Idempotency in Services

Applies to:

SAP Business Suite 7.0 and NetWeaver CE 7.1 EhP1

Summary

Idempotency guarantees delivery of synchronous messages exactly once. This document details the why and how of this feature, as implemented in SAP Business Suite and CE 7.1 EhP1

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Author Bio

Suresh Ranganathan has 12 years of application software development and consulting experience and over 10 years of ABAP experience in SAP application software development. Suresh worked for over three years as Development Manager for SAP standard product development. Currently, he assists customers with implementing business scenarios using SOA principles and tools.

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Prerequisites

It is assumed that the readers are familiar with the basics of SOA and the tools used in a SOA based development.

Why should Services be Idempotent?

In business scenarios, reliable message transfer is required. This means that it must be guaranteed that a message sent to the receiver to modify an object state is processed exactly once (EO). For example, if a new purchase order is to be created via a service invocation, it is neither acceptable to have no purchase order created nor to have two or more duplicates created. In case of asynchronous services, the XI 3.0 protocol guarantees reliability. However, in synchronous communication, there is no intrinsic mechanism guaranteeing that a message sent arrives at the recipient, nor that a request is processed exactly once by the recipient. A message may be lost or arrive several times in case of network problems. Even if a request reaches the provider, the response may be lost during network transport, in which case the consumer might assume that its request did not arrive and resend it.

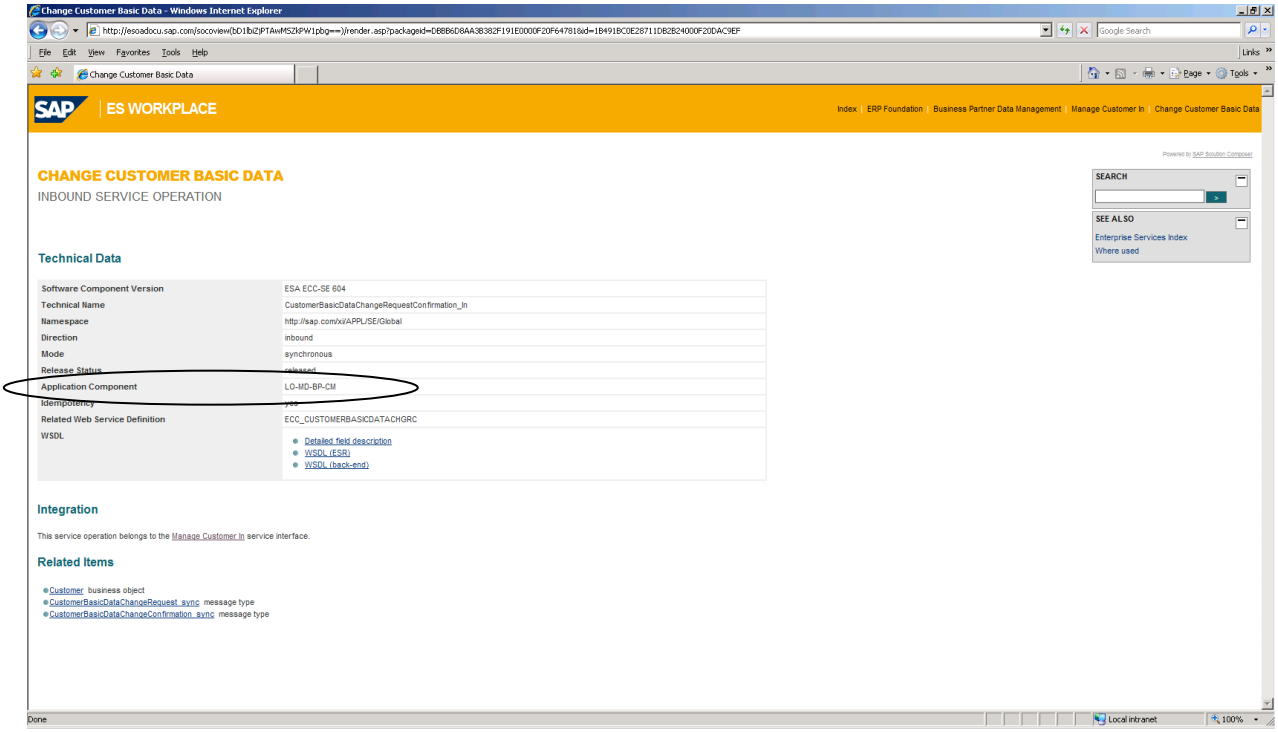
To avoid inconsistencies in the provider or consumer system, the relevant SAP Enterprise Services are implemented as idempotent. An idempotent service receiving the exact same request message multiple times within a limited time frame will still process it once only, and return the original response. The restriction to a limited time frame is made to avoid overloading the database, as the system must store the original response message during the time frame.

More details at
http://esoadocu.sap.com/socoview(bD1lbiZjPTAwMSZkPW1pbg==)/render.asp?packageid=484F2D49F106E577E10000000A4218AA&id=ED8CCB8D3C62430681A66DBC6511A15A

Incidentally, Idempotency is not part of the Web Services Standards

How to check if SAP delivered services are idempotent?

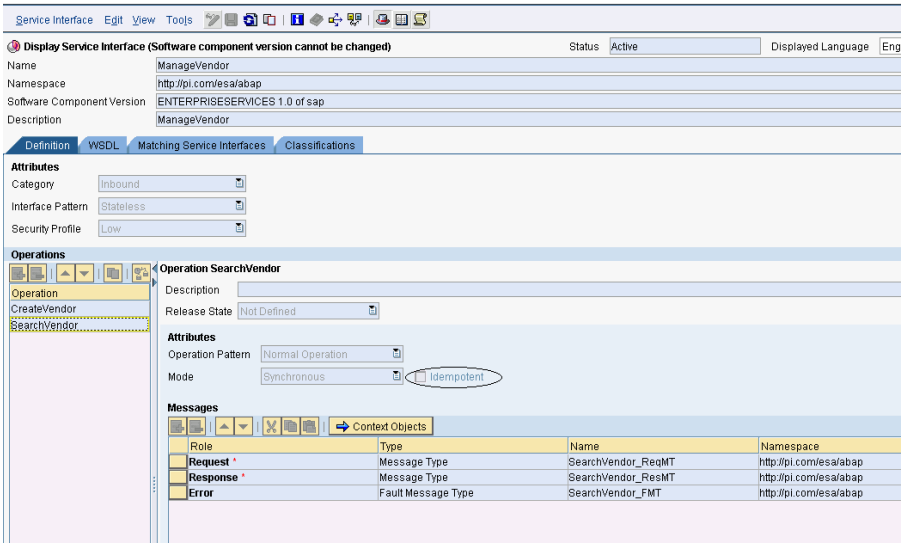
The ES Workplace documents if a service is idempotent or not. See example below.



Most SAP standard services (based on Business Suite), that change state (Create, Update and Delete) are designed to be Idempotent.

Can I indicate Idempotency for a Service at Design time?

Yes. Going forward, it should be possible for services modeled in Enterprise Service Repository (ESR) based on CE7.1.1 (EhP1 of CE 7.1). There is a new option to indicate whether a service is Idempotent or not.



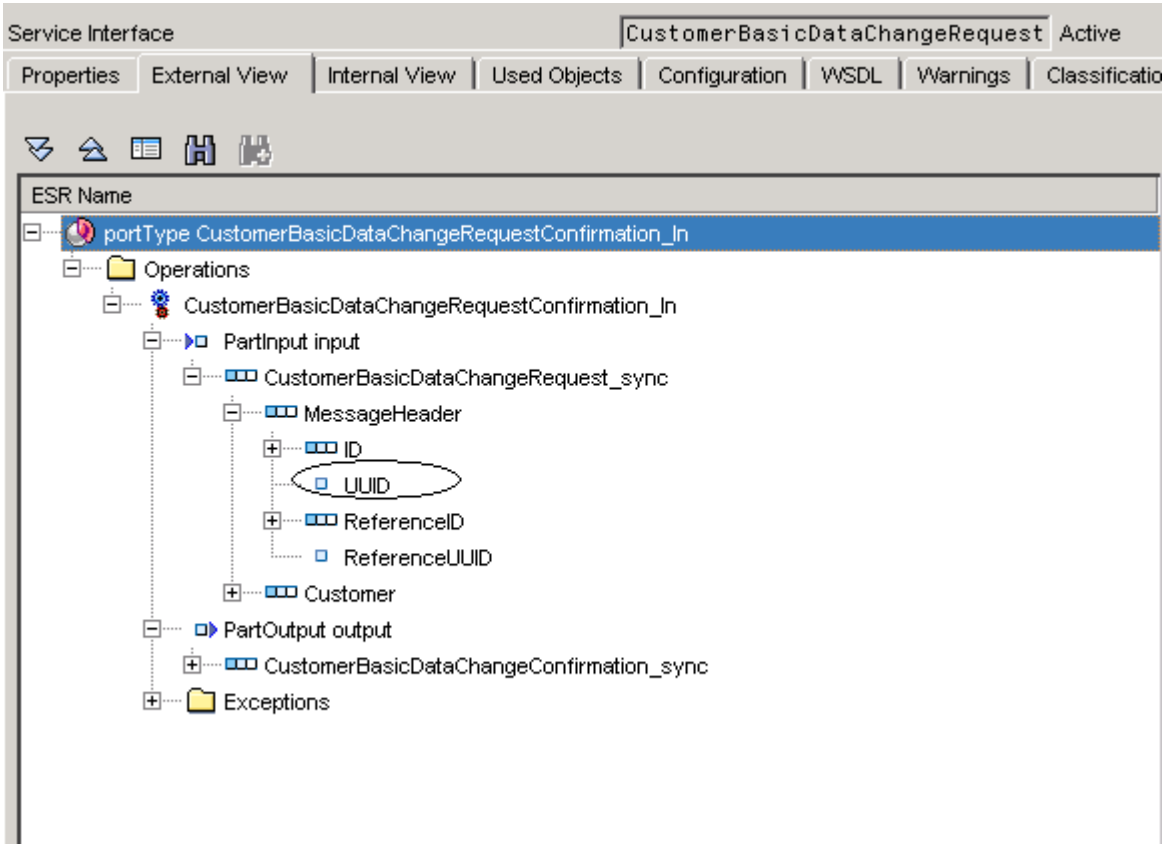
Refer details at

http://help.sap.com/saphelp_nwce711/helpdata/en/b3/373b4546024560949ecd74bd908f7c/frameset.htm

If I am building custom services (in ABAP), how to do I make them Idempotent?

If you are developing your custom services in ABAP, you have to do a few things to make them idempotent. Incidentally you do not need to make Query or Read services (those that don't change the state of the back-end data) idempotent. You would need only to make state-changing services Idempotent.

Make sure though that your service has the 'MessageHeader' element in your service definition. Refer diagram below for how it is done for a SAP standard service

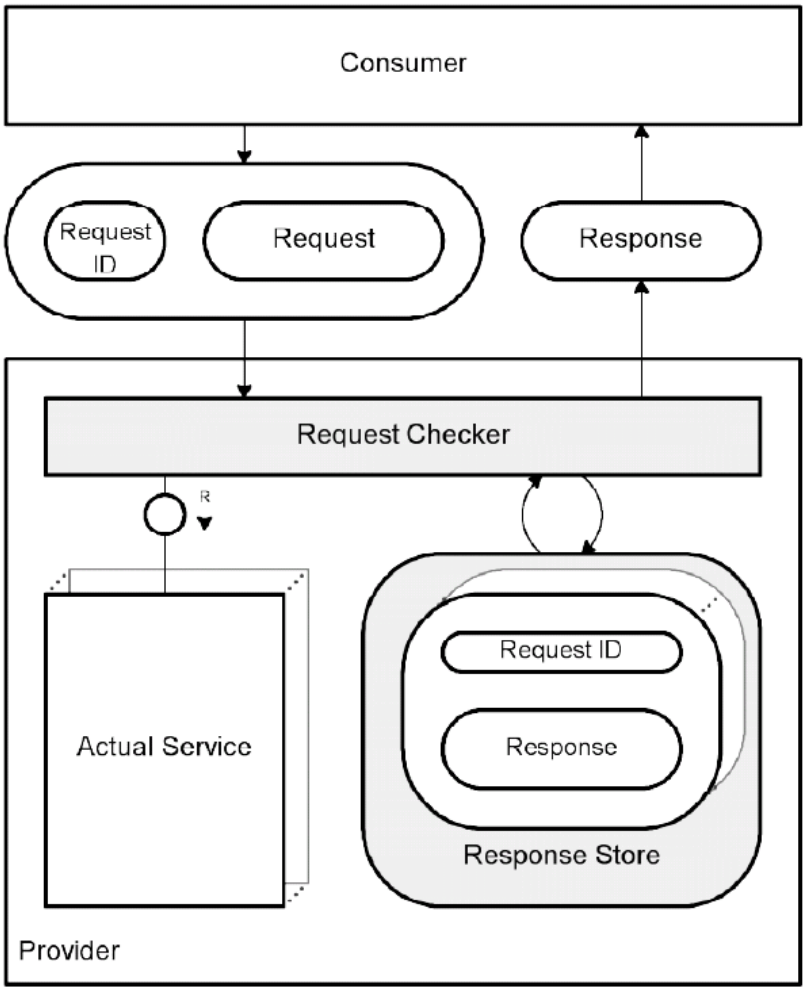


If you are extending or wrapping your custom service over a SAP Standard Service that is idempotent, you can rest assured that your services are already idempotent.

If on the other hand, you are custom coding the service yourself (like calling a BAPI), you will have to implement the feature in your Proxy Class. Thankfully, you have an underlying framework to ease the implementation. The details of how to use it are provided in the Appendix.

How does this Framework work?

The framework is used to store a message created in response to an incoming service call before the response is actually sent to the consumer. The response is identified by the request message's ID. For each incoming request, the provider can thus determine if the exact same request has already been processed by checking if a response for the request ID has been stored, and if yes directly return the earlier created response without really reprocessing the request.



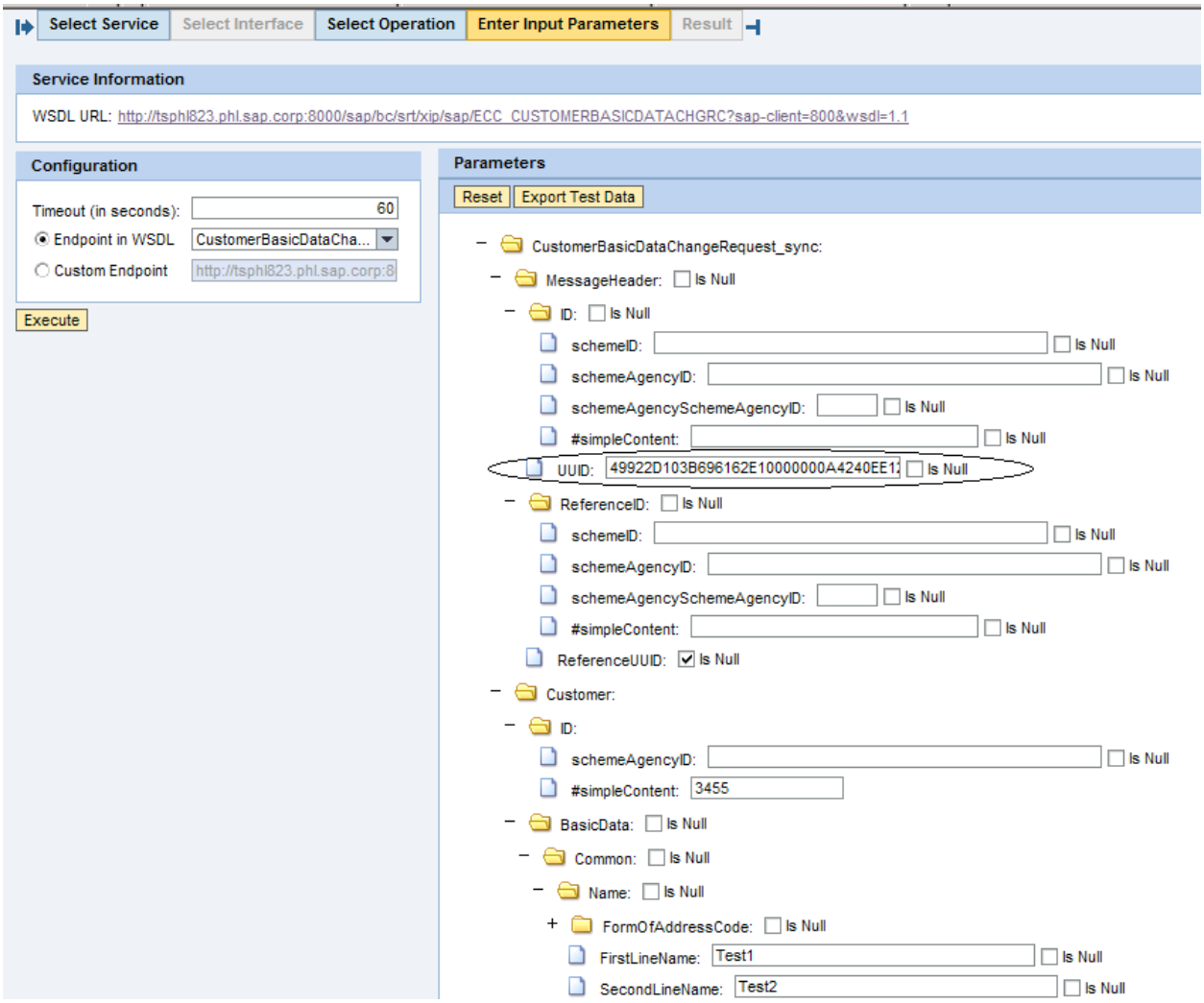
What configuration is needed?

The BASIS Administrator will need to set up the transaction WSIDPADMIN to turn on underlying Idempotency framework for services. It is needed to be set up once in each ECC/CRM/ SRM, etc environments (Dev, Quality and Production). It cannot be transported across the landscape.

WSIDPADMIN should be run to configure the frequency of cleaning the 'temporary' cluster tables that store message requests and responses. The defaults are 6 and 12 hours. If a very high volume of synchronous request-confirmation service calls is expected in a given system landscape, the values should be reduced to 2hrs / 4hrs.

How do I test if the feature works for my service implementation?

When you test a service, make sure you pass a Universal Identifier value in the UUID sub-element in the MessageHeader element of the service. An example of how to test it using WSNAVIGATOR is shown below



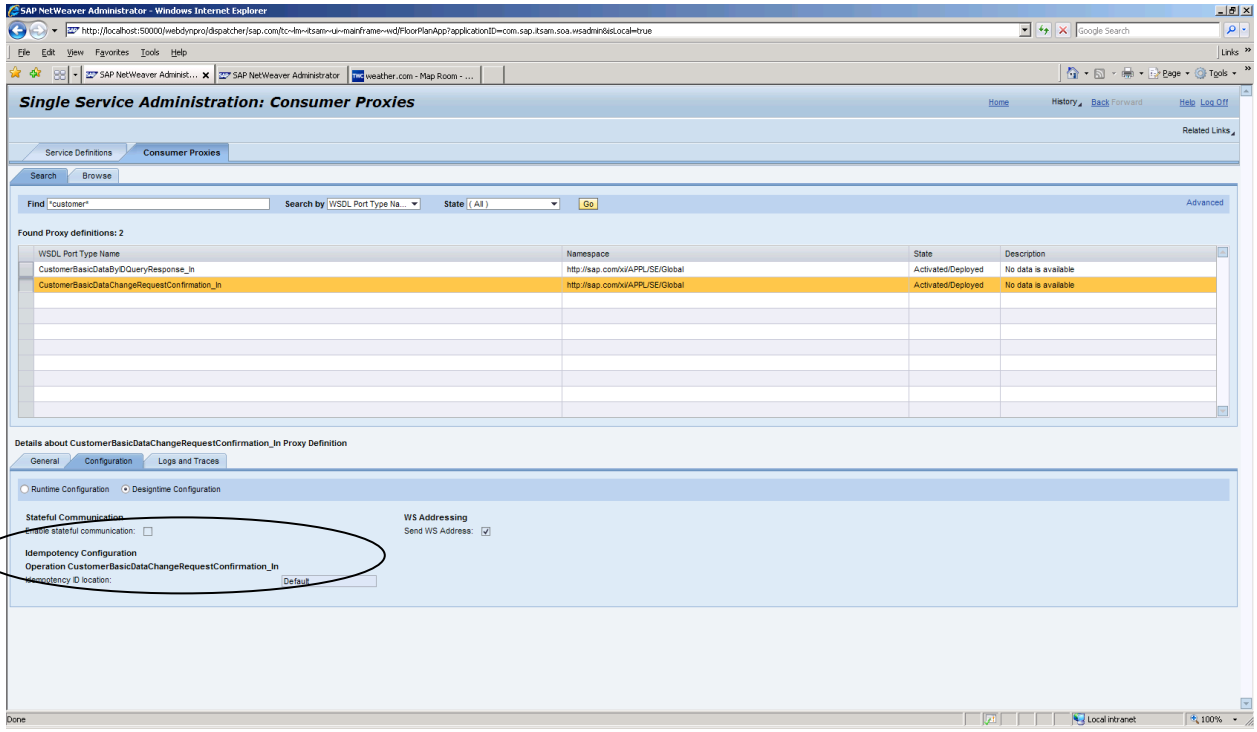
If you pass the same identifier in two consecutive calls, the second call would not process the request. The response from the first call will persist and the second one will be neglected.

What should I do when I consume the service from my composite application? Should I pass the identifier every time?

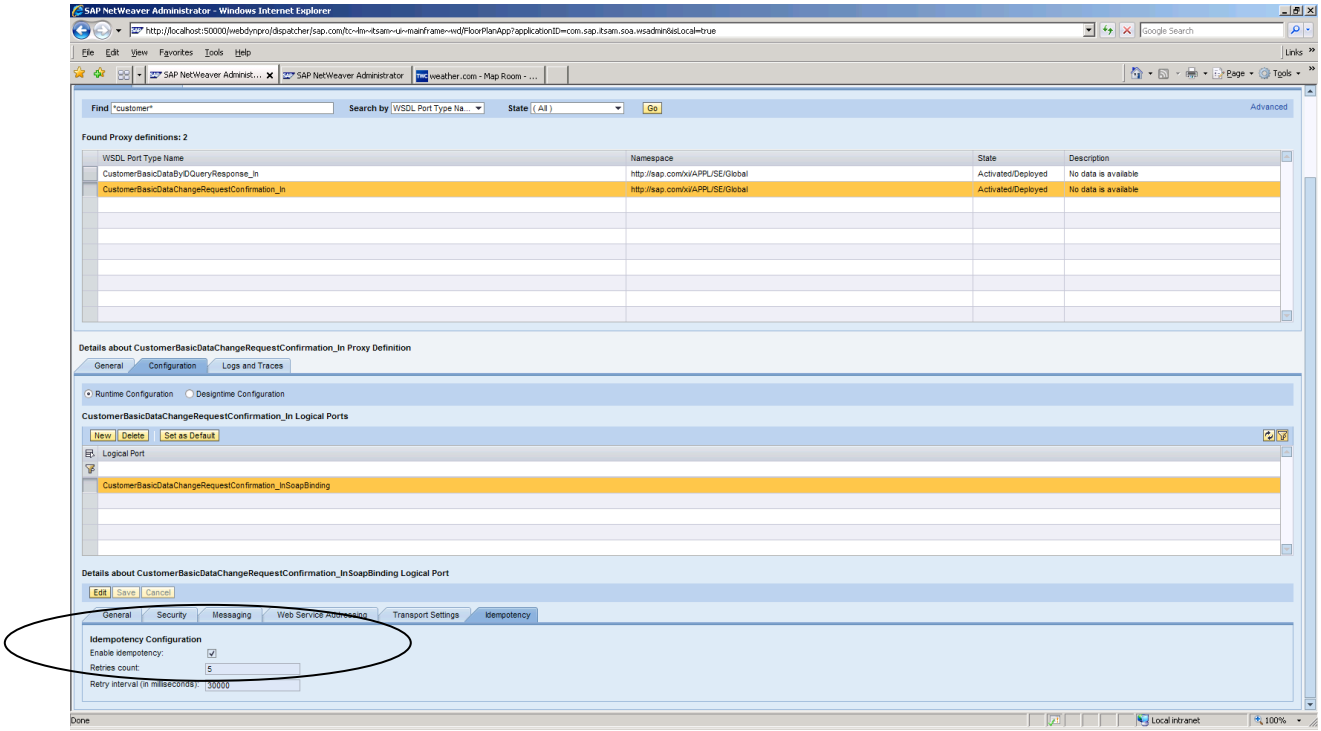
It depends on your tool for composition. Starting CE 7.1.1, you get an excellent feature that allows for Idempotency to be automatically available for service consumers. You will not have to code for it in your individual applications. You can configure the activation of Idempotency, the number or retries and the retry interval. More details at
http://help.sap.com/saphelp_nwce711/helpdata/en/47/f8af96fdb84aa7e10000000a421937/frameset.htm

Here's an example of the configuration of an idempotent service consumer created in CE 7.1.1.

First in Design Time configuration,



Now in Runtime configuration,



Remember that these configurations are not visible for non-idempotent services.

If instead of CE, you use .NET or some other environment; you will have to code and pass the identifier in your application.

Some FAQs on Idempotency

1. Is this SAP best practice limited to "duplicate prevention" or does it also help in the area of "guaranteed delivery" or help with other areas?

   Idempotency is intended for avoiding duplicate entries. Guaranteed delivery is generally assured for Asynch messages but not for Synch ones. A synch message may be lost or arrive several times in case of network problems. Even if a request reaches the provider, the response may be lost during network transport, in which case the consumer might assume that its request did not arrive and resend it. Idempotency avoids it

2. Do SAP delivered services automatically come equipped with Idempotency feature and it's only "custom delivered" services that require it?

   Most state-changing SAP services are delivered idempotent. Custom Services will have to be made idempotent, by using the SAP delivered framework

3. Why does this feature not get turned on up front if standard services use it out of the box?

   The feature itself is ‘dormant’ in the services. There is an administrative setup that needs to done for the framework to be activated and then you can use the feature

4. What authorization does SAP recommend to set up batch jobs?

   This is normally a role of a BASIS Administrator who schedules other batch jobs. He should have authority for ‘S_SRT_ADM’ (Administration/Configuration of SOAP Runtime), Activity ‘70’ and WS_NAME ‘*’

5. Is there much of any performance overhead by scheduling and checking GUID's

   Yes. But it should be marginal. There is also a small price for updating the GUID when a successful update happens.

6. Are tables already created or does the transaction create them?

   There are ‘auto-generated’ tables that get created in each system for storing the messages. These tables (an example is /1SAP1/IDPBD1003) are generated on the fly by the scheduling program and are stored in $TMP and hence do not to be transported across the landscape

7. Is this feature client dependent or independent?

   The tables are client dependent

Appendix

Here are some details on how make your ABAP custom services Idempotent. You can follow using the class L_SLS_SALESORDERCRTRC1 in an ECC EhP2 or higher (with NW 7.0 SP09 or higher) system as an example.

1. Create the proxy for your Service Interface (using transaction SPROXY)

2. Create the following attributes in your proxy class

a. Name: MV_IS_EO_REQUESTED

   Level: Instance Attribute

   Visibility: Private

   Associate Type: ABAP_BOOL

b. Name: MV_MSG_ID

   Level: Instance Attribute

   Visibility: Private

   Associate Type: STRING

c. Name: MV_MSG_UUID

   Level: Instance Attribute

   Visibility: Private

   Associate Type: GUID_32

d. Name: MR_IDP_HELPER

   Level: Instance Attribute

   Visibility: Private

   Associate Type: IF_WS_IDP_HELPER

3. Create the method ONLY_ONE_PREPARE in your proxy class.

Name: ONLY_ONE_PREPARE

Level: Instance

Visibility: Private

Description: Only-One: Preparatory steps for request processing

Parameters:

a. IS_INPUT, Type: Importing

   Associated Type: <Use the same type as the input structure of your proxy class>

b. ES_OUTPUT, Type: Exporting

   Associated Type: <Use the same type as the output structure of your proxy class>

c. EV_IS_PROCESSED, Type: Exporting

   Associated Type: ABAP_BOOL

Exceptions:

a. Exception of type CX_SAPPLCO_STANDARD_MSG_FAULT

Code: Introduce the following code. Replace <InputStructure> with appropriate structure of your input

```
  method ONLY_ONE_PREPARE.

  DATA: lcx_idp_enqueue_failure  TYPE REF TO cx_soap_idp_enqueue_failure,
        lr_response_data         TYPE REF TO data,
        lv_msgtext               TYPE symsgv,              "#EC NEEDED
        ls_exc_message           TYPE applco_exchange_fault_data,
        ls_exc_message_line      TYPE applco_exchange_log_data.


* 1 - get message ID and UUID from message header
  me->mv_msg_id = is_input-<InputStructure>-message_header-ID-CONTENT.

  TRY.

      TRY.
* 2 - check if idempotency requested ...
          IF is_input-<InputStructure>-message_header-uuid IS NOT INITIAL.

            CALL METHOD cl_gdt_conversion=>guid_inbound
              EXPORTING
                im_value  = is_input-<InputStructure>-message_header-uuid
              IMPORTING
                ex_guid_c = me->mv_msg_uuid.

* 3- use NW helper class to implement idempotency
            me->mv_is_eo_requested = abap_true.
            me->mr_idp_helper = cl_ws_idp_factory=>create_idp_helper( me-
>mv_msg_uuid ).
*             First attempt to check whether request was processed already
            ev_is_processed = me->mr_idp_helper->is_message_processed( ).

          ENDIF.

        CATCH cx_soap_idp_enqueue_failure INTO lcx_idp_enqueue_failure.

*         request message ID can?t be locked ? can have two causes:
          CASE lcx_idp_enqueue_failure->exception_nr.

            WHEN cx_soap_idp_enqueue_failure=>co_exception_nr_foreign_lock.
*             foreign lock on the document -
> wait a few moments and try again
              WAIT UP TO '2' SECONDS.
*             Second attempt to check whether request was processed already
              ev_is_processed = me->mr_idp_helper->is_message_processed( ).

            WHEN OTHERS.
*             system error during lock attempt -
> throw exception, but allow retry
              ls_exc_message-fault_text = lcx_idp_enqueue_failure->get_text( ).
              MESSAGE e024(appl_common) WITH ls_exc_message-fault_text
                                             lcx_idp_enqueue_failure->exception_nr
                                        INTO lv_msgtext. "Exactly-
once request cannot be locked: &1 (error code &2)
              CALL METHOD cl_proxy_fault=>get_fault_detail
```

```
                EXPORTING
                  msgty    = sy-msgty
                  msgid    = sy-msgid
                  msgno    = sy-msgno
                  msgv1    = sy-msgv1
                  msgv2    = sy-msgv2
                  msgv3    = sy-msgv3
                  msgv4    = sy-msgv4
                IMPORTING
                  severity = ls_exc_message_line-severity
                  text     = ls_exc_message_line-text
                  url      = ls_exc_message_line-url
                  id       = ls_exc_message_line-id.
              APPEND ls_exc_message_line TO ls_exc_message-fault_detail.

              RAISE EXCEPTION TYPE cx_applco_standard_msg_fault
                EXPORTING
                  automatic_retry = abap_false
                  no_retry = abap_false
                  standard = ls_exc_message.

          ENDCASE.

      ENDTRY.

      IF ev_is_processed = abap_true.
* 4 - request was already processed -> return stored response
        GET REFERENCE OF es_output INTO lr_response_data.
        CALL METHOD me->mr_idp_helper-
>retrieve( CHANGING cr_msg_data = lr_response_data ).

      ENDIF.

    CATCH cx_soap_idp_enqueue_failure INTO lcx_idp_enqueue_failure.
*     error locking request after second attempt -
> throw exception, but allow retry
      ls_exc_message-fault_text = lcx_idp_enqueue_failure->get_text( ).
      MESSAGE e024(appl_common) WITH ls_exc_message-fault_text
                                     lcx_idp_enqueue_failure->exception_nr
                                INTO lv_msgtext.  "Exactly-
once request cannot be locked: &1 (error code &2)
      CALL METHOD cl_proxy_fault=>get_fault_detail
        EXPORTING
          msgty    = sy-msgty
          msgid    = sy-msgid
          msgno    = sy-msgno
          msgv1    = sy-msgv1
          msgv2    = sy-msgv2
          msgv3    = sy-msgv3
          msgv4    = sy-msgv4
        IMPORTING
          severity = ls_exc_message_line-severity
          text     = ls_exc_message_line-text
          url      = ls_exc_message_line-url
          id       = ls_exc_message_line-id.
      APPEND ls_exc_message_line TO ls_exc_message-fault_detail.
```

```
      RAISE EXCEPTION TYPE cx_applco_standard_msg_fault
        EXPORTING
          automatic_retry = abap_false
          no_retry = abap_false
          standard = ls_exc_message.

    CATCH cx_soap_idp_time_out.
*     Request was processed before, but stored response already cleaned up -
> unrecoverable exception
      MESSAGE e025(appl_common) WITH me->mv_msg_uuid INTO lv_msgtext. "Exactly-
once request timed out (message UUID &1)
      CALL METHOD cl_proxy_fault=>get_fault_detail
        EXPORTING
          msgty    = sy-msgty
          msgid    = sy-msgid
          msgno    = sy-msgno
          msgv1    = sy-msgv1
          msgv2    = sy-msgv2
          msgv3    = sy-msgv3
          msgv4    = sy-msgv4
        IMPORTING
          severity = ls_exc_message_line-severity
          text     = ls_exc_message_line-text
          url      = ls_exc_message_line-url
          id       = ls_exc_message_line-id.
      APPEND ls_exc_message_line TO ls_exc_message-fault_detail.
      ls_exc_message-fault_text = ls_exc_message_line-text.

      RAISE EXCEPTION TYPE cx_applco_standard_msg_fault
        EXPORTING
          automatic_retry = abap_false
          no_retry = abap_true
          standard = ls_exc_message.

    CATCH cx_soap_idp_not_found.
      MESSAGE e026(appl_common) WITH me-
>mv_msg_uuid INTO lv_msgtext. "Internal error in exactly-
once processing (message UUID &1)
      CALL METHOD cl_proxy_fault=>get_fault_detail
        EXPORTING
          msgty    = sy-msgty
          msgid    = sy-msgid
          msgno    = sy-msgno
          msgv1    = sy-msgv1
          msgv2    = sy-msgv2
          msgv3    = sy-msgv3
          msgv4    = sy-msgv4
        IMPORTING
          severity = ls_exc_message_line-severity
          text     = ls_exc_message_line-text
          url      = ls_exc_message_line-url
          id       = ls_exc_message_line-id.
      APPEND ls_exc_message_line TO ls_exc_message-fault_detail.
      ls_exc_message-fault_text = ls_exc_message_line-text.
```

```
      RAISE EXCEPTION TYPE cx_applco_standard_msg_fault
        EXPORTING
          automatic_retry = abap_false
          no_retry = abap_false
          standard = ls_exc_message.

    CATCH cx_soap_idp_failure .
*     unqualified error when retrieving stored response (e.g. authorizarion
issue)
      MESSAGE e026(appl_common) WITH me-
>mv_msg_uuid INTO lv_msgtext. "Internal error in exactly-
once processing (message UUID &1)
      CALL METHOD cl_proxy_fault=>get_fault_detail
        EXPORTING
          msgty    = sy-msgty
          msgid    = sy-msgid
          msgno    = sy-msgno
          msgv1    = sy-msgv1
          msgv2    = sy-msgv2
          msgv3    = sy-msgv3
          msgv4    = sy-msgv4
        IMPORTING
          severity = ls_exc_message_line-severity
          text     = ls_exc_message_line-text
          url      = ls_exc_message_line-url
          id       = ls_exc_message_line-id.
      APPEND ls_exc_message_line TO ls_exc_message-fault_detail.
      RAISE EXCEPTION TYPE cx_applco_standard_msg_fault
        EXPORTING
          automatic_retry = abap_false
          no_retry = abap_true
          standard = ls_exc_message.

    CATCH cx_gdt_conversion.
*     message UUID passed, but it's not really a UUID -> raise exception
      MESSAGE e021(appl_common)
             WITH  is_input-<InputStructure>-message_header-uuid
                   'MessageHeader/UUID'                    "#EC NOTEXT
             INTO lv_msgtext.  "UUID &1 for element &2 does not comply to requ
ired pattern
      CALL METHOD cl_proxy_fault=>get_fault_detail
        EXPORTING
          msgty    = sy-msgty
          msgid    = sy-msgid
          msgno    = sy-msgno
          msgv1    = sy-msgv1
          msgv2    = sy-msgv2
          msgv3    = sy-msgv3
          msgv4    = sy-msgv4
        IMPORTING
          severity = ls_exc_message_line-severity
          text     = ls_exc_message_line-text
          url      = ls_exc_message_line-url
          id       = ls_exc_message_line-id.
      APPEND ls_exc_message_line TO ls_exc_message-fault_detail.
      ls_exc_message-fault_text = ls_exc_message_line-text.
```

```
        RAISE EXCEPTION TYPE cx_applco_standard_msg_fault
          EXPORTING
            automatic_retry = abap_false
            no_retry = abap_true
            standard = ls_exc_message.

    ENDTRY.

  endmethod.
```

4. Create a second method ONLY_ONE_FINALIZE in your proxy class.

Name: ONLY_ONE_FINALIZE

Level: Instance

Visibility: Private

Description: Only-One : Finalizing steps after request processing

Parameters:

a. IV_FLAG_ERROR, Type: Importing

   Associated Type:ABAP_BOOL

b. CS_OUTPUT, Type: Changing

   Associated Type: <Use the same type as the output structure of your proxy class>

Exceptions:

b. Exception of type CX_SAPPLCO_STANDARD_MSG_FAULT

Code: Introduce the following code. Replace <OutputStructure> with appropriate structure of your output structure

```
  method ONLY_ONE_FINALIZE.

  * exception CX_SAPPLCO_STANDARD_MSG_FAULT is not caught
  * if the exception cx_gdt_conversion is thrown the
  * exception CX_SAPPLCO_STANDARD_MSG_FAULT will be
  * propagated

    data: lv_error_uuid          type guid_32,
          lv_error_field         type SYMSGV.

    DATA: lr_response_data       TYPE REF TO data,
          lv_msgtext             TYPE string,                  "#EC NEEDED
          ls_exc_message         TYPE sapplco_exchange_fault_data,
          ls_exc_message_line    TYPE sapplco_exchange_log_data,
          lv_uuid                TYPE guid_32.

    TRY.
  *     prepare to fill identifiers for output message itself in output messag
  e header
  *     the elements will only be filled if corresponding message identieres w
  ere passed in input message
        CALL FUNCTION 'GUID_CREATE'
          IMPORTING
            ev_guid_32 = lv_uuid.
```

```
*     fill reference to input message in output message's header.
      IF me->mv_msg_id IS NOT INITIAL.
        cs_output-<OutputStructure> -message_header-ID-CONTENT   = lv_uuid.
        cs_output-<OutputStructure> -message_header-reference_id-content = me-
>mv_msg_id.
      ENDIF.

      IF me->mv_msg_uuid IS NOT INITIAL.

        move : lv_uuid                to  lv_error_uuid,
               'MessageHeaderUUID'                          "#EC NOTEXT
                                      to  lv_error_field.

        CALL METHOD cl_gdt_conversion=>guid_outbound
          EXPORTING
            im_guid_c = lv_uuid
          IMPORTING
            ex_value  = cs_output-<OutputStructure> -message_header-uuid.

        move : me->mv_msg_uuid        to  lv_error_uuid,
               'MessageHeaderReferenceUUID'                 "#EC NOTEXT
                                      to  lv_error_field.

        CALL METHOD cl_gdt_conversion=>guid_outbound
          EXPORTING
            im_guid_c = me->mv_msg_uuid
          IMPORTING
            ex_value  = cs_output-<OutputStructure> -message_header-reference_uuid.
      ENDIF.


*     store output message if idempotency is requested
      IF iv_flag_error          = abap_false AND
         me->mv_is_eo_requested = abap_true.
*       store response in case request is received a second time
        GET REFERENCE OF cs_output INTO lr_response_data.
        CALL METHOD me->mr_idp_helper->save( ir_msg_data = lr_response_data ).

      ENDIF.

    CATCH cx_soap_idp_failure .
*     unqualified error when storing response
      MESSAGE e027(appl_common) WITH me-
>mv_msg_uuid INTO lv_msgtext. "Internal error storing response for request mess
age UUID &1
      CALL METHOD cl_proxy_fault=>get_fault_detail
        EXPORTING
          msgty    = sy-msgty
          msgid    = sy-msgid
          msgno    = sy-msgno
          msgv1    = sy-msgv1
          msgv2    = sy-msgv2
          msgv3    = sy-msgv3
          msgv4    = sy-msgv4
        IMPORTING
          severity = ls_exc_message_line-severity
```

```
          text     = ls_exc_message_line-text
          url      = ls_exc_message_line-url
          id       = ls_exc_message_line-id.
      APPEND ls_exc_message_line TO ls_exc_message-fault_detail.
      RAISE EXCEPTION TYPE cx_applco_standard_msg_fault
        EXPORTING
          automatic_retry = abap_false
          no_retry = abap_true
          standard = ls_exc_message.

    CATCH cx_gdt_conversion.
*     message UUID passed, but it's not really a UUID -> raise exception
      MESSAGE e021(appl_common)
             WITH  lv_error_uuid
                   lv_error_field
             INTO lv_msgtext.  "UUID &1 for element &2 does not comply to requ
ired pattern

      CALL METHOD cl_proxy_fault=>get_fault_detail
        EXPORTING
          msgty    = sy-msgty
          msgid    = sy-msgid
          msgno    = sy-msgno
          msgv1    = sy-msgv1
          msgv2    = sy-msgv2
          msgv3    = sy-msgv3
          msgv4    = sy-msgv4
        IMPORTING
          severity = ls_exc_message_line-severity
          text     = ls_exc_message_line-text
          url      = ls_exc_message_line-url
          id       = ls_exc_message_line-id.

      APPEND ls_exc_message_line TO ls_exc_message-fault_detail.
      ls_exc_message-fault_text = ls_exc_message_line-text.

      RAISE EXCEPTION TYPE cx_applco_standard_msg_fault
        EXPORTING
          automatic_retry = abap_false
          no_retry = abap_true
          standard = ls_exc_message.

  ENDTRY.

endmethod.
```

5. **Make the changes to your 'EXECUTE_SYNCHRONOUS' of your proxy class to invoke the two new methods created above.**

Make the first executable line in this method to invoke the method only_one_prepare as below:

```
DATA : lv_flag_is_processed TYPE  abap_bool."definition of local working area
* Check whether this particular input-message has already been
* processed using the "only once"-processing
* if the exception CX_SAPPLCO_STANDARD_MSG_FAULT is thrown
* in this method the processing of this proxy will be
* terminated immediately
  CALL METHOD me->only_one_prepare
    EXPORTING
      is_input        = input
    IMPORTING
      es_output       = output
      ev_is_processed = lv_flag_is_processed.
* If a recent messages with the identifier has been processed already,
* no further processing will be done -> leave this method
  if lv_flag_is_processed = abap_true.
    return.                 " leave this method immediately
  endif.
```

Make the last executable line in this method to invoke the method only_one_finalize as below:

```
* finalize "only-once"-processing (checking handle)
* if the exception CX_SAPPLCO_STANDARD_MSG_FAULT is thrown
* in this method the processing of this proxy will be
* terminated immediately
  CALL METHOD me->only_one_finalize
    EXPORTING
      iv_flag_error = ''
    CHANGING
      cs_output     = output.
```

6. **Syntax Check and Activate your proxy class!**

Related Content

http://esoadocu.sap.com/socoview(bD1lbiZjPTAwMSZkPW1pbg==)/render.asp?packageid=484F2D49F106E577E10000000A4218AA&id=ED8CCB8D3C62430681A66DBC6511A15A

http://help.sap.com/saphelp_nwce711/helpdata/en/b3/373b4546024560949ecd74bd908f7c/frameset.htm

http://help.sap.com/saphelp_nwce711/helpdata/en/47/f8af96fdb84aa7e10000000a421937/frameset.htm

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