

CA IDMS™ 19.0 Web Services for Modernization

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Abstract

The vision of CA IDMS 19.0 is to improve CA IDMS modernization capabilities through features that enable customers to expand investments in core CA IDMS applications and improve developer productivity using modern skills and industry-standard technology. This session discusses a CA IDMS 19.0 project to simplify integration of CA IDMS applications and Web services.



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Agenda

- 1 LEVERAGING YOUR INVESTMENT WITH WEB SERVICES
- 2 WEB SERVICES WITHIN CA IDMS
- 3 XML GENERATION AND PARSING
- 4 WEB SERVICES DEMO
- 5 TROUBLESHOOTING AND DOCUMENTATION



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Leveraging and Extending CA IDMS

Leverage
CA IDMS
databases

- Keep your database in place
- Access from web services
- Use standard interfaces

Extend
CA IDMS
applications

- Reuse your application business logic
- Invoke web services
- Provide web services



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Web Services participants

- The calling program
 - Consumer
 - Requester
 - Sometimes called outbound Web services
- The responding (or 'called') program
 - Provider
 - Producer
 - Sometimes called inbound Web services
 - Sometimes called the 'service implementation'



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CA IDMS™ Web Services

CA IDMS Web Services

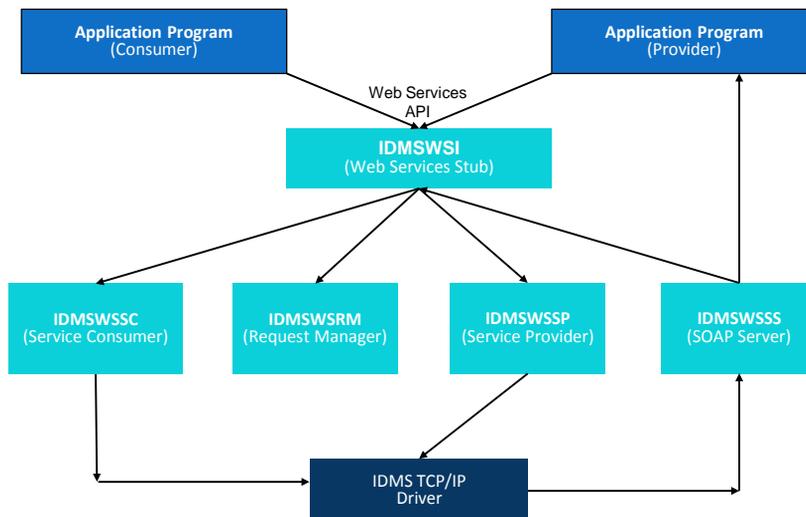
- Web Service Consumer
- Web Service Provider
- Web Services API
- Leverage and extend CA IDMS applications
 - COBOL
 - ADS
 - PL/1
 - Assembler



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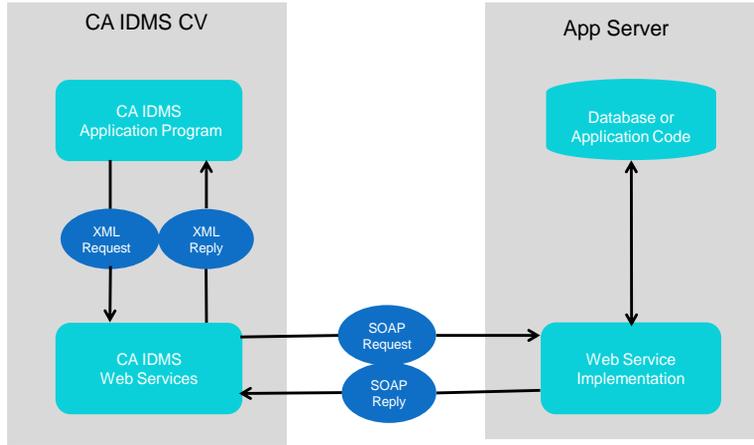
CA IDMS Web Services Internal Architecture



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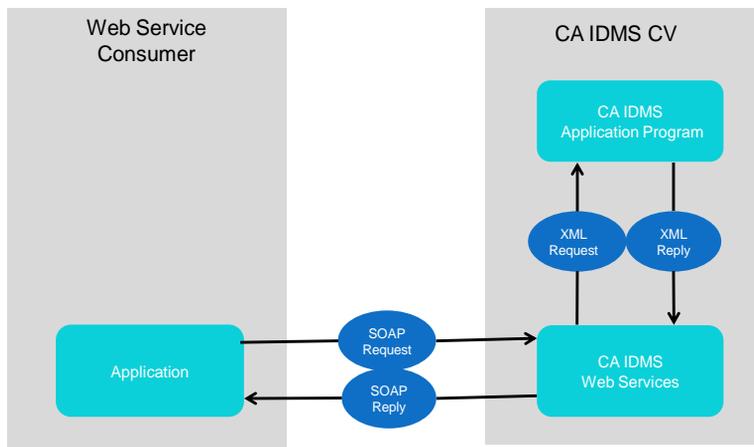
CA IDMS as a Web Service Consumer



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CA IDMS as a Web Service Provider



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The CA IDMS™ Web Service API

Web Services API

- Well defined, extendable interface
 - Simplifies application development
 - Isolate user code from product changes
 - Provide consistent base for product enhancement
- CA IDMS Callable Service
 - COBOL, ADS, PL/1, Assembler
- WS API Functions
 - Data transfer
 - Session management
 - Option management

Web Services API Functions

| Function Code | Description | Used By |
|---------------|-------------|-------------------|
| 4 | INITIALIZE | Consumer/Provider |
| 8 | SETOPTION | Consumer/Provider |
| 12 | GETOPTION | Consumer/Provider |
| 16 | REQUEST | Consumer |
| 20 | SEND | Provider |
| 24 | RECEIVE | Provider |
| 28 | RELEASE | Consumer/Provider |



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Using the Web Services API

| Consumer | | Provider | |
|-------------------------|----------------------------|------------------------|----------------------------|
| Operation | API Function | Operation | API Function |
| Initialize Environment | WSINITIALIZE | Initialize Environment | WSINITIALIZE |
| Manage Options | WSGETOPTION WSSETOPTION | Manage Options | WSGETOPTION WSSETOPTION |
| Send Request | WSREQUEST | Receive Request | WSRECEIVE |
| and Receive Response | | Send XML Response | WSSEND |
| Free Resources | WSRELEASE | Free Resources | WSRELEASE |



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Invoking the Web Services API

```

COBOL          CALL 'IDMSWSI' USING
                function,
                return-code,
                error-info,
                function-dependent-parameter1,
                . . .
    
```

```

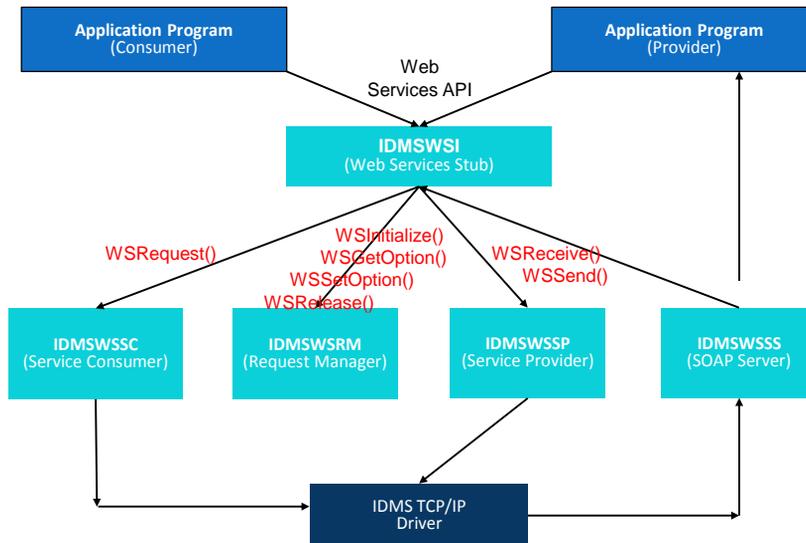
ADS           LINK TO PROGRAM 'IDMSWSI' USING
                function,
                return-code,
                error-info,
                function-dependent-parameter1,
                . . .
    
```



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CA IDMS Web Services Internal Architecture



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Web Services API – API Records

- Every API call will have the following 4 records at the beginning of each call and a variation of the additional records following.

| | |
|--------------------------------|--------------------------|
| •WS-FUNCTION-CODE-RECORD | API Function Code |
| •WS-RETURN-CODE-RECORD | API Return Code |
| •WS-ERROR-INFO | API Error Information |
| •WS-INTERFACE-VERSION-NUMBER | API Interface version |
| •WS-REQUEST-INFO | Request SOAP information |
| •WS-REQUEST-HANDLE-RECORD | Request Handle record |
| •WS-OPTION-NUMBER-RECORD | Get/Set Option number |
| •WS-OPTION-VALUE-RECORD | Get/Set Option value |
| •WS-REQUEST-MSG-DATA (Module) | Request Message |
| •WS-REQUEST-MSG-PTR-RECORD | Request Pointer |
| •WS-RESPONSE-MSG-DATA (Module) | Response Message |
| •WS-RESPONSE-MSG-PTR-RECORD | Response Pointer |
| •WS-REQUEST-MSG-DESCRIPTOR | Request Length |
| •WS-RESPONSE-MSG-DESCRIPTOR | Response Length |



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Web Services API – INITIALIZE (4)

- Allocate and initialize Web Services data structures

Example for COBOL, ADS and PL/I

```
WS-INITIALIZE,
return-code,
error-info,
request-handle,
interface-version.
```



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Web Services API – SETOPTION (8)

- Dynamically override default settings of the CA IDMS Web services system-level options

| Option Name | Number | Description |
|--------------------|--------|---|
| LOG-SERVICES | 1 | Turn Web Services Logging on or off |
| LOG-PROGRAM | 2 | Log Specific program |
| REQUIRE-SIGNON | 3 | Require CV logon |
| CHECK-AUTH | 4 | Requires that User is part of Services security Group |
| CONNECT-TIMEOUT | 5 | Specify wait time for external services |
| READ-WRITE-TIMEOUT | 6 | Specify wait time for TCP/IP calls |
| XML-CODE-PAGE | 7 | Set codepage value for XML Processing |

Example: COBOL, ADS and PL/I

```
WS-SETOPTION,
return-code,
error-info,
request-handle,
option-number,
option-value.
```



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Web Services API – GETOPTION (12)

- GETOPTION retrieves the values for the Web Services system-level options.

Example for COBOL, ADS and PL/I

```
WS-GETOPTION,
return-code,
error-info,
request-handle,
option-number,
option-value.
```



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Web Services API – REQUEST (16)

- The REQUEST function builds and transmits a SOAP service request.

Example: COBOL, ADS and PL/I

WS-REQUEST,
return-code,
error-info,
request-handle,
request-info,
request-message-data,
request-message-descriptor,
response-message-data,
response-message-descriptor.



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Web Services API – SEND (20)

- The SEND function is used to transmit a Response message to a service Consumer

Example: COBOL, ADS and PL/I

WS-SEND,
return-code,
error-info,
request-handle,
response-message-data,
response-message-descriptor.



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Web Services API – RECEIVE (24)

- The RECEIVE function is used to return the address and length of an incoming Web service Request buffer

Example: COBOL, ADS and PL/I

WS-RECEIVE,
return-code,
error-info,
request-handle,
request-message-data,
request-message-descriptor.



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Web Services API – RELEASE (28)

- The RELEASE function is used to terminate a Web Services request. It frees all structures allocated on behalf of the Web Services request

Example: COBOL, ADS and PL/I

WS-RELEASE,
return-code,
error-info,
request-handle.



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XML Generation and Parsing

What is XML Generation and Parsing?

```
<?xml version="1.0" encoding="utf-8"?>
<soap:Envelope
  xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/"
  <soap:Body>
    <IDMSWSPIOperation
      xmlns="http://www.IDMSWSPI.Request.com">
      <InputFields>
        <EmplID>0472</EmplID>
        <dbname>EMPDEMO</dbname>
      </InputFields>
    </IDMSWSPIOperation>
  </soap:Body>
</soap:Envelope>
```

What is XML Generation and Parsing?

- XML Generation
 - Uses input variables to create an XML Message
 - Final message includes your data as the payload

```
<?xml version="1.0" encoding="utf-8"?>
<soap:Envelope xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema">
  <soap:Body><IDMSWSPIOperation xmlns="http://www.IDMSWSPI.Request.com">
    <InputFields>
      <EmplID>0472</EmplID>
      <dbname>EMPDEMO</dbname>
    </InputFields>
  </IDMSWSPIOperation></soap:Body>
</soap:Envelope>
```

Input
EmplID: 0472
dbname: EMPDEMO

Output
EmplID: 0472
dbname: EMPDEMO

- XML Parsing
 - Extracts the payload from a given XML message
 - Payload is interpreted as individual variables for use Web services
- Two main approaches: use of IBM's COBOL functions or use of built-in SQL/XML functions



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Use of SQL/XML Functions for XML Generation

```
0000-MAINLINE-BEG. } COBOL paragraph name
EXEC SQL
  set :DOC= } 01 DOC PIC X(1000) VALUE SPACES.
  xmlserialize(content
  xmlelement(name "soapenv:Envelope"
  , xmlnamespaces(
    'http://schemas.xmlsoap.org/soap/envelope/'
    as "soapenv"
  , default 'HTTP://CA.COM/HR/GLOBALXML'),
  , xmlelement(name "soapenv:Header")
  , xmlelement(name "soapenv:Body"
  , xmlelement(name "IDMSWSPIOperation"
    , xmlnamespaces('http://www.IDMSWSPI.Request.com'
    , xmlconcat(xmlelement(name "InputFields"
    , xmlconcat(xmlelement(name "EmplID", :EMPLID)
    xmlelement(name "dbname", :DBNAME)
  )))) as char(1000))
END-EXEC. } 01 EMPLID PIC X(4).
           } 01 DBNAME PIC X(8).
```

Example of generation of an XML message



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COBOL XML Generate

Enterprise COBOL for z/OS V3R3 introduced the XML GENERATE statement that can accept almost any COBOL data structure and generate XML documents.

- Can be leveraged by CA IDMS/DC COBOL programs that extract CA IDMS database data that needs to be returned in XML format
- CA Web Services COBOL programs compiled with the XMLSS compile option so that the z/OS XML System Services parser is used
- Ease of use in that extracted CA IDMS database data can be reformatted into any XML output format required
- IBM also supports XML Generate for PL/1 programs



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COBOL XML Generate

Using an example from the CA Web Services Demo Provider program ...

1. A COBOL data structure is defined containing the fields extracted from the Employee Demo Data base required for the Provider Service. CA Web Services provides routines that will execute the XML Generate for the COBOL data structure 'OutputFields'. Just define the output data under this 01 level.

```
01 OutputFields.
05  EmpID          PIC X(04) VALUE SPACES.
05  EmpFirstName   PIC X(10) VALUE SPACES.
05  EmpLastName    PIC X(15) VALUE SPACES.
05  EmpStreet      PIC X(20) VALUE SPACES.
05  EmpCity        PIC X(15) VALUE SPACES.
05  EmpState       PIC X(02) VALUE SPACES.
05  EmpZip         PIC X(05) VALUE SPACES.
```

2. The data structure fields are case sensitive, the above fields will appear with upper/lower case in the XML data tag.
<EmpFirstName> </EmpFirstName>



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COBOL XML Generate

Using an example from the CA Web Services Demo Provider program ...

1. The COBOL XML Generate Statement creates an XML Response from the COBOL data structure.

```
XML GENERATE WS-RESPONSE-MESSAGE
  (1:WS-RSP-MSG-BUFF-LEN)
  FROM OutputFields          Defined COBOL data structure
  COUNT IN WSPI-XML-OUT-LENGTH
  WITH ENCODING WS-CODEPAGE-VALUE
  ON EXCEPTION
    MOVE 'NO ' TO WSPI-WAS-GENERATE-SUCCESS
```

2. The resulting XML structure is stored in WS-RESPONSE-MESSAGE where it can be wrapped by a SOAP Envelope as a Service Response

```
<OutputFields><EmpID>0472</EmpID>
<EmpFirstName>ROBBY</EmpFirstName><EmpLastName>WILDER
</EmpLastName><EmpStreet>4567 E. GROWTH ST</EmpStreet>
<EmpCity>SOUTHBORO</EmpCity><EmpState>MA</EmpState><Emp
pZip>03145</EmpZip></OutputFields>
```



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COBOL XML Parse

The COBOL XML Parse statement to transform XML String into COBOL data items.

XML string

```
<EmpID>0472</EmpID>
```

COBOL Parse XML string

```
XML PARSE CWA1-REPLY-BUFFER
  (1:CWA1-REPLY-BUFFER-LENGTH)
  WITH ENCODING CWA1-CODEPAGE-VALUE
  PROCESSING PROCEDURE CPA1-PARSE-XML
  ON EXCEPTION
    MOVE 'NO ' TO CWA1-WAS-PARSE-SUCCESSFUL
```

Evaluate the data tags and populate data into COBOL data structure

```
EVALUATE FUNCTION UPPER-CASE(CWA1-EDITED-ELEMENT)
  WHEN 'EMPLID'
    MOVE XML-TEXT TO WS-EMP-ID
```

Results in:

```
WS-EMP-ID = 0472
```

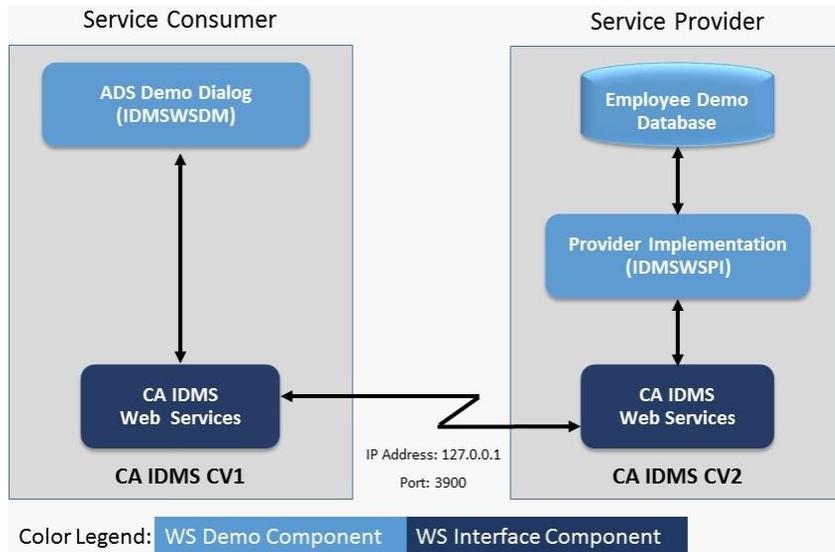


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Web Services Demo Programs

CA IDMS Web Services Demo



CA IDMS Web Services Demo

- Enter task code 'IDMSWSDM'

Terminal window showing the CA IDMS Web Services Demo. The title bar reads 'IDMSWSMP IDMS WEB SERVICES DEMO'. The screen displays the following data:

```

APPLICATION-LEVEL INPUT DATA:
EMPLOYEE INFORMATION
EMPLOYEE ID      : 0472
EMPLOYEE DEMO DBNAME: EMPDEMO

APPLICATION-LEVEL OUTPUT DATA:
NAME:
STREET:
CITY:                STATE:    ZIP:

SERVICE-LEVEL INPUT DATA:
IP ADDRESS: 127.0.0.1
PORT      : 3850
USER ID   :
PASSWORD  :
  
```

Red arrows point to the 'APPLICATION-LEVEL INPUT DATA', 'APPLICATION-LEVEL OUTPUT DATA', and 'SERVICE-LEVEL INPUT DATA' sections. At the bottom, the prompt reads 'ENTER EMPLOYEE ID AND PRESS <ENTER>.' The footer includes the IUA logo, 'Copyright © 2018 CA. All rights reserved.', and the CA Technologies logo.

CA IDMS Web Services Demo

- CA IDMS Web Services Consumer receives reply from CA Web Services Provider Service.

Terminal window showing the CA IDMS Web Services Demo. The title bar reads 'IDMSWSMP IDMS WEB SERVICES DEMO'. The screen displays the following data:

```

APPLICATION-LEVEL INPUT DATA:
EMPLOYEE INFORMATION
EMPLOYEE ID      : 0472
EMPLOYEE DEMO DBNAME: EMPDEMO

APPLICATION-LEVEL OUTPUT DATA:
NAME: ROBBY WILDER
STREET: 4567 E. GROWTH ST
CITY: SOUTHBORO STATE: MA ZIP: 03145

SERVICE-LEVEL INPUT DATA:
IP ADDRESS: 127.0.0.1
PORT      : 3850
USER ID   :
PASSWORD  :
  
```

The 'APPLICATION-LEVEL OUTPUT DATA' section is circled in red. At the bottom, the prompt reads 'ENTER ANOTHER EMP ID AND PRESS <ENTER>.' The footer includes the IUA logo, 'Copyright © 2018 CA. All rights reserved.', and the CA Technologies logo.

CA IDMS Web Services Demo – Request API

- To send a Service Request for the Consumer, the ADS dialog uses the Web Service Request API

```

!* WSREQUEST()      - PERFORM A REQUEST TO CONSUME A WEB SERVICE
!*****
MOVE 16 TO WS-FUNCTION-CODE.          ! WSREQUEST()
LINK TO PROGRAM 'IDMSWSI' USING
  (WS-FUNCTION-CODE-RECORD,
   WS-RETURN-CODE-RECORD,
   WS-ERROR-INFO,
   WS-REQUEST-HANDLE-RECORD,
   WS-REQUEST-INFO,
   WSDemo-REQUEST-MSG-DATA,
   WS-REQUEST-MSG-DESCRIPTOR,
   WSDemo-RESPONSE-MSG-DATA,
   WS-RESPONSE-MSG-DESCRIPTOR) .

```

Defines Service Request SOAP information
 Defines Service Request message
 Defines Service Request Length
 Defines Service Response message
 Defines Service Response Length



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Troubleshooting

CA IDMS Web Services Troubleshooting

- Enable system level logging of Web Services programs using task WSQP
- CA Web Services API offers additional troubleshooting techniques
- The first 4 fields in every API call are WS-FUNCTION-CODE, WS-RETURN-CODE, WS-ERROR-INFO and WS-REQUEST-HANDLE



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CA IDMS Web Services Troubleshooting

- At a high level, WS-RETURN-CODE gives a quick indication of the status of the API call

| Return Code | Severity | Description |
|-------------|------------|---------------------------------------|
| 0 | Successful | Successful return |
| 4 | Warning | Request processed, warning msg issued |
| 8 | Error | Request fails, error message returned |
| 12 | Critical | Request fails, Service terminated |
| 16 | Systemic | Request fails, impact to all Services |



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CA IDMS Web Services Troubleshooting

- WS-ERROR-INFO provides additional fields that define the result of the call

Error Type:

| | |
|--------------|--|
| INTERNAL (I) | Generated from failures in CA IDMS/DC operations |
| API (A) | Failure to adhere to Web Services API protocol |
| XML (X) | Generated if XML Parsing or Generation fails |
| HTTP (H) | API receives an unexpected HTTP status code |
| TCPIP (T) | An unexpected TCPIP code received |
| SOAP (S) | An unexpected SOAP fault code received |
| OTHER (O) | An unclassified error occurred |

Error Text: Text that describes additional content to the error



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CA IDMS Web Services Troubleshooting

- Enable Logging at System Level using Task Code WSQP

In your CV to monitor, enter:

WSQP LOG WEB SERVICES=YES (Turns logging on for all Web Services Programs)

or

WSQP LOG WEB SERVICES=NO (Turns logging off)

WSQP LOG WEB SERVICES=USERPRGM (Turns logging on for a single program)

or

WSQP LOG WEB SERVICES= (Clears single program logging off)

Sample Web Services Log:

```
15:42 IDMS DC504900 V130 T242 IDMSWSSS --- DATABASE ERROR STATUS 3020, DURING:
15:42 IDMS DC504902 V130 T242 IDMSWSSS SOAP LOGIC WSEND
15:42 IDMS DC504600 V130 T242 IDMSWSI CALLING SEND
15:42 IDMS DC504800 V130 T242 IDMSWSSP START PROGRAM
15:42 IDMS DC504800 V130 T242 IDMSWSSP MESSAGE DATA SENT:
15:42 IDMS DC504800 V130 T242 IDMSWSSP Service requested invalid or unavailable
```



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CA IDMS Web Services Troubleshooting

- Enable Logging Dynamically using API function SETOPTION

```
MOVE 8 TO WS-FUNCTION-CODE. ! WSSETOPTION()  
MOVE 1 TO WS-OPTION-NUMBER.  
MOVE 'YES' TO WS-OPTION-VALUE.  
LINK TO PROGRAM 'IDMSWSI' USING  
  (WSDEMO-FUNCTION,  
   WSDEMO-RETURN,  
   WS-ERROR-INFO,  
   WSDEMO-SESSION,  
   WS-OPTION-NUMBER-RECORD,  
   WS-OPTION-VALUE-RECORD).
```

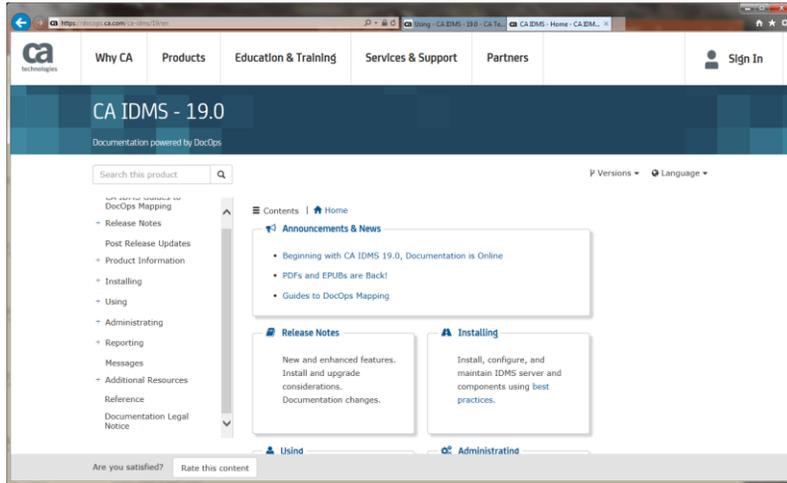


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Web Services Documentation

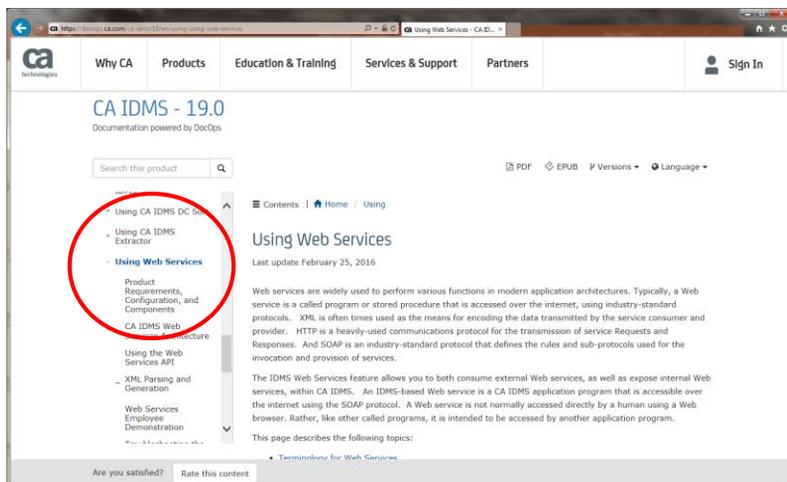
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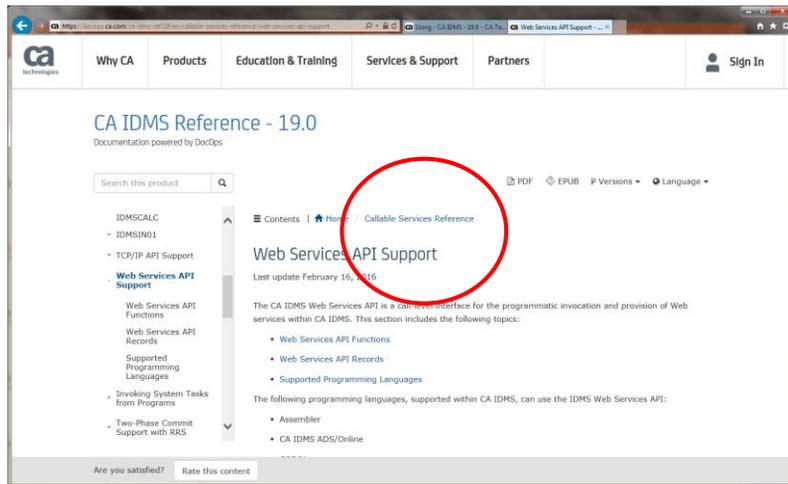
Using Web Services



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Web Services API Reference



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Summary

- The Web Services feature provides another means by which clients can modernize their CA IDMS-based applications, as well as provide modern-day applications easy access to CA IDMS-based data using industry-standard technology.



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Questions & Answers



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