine to the *Source* engine.

Request Fields

Field	Comment
ProcessID	The process-id of the process instance that will be affected by this operation. If this operation is the same message than the StartConversation, this field must be omitted and the target workflow engine will use the TargetPID from the reply to StartConversation.
OpID	The operation-id of this operation within the message.
Number	The number of Attributes for which value changes are required.
Name ⁴	attribute identifier
Type	attribute type (Refer to "Basic Attribute Types" in section 4.2 Data Types & Declaratives)
Value	new attribute value
...	...

Example of a wfmc-if4-request message:

```
SetProcessInstanceAttributes?OpID=2&ProcessID=24&  
Number=1&Name=copies&Type=WMTINT8&Value=3&&
```

Response Fields

Field	Comment
ErrorCode	Overall operation error. If it is different than zero, then the message may contain attribute errors

⁴ Information repeated for each attribute value to be set.

ErrorText	Optional
OpID	The operation-id of this operation within the message.
ProcessID	The process-id of the process instance for which changes to attribute values were requested.
Number	The number of attributes on error, or zero if there are no attribute errors. It indicates the number of Name-AErrorCode pairs present in this operation response.
Name	The name of an attribute that has an error.
AErrorCode	The error code for the attribute name preceding this field. Valid errors are: 5 -- Invalid or unknown attribute name 7 -- Invalid attribute type 8 -- Attribute value does not corresponds to attribute type

Note that SetProcessInstanceAttributes has two possible response formats:

- On success (noerrors caused by attributes), the field 'number' is set to zero. In this case, the fields 'Name' and 'AErrorCode' are not present.
- On errors caused by attributes, the field 'number' indicates the number of attributes in error. For each of those attributes, the fields 'Name' and 'AErrorCode' provide the details. The overall ErrorCode must be different than zero.

Error Codes

0	Success
1	Operation not implemented
2	Not authorized
3	Unknown ProcessID
5	Invalid or unknown attribute name
7	Invalid attribute type for this attribute
8	Attribute value does not corresponds to attribute type
30	Operation failed see AErrorCode for details
254	Operation was rollback, because of a failure of a subsequent operation.in the message
255	Operation not performed, because of a failure by an earlier operation.

Example of a wfmc-if4-response message:

```
SetProcessInstanceAttributes?OpID=2&ErrorCode=0&Number=0&&
```

or

```
SetProcessInstanceAttributes?OpID=2&ErrorCode=30&number=2&  
Name=copies&AErrorCode=7&name=name&AErrorCode=8&&
```

11.8 Start Conversation

StartConversation

- Description** Connect to the designated workflow engine, starting a new conversation.
 Both workflow engines create a conversation management record as defined in [WfMC015] to mark the start of the conversation.
- Rationale** For dialogues effecting interoperation, it is necessary that a connection be established between the interoperating workflow engines before interoperation can take place.
- Direction** This message is always sent from *Source* Engine to *Target* Engine

Request Fields

Field	Comment
ActivityID	Identifies the activity that originates the conversation start request. . This field is optional.
ContractID	Contract-id for set of workflow engines interoperating within the current business agreement
Language	Two character ISO 639-1 code. This field is optional, in which case the target engine decides the language to use.
OpID	The operation-id of this operation within the message.
ProductID	String, that identifies the product making the request, of the form: <product name>/<version number>
RootPID	Process-id of top root workflow process instance
SourceConversationID	Conversation-id allocated by source workflow engine
SourceNodeID	Mail address for source workflow engine
SourcePID	Process instance-id of process that originates the conversation start request
Version	Version of MIME Binding used to construct messages

Example of a wfmc-if4-request message:

```
StartConversation?OpID=1&ContractID=Nice Group&Version=1.1&Language=de&
SourceNodeID=xyz@wfmc.org&RootPID=730&ProductID=MagicWorkflow/5.0&
SourcePID=24&SourceConversationID=123&&
```

Response Fields

Field	Comments
ErrorCode	
ErrorText	Optional
OpID	The operation-id of this operation within the message.
ProductID	String, identifying the product (answering the request), of the form: <product name>/<version number>
SourceConversationID	Conversation-id allocated by source workflow engine. This must match the SourceConversationID received in the request message.

TargetConversationID	Conversation-id allocated by target workflow engine. If ErrorCode is zero, this field must be present; otherwise, it is optional.
TargetNodeID	Mail address for target workflow engine
Version	Version of MIME Binding used to construct messages

Error Codes

0	Success
2	Not authorized
10	Invalid or expired ContractID
11	Invalid or unsupported language
12	Invalid or unsupported MIME version
254	Operation was rollback, because of a failure of a subsequent operation.in the message

Example of a wfmc-if4-response message:

```
StartConversation?OpID=1&ErrorCode=0&SourceConversationID=123&  
TargetConversationID=456&TargetNodeID=abc@wfmc.org&  
Version=1.1&ProductID=BetterMagicWorkflow/8.1&&
```

11.9 Stop Conversation

StopConversation

Description Terminate the current conversation, disconnect from the interoperating workflow engine. Notify another workflow engine that, as far as this workflow engine is concerned, it may now 1) release all memory that contains data structures that pertain to the given conversation and/or 2) not send notification messages concerning that conversation.

This does not terminate processes that started during the conversation, these continue unaffected. Both workflow engines create a conversation management record as defined in [WfMC015] to mark the end of the conversation.

Rationale Provides a way to close a conversation.

Direction This message is normally sent from *Source* Engine to *Target* Engine; however, it may be sent from the *Target* engine to the *Source* engine.

Request Fields

Field	Comments
OpID	The operation-id of this operation within the message.

Example of a wfmc-if4-request message:

```
StopConversation?OpID=5&&
```

Response Fields

Field	Comments
ErrorCode	
ErrorText	Optional
OpID	The operation-id of this operation within the message.

Error Codes

0	Success
20	There is no conversation in process
255	Operation not performed, because of a failure by an earlier operation.

Example of a wfmc-if4-response message:

```
StopConversation?OpID=5&ErrorCode=301&ErrorText=I don't like you&&
```

12 References

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- [ISO-639.1] ISO Code for the representation of names of languages.
- [ISO-8601] ISO Data Elements and Interchange Formats - Information Interchange-Representation of Dates and Times.
- [ISO-8859] ISO Information processing - 8-Bit single byte coded graphic character sets.
- [OMG93] OMG 93.12.43 The Common Object Request Broker: Architecture and Specification (1.2)
- [RFC-1738] IETF Uniform resource locators (URL).
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- [RFC-2049] IETF MIME Part 5: Conformance Criteria and Examples.
- [RFC-2183] IETF Communicating Presentation Information in Internet Messages: The Content-Disposition Header.
- [WfMC000] Workflow Management Coalition Glossary
- [WfMC1009] WFMC TC-1009 Workflow Management Coalition Interface 2 Application Programming Interface (WAPI) Specification, November 1995
- [WfMC1012] WFMC TC - 1012 Workflow Management Coalition Workflow Standard - Interoperability Abstract Specification, October 1996
- [WfMC1013] WFMC-TC-1013 Workflow Application Programmer's (WAPI) Interface 2 Naming Conventions
- [WfMC1015] WFMC-TC-1015 Workflow Management Coalition Interface 5 Audit Data Specification, July 1998
- [WfMC1011] WFMC-TC-1011 Terminology and Glossary, June 96

13 Appendix A -- Audit Data

The audit data specification below, defines presentation of audit data that must be possible following interoperation between workflow engines using this binding. It is not intended that this part of the specification be taken as a literal description of how such data must be stored, rather it is included as an aid to designers who subsequently implement the Coalition's Audit and Management Interfaces.

13.1 Audit Data Types

The concrete realization (WMTEngineID) of the abstract data type WMTAEngineID is a data structure that identifies a particular workflow engine by:

- ID of the workflow contract within which the interoperability is effected
- Mail address⁵ from which it receives messages from other workflow engines operating within the given workflow contract
- Source conversation-id it has assigned to the interoperability dialogue it conducts with another designated workflow engine
- Target conversation-id assigned by the other workflow engine to the interoperability dialogue it conducts with this workflow engine⁶

```
typedef
{
    WMTResourceID    contract_id;
    WMTResourceID    node_id;
    WMTResourceID    source_conversation;
    WMTResourceID    target_conversation;
} WMTEngineID;
```

The following types are derived from the audit data specification document [WfMC1015]:

```
Typedef
{
    WMTText          object_id[UNIQUE_ID_SIZE];
}WMTObjectID; //Object is Process, Activity or Workitem

typedef
{
    WMTText          resource_ID[UNIQUE_ID_SIZE];
}WMTResourceID;
//Resource is Person,Role or Network Resource
```

All other types and declaratives used in this binding specification are defined in the specification of the Workflow Management API [WfMC1009]

13.2 Audit Information

⁵ In this binding mail address equates to node id

⁶ Note that it is possible for two workflow engines to be conducting multiple interoperability dialogues with each other, in parallel, within a given time frame.

13.2.1 Change Process Instance State

The following audit data records would be created as a result of changing the state of a process instance being enacted on the source workflow engine on behalf of the target workflow engine.

Source Workflow Engine Audit Data -- Request

Name	M/O	Data Type	Description
InitialProcessInstanceID	M	WMObjectID	Unique ID of initial (root) process instance
CurrentProcessInstanceID	M	WMObjectID	Unique ID of current process instance
ActivityInstanceID	O	WMObjectID	Unique ID of current activity instance
ProcessState	M	WMObjectState	state of current process instance
EventCode	M	WMTEventCode	'WMSentRequestChangeProcessInstanceState'
ContractID	M	WMResourceID	Contract ID for source workflow engine
NodeID	M	WMResourceID	Node ID for source workflow engine
UserID	O	WMResourceID	ID of user whom the business would consider the primary person involved with this event. This could be a person or entity. May be null.
RoleID	O	WMResourceID	null | as supplied by target workflow engine
Timestamp	M	WMDateTime	Timestamp event was recorded
Information ID	M	WMObjectID	'WfMC'
MessageID	O	WMObjectID	Message ID associated with event.
Source Activity Definition Business Name	O	WMObjectName	Business name of current activity on the source engine originating the request to change process state
Target Process Definition ID	O	WMObjectID	as supplied to target workflow engine
Target Process Instance ID	M	WMObjectID	Process instance on target workflow engine
Target Process Definition Business Name	O	WMObjectName	null | as supplied by target workflow engine
TargetNodeID	M	WMResourceID	Node ID of Workflow Engine accepting change state request.
TargetUserID	O	WMResourceID	ID of remote user currently performing the process (may be null)
TargetRoleID	O	WMResourceID	ID of remote role currently performing the process (may be null)
Target State	O	WMObjectState	new state of process instance on remote engine
Extension Number	M	WMInt16	'1'
Extension Type	M	WMText	'4MIME'
SourceConversation ID	M	WMText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMText	As supplied by target workflow engine or by the transport mechanism

Target Workflow Engine Audit Data -- Request

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMObjectID	Process Instance ID for process instance on source workflow engine which caused the sub-process to be created on the target workflow engine
Current Process Instance ID	M	WMObjectID	Process Instance ID for sub-process created on the target workflow engine
Activity Instance ID	O	WMObjectID	null
Process State	M	WMObjectState	new state of process instance
Event Code	M	WMTEventCode	'WMReceivedRequestChangeProcessInstanceState'
Contract ID	M	WMTRResourceID	Contract ID for source workflow engine
Node ID	M	WMTRResourceID	Node ID for target workflow engine
User ID	O	WMTRResourceID	null or as instantiated
Role ID	O	WMTRResourceID	null or as instantiated
Timestamp	M	WMDateTime	Timestamp for when request to change process state was received
Information ID	M	WMObjectID	'WfMC'
MessageID	O	WMObjectID	Message ID associated with event.
SourceInitialProcessInstance ID	M	WMObjectID	Initial Process Instance ID of source workflow engine
SourceCurrentProcess InstanceID	M	WMObjectID	Current Process Instance ID of source workflow engine
SourceActivityInstanceID	M	WMObjectID	Activity Instance ID of the source WFE
SourceTimestamp	M	WMDateTime	Timestamp of source WFE event
SourceNodeID	M	WMTRResourceID	Node ID of source Workflow Engine
SourceUserID	O	WMTRResourceID	User ID associated with the remote workflow engine request
SourceRoleID	O	WMTRResourceID	Role ID associated with the remote workflow engine request
SourceProcessDefinition BusinessName	O	WMObjectName	Business name of remote workflow engine process that initiated the process instance (may be null)
SourceActivityDefinition BusinessName	O	WMObjectName	Business name of the remote WFE activity spawning the request
SourceProcess Definition ID	O	WMObjectID	as supplied by source workflow engine
SourceRequestedState	O	WMObjectState	state process instance requested to change to
Process Definition Business ID	O	WMObjectName	as supplied by source workflow engine - may be null
Extension Number	M	WMInt16	'1'
Extension Type	M	WMText	'4MIME'
SourceConversation ID	M	WMText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMText	As supplied by target workflow engine or by the

			transport mechanism
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Source Workflow Engine Audit Data - Operation

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMObjectID	Unique ID of initial (root) process instance
Current Process Instance ID	M	WMObjectID	Unique ID of current process instance
Activity Instance ID	O	WMObjectID	Unique ID of current activity instance
Process State	M	WMObjectState	new state of process instance
Event Code	M	WMTEventCode	'WMChangedProcessInstanceState'
Contract ID	M	WMTRResourceID	Contract ID for source workflow engine
Node ID	M	WMTRResourceID	Node ID for source workflow engine
User ID	O	WMTRResourceID	ID of user whom the business would consider the primary person involved with this event. This could be a person or entity. May be null.
Role ID	O	WMTRResourceID	null | as supplied by target workflow engine
Timestamp	M	WMDateTime	Timestamp event was recorded
Information ID	M	WMObjectID	'WfMC'
MessageID	O	WMObjectID	Message ID associated with event.
SourceActivityInstanceID	M	WMObjectID	Activity ID on source workflow engine
RemoteNodeID	M	WMTRResourceID	NodeID of target WFE
RemoteProcessInstanceID	M	WMObjectID	Process instance on target workflow engine
RemoteTimestamp	M	WMDateTime	Timestamp for when enactment of the process instance state changed on target workflow engine
RemoteProcessDefinitionBusinessName	O	WMObjectName	null | as supplied by target workflow engine
Extension Number	M	WMInt16	'1'
Extension Type	M	WMText	'4MIME'
SourceConversation ID	M	WMText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMText	As supplied by target workflow engine or by the transport mechanism

Target Workflow Engine Audit Data - Operation

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMObjectID	Unique ID of initial (root) process instance
Current Process Instance ID	M	WMObjectID	Unique ID of current process instance
Activity Instance ID	O	WMObjectID	Unique ID of current activity instance
Process State	M	WMObjectState	new state of process instance

Event Code	M	WMTEventCode	'WMChangedProcessInstanceState'
Contract ID	M	WMTResourceID	Contract ID for source workflow engine
Node ID	M	WMTResourceID	Node ID for source workflow engine
User ID	O	WMTResourceID	ID of user whom the business would consider the primary person involved with this event. This could be a person or entity. May be null.
Role ID	O	WMTResourceID	null | as supplied by target workflow engine
Timestamp	M	WMTDateTime	Timestamp event was recorded
Information ID	M	WMTOBJECTID	'WfMC'
MessageID	O	WMTOBJECTID	Message ID associated with event.
PreviousProcessState	M	WMTOBJECTSTATE	State of process instance prior to change
Extension Number	M	WMTInt16	'1'
Extension Type	M	WMTText	'4MIME'
SourceConversation ID	M	WMTText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMTText	As supplied by target workflow engine or by the transport mechanism

Source Workflow Engine Audit Data - Response

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMTOBJECTID	Process Instance ID for process instance on source workflow engine which caused the sub-process to be created on the target workflow engine
Current Process Instance ID	M	WMTOBJECTID	Process Instance ID for sub-process created on the target workflow engine
Activity Instance ID	O	WMTOBJECTID	null
Process State	M	WMTOBJECTSTATE	new state of process instance
Event Code	M	WMTEventCode	'WMReceivedChangedProcessInstanceState'
Contract ID	M	WMTResourceID	Contract ID for source workflow engine
Node ID	M	WMTResourceID	Node ID for target workflow engine
User ID	O	WMTResourceID	null or as instantiated
Role ID	O	WMTResourceID	null or as instantiated
Timestamp	M	WMTDateTime	Timestamp for when notification that process state changed was received
Information ID	M	WMTOBJECTID	'WfMC'
MessageID	M	WMTOBJECTID	Message ID associated with event.
SourceInitialProcessInstance ID	M	WMTOBJECTID	Initial Process Instance ID of source workflow engine
SourceCurrentProcess InstanceID	M	WMTOBJECTID	Current Process Instance ID of source workflow engine
SourceActivityInstanceID	M	WMTOBJECTID	Activity Instance ID of the source WFE

SourceTimestamp	M	WMDateTime	Timestamp of source WFE event
SourceNodeID	M	WMResourceID	Node ID of source Workflow Engine
SourceUserID	O	WMResourceID	User ID associated with the remote workflow engine request
SourceRoleID	O	WMResourceID	Role ID associated with the remote workflow engine request
SourceProcessDefinition BusinessName	O	WMText	Business name of remote workflow engine process that initiated the process instance (may be null)
SourceActivityDefinition BusinessName	O	WMText	Business name of the remote WFE activity spawning the request
SourceProcess Definition ID	O	WMObjectID	as supplied by source workflow engine
SourceRequestedState		WMObjectState	state process instance requested to change to
Extension Number	M	WMInt16	'1'
Extension Type	M	WMText	'4MIME'
SourceConversation ID	M	WMText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMText	As supplied by target workflow engine or by the transport mechanism

Target Workflow Engine Audit Data - Response

Name	M/O	Data Type	Description
InitialProcessInstanceID	M	WMObjectID	Unique ID of initial (root) process instance
CurrentProcessInstanceID	M	WMObjectID	Unique ID of current process instance
ActivityInstance ID	O	WMObjectID	Unique ID of current activity instance
ProcessState	M	WMObjectState	state of current process instance
EventCode	M	WMEventCode	'WMSentChangedProcessInstanceState'
Contract ID	M	WMResourceID	Contract ID for source workflow engine
Node ID	M	WMResourceID	Node ID for source workflow engine
User ID	O	WMResourceID	ID of user whom the business would consider the primary person involved with this event. This could be a person or entity. May be null.
Role ID	O	WMResourceID	null | as supplied by target workflow engine
Timestamp	M	WMDateTime	Timestamp event was recorded
Information ID	M	WMObjectID	'WfMC'
MessageID	O	WMObjectID	Message ID associated with event.
Source Activity Definition Business Name	O	WMObjectName	Business name of current activity on the source engine originating the request to change process state
Target Process Definition ID	O	WMObjectID	as supplied to target workflow engine
Target Process Instance ID	O	WMObjectID	Process instance on target workflow engine

Target Process Definition Business Name	O	WMObjectname	null | as supplied by target workflow engine
TargetNodeID	M	WMResourceID	Node ID of Workflow Engine accepting change state request.
TargetUserID	O	WMResourceID	ID of remote user currently performing the process (may be null)
TargetRoleID	O	WMResourceID	ID of remote role currently performing the process (may be null)
Target State	O	WMObjectState	new state of process instance on remote engine
Extension Number	M	WMInt16	'1'
Extension Type	M	WMText	'4MIME'
SourceConversation ID	M	WMText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMText	As supplied by target workflow engine or by the transport mechanism

13.2.2 Create Process Instance

Source Workflow Engine Audit Data -- Request

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMObjectID	Unique ID of initial (root) process instance
Current Process Instance ID	M	WMObjectID	Unique ID of current process instance
Activity Instance ID	O	WMObjectID	Unique ID of current activity instance
Process State	M	WMObjectState	'open.not-running'
Event Code	M	WMTEventCode	'WMSentRequestCreatetProcessInstance'
Contract ID	M	WMTResourceID	Contract ID for source workflow engine
Node ID	M	WMTResourceID	Node ID for source workflow engine
User ID	O	WMTResourceID	ID of user whom the business would consider the primary person involved with this event. This could be a person or entity. May be null.
Role ID	O	WMTResourceID	null | as supplied by target workflow engine
Timestamp	M	WMDateTime	Timestamp event was recorded
Information ID	M	WMObjectID	'WfMC'
MessageID	O	WMObjectID	Message ID associated with event.
SourceActivityDefinitionBusiness Name	O	WMObjectName	Business name of current activity on the source engine originating the request to create a new process instance
TargetProcessDefinitionID	M	WMObjectID	as supplied to target workflow engine
Target Process Instance ID	M	WMObjectID	Process instance created on target workflow engine
TargetProcessDefinitionBusinessName	O	WMObjectName	null | as supplied by target workflow engine
TargetNodeID	M	WMTResourceID	Node ID of Workflow Engine accepting the conversation request.
TargetUserID	O	WMTResourceID	ID of remote user requested to perform the process (may be null)
TargetRoleID	O	WMTResourceID	ID of remote role requested to perform the process (may be null)
Target State	O	WMObjectState	State of new process instance
Extension Number	M	WMInt16	'1'
Extension Type	M	WMText	'4MIME'
SourceConversation ID	M	WMText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMText	As supplied by target workflow engine or by the transport mechanism

Target Workflow Engine Audit Data -- Request

Name	M/O	Data Type	Description
InitialProcessInstanceID	M	WMObjectID	Process Instance ID for process instance on source workflow engine which caused the request for the sub-process to be created on the target workflow engine
CurrentProcessInstanceID	M	WMObjectID	Process Instance ID for sub-process created on the target workflow engine
ActivityInstanceID	O	WMObjectID	null
ProcessState	M	WMObjectState	State of created process instance
EventCode	M	WMTEventCode	'WMReceivedRequestCreateProcessInstance'
ContractID	M	WMTRResourceID	Contract ID for source workflow engine
NodeID	M	WMTRResourceID	Node ID for target workflow engine
UserID	O	WMTRResourceID	null or as instantiated
RoleID	O	WMTRResourceID	null or as instantiated
Timestamp	M	WMDateTime	Timestamp for when request to create process instance was received
InformationID	M	WMObjectID	'WfMC'
MessageID	O	WMObjectID	Message ID associated with event.
SourceInitialProcessInstance ID	M	WMObjectID	Initial Process Instance ID of source workflow engine
SourceCurrentProcessInstanceID	M	WMObjectID	Current Process Instance ID of source workflow engine
SourceActivityInstanceID	M	WMObjectID	Activity Instance ID of the source WFE
SourceTimestamp	M	WMDateTime	Timestamp of source WFE event
SourceNodeID	M	WMTRResourceID	Node ID of source Workflow Engine
SourceUserID	O	WMTRResourceID	User ID associated with the remote workflow engine request
SourceRoleID	O	WMTRResourceID	Role ID associated with the remote workflow engine request
SourceProcess Definition ID	M	WMObjectID	as supplied by source workflow engine
SourceProcessDefinition BusinessName	O	WMText	Business name of remote workflow engine process that generated the start process request.
SourceActivityDefinition BusinessName	O	WMText	Business name of the remote WFE activity spawning the request
Extension Number	M	WMInt16	'1'
Extension Type	M	WMText	'4MIME'
SourceConversation ID	M	WMText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMText	As supplied by target workflow engine or by the transport mechanism

Source Workflow Engine Audit Data - Operation

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMObjectID	Unique ID of initial (root) process instance
Current Process Instance ID	M	WMObjectID	Unique ID of current process instance
Activity Instance ID	O	WMObjectID	Unique ID of current activity instance
Process State	M	WMObjectState	'open.not-running'
Event Code	M	WMTEventCode	'WMCreatedProcessInstance'
Contract ID	M	WMTRResourceID	Contract ID for source workflow engine
Node ID	M	WMTRResourceID	Node ID for source workflow engine
User ID	O	WMTRResourceID	ID of user whom the business would consider the primary person involved with this event. This could be a person or entity. May be null.
Role ID	O	WMTRResourceID	null | as supplied by target workflow engine
Timestamp	M	WMDateTime	Timestamp event was recorded
Information ID	M	WMObjectID	'WfMC'
MessageID	O	WMObjectID	Message ID associated with event.
SourceActivityInstanceID	M	WMObjectID	Activity ID on source workflow engine
RemoteNodeID	M	WMTRResourceID	NodeID of target WFE
RemoteProcessInstanceID	M	WMObjectID	Process instance created on target workflow engine
RemoteTimestamp	M	WMDateTime	Timestamp for when process instance created on target WFE
RemoteProcessDefinitionBusinessName	O	WMObjectName	null | as supplied by target workflow engine
Extension Number	M	WMInt16	'1'
Extension Type	M	WMText	'4MIME'
SourceConversation ID	M	WMText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMText	As supplied by target workflow engine or by the transport mechanism

Target Workflow Engine Audit Data - Operation

Name	M/O	Data Type	Description
InitialProcessInstanceID	M	WMObjectID	Process Instance ID for process instance on source workflow engine which caused the request for the sub-process to be created on the target workflow engine
CurrentProcessInstanceID	M	WMObjectID	Process Instance ID for sub-process created on the target workflow engine
ActivityInstanceID	O	WMObjectID	null
ProcessState	M	WMObjectState	State of created process instance

EventCode	M	WMTEventCode	'WMCreatedProcessInstance'
ContractID	M	WMTRResourceID	Contract ID for source workflow engine
NodeID	M	WMTRResourceID	Node ID for target workflow engine
UserID	O	WMTRResourceID	null or as instantiated
RoleID	O	WMTRResourceID	null or as instantiated
Timestamp	M	WMTDateTime	Timestamp for when request to create process instance was received
InformationID	M	WMTOBJECTID	'WfMC'
MessageID	O	WMTOBJECTID	Message ID associated with event.
ProcessDefinition ID	M	WMTOBJECTID	Process Definition ID identifying the definition used to create this process instance
ProcessDefinitionBusinessName	O	WMTText	Business name of the process definition
Extension Number	M	WMTInt16	'1'
Extension Type	M	WMTText	'4MIME'
SourceConversation ID	M	WMTText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMTText	As supplied by target workflow engine or by the transport mechanism

Source Workflow Engine Audit Data - Response

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMTOBJECTID	Unique ID of initial (root) process instance
Current Process Instance ID	M	WMTOBJECTID	Unique ID of current process instance
Activity Instance ID	O	WMTOBJECTID	Unique ID of current activity instance
Process State	M	WMTOBJECTState	'open.not-running'
Event Code	M	WMTEventCode	'WMReceivedCreatedProcessInstance'
Contract ID	M	WMTRResourceID	Contract ID for source workflow engine
Node ID	M	WMTRResourceID	Node ID for source workflow engine
User ID	O	WMTRResourceID	ID of user whom the business would consider the primary person involved with this event. This could be a person or entity. May be null.
Role ID	O	WMTRResourceID	null | as supplied by target workflow engine
Timestamp	M	WMTDateTime	Timestamp event was recorded
Information ID	M	WMTOBJECTID	'WfMC'
MessageID	O	WMTOBJECTID	Message ID associated with event.
SourceActivityDefinitionBusiness Name	O	WMTOBJECTName	Business name of current activity on the source engine originating the request to create a new process instance
TargetProcessDefinitionID	M	WMTOBJECTID	as supplied to target workflow engine
Target Process Instance ID	M	WMTOBJECTID	Process instance created on target

TargetProcessDefinitionBusinessName	O	WMObjectName	workflow engine null | as supplied by target workflow engine
TargetNodeID	M	WMResourceID	Node ID of Workflow Engine accepting the conversation request.
TargetUserID	O	WMResourceID	ID of remote user requested to perform the process (may be null)
TargetRoleID	O	WMResourceID	ID of remote role requested to perform the process (may be null)
Target State	O	WMObjectState	State of new process instance
Extension Number	M	WMInt16	'1'
Extension Type	M	WMText	'4MIME'
SourceConversation ID	M	WMText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMText	As supplied by target workflow engine or by the transport mechanism

Target Workflow Engine Audit Data - Response

Name	M/O	Data Type	Description
InitialProcessInstanceID	M	WMObjectID	Process Instance ID for process instance on source workflow engine which caused the request for the sub-process to be created on the target workflow engine
CurrentProcessInstanceID	M	WMObjectID	Process Instance ID for sub-process created on the target workflow engine
ActivityInstanceID	O	WMObjectID	null
ProcessState	M	WMObjectState	State of created process instance
EventCode	M	WMEventCode	'WMSentCreatedProcessInstance'
ContractID	M	WMResourceID	Contract ID for source workflow engine
NodeID	M	WMResourceID	Node ID for target workflow engine
UserID	O	WMResourceID	null or as instantiated
RoleID	O	WMResourceID	null or as instantiated
Timestamp	M	WMDateTime	Timestamp for when request to create process instance was received
InformationID	M	WMObjectID	'WfMC'
MessageID	O	WMObjectID	Message ID associated with event.
SourceInitialProcessInstance ID	M	WMObjectID	Initial Process Instance ID of source workflow engine
SourceCurrentProcessInstanceID	M	WMObjectID	Current Process Instance ID of source workflow engine
SourceActivityInstanceID	M	WMObjectID	Activity Instance ID of the source WFE
SourceTimestamp	M	WMDateTime	Timestamp of source WFE event
SourceNodeID	M	WMResourceID	Node ID of source Workflow Engine

SourceUserID	O	WMResourceID	User ID associated with the remote workflow engine request
SourceRoleID	O	WMResourceID	Role ID associated with the remote workflow engine request
SourceProcess Definition ID	M	WMObjectID	as supplied by source workflow engine
SourceProcessDefinition BusinessName	O	WMText	Business name of remote workflow engine process that generated the start process request.
SourceActivityDefinition BusinessName	O	WMText	Business name of the remote WFE activity spawning the request
Extension Number	M	WMInt16	'1'
Extension Type	M	WMText	'4MIME'
SourceConversation ID	M	WMText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMText	As supplied by target workflow engine or by the transport mechanism

13.2.3 Get Process Instance Attributes

The following audit data records would be created as a result of the target workflow engine successfully providing each requested attribute value at the behest of the source workflow engine.

Source Workflow Engine Audit Data -- Request

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMXObjectID	Unique ID of initial (root) process instance
Current Process Instance ID	M	WMXObjectID	Unique ID of current process instance
Activity Instance ID	O	WMXObjectID	Unique ID of current activity instance (may be null)
Process State	M	WMXObjectState	State of process instance on source workflow engine
Event Code	M	WMTEventCode	'WMSentRequestGetProcessInstanceAttribute'
Contract ID	M	WMTResourceID	Contract ID for source workflow engine
Node ID	M	WMTResourceID	Node ID for source workflow engine
User ID	O	WMTResourceID	ID of user whom the business would consider the primary person involved with this event. This could be a person or entity. May be null.
Role ID	O	WMTResourceID	null | as instantiated
Timestamp	M	WMTDateTime	Timestamp event was recorded
Information ID	M	WMXObjectID	'WfMC'
MessageID	O	WMXObjectID	Message ID associated with event.
Source Activity Definition Business Name	O	WMObjectName	Business name of current activity on the source engine (may be null)
Target Process Instance ID	M	WMXObjectID	Process instance on target workflow engine
Target Process Definition Business Name	O	WMObjectName	null | as declared in process definition
TargetNodeID	M	WMTResourceID	Node ID of Workflow Engine accepting request for attribute value(s).
TargetUserID	O	WMTResourceID	ID of remote user requested to provide attribute value (may be null)
TargetRoleID	O	WMTResourceID	ID of remote role requested to provide attribute value (may be null)
Attribute Name	O	WMTAttributeName	Name of attribute requested
Extension Number	M	WMTInt16	'1'
Extension Type	M	WMTText	'4MIME'
SourceConversation ID	M	WMTText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMTText	As supplied by target workflow engine or by the transport mechanism

Target Workflow Engine Audit Data -- Request

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMObjectID	Process Instance ID for process instance on source workflow engine which caused the request for the sub-process to be created on the target workflow engine
Current Process Instance ID	M	WMObjectID	Process Instance ID for sub-process created on the target workflow engine
Activity Instance ID	O	WMObjectID	null
Process State	M	WMObjectState	State of process instance
Event Code	M	WMTEventCode	'WMReceivedRequestGetProcessInstanceAttribute'
Contract ID	M	WMResourceID	Contract ID for source workflow engine
Node ID	M	WMResourceID	Node ID for target workflow engine
User ID	O	WMResourceID	null or as instantiated
Role ID	O	WMResourceID	null or as instantiated
Current Timestamp	M	WMDateTime	Timestamp for when attribute value was sent
Information ID	M	WMObjectID	'WfMC'
MessageID	O	WMObjectID	Message ID associated with event.
SourceInitialProcessInstance ID	M	WMObjectID	Initial Process Instance ID of source workflow engine
SourceCurrentProcess InstanceID	M	WMObjectID	Current Process Instance ID of source workflow engine
SourceActivityInstanceID	M	WMObjectID	Activity Instance ID of the source WFE
SourceTimestamp	M	WMDateTime	Timestamp of source WFE event
SourceNodeID	M	WMResourceID	Node ID of source Workflow Engine
SourceUserID	O	WMResourceID	User ID associated with the remote workflow engine request
SourceRoleID	O	WMResourceID	Role ID associated with the remote workflow engine request
SourceProcessDefinition BusinessName	O	WMText	Business name of remote workflow engine process that generated the start process request.
SourceActivityDefinition BusinessName	O	WMText	Business name of the remote WFE activity spawning the request
Attribute Name	O	WMAttributeName	Name of attribute requested
Extension Number	M	WMInt16	'1'
Extension Type	M	WMText	'4MIME'
SourceConversation ID	M	WMText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMText	As supplied by target workflow engine or by the transport mechanism

Source Workflow Engine Audit Data - Response

	M/O	Data Type	
Initial Process Instance ID	M	WMTOBJECTID	Process Instance ID for process instance on source workflow engine which caused the request for the sub-process to be created on the target workflow engine
Current Process Instance ID	M	WMTOBJECTID	Process Instance ID for sub-process created on the target workflow engine
Activity Instance ID	O	WMTOBJECTID	null
Process State	M	WMTOBJECTSTATE	State of process instance
Event Code	M	WMTEVENTCODE	'WMReceivedRetrievedProcessInstanceAttribute'
Contract ID	M	WMRESOURCEID	Contract ID for source workflow engine
Node ID	M	WMRESOURCEID	Node ID for target workflow engine
User ID	O	WMRESOURCEID	null or as instantiated
Role ID	O	WMRESOURCEID	null or as instantiated
Current Timestamp	M	WMDATE TIME	Timestamp for when attribute value was sent
Information ID	M	WMTOBJECTID	'WfMC'
MessageID	O	WMTOBJECTID	Message ID associated with event.
SourceInitialProcessInstance ID	M	WMTOBJECTID	Initial Process Instance ID of source workflow engine
SourceCurrentProcess InstanceID	M	WMTOBJECTID	Current Process Instance ID of source workflow engine
SourceActivityInstanceID	M	WMTOBJECTID	Activity Instance ID of the source WFE
SourceTimestamp	M	WMDATE TIME	Timestamp of source WFE event
SourceNodeID	M	WMRESOURCEID	Node ID of source Workflow Engine
SourceUserID	O	WMRESOURCEID	User ID associated with the remote workflow engine request
SourceRoleID	O	WMRESOURCEID	Role ID associated with the remote workflow engine request
SourceProcessDefinition BusinessName	O	WMTEXT	Business name of remote workflow engine process that generated the start process request.
SourceActivityDefinition BusinessName	O	WMTEXT	Business name of the remote WFE activity spawning the request
Attribute Name	O	WMATTRIBUTE NAME	Name of attribute requested
Attribute Type	O	WMATTRIBUTETYPE	Type of attribute requested
Attribute Length	O	WMATTRIBUTELENGTH	Length of requested attribute
Attribute Value	O	WMATTRIBUTEVALUE	Value
Extension Number	M	WMINT16	'1'
Extension Type	M	WMTEXT	'4MIME'
SourceConversation ID	M	WMTEXT	As supplied by source workflow engine or by the transport mechanism

TargetConversation ID	M		As supplied by target workflow engine or by the transport mechanism
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Target Workflow Engine Audit Data - Response

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMObjectID	Unique ID of initial (root) process instance
Current Process Instance ID	M	WMObjectID	Unique ID of current process instance
Activity Instance ID	O	WMObjectID	Unique ID of current activity instance (may be null)
Process State	M	WMObjectState	State of process instance on source workflow engine
Event Code	M	WMTEventCode	'WMSentRetrievedProcessInstanceAttribute'
Contract ID	M	WMTResourceID	Contract ID for source workflow engine
Node ID	M	WMTResourceID	Node ID for source workflow engine
User ID	O	WMTResourceID	ID of user whom the business would consider the primary person involved with this event. This could be a person or entity. May be null.
Role ID	O	WMTResourceID	null | as instantiated
Timestamp	M	WMDateTime	Timestamp event was recorded
Information ID	M	WMObjectID	'WfMC'
MessageID	O	WMObjectID	Message ID associated with event.
Source Activity Definition Business Name	O	WMObjectName	Business name of current activity on the source engine (may be null)
Target Process Instance ID	M	WMObjectID	Process instance on target workflow engine
Target Process Definition Business Name	O	WMObjectName	null | as declared in process definition
TargetNodeID	M	WMTResourceID	Node ID of Workflow Engine accepting request for attribute value(s).
TargetUserID	O	WMTResourceID	ID of remote user requested to provide attribute value (may be null)
TargetRoleID	O	WMTResourceID	ID of remote role requested to provide attribute value (may be null)
Attribute Name	O	WMTAttributeName	Name of attribute requested
Attribute Type	O	WMTAttributeType	Type of attribute requested
Attribute Length	O	WMTAttributeLength	Length of requested attribute
Attribute Value	O	WMTAttributeValue	Value
Extension Number	M	WMInt16	'1'
Extension Type	M	WMText	'4MIME'
SourceConversation ID	M	WMText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMText	As supplied by target workflow engine or by the transport mechanism

13.2.4 Get Process Instance State

Audit data is not specified for this operation.

13.2.5 Process Instance Attribute Changed

The following audit data records would be created as a result of the workflow engine having changed the value of a notifiable attribute.

- Actual Event

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMObjectID	Process Instance ID for process instance on Source workflow engine which caused the request for the sub-process to be created on the target workflow engine
Current Process Instance ID	M	WMObjectID	Process Instance ID for sub-process created on the target workflow engine
Activity Instance ID	O	WMObjectID	null
Process State	M	WMObjectState	State of created process instance
Event Code	M	WMTEventCode	'WMAssignedProcessInstanceAttribute'
Contract ID	M	WMResourceID	Contract ID for source workflow engine
Node ID	M	WMResourceID	Node ID for target workflow engine
User ID	O	WMResourceID	null or as instantiated
Role ID	O	WMResourceID	null or as instantiated
Timestamp	M	WMDateTime	Timestamp for when request to create process instance was received
Information ID	M	WMObjectID	'WfMC'
MessageID	O	WMObjectID	Message ID associated with event.
Changed Attribute Name	M	WMTAttributeName	Name of attribute changed
Changed Attribute Type	M	WMTAttributeType	Type of attribute changed
Changed Attribute Length	M	WMTAttributeLength	Changed length of attribute
Changed Attribute Value	M	WMTAttributeValue	New value
Extension Number	M	WMInt16	'1'
Extension Type	M	WMText	'4MIME'
SourceConversation ID	M	WMText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMText	As supplied by target workflow engine or by the transport mechanism

Notifying Workflow Engine Audit Data – Notification

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMObjectID	Unique ID of initial (root) process instance
Current Process Instance ID	M	WMObjectID	Unique ID of current process instance
Activity Instance ID	O	WMObjectID	Unique ID of current activity instance
Process State	M	WMObjectState	state of process instance when event occurred
EventCode	M	WMTEventCode	'WMSentChangedProcessInstanceAttribute'

ContractID	M	WMTRResourceID	Contract ID for source workflow engine
NodeID	M	WMTRResourceID	Node ID for source workflow engine
UserID	O	WMTRResourceID	ID of user whom the business would consider the primary person involved with this event. This could be a person or entity. May be null.
RoleID	O	WMTRResourceID	null | as instantiated
CurrentTimestamp	M	WMTDateTime	Timestamp event was recorded
InformationID	M	WMTObjectID	'WfMC'
MessageID	O	WMTObjectID	Message ID associated with event.
Source Activity Definition Business Name	O	WMTObjectName	Business name of current activity on the source engine when attribute value changed
Target Process Instance ID	M	WMTObjectID	Process instance created on target workflow engine
TargetNodeID	M	WMTRResourceID	Node ID of Workflow Engine receiving the notification.
TargetTimestamp	M	WMTDateTime	Timestamp event was recorded
Attribute Name	O	WMTAttributeName	Name of attribute changed
Attribute Type	O	WMTAttributeType	Type of attribute changed
Attribute Length	O	WMTAttributeLength	Changed length of attribute
Attribute Value	O	WMTAttributeValue	New value
Extension Number	M	WMTInt16	'1'
Extension Type	M	WMTText	'4MIME'
SourceConversation ID	M	WMTText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMTText	As supplied by target workflow engine or by the transport mechanism

Target Workflow Engine Audit Data

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMTObjectID	Unique ID of initial (root) process instance
Current Process Instance ID	M	WMTObjectID	Unique ID of current process instance
Activity Instance ID	O	WMTObjectID	Unique ID of current activity instanceRemoteAID=2
Process State	M	WMTObjectState	state of current process instance
Event Code	M	WMTEventCode	'WMReceivedChangedProcessInstanceAttribute'
Contract ID	M	WMTRResourceID	Contract ID for target workflow engine
Node ID	M	WMTRResourceID	Node ID for target workflow engine
User ID	O	WMTRResourceID	ID of user whom the business would consider the primary person involved with this event. This could be a person or entity. May be null.
Role ID	O	WMTRResourceID	null | as instantiated

Current Timestamp	M	WMTDateTime	Timestamp for when notification was received
Information ID	M	WMTObjectID	'WfMC'
MessageID	M	WMTObjectID	Message ID associated with event.
Source Activity Definition Business Name	O	WMTObjectName	Business name of current activity on the source engine when the process attribute value changed
Source Process Instance ID	M	WMTObjectID	Process instance ID on source workflow engine
Source Activity Instance ID	M	WMTObjectID	Remote workflow engine activity instance ID
sourceNodeID	M	WMTResourceID	Node ID of Workflow Engine sending the notification.
SourceTimestamp	M	WMTDateTime	Timestamp event was recorded on remote engine
Attribute Name	O	WMTAttributeName	Name of attribute changed
Attribute Type	O	WMTAttributeType	Type of attribute changed
Attribute Length	O	WMTAttributeLength	Changed length of attribute
Attribute Value	O	WMTAttributeValue	New value
Extension Number	M	WMTInt16	'1'
Extension Type	M	WMTText	'4MIME'
SourceConversation ID	M	WMTText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMTText	As supplied by target workflow engine or by the transport mechanism

13.2.6 Process Instance State Changed

The following audit data records would be created as a result of the completion of a process instance being enacted on the source workflow engine on behalf of the target workflow engine.

Notifying Workflow Engine Audit Data - Actual Event

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMTOBJECTID	Unique ID of initial (root) process instance
Current Process Instance ID	M	WMTOBJECTID	Unique ID of current process instance
Activity Instance ID	O	WMTOBJECTID	Unique ID of current activity instance
Process State	M	WMTOBJECTSTATE	new state of process instance
Event Code	M	WMTEVENTCODE	'WMChangedProcessInstanceState'
Contract ID	M	WMRESOURCEID	Contract ID for source workflow engine
Node ID	M	WMRESOURCEID	Node ID for source workflow engine
User ID	O	WMRESOURCEID	ID of user whom the business would consider the primary person involved with this event. This could be a person or entity. May be null.
Role ID	O	WMRESOURCEID	null | as supplied by target workflow engine
Timestamp	M	WMTDATETIME	Timestamp event was recorded
Information ID	M	WMTOBJECTID	'WfMC'
PreviousProcessState	M	WMTOBJECTSTATE	State of process instance prior to change
Extension Number	M	WMINT16	'1'
Extension Type	M	WMTEXT	'4MIME'
SourceConversation ID	M	WMTEXT	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMTEXT	As supplied by target workflow engine or by the transport mechanism

Notifying Workflow Engine Audit Data – Notification

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMTOBJECTID	Unique ID of initial (root) process instance
Current Process Instance ID	M	WMTOBJECTID	Unique ID of current process instance
Activity Instance ID	O	WMTOBJECTID	Unique ID of current activity instance
Process State	M	WMTOBJECTSTATE	new state of process instance
Event Code	M	WMTEVENTCODE	'WMSentChangedProcessInstanceState'
Contract ID	M	WMRESOURCEID	Contract ID for source workflow engine
Node ID	M	WMRESOURCEID	Node ID for source workflow engine
User ID	O	WMRESOURCEID	ID of user whom the business would consider the primary person involved with this event. This could be a person or entity. May be null.
Role ID	O	WMRESOURCEID	null | as instantiated

Current Timestamp	M	WMDateTime	Timestamp event was recorded
Information ID	M	WMObjectID	'WfMC'
MessageID	M	WMObjectID	Message ID associated with event.
Source Activity Definition Business Name	O	WMObjectName	Business name of first activity on the source engine
Target Process Instance ID	M	WMObjectID	Process instance created on target workflow engine
Target Activity Instance ID	M	WMObjectID	Remote workflow engine activity instance ID
TargetNodeID	M	WMResourceID	Node ID of Workflow Engine receiving the notification.
TargetTimestamp	M	WMDateTime	Timestamp event was recorded
Extension Number	M	WMInt16	'1'
Extension Type	M	WMText	'4MIME'
SourceConversation ID	M	WMText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMText	As supplied by target workflow engine or by the transport mechanism

Target Workflow Engine Audit Data

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMObjectID	Unique ID of initial (root) process instance
Current Process Instance ID	M	WMObjectID	Unique ID of current process instance
Activity Instance ID	O	WMObjectID	Unique ID of current activity instanceRemoteAID=2
Process State	M	WMObjectState	state of current process instance
Event Code	M	WMEventCode	'WMReceivedChangedProcessInstanceState'
Contract ID	M	WMResourceID	Contract ID for target workflow engine
Node ID	M	WMResourceID	Node ID for target workflow engine
User ID	O	WMResourceID	ID of user whom the business would consider the primary person involved with this event. This could be a person or entity. May be null.
Role ID	O	WMResourceID	null | as instantiated
Current Timestamp	M	WMDateTime	Timestamp for when notification was received
Information ID	M	WMObjectID	'WfMC'
MessageID	M	WMObjectID	Message ID associated with event.
Source Activity Definition Business Name	O	WMObjectName	Business name of current activity on the source engine when the process instance state change occurred
Source Process Instance ID	M	WMObjectID	Process instance for which state change occurred on source workflow engine
Source Activity Instance ID	M	WMObjectID	Remote workflow engine activity instance ID
SourceNodeID	M	WMResourceID	Node ID of Workflow Engine sending the

SourceTimestamp	M	WMTDateTime	notification. Timestamp event was recorded on remote engine
Extension Number	M	WMTInt16	'1'
Extension Type	M	WMTText	'4MIME'
SourceConversation ID	M	WMTText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMTText	As supplied by target workflow engine or by the transport mechanism

13.2.7 Set Process Instance Attributes

The following audit data records would be created as a result of the target workflow engine successfully changing each attribute value at the behest of the source workflow engine.

Source Workflow Engine Audit Data -- Request

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMObjectID	Unique ID of initial (root) process instance
Current Process Instance ID	M	WMObjectID	Unique ID of current process instance
Activity Instance ID	O	WMObjectID	Unique ID of current activity instance
Process State	M	WMObjectState	State of process instance on source workflow engine
Event Code	M	WMTEventCode	'WMSentRequestChangeProcessInstanceAttribute'
Contract ID	M	WMResourceID	Contract ID for source workflow engine
Node ID	M	WMResourceID	Node ID for source workflow engine
User ID	O	WMResourceID	ID of user whom the business would consider the primary person involved with this event. This could be a person or entity. May be null.
Role ID	O	WMResourceID	null | as supplied by target workflow engine
Timestamp	M	WMDateTime	Timestamp event was recorded
Information ID	M	WMObjectID	'WfMC'
MessageID	O	WMObjectID	Message ID associated with event.
SourceActivityDefinitionBusiness Name	O	WMObjectName	Business name of current activity on the source engine originating the request to create a new process instance
TargetProcessInstanceID	M	WMObjectID	Process instance created on target workflow engine
TargetProcessDefinitionBusiness Name	O	WMObjectName	null | as supplied by target workflow engine
TargetNodeID	M	WMResourceID	Node ID of Workflow Engine accepting the conversation request.
TargetUserID	O	WMResourceID	ID of remote user requested to perform the process (may be null)
TargetRoleID	O	WMResourceID	ID of remote role requested to perform the process (may be null)
Target State	O	WMObjectState	State of new process instance
Attribute Name	O	WMTAttributeName	Name of attribute changed
Attribute Type	O	WMTAttributeType	Type of attribute changed
Attribute Length	O	WMTAttributeLength	Changed length of attribute
Attribute Value	O	WMTAttributeValue	New value
Extension Number	M	WMTInt16	'1'
Extension Type	M	WMTText	'4MIME'
SourceConversation ID	M	WMTText	As supplied by source workflow engine or by the

TargetConversation ID	M	WMTText	transport mechanism As supplied by target workflow engine or by the transport mechanism
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Target Workflow Engine Audit Data -- Request

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMTOBJECTID	Process Instance ID for process instance on Source workflow engine which caused the request for the sub-process to be created on the target workflow engine
Current Process Instance ID	M	WMTOBJECTID	Process Instance ID for sub-process created on the target workflow engine
Activity Instance ID	O	WMTOBJECTID	null
Process State	M	WMTOBJECTSTATE	State of created process instance
Event Code	M	WMTEVENTCODE	'WMReceivedRequestChangeProcessInstanceAttribute'
Contract ID	M	WMRESOURCEID	Contract ID for source workflow engine
Node ID	M	WMRESOURCEID	Node ID for target workflow engine
User ID	O	WMRESOURCEID	null or as instantiated
Role ID	O	WMRESOURCEID	null or as instantiated
Timestamp	M	WMTDATETIME	Timestamp for when request to create process instance was received
Information ID	M	WMTOBJECTID	'WfMC'
MessageID	O	WMTOBJECTID	Message ID associated with event.
SourceInitialProcessInstanceID	M	WMTOBJECTID	Initial Process Instance ID of source workflow engine
SourceCurrentProcessInstanceID	M	WMTOBJECTID	Current Process Instance ID of source workflow engine
SourceActivityInstanceID	M	WMTOBJECTID	Activity Instance ID of the source WFE
SourceTimestamp	M	WMTDATETIME	Timestamp of source WFE event
SourceNodeID	M	WMRESOURCEID	Node ID of source Workflow Engine
SourceUserID	O	WMRESOURCEID	User ID associated with the remote workflow engine request
SourceRoleID	O	WMRESOURCEID	Role ID associated with the remote workflow engine request
SourceProcessDefinition BusinessName	O	WMTTEXT	Business name of remote workflow engine process that generated the start process request.
SourceActivityDefinition BusinessName	O	WMTTEXT	Business name of the remote WFE activity spawning the request
Attribute Name	O	WMTATTRIBUTEName	Name of attribute changed
Attribute Type	O	WMTATTRIBUTEType	Type of attribute changed
Attribute Length	O	WMTATTRIBUTELength	Changed length of attribute

Attribute Value	M	WMTAttributeValue	New value
Extension Type	M	WMTInt16	'4MIME'
SourceConversation ID		WMTText	As supplied by source workflow engine or by the
TargetConversation ID	M		As supplied by target workflow engine or by the transport mechanism

Name	M/O		Description
Initial Process Instance ID	M	WMTObjectID	Unique ID of initial (root) process instance
Activity Instance ID	O	WMTObjectID	Unique ID of current activity instance
Process State		WMTObjectState	State of process instance on source workflow
Event Code	M		'WMAssignedProcessInstanceAttribute'
Contract ID	M	WMTResourceID	Contract ID for source workflow engine
User ID	O	WMTResourceID	ID of user whom the business would consider the primary person involved with this event.
Role ID	O		null | as supplied by target workflow engine
Timestamp	M	WMTDateTime	Timestamp event was recorded
MessageID	O	WMTObjectID	Message ID associated with event.
SourceActivityInstanceID	M	WMTResourceID	Activity ID on source workflow engine
RemoteProcessInstanceID	M		Process instance on target workflow engine
RemoteTimestamp		WMAObjectID	Timestamp for when attribute value changed
RemoteProcessDefinitionBusiness Name	O	WMTObjectName	null | as supplied by target workflow engine
Attribute Type	O	WMTAttributeName	Type of attribute changed
Attribute Length	O	WMTAttributeLength	Changed length of attribute
Extension Number	M	WMTAttributeValue	'1'
Extension Type	M	WMTText	'4MIME'
TargetConversation ID		WMTText	the transport mechanism
		WMTText	As supplied by target workflow engine or by

			the transport mechanism
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Target Workflow Engine Audit Data - Operation

	M/O	Data Type	
Initial Process Instance ID	M		Process Instance ID for process instance on Source workflow engine which caused the request for the engine
Current Process Instance ID		WMObjectID	Process Instance ID for sub-process created on the
Activity Instance ID	O		null
Process State		WMObjectState	State of created process instance
	M	WMTEventCode	
Contract ID	M		Contract ID for source workflow engine
Node ID		WMResourceID	Node ID for target workflow engine
	O	WMResourceID	
Role ID	O		null or as instantiated
Timestamp		WMDateTime	Timestamp for when request to create process
Information ID	M		'WfMC'
Changed Attribute Name		WMAttributeName	Name of attribute changed
	M	WMAttributeType	
Changed Attribute Length	M		Changed length of attribute
Changed Attribute Value		WMAttributeValue	New value
	M	WMInt16	
Extension Type	M		'4MIME'
SourceConversation ID		WMText	As supplied by source workflow engine or by the
TargetConversation ID	M		As supplied by target workflow engine or by the transport mechanism

Name	M/O		Description
Initial Process Instance ID		WMObjectID	Process Instance ID for process instance on
	M	WMObjectID	for the sub-process to be created on the target workflow engine
Activity Instance ID		WMObjectID	target workflow engine
	M	WMObjectState	null
Event Code	M		'WMReceivedChangedProcessInstanceAttribute'

Contract ID	M	WMTResourceID	Contract ID for source workflow engine
Node ID		WMTResourceID	Node ID for target workflow engine
	O	WMTResourceID	
Role ID	O		null or as instantiated
Timestamp		WMTDateTime	Timestamp for when request to create process
Information ID	M		'WfMC'
MessageID		WMTObjectID	Message ID associated with event.
ID	M		Initial Process Instance ID of source workflow engine
InstanceID	M		Current Process Instance ID of source workflow engine
	M	WMTObjectID	
SourceTimestamp	M		Timestamp of source WFE event
SourceNodeID		WMTResourceID	Node ID of source Workflow Engine
	O	WMTResourceID	engine request
SourceRoleID		WMTResourceID	Role ID associated with the remote workflow
SourceProcessDefinition BusinessName		WMTText	Business name of remote workflow engine process
SourceActivityDefinition BusinessName		WMTText	Business name of the remote WFE activity
Attribute Name	O		Name of attribute changed
Attribute Type		WMTAttributeType	Type of attribute changed
	O	WMTAttributeLengt	Changed length of attribute
Attribute Value		WMTAttributeValue	New value
	M	WMTInt16	
Extension Type	M		'4MIME'
SourceConversation ID		WMTText	As supplied by source workflow engine or by the
TargetConversation ID	M		As supplied by target workflow engine or by the transport mechanism

Name	M/O		Description
Initial Process Instance ID		WMTObjectID	Unique ID of initial (root) process instance
	M	WMTObjectID	
Activity Instance ID	O		Unique ID of current activity instance
Process State		WMTObjectState	State of process instance on source workflow

			engine
Contract ID	M	WMTEventCode	
Node ID	M	WMTResourceID	Contract ID for source workflow engine
		WMTResourceID	Node ID for source workflow engine
	O	WMTResourceID	the primary person involved with this event. This could be a person or entity. May be null.
	O	WMTResourceID	
Timestamp	M		Timestamp event was recorded
Information ID		WMTObjectID	'WfMC'
	O	WMTObjectID	
SourceActivityDefinitionBusiness Name		WMTObjectName	Business name of current activity on the source process instance
TargetProcessInstanceID		WMTObjectID	Process instance created on target workflow
TargetProcessDefinitionBusiness Name		WMTObjectName	null | as supplied by target workflow engine
	M	WMTResourceID	conversation request.
TargetUserID		WMTResourceID	ID of remote user requested to perform the
TargetRoleID	O		ID of remote role requested to perform the process (may be null)
	O	WMTAttributeName	
Attribute Type	O		Type of attribute changed
Attribute Length		WMTAttributeLength	Changed length of attribute
	O	WMTAttributeValue	
Extension Number	M		'1'
Extension Type		WMTText	'4MIME'
	M	WMTText	the transport mechanism
TargetConversation ID		WMTText	As supplied by target workflow engine or by

13.2.8 Start Conversation

Source Engine Audit Data

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMObjectID	Unique ID of initial (root) process instance
Current Process Instance ID	M	WMObjectID	Unique ID of current process instance
Activity ID	O	WMObjectID	Unique ID of current activity instance
Process State	M	WMObjectState	The state of the current process instance
Event Code	M	WMTEventCode	'WMStartedConversation'
Contract ID	M	WMResourceID	Contract ID for source workflow engine
Node ID	M	WMResourceID	Node ID for source workflow engine
User ID	O	WMResourceID	ID of user whom the business would consider the primary person involved with this event. This could be a person or entity. May be null.
Role ID	O	WMResourceID	null | the role of the user involved in this event
Current Timestamp	M	WMDateTime	Time when event was recorded
InformationID	M	WMObjectID	'WfMC'
MessageID	O	WMObjectID	Message ID associated with event.
CorrespondentContextID	M	WMResourceID	ContractID of Workflow Engine accepting the conversation request.
CorrespondentNodeID	M	WMResourceID	Node ID of Workflow Engine accepting the conversation request.
Extension Number	M	WMInt16	'1'
Extension Type	M	WMText	'4MIME'
SourceConversation ID	M	WMText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMText	As supplied by target workflow engine or by the transport mechanism

Target Workflow Engine Audit Data

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMObjectID	Process Instance ID for process instance on source workflow engine which caused the request for the conversation to be started
Current Process Instance ID	M	WMObjectID	null
Activity ID	O	WMObjectID	null
Process State	M	WMObjectState	null
Event Code	M	WMTEventCode	'WMStartedConversation'
Contract ID	M	WMResourceID	Contract ID for target workflow engine
Node ID	M	WMResourceID	Node ID for target workflow engine
User ID	O	WMResourceID	ID of user whom the business would consider the primary person involved with this event. This could

Role ID	O		be a person or entity. May be null.
Current Timestamp		WMTDateTime	null Time event was recorded
	M	WMTObjectID	
MessageID	O		Message ID associated with event.
CorrespondentContextID		WMAResourceID	ContractID of source workflow engine source
CorrespondentNodeID	M		Node ID of source workflow engine source the conversation start.
	M	WMTInt16	
Extension Type	M		'4MIME'
SourceConversation ID		WMTText	As supplied by source workflow engine or by the
TargetConversation ID	M		As supplied by target workflow engine or by the transport mechanism

13.2.9 Stop Conversation

Source Workflow Engine Audit Data

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMTOBJECTID	Unique ID of initial (root) process instance
Current Process Instance ID	M	WMTOBJECTID	Unique ID of current process instance
Activity ID	O	WMTOBJECTID	Unique ID of current activity instance
Process State	M	WMTOBJECTSTATE	The state of the current process instance
Event Code	M	WMTEVENTCODE	'WMStoppedConversation'
Contract ID	M	WMRESOURCEID	Contract ID for source workflow engine
Node ID	M	WMRESOURCEID	Node ID for source workflow engine
User ID	O	WMRESOURCEID	ID of user whom the business would consider the primary person involved with this event. This could be a person or entity. May be null.
Role ID	O	WMRESOURCEID	null | the role of the user involved in this event
Current Timestamp	M	WMTDATETIME	Timestamp provided by target workflow engine
InformationID	M	WMTOBJECTID	'WfMC'
MessageID	O	WMTOBJECTID	Message ID associated with event.
CorrespondentContextID	M	WMARESOURCEID	ContractID of Workflow Engine accepting the conversation request.
CorrespondentNodeID	M	WMARESOURCEID	Node ID of Workflow Engine accepting the conversation request.
Extension Number	M	WMINT16	'1'
Extension Type	M	WMTEXT	'4MIME'
SourceConversation ID	M	WMTEXT	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMTEXT	As supplied by target workflow engine or by the transport mechanism

Target Workflow Engine Audit Data

Name	M/O	Data Type	Description
Initial Process Instance ID	M	WMTOBJECTID	Process Instance ID for process instance on source workflow engine which caused the request for the conversation to be started
Current Process Instance ID	M	WMTOBJECTID	Unique ID of current process instance
Activity ID	O	WMTOBJECTID	Unique ID of current activity instance
Process State	M	WMTOBJECTSTATE	The state of the current process instance
Event Code	M	WMTEVENTCODE	'WMStoppedConversation'
Contract ID	M	WMRESOURCEID	Contract ID for target workflow engine
Node ID	M	WMRESOURCEID	Node ID for target workflow engine
User ID	O	WMRESOURCEID	ID of user whom the business would consider the primary person involved with this event. This could

	O	WMTResourceID	be a person or entity. May be null.
Current Timestamp	M	WMTDateTime	Timestamp event was recorded
InformationID	M	WMTOBJECTID	'WfMC'
MessageID	O	WMTOBJECTID	Message ID associated with event.
CorrespondentContextID	M	WMAResourceID	ContractID of Workflow Engine source the conversation stop.
CorrespondentNodeID	M	WMAResourceID	Node ID of Workflow Engine source the conversation stop.
Extension Number	M	WMTInt16	'1'
Extension Type	M	WMTText	'4MIME'
SourceConversation ID	M	WMTText	As supplied by source workflow engine or by the transport mechanism
TargetConversation ID	M	WMTText	As supplied by target workflow engine or by the transport mechanism

14 Appendix B – Character Set

The following table shows the character set used in this specification. It is a subset of US-ASCII (ANSI)

char	dec	hex	Description	char	dec	hex	Description
()	32	20	Space	(P)	80	50	Capital letter P
(!)	33	21	Exclamation mark	(Q)	81	51	Capital letter Q
(")	34	22	Quotation mark	(R)	82	52	Capital letter R
(#)	35	23	Pound sign	(S)	83	53	Capital letter S
(\$)	36	24	Dollar sign	(T)	84	54	Capital letter T
(%)	37	25	Percent sign	(U)	85	55	Capital letter U
(&)	38	26	Ampersand	(V)	86	56	Capital letter V
(')	39	27	Apostrophe	(W)	87	57	Capital letter W
((	40	28	Left parenthesis	(X)	88	58	Capital letter X
())	41	29	Right parenthesis	(Y)	89	59	Capital letter Y
(*)	42	2A	Asterisk	(Z)	90	5A	Capital letter Z
(+)	43	2B	Plus sign	([	91	5B	Left square bracket
(,)	44	2C	Comma	(\)	92	5C	Reverse solidus, backslash
(-)	45	2D	Hyphen, minus sign	(])	93	5D	Right square bracket
(.)	46	2E	Period, full stop	(^)	94	5E	Circumflex accent
(/)	47	2F	Solidus, slash	(_)	95	5F	Low line, underline
(0)	48	30	Digit zero	(`)	96	60	Grave accent
(1)	49	31	Digit one	(a)	97	61	Small letter a
(2)	50	32	Digit two	(b)	98	62	Small letter b
(3)	51	33	Digit three	(c)	99	63	Small letter c
(4)	52	34	Digit four	(d)	100	64	Small letter d
(5)	53	35	Digit five	(e)	101	65	Small letter e
(6)	54	36	Digit six	(f)	102	66	Small letter f
(7)	55	37	Digit seven	(g)	103	67	Small letter g
(8)	56	38	Digit eight	(h)	104	68	Small letter h
(9)	57	39	Digit nine	(i)	105	69	Small letter i
(:)	58	3A	Colon	(j)	106	6A	Small letter j
(;)	59	3B	Semicolon	(k)	107	6B	Small letter k
(<)	60	3C	Less-than sign, left angle bracket	(l)	108	6C	Small letter l
(=)	61	3D	Equals sign	(m)	109	6D	Small letter m
(>)	62	3E	Greater-than sign, right angle bracket	(n)	110	6E	Small letter n
(?)	63	3F	Question mark	(o)	111	6F	Small letter o
(@)	64	40	Commercial at sign	(p)	112	70	Small letter p
(A)	65	41	Capital letter A	(q)	113	71	Small letter q
(B)	66	42	Capital letter B	(r)	114	72	Small letter r
(C)	67	43	Capital letter C	(s)	115	73	Small letter s
(D)	68	44	Capital letter D	(t)	116	74	Small letter t
(E)	69	45	Capital letter E	(u)	117	75	Small letter u
(F)	70	46	Capital letter F	(v)	118	76	Small letter v
(G)	71	47	Capital letter G	(w)	119	77	Small letter w
(H)	72	48	Capital letter H	(x)	120	78	Small letter x
(I)	73	49	Capital letter I	(y)	121	79	Small letter y
(J)	74	4A	Capital letter J	(z)	122	7A	Small letter z
(K)	75	4B	Capital letter K	{	123	7B	Left curly bracket, left brace
(L)	76	4C	Capital letter L	|	124	7C	Vertical line, vertical bar
(M)	77	4D	Capital letter M	}	125	7D	Right curly bracket, right brace
(N)	78	4E	Capital letter N	~	126	7E	Tilde
(O)	79	4F	Capital letter O				

15 Appendix C – Implementation Hints (Non-Normative)

This appendix presents a collection of useful hints and ideas to implement the specification. This appendix is non-normative, and the hints and ideas presented in here are not required to claim compliance with the specification; however, they may help implementers to architect their implementations.

15.1 Contracts

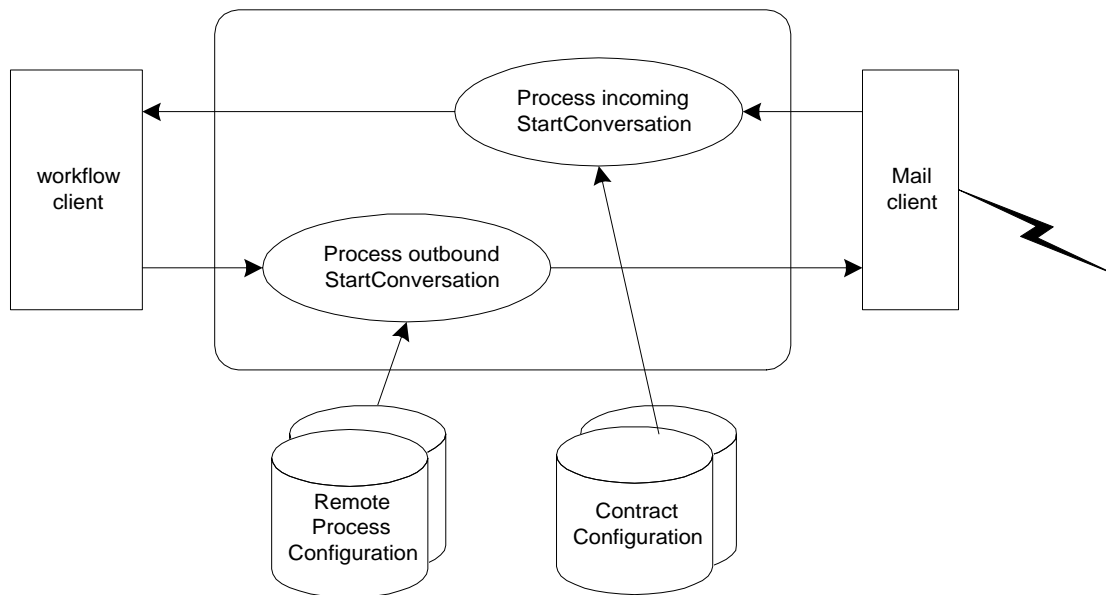
Interoperability contracts denote trading agreements across service boundaries, which operate between workflow applications, enacted on different workflow engines. These cooperating workflow engines may be within the same organization or within separate organizations, that collectively operates a value chain. An interoperability contract governing workflow engine interoperability across a service boundary will describe elements from the list presented below according to the nature and requirements of the business process being supported across the service boundary and the requirements of the organizations operating that process.

1. Which workflow engines within one service domain are visible to/capable of interoperating with workflow engines in the other service domain
2. Which workflow definitions can be enacted within one service domain at the behest of workflow engines in the other service domain
3. The transport binding supported (e.g. MIME)
4. For each workflow definition identified in the contract:
 - The conformance profile required to effect interoperability
 - Enactment requirements. For example, the ProcessDefinitionID, and attributes required to enact the process.
 - For each traded (shared) element of workflow relevant data
 - Access rights (readable/writable)
 - Value constraints (minimum/maximum values, number of permitted updates/accesses)
 - Outcomes/outputs/returned elements of workflow relevant data
 - Audit data policy
 - Change control policy
5. Security policy and implementation
 - Authentication
 - Support for policy on non-repudiation
 - Shared key cryptography & key management
 - Handling security breaches
6. Exception handling/recovery protocols & transactional behavior
7. The handling of lost messages
 - The length of time a workflow engine might wait for a missing message to turn up
 - The number of resend attempts before giving up
 - What to do in case it gives up
8. Service level agreements, metrication/escalation and performance penalties

Individual interoperability contracts will have a unique ContractID identifier, determined by the organizations trading across the service boundary, which is used to support authentication mechanisms.

15.2 Process and Contract Information

To effect interoperability under an agreed contract, it is necessary for an administrator to configure his or her workflow engine. This configuration includes information on incoming requests as well as information required for outbound requests. This configuration information may be maintained in a database, and configuration tools maybe provided. For sake of simplicity, simple configuration files are presented in here.



15.2.1 Incoming Requests

An incoming request start with a StartConversation. The processing of StartConversation includes a validation against the contract information agreed in the business agreement. This information can be described in a contract-configuration file. There is one contract-configuration file for each contract that can be used from external workflow engines. It contains information on which remotes engines have access to this system, and what processes can they enact under that contract.

This is an example of this configuration file:

```
; Example contract configuration
; There should be one of these for each contract that can be used
; by external workflow engines
ContractName=My Friends

; Protocol being used. The only valid value is I4MIME
; This field is optional, if omitted I4MIME is used.
Protocol=I4MIME

; list of workflow engines that are allow to use this contract.
; An "*" indicates any email address is valid
ValidAddress=abc@xyz.com
ValidAddress=friend@other.com
ValidAddress=qwerty@another.com

; List of valid processes that can be enacted
; by an external workflow engine using this contract
ValidProcessDefinitionID=Credit validation
ValidProcessDefinitionID=Expense Report
ValidProcessDefinitionID=PinkSlipProcessing
```

```

; Message timer. Used for retransmissions and
; to ignore expired messages

; Attachment support
; 0- attachment are not supported

; 2- filename referencing
Attachments=1

Reties=5

; Other configuration information

```

15.2.2

Outbound requests also start with the creation of a StartConversation. To create a StartConversation it is necessary to have information on how to contact the remote workflow engine and what business agreement configuration file for each process that can be remotely invoked. It contains information on how to contact the remote workflow engine and what contract to use.

```

; Example process configuration
; There should be one of these for each process that can

; Protocol being used. The only valid value is I4MIME
; This field is optional, if omitted I4MIME is used.

; email address of the remote workflow engine
Address=abc@xyz.com

; to ignore expired messages
Timer=24:00:00

; this workflow engine.
Contract=MyRemoteContract

ProcessDefinitionID=MyRemoteWorkClass

; Attachment support

; 1- part-number referencing
; 2- filename referencing

; Specify the number of lost message retries
Reties=5

; ...

```

15.3 Mailbox Setup

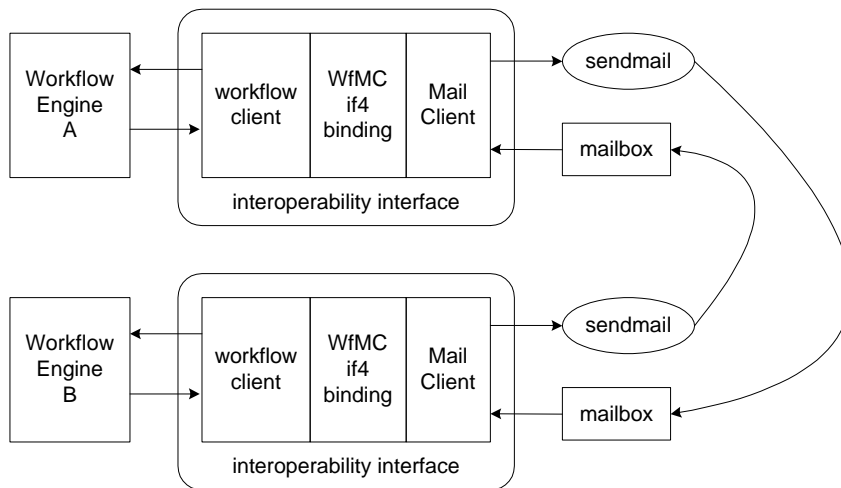
Using a standard utility such as UNIX `sendmail`⁷, a user can be set up to receive requests and responses from other workflow engines. By creating a `.forward` file in the user's home directory, a developer may specify that an application receive messages, piped into its standard input for processing.

An example of the contents of a `.forward` file is:

```
\username, " | /export/home/wfmc/interop"
```

This would automatically invoke the application `/export/home/wfmc/interop` when a mail message is received. The application can interpret requests and responses and make appropriate calls on the vendor's workflow engine.

To send a message to another workflow engine, the message can be written to a file and `sendmail` can be invoked using a system call to dispatch it.



Architecture to effect mail based interoperability between two workflow engines

In this scheme, each workflow engine is uniquely identified by the mailbox it listens to (i.e. its mail address).

⁷ Although this example of an implementation strategy is based on tools and directory structures available in the UNIX environment, similar strategies are feasible for other environments.