

BCP 1.0A

Technical
implementation of
standards

An overview and comparison of
different methods

Notes:

© Copyright 2009 QuantityWare GmbH. All rights reserved.

SAP, R/3, mySAP, mySAP.com, xApps, xApp, SAP NetWeaver, and other SAP products and services mentioned herein as well as their respective logos are trademarks or registered trademarks of SAP AG in Germany and in several other countries all over the world. All other product and service names mentioned are the trademarks of their respective companies.

Microsoft, Windows, SQL-Server, Powerpoint and Outlook are registered trademarks of Microsoft Corporation.

These materials and the information therein are subject to change without notice. These materials are provided by the company QuantityWare GmbH for informational purposes only. There is no implied representation or warranty of any kind, and QuantityWare GmbH shall not be liable for errors or omissions with respect to the materials provided. The only warranties for the products and services of QuantityWare GmbH are those set forth in the express warranty statements accompanying such products and services, if any. No statement within this document should be construed as constituting an additional warranty.

Contents

BCP 1.0A.....	1
TECHNICAL IMPLEMENTATION OF STANDARDS.....	1
Notes:	2
Contents	3
Introduction	4
1. Different implementation Methods.....	5
1.1. Interface to special external binary executables	5
1.2. Interface to ABAP functions.....	5
1.3. Provided implementations of BAdI's.....	6
2. Implementation Comparison.....	7
2.1. Technical aspects of calling external binary executables.....	7
2.1.1. CALL SYSTEM	7
2.1.2. RFC Server	8
2.2. Comparison of ABAP and external binary executables.....	8
3. Conclusion	13

Introduction

SAP does not provide any implementation of external standards for quantity conversions of petroleum products; however SAP does provide a powerful interface (QCI) that can be used to communicate with 3rd party implementations of such standards.

SAP note 959327 provides an overview as to how the interface works and how it can be configured.

There are currently two ways in which external standards are used.

- Via the “conventional” interface that was developed to support the standard ASTM D 1250-80. It supports the C codes of the American Petrol Institute (API), an implementation of ASTM D 1250-80. This implementation is provided as C function sources. SAP provides example sources of an interface program to make the C codes usable as external standards. Later, SAP provided an additional interface to support the standard ASTM D 1250-04 and provided limited example source coding which demonstrates how the API C++ codes can be implemented for use with the SAP application.
- Since 1999 a new powerful interface - the SAP Quantity Conversion Interface (QCI) has been available. It is based on the SAP development language APAP and fully integrated in the SAP platform. The QCI allows the support of ABAP implementations for ‘external’ standards.

An interface overview is documented in SAP note 959327.

1. Different implementation Methods

SAP offers three different kinds of interfaces to external implementations and the potential to change the data calculated according to customer needs.

- Traditional interface to a limited number of special external binary executables based on C or C++ sources codes.
- A wide open interface for any ABAP implementation that follows the design of the QCI interface.
- BAdI's allowing results of internal QCI steps to be changed in any way.

1.1. Interface to special external binary executables

There are only two ways in which any external executable can be used from an application within a standard SAP R/3 system:

- CALL SYSTEM
- RFC Server Implementation

Thus, the SAP QCI must provide a special interface able support any standard - this resulted in the development and provision of a special QCI interface for each standard (executable). In addition to this, an external executable must exactly follow the interface definitions and be able to call the functions necessary for the calculation.

Up until now, as a courtesy to the customer, SAP has provided special interfaces and limited example, unsupported, coding for the following interfaces to external binary executables:

- AGA 8 report via CALL SYSTEM and RFC Server. (outdated)
- API implementation of ASTM D 1250-80 via CALL SYSTEM and RFC Server. (outdated)
- API implementation of ASTM D 1250-04 CALL SYSTEM (Only for UNIX - no examples for Windows or RFC Server are provided).

For more information, please read the SAP notes found in area IS-OIL-DS-QCI.

1.2. Interface to ABAP functions

The upstream application (PRA) developed by SAP, needs a considerably more sophisticated and flexible interface than the relatively simple calculation of oil quantities necessary in Downstream operations. In addition to this, the implementation of new standards (e.g. Aromatics, LPG etc.) became necessary, however no C++ codes were available.

In order to provide a solution to this issue, SAP developed a powerful interface to call 'external' functions without the need of developing special interfaces for each function. External functions whose implementation takes advantage of this interface (exclusively developed in ABAP) are the solutions most closely integrated with the QCI. This new, open interface is very complex, but highly flexible. The net result of this type of implementation is that the solution is entirely 'inside' the SAP ABAP environment and is therefore extremely fast, reliable, safe and as platform independent as ABAP. Technically seen - it is a part of the SAP solution environment.

1.3. Provided implementations of BAdI's

Several BAdI Implementations are offered by SAP. They can be used for tasks of varying complexity – from rounding results, to avoiding QCI calculations altogether! The BAdIs provided allow for great flexibility, however using a BAdI means that the customer has made the choice to process data in a completely different way to that for which the QCI and IS-Oil functionality was designed; it is a pure Customer Solution. In many cases this may be helpful, but a considerable amount of physics, standards, ABAP and process knowledge is required to be able to change the results of QCI processing in a meaningful and consistent way.

1.4 A new generation: MQCI

QuantityWare has utilised the flexibility of the SAP architecture to provide its customers with a modification-free alternative to the SAP QCI. The QuantityWare "MQCI" is an extremely flexible, high-performance, model-based interface which allows customers to be provided with support for measurements standards which do not adhere to the single standard SAP calculation model.

2. Implementation Comparison

2.1. Technical aspects of calling external binary executables

Calling any external binary executable from an SAP application can only be done by using the interfaces provided by SAP.

There are two ways to call such an executable

- CALL SYSTEM
- RFC Server

2.1.1. CALL SYSTEM

Initially, this seems to be the easiest method to use.

The basic theory is that an SAP application “Calls” an O/S command i.e. passing an O/S command line to the O/S and then starting a second process which “pipes” the standard output of the command executed back to the SAP application.

This implementation has some major issues which must be carefully considered:

1. It is dependent on the used operating systems' command line syntax.
2. It is dependent on the used operating systems' standard output syntax.
3. Two processes must be installed in order for the call to work. This can often cause reliability and capacity problems under high workload.
4. There is no way to handle errors. A delay (in practice, often seen with specific operating systems under high workload) will force a short dump and will halt the process causing an execution termination.
5. At a minimum, a CALL SYSTEM execution costs around 150 times the time of any ABAP function call (more often than not, 300 – 600 times) This is because the interface has not been designed for such usage.
6. CALL SYSTEM cannot support security needs. SYSTEM is a kernel program. When using this solution, all users in IS-OIL MUST have the permission to use it. It is important to be aware that SYSTEM hands over ANY command to the operating system as user <sid>adm. This is a massive security risk which can be easily exploited.
7. To our knowledge, SAP is trying to retire CALL SYSTEM. For this reason, the RFC Server method was developed - see below.
8. SAP note # 23697, component BC-OP, states: "CALL SYSTEM" should not be used and is not released nor supported by SAP for customer applications.

2.1.2. RFC Server

When compared to CALL SYSTEM, an RFC Server can provide an interface that is more stable and secure. An IS-OIL user can only call this application – i.e. they cannot send “any” operating system command. An RFC Server is several times faster than CALL SYSTEM, but is still an external interface and is therefore in its essence “slow” when compared to a direct call of an ABAP function inside of a SAP application. According to our measurements, RFC server calls to external VCF calculation routines are at least 7 to 10 times slower than any ABAP call. An example RFC server interface program is available for the AGA routines and API 1980.

2.2. Comparison of ABAP and external binary executables

Any ABAP implementation can take advantage of the full functionality of the SAP environment as it works “inside” the SAP ABAP platform. Almost all data from such implementations are available without the need for any special external interface.

Any external application in the form of a binary executable will always have to depend upon a special interface to “open the door” to the “world of SAP”. In other words, “a party” would have to provide and maintain a special interface in the QCI (SAP code) for each of the desired standards as well as providing the source of an interface program in the language chosen by the implementing 3rd party. This must then be available for all operating systems, and for CALL SYSTEM and RFC Server. As you can see – this task presents some unique challenges in design, production and maintenance.

After analysing the situation while applying our experience in the provision of such solutions, we have come up with a basic list of criteria by which an implementation in ABAP and external binary executables can be compared:

Category	ABAP	RFC Server	CALL SYSTEM
Interface	Generic and Customizable. Easy access to all data	Each standard needs a special Interface in the SAP QCI and an Interface for the external program	Each standard needs a Special Interface in the SAP QCI and an Interface in the external program
O/S dependencies	Independent	Heavily dependent on O/S	Heavily dependent on O/S and standard output

Category	ABAP	RFC Server	CALL SYSTEM
SAP release Dependency	No	Yes, dependent on the RFC-SDK	No
Security	Full SAP Authorization Concept	One RFC authorization for all RFC calls - only implemented functionality can be used.	One authorization for all Calls. If changed, any command can be sent to the OS. HIGH RISK
Reliability	Absolutely reliable	As reliable as any RFC call.	Not designed for high call frequency. Problems often occur in this scenario. (O/S dumps)
Message handling	Full SAP functionality	Restricted and must be developed as data transfer. Dependent on the SAP interface used.	Abort or timeout can happen without any clear message. Messages must be handled as data transfer. No clear return code is provided.
Performance	Performance comparable to any SAP application. All data are held in the ABAP Memory.	The interface is about 7 to 10 times slower than ABAP.	Not designed for high frequency calls. At least 150 times slower than any ABAP interface.
Installation	Using SAP standard tools (SAINT / SPAM).	Installation requires a highly experienced C++ programmer with O/S knowledge. Must be repeated for each O/S and each standard.	Installation requires a highly experienced C++ programmer with O/S knowledge. Must be repeated for each O/S and each standard.
Test Programs (Compliance tools)	Available and supported	None	None

Category	ABAP	RFC Server	CALL SYSTEM
Handling	Known to support and development teams - as easy as any R/3 application	Must be handled at the O/S level – but still ‘sort of belongs to SAP’ – no clear definition of responsibilities. Dependencies on System-ID and file system definition. Each O/S requires its own executable.	Must be handled at the O/S level – but still ‘sort of belongs to SAP’ – no clear definition of responsibilities. Dependencies on System-ID and file system definition. Each O/S requires its own executable.
Customising	Full templates delivered – over 300 Conversion groups alone are provided with the BCP solution + Units of Measure and Reading groups	No business-relevant customising	No business-relevant customising
Support	Fully supported by providing organisation. One partner.	Support of the ABAP interface part (SAP QCI) only. Framework (interface) routines and external program is a customer solution. Multiple parties involved	Support of the ABAP interface part (SAP QCI) only. Framework (interface) routines and external program is a customer solution. Multiple parties involved.

Category	ABAP	RFC Server	CALL SYSTEM
Available Oil Standards (BCP) ¹	ASTM D 1250-08 ASTM D 1250-04 ASTM D 1250-80 ASTM D 1250-52 ASTM D 4311-04 (Asphalt) ASTM D 1555-04a ASTM D 1555M-04a DIN 51757 + DIN 51650 (Aromatics) EN 14212 (Bio Diesel) ASTM D633 (Road Tars) ABNT NBR 5992-80+08 (Ethanol) GPA TP-25 + GPA TP-27 (LPG) ASTM D 1298-99 (Hydro-Corr.) ASTM D1250-80 Tables 8, 26 and 56 API MPMS Ch.11.5	D 1250-80	D 1250-04 D 1250-80

¹ Check the document „BCP 10A Supported Standards SPxx„ on www.quantityware.com for a current list.

Category	ABAP	RFC Server	CALL SYSTEM
Available Gas Standards (BCG)	AGA Report No.3 AGA Report No. 8 SGERG 88 ISO 13443 ISO 6976 ISO 12213 GPA 2145-03 GPA 2172-96 ISO 6578 ASTM D4784 (revised Klosek & McKinley) GPA 8173 GPA 1167-83	AGA Report No. 8	AGA Report No. 8
Calculation 'Model' Support	QW MQCI. An unlimited number of models may be supported. (E.g. necessary for DIN 51757 and DIN 51650 implementation)	SAP QCI – single model supported-	SAP QCI – single model supported-
Further Functionality	<ul style="list-style-type: none"> • Weight and Mass differentiation. • Definition of Customer specific Range limit checks (Warning / Error) • Definition of UOM specific rounding via customizing • Calculation of Vapor-phase product quantities (e.g. LPG) • Calculation display and storage of all relevant calculation parameters. (SAP standard: Base density) 	None	None

3. Conclusion

- An ABAP solution is fully integrated into the SAP world and can take full advantage of all that is offered and supported by the mature SAP ABAP environment including its stability and performance. All data are held in ABAP memory and the calls are as fast as only ABAP can be. The interface is open and customizable for a wide range of customer needs.
- The QuantityWare BCP solution is integrated in such a way so that (for the end-user) it seems to be a part of the SAP solution.
- Extensive additional functionality is provided in BCP allowing the processing of Mass AND Weight, support of calculations 'ranges' and, via the Petroleum Measurement Cockpit, a comprehensive configuration and test workbench, through which governance, risk and compliance in the area of bulk calculations can be managed.
- External functions provided as source coding in C must be handled in a completely different way. The interfaces are complicated, hard-coded, slow and difficult to maintain.
- Building and using such external executables means operating outside of the "SAP ABAP world" and requires dependency on "a party" supporting the special interface required, not only on the ABAP side of the QCI but as an external interface too in a programming language dictated by the supplier of the external standard. In reality, this is a customer solution, necessary for each single standard which is required.
- Only ASTM D 1250-80, ASTM D 1250-04 and AGA report 8 are available as source codes in C/C++; all other standards are only available as written documents describing the VCF procedure, without code examples that could be used to build an executable to enable the standard to be called from an SAP environment. Furthermore "a party" would have to develop a special QCI interface for each individual standard (which would probably need to be changed as the standard changes – i.e. full re-implementation). The corresponding external interface should also not be forgotten – see above.
- Support is complex, expensive and hard to maintain at an acceptable level for such customer solutions.
- The handling of solutions which exist externally to the SAP ABAP platform is a complex challenge in terms of design, coding, testing, implementation and maintenance.
- The QuantityWare ABAP solution BCP has been tested by multiple customers around the globe and has been used in productive environments with no reported errors since its first implementation in October 2006.