Technical Standard

Systems Management:
Common Manageability Programming Interface (CMPI)

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This specification has not been verified for avoidance of possible third-party proprietary rights. In implementing this specification, usual procedures to ensure the respect of possible third-party intellectual property rights should be followed.

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Systems Management: Common Management Programming Interface (CMPI)

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Preface

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This Document

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  - — Environment variables, which are also shown in capitals
  - — Utility names
  - — External variables, such as *errno*
  - — Functions; these are shown as follows: *name*(). Names without parentheses are C external variables, C function family names, utility names, command operands, or command option-arguments.
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- The notation **<file.h>** indicates a header file.
- Names surrounded by braces – for example, {ARG_MAX} – represent symbolic limits or configuration values which may be declared in appropriate headers by means of the C #define construct.
- The notation [ABCD] is used to identify a return value ABCD, including if this is an error value.
- Syntax, code examples, and user input in interactive examples are shown in fixed width font. Brackets shown in this font, [], are part of the syntax and do not indicate optional items. In syntax the | symbol is used to separate alternatives, and ellipses (…) are used to show that additional arguments are optional.

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Referenced Documents

The following documents are referenced in this Technical Standard:

- ANSI/IEEE Std 754-1985, Standard for Binary Floating-Point Arithmetic.

1 Introduction

1.1 Purpose

The purpose of this document is to describe a standard C API to be supported by Management Brokers[1] (MB, *aka* CIM Object Managers) for interacting with Management Instrumentation (MI, *aka* CIM Providers).

1.2 Intended Audience

This document is not a programming guide, although it is recognized that one is needed eventually. The intended audience should be knowledgeable in CIM terms and concepts in general, and have knowledge of one or more CIMOM implementations.

1.3 Summary of Requirements

In a number of related discussions, requirements and suggestions have been collected and form the basis for this specification. The following list summarizes these requirements:

1. Reduce the complexity of writing MI.
2. Complete encapsulation and independence of data structures used by MBs.
3. No (MB implementation-specific) library needed for writing MIs; a C header file is all that is needed.
4. Support for interface opaque mapping strings to be passed by the MB down to the MI.
5. Support for remote MI using Pegasus-style response handling and progress indications.
6. Place no requirement on the instrumentation to maintain state between calls. This is to support instrumentation implemented as shell scripts, and generic providers that get their context from the registration schema.
7. Be thread-safe and reentrant. The MB may call into the MI on multiple threads simultaneously.
8. Support an arbitrary number of providers implemented in a single library.
9. Allow instrumentation libraries to be secure.
10. Allow one instrumentation library to easily load another.

1 The terms “Management Broker” and “Management Instrumentation” are used instead of CIMOM and providers because CMPI is not necessarily restricted to CIMOM environments.

2 CMPI Interface General Structure

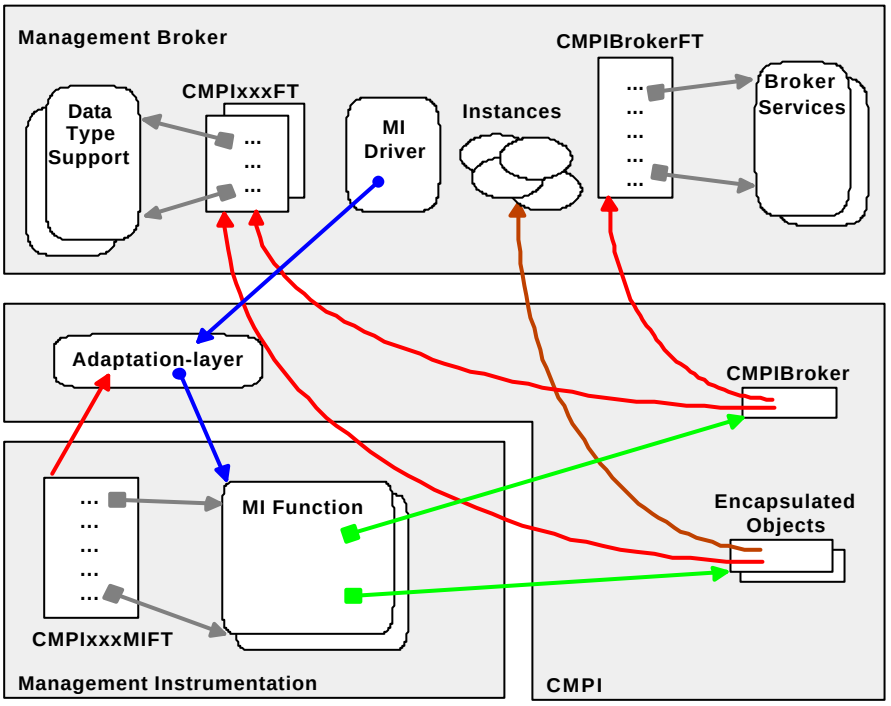
The environment provided by Management Brokers (MBs) in which Management Instrumentation (MI) executes has to provide the following support:

1. Access to data type manipulation functions.
   This support is made accessible to the MI via vectors of entry points. MBs must provide these vectors and provide MB-specific implementation for this support. All defined functions must be implemented.

2. Access to MB services.
   This support is made accessible to MIs via a vector of entry points. MBs must provide this vector and provide MB-specific implementation. MBs may opt to implement a subset of these services according to its classification (see Chapter 9).

MIs must provide the following:

1. Access to the MI function entry points.
   Access is provided by passing a vector of entry points to the MB at initial invocation time. In addition, this vector will have information about the groups of MI functions supported (instance, associations, etc.) and the level of API used.



Layout of the vectors and function signatures will be described by a set of C header files. A set of C macros will be provided to hide the vector indirection. For C++ environments, methods will be defined that enable C++-style processing of CMPI entities.

3 API Concepts

In this chapter the principles of CMPI are explained. Code fragments must be seen in the context of the text describing them, and are not complete or are generic descriptions. The notation "//..." indicates pieces that are left out. Appendix A is used to describe the complete set of APIs and data structures and will be guaranteed to compile without failure (eventually).

3.1 Highlights

3.1.1 Guiding Principles

There are four basic thoughts that have governed the design of this interface:

1. Existing Management Brokers (MBs) must be able to use CMPI without the need for extensive rework. This resulted in the concept of encapsulation.
2. The external API signatures should be structured such that the number of them is containable and where possible have a high degree of regularity. Ease-of-use is achieved by defining a set of convenience macros and C++ wrappers.
3. Since most functions result in transformations to the respective MB APIs, CMPI should not introduce new structures containing function parameter data; instead, data should be passed directly as function parameters.
4. CMPI strives to make Management Instrumentation (MI) programming simpler and will eliminate, as far as possible, intermediate objects, in particular **CIMValue** and **CIMProperty**.

3.1.2 Encapsulation

Any CMPI data type that has MB implementation-dependent details or contains CMPI data areas is called an "encapsulated data type". An encapsulated data type instance has two parts: a pointer to its MB-dependent implementation and a pointer to the function table giving access to all operations supported by this type. The operation repertoire of encapsulated data types is a major portion of the CMPI interface. This repertoire includes, at a minimum, lifecycle operations (release and clone).

3.1.3 Data Transfer

Most of the API functions deal with transferring property values to and from MBs. Generically there are at least two components needed to define data items: the value itself and its type. Since CIM also supports the notion of NULL values, meaning a property has no value set, a third component is used to define the state of a value indicating whether or not a value has been set.

Values are represented as a union of all types supported by CMPI (**CMPIValue**). Types are represented as a typedef (**CMPIType**). Value states are also represented as a typedef (**CMPIValueState**).

Simple Data Items

For property data transfer calls into CMPI two parameters are used: the address of the value (**CMPIValue***) and its type (**CMPIType**). If the type does not conform to the schema-defined type, the MB will attempt to cast to the schema-defined type where possible.

Assume a schema-defined property contains a 32-bit signed integer. If the MI wants to set a value, it will pass the address of a **CMPIValue** item containing the value and a **CMPIType** of **CMPI_sint32**. If the MI wants to set a NULL value, it will pass a NULL **CMPIValue** address and a **CMPIType** of **CMPI_sint32**.

Property data transfers from CMPI functions to the MI return three components: the value, its state, and its type as defined by the schema. All three components are bundled into one structure (**CMPIData**).

Assume a schema-defined property contains a 32-bit signed integer. If the value is set, the MB uses the **CMPIData** structure to return the value and the type is set to **CMPI_sint32**. If the value is not set, the MB uses the **CMPIData** structure to return the type set to **CMPI_sint32**, with its state set to **CMPI_nullValue**. In this case, the value union contains no meaningful data.

Array Data Items

Because NULL values must be supported, CMPI cannot directly support C-style arrays. Instead, arrays must be represented as if they are arrays of **CMPIData** structures. CMPI arrays are encapsulated data types (**CMPIArray**).

Before transferring arrays into CMPI the MI first has to create a **CMPIArray** of a **CMPIType**-defined array type (any of **CMPI_xxxA**) and fill it with data using the *setElementAt*() function provided by the **CMPIArray** encapsulated object using the simple data transfer scheme described above.

For property data transfer calls of completed arrays into CMPI the same scheme is used as for transferring simple items; the two parameters are the address of the **CMPIValue** union containing the pointer to the **CMPIArray** and **CMPI_xxxA** as a type.

Property operations returning arrays to an MI use the scheme as used for simple items. If the array property is set, then **CMPIValue** holds a pointer to a **CMPIArray** encapsulated data type with any of the **CMPI_xxxA** types. Otherwise, a **CMPI_nullValue** state is returned along with the schema-defined type (any of **CMPI_xxxA**).

Access to the individual elements of the array is done using the *getElementAt*() function provided by the CMPIArray encapsulated data type following the simple data item transfer scheme.

3.1.4 Error Indication

All MI and CMPI functions return a **CMPIStatus** structure, either as a return value or via an output parameter, which contains a CMPIrc return code and an optional message in **CMPIString** format. The return codes are compatible with DMTF's CIM error codes. Special codes for additional error indications from CMPI data manipulation routines will be added if needed.

If the **CMPIStatus** output parameter equals NULL, no status structure will be returned.

3.1.5 Threading

CMPI imposes no limits on threading concepts and is itself thread-safe. Whether MIs themselves are thread-safe and can maintain data integrity is a different story. This depends entirely on the nature of the MI and the resources it controls or represents and on the semantics, or lack thereof, imposed by CIM. MIs must ensure thread-safety, if needed, by using serialization techniques internally.

Support for security context will be provided. If an MI wishes to use threads in which CMPI functions are invoked, the thread has to be introduced to CMPI prior to invoking any CMPI functions using the *prepareAttachThread*(), *attachThread*(), and *detachThread*() broker functions. The *prepareAttachThread*() function requires the original **CMPIContext** object to be passed as a parameter and produces a new **CMPIContext** to be used by *attachThread*().

3.1.6 Memory Ownership

Due to its encapsulating nature, all complex data structures are created by or via CMPI functions and should therefore be released by or via CMPI. This enables the insulation of MIs from specific memory management techniques used by the MB.

CMPI performs automatic release of all its encapsulated objects used and/or created during an MI function invocation cycle, except for those structures that have been copied explicitly using the *clone*() function by the MI.

Structures that have been copied must eventually be released by the MI explicitly using the *release*() function. This function can be used by long-running indication threads or during invocation cycles to indicate that particular encapsulated objects (not necessarily cloned) are not needed anymore.

3.1.7 The Other Side of the API

The other side of the API is the implementation of CMPI. It mostly is an adaptation layer that transforms CMPI semantics to the semantics employed by the respective MB. In general, this is a straightforward process; however, there are cases where this is not so easy. Management applications that wish to call CMPI-style MI without using an MB must provide support for all CMPI encapsulated data types. There is an opportunity for a reference implementation for this purpose, but that is outside the scope of this document.

3.1.8 Asymmetric Properties

The API concept has some asymmetric properties due to the fact that MBs have very diverse implementation principles. For instance, Pegasus is enabled for asynchronous delivery of partial results from the MI towards the MB, whereas other MBs expect an enumeration of some kind to be returned. The lowest common denominator chosen is to use Pegasus' *ReturnHandler* concept. MBs expecting enumeration returns can easily adapt the *returnData* mechanism to create the required enumeration. On the other hand, an MI invoking MB services always gets back a CMPIEnumeration. This asymmetry is visible, but is not considered to be a problem.

3.2 Broker Services

The MB offers services to invoke complex operations similar to operations issued by a CIMClient. In addition, the MB gives access to factory services for creating encapsulated types.

A **CMPIBroker** data type is defined to provide access to the broker services. The format of the **CMPIBroker** data type is as follows:

```
typedef struct _CMPIBroker {
    CMPIBrokerFT* bft;
    CMPIBrokerEncFT* eft;
} CMPIBroker;
```

The **CMPIBroker** object is passed as a pointer to an MI made available to the MI factory (<mi-name>_Create<mi-type>MI) at initialization time. The MI will cache this pointer across calls and use it where appropriate.

3.3 Encapsulated Types

As mentioned before, encapsulated data types have a per-type function table. For every type a mandatory repertoire of functions is defined and must be implemented by respective MBs. The sum of all routines accessible via the function tables constitutes a major part of the CMPI interface. This concept enables MI to work transparently (and simultaneously if needed) to work with data type instances coming from different MBs using different heap management concepts.

Generically, an encapsulated type has the following format:

```
typedef struct _<E-Type> {
    void *hdl;
    <E-Type>FT ft;
} <E-Type>;
```

The following is a partial example of the type and function table for **CMPIInstance**:

```
typedef struct _CMPIInstance {
    void *hdl;
    CMPI_Instance_Ftab;
} CMPIInstance;

typedef struct _CMPI_Instance_Ftab {
    CMPIStatus    (*release)(CMPIInstance*);
    CMPIInstance *(*clone)(CMPIInstance*,CMPIStatus*);
    CMPIStatus    (*setProperty)(CMPIInstance*,char*,CMPIValue*,
                         CMPIType);
    CMPIData      (*getProperty)(CMPIInstance*,char*,CMPIStatus*);

} CMPI_Instance_Ftab;
```

The *release*() and *clone*() functions are common across and mandatory for every encapsulated object. The *setProperty*() and *getProperty*() functions are typical examples for setting and getting the values in/from encapsulated objects. The *setProperty*()-like operations always have a **CMPIValue** and **CMPIType** pair as parameters. The *getProperty*()-like operations always return a **CMPIData** structure containing the actual value and its type and

state. See Chapter 8 for exact definitions of **CMPIValue**, **CMPIValueState**, and **CMPIType**.

```
typedef struct _CMPIData {
    CMPIType type;
    CMPIValueState state;
    CMPIValue value;
} CMPIData;
```

Arrays are returned as **CMPIArray** encapsulated types. This type has functions to get data pertaining to arrays like type, size, and individual elements.

The following example shows some of the actual CMPI functions related to the **CMPIInstance** data type:

```
void aUselessRoutine(CMPIInstance *ci)
{
    CMPIInstance *cic;
    CMPIArray *ar;
    CMPICount count;
    CMPIStatus rc;
    CMPIValue val;
    int intVal;

    val.sint32=25;
    cic=ci->ft->clone(ci,&rc);
    rc =
    cic->ft->getProperty(cic,"prop1",&value,CMPI_sint32);
    intVal =
    cic->ft->getProperty(cic,"prop1",&rc).value.sint32;

    ar=cic->ft->getProperty(cic,"propA",&rc).value.array;
    count=cic->ft->getSize(ar,&rc);
    for (int i=0; i<count; i++)
        intVal =
            ar->ft->getElementAt(ar,i,&rc).value.sint32;
}
```

3.4 Programming Convenience Support

Notice that the mapping macros and classes described here are programming convenience supportive elements. Since they are resolved by the compiler, they do not affect the inter-operability between MBs and MIs. Nevertheless they are important and should be considered part of the specification.

3.4.1 Macro Support

Using direct, unaided invocation can become tedious. C macros can be used to make this easier. CMPI data manipulation macro names start with CM.

```
#define CMRelease(o)         ((o)->ft->release((o)))
#define CMClone(o,rc)        ((o)->ft->clone((o),(rc)))

#define CMSetProperty(o,v,t) \
            ((o)->f->setProperty((o),(CMPIValue*)(v),(t)))
#define CMGetProperty(o,rc)  ((o)->ft->get((o),(rc)))
//...
```

The example above recoded using the macro support:

```
void aUselessRoutine(CMPIInstance *ci)
{
    CMPIInstance *cic;
    CMPIArray* ar;
    CMPICount count;
    CMPIStatus rc;
    int IntVal=25;

    cic=CMClone(ci,&rc);
    rc=CMSetProperty(cic,"prop1",&val,CMPI_sint32);
    intVal=CMGetProperty(cic,"prop1",&rc).value.sint32;

    ar=CMGetProperty(cic,"propA",&rc).value.array;
    count=CMGetArraySize(ar,&rc);
    for (int i=0; i<count; i++)
        intVal=CMGetArrayElementAt(ar,i,&rc).value.sint32;
}
```

A complete listing can be found in Section B.2.

3.4.2 C++ Class Support

In a C++ environment, C++ classes can be used to access and manipulate encapsulated types. There are two possible ways to do this:

1. Inline method declarations within the encapsulated types
2. Wrapping of the encapsulated types

Both methods have their advantages and are independent of the C ABI interface. Wrappers will introduce a proper class structure that is extendible as first-class C++ objects. For that reason the wrapping model will be used. Classes use their own naming structure, starting with “Cmpi”. The following is an example; the complete class definitions can be found in Section B.1.

```
Class CmpiInstance {
    private:
        CMPIInstance *enc;
        CmpiInstance();
        CmpiInstance(CMPIInstance*);
    public:
        CmpiInstance(const CmpiInstance&);
       ~CmpiInstance();
        CmpiInstance(const CmpiObjectPath&);
        CmpiData getProperty(char*);
        void getProperty(char*,CMPIsint8&);
        void getProperty(char*,CMPIsint8&);
        //...
        void getProperty(char*,CmpiObjectPath&);
        void setProperty(char*,CmpiData&);
        void setProperty(char*,CmpiObjectPath&);
        //...
};
```

The examples above recoded using the C++ methods and macro support:

```
void xx::aUselessRoutine(CmpiInstance &ci, ..) {
```

```
    CMPIType type;
    CMPICount count;
    CmpiArray ar;
    int val=25;

    CmpiInstance& cic(ci);
    cic.setProperty("prop1",CmpiValue(val));
    cic.getProperty("prop1",val);
    cic.getProperty("prop1",val);

    cic.getProperty("propA",ar);
    count=ar.getSize();
    for (int i=0; i<count; i++)
        ar.getElementAt(i,val);
}
```

The C++ support also introduces a helper class called **CmpiValue**. It is used to exploit method overloading and the facilities of C++ not available in C. It creates the **CMPIType**/**CMPIValue** pair.

3.5 Query and Indication Filtering

The filtering concept for indication support is based on experiences with Sun WBEM Services and The Open Group OpenCimom implementations. In essence the filter is representing the complete select expression as a combination of a list defining the projection and a parse tree defining the select condition. A select expression is encapsulated by **CMPISelectExp**. Similarly, for query support, a string containing a select condition is passed to the *execQuery*() function.

3.5.1 Indication Filtering

For indication filtering there are two distinct reasons for having access to the select condition. The most obvious one is for filtering indication candidates. This is probably best done by the MB itself, and presumably the filter structure is set up for effective filter processing.

The other reason is to enable an MI supporting indications to inspect and understand the filter and instrument itself for effective monitoring of the resources it controls. For example, an MI that monitors the availability of a critical service or daemon in a system could arbitrarily poll all services in a system regularly, or, intelligently use instrumentation in a system that natively monitors the availability of services by specifying which service(s) should be monitored.

3.5.2 Query

Effective query processing has similar needs: the query process might transform the query into a native format known by the domain this MI function represents. The *execQuery*() function has one more difficulty: it has to parse and query the string which is not necessarily WQL. In case a WQL-style language is used, a factory function is offered to transform a query string into a **CMPISelectExp**.

3.5.3 Normalized Select Conditions

In order to inspect a select expression, MIs can request the expression to be transformed into either a conjunction of disjunctions (CoD), or a disjunction of conjunctions (DoC) canonical form, encapsulated as **CMPISelectCond**. In both forms all parenthesis and negations are resolved. As part of this function the projection list can also be requested.

The **CMPISelectCond** is a list of **CMPISubCond** objects. A **CMPISubCond** object is a list of **CMPIPredicates**. Depending on the requests (DoC or CoD), the resulting predicates of a sub-expression list are either conjunctive (to be AND'ed) for DoC, or disjunctive (to be OR'ed) for CoD requests. The resulting expressions of a normalized select condition are either disjunctive (to be OR'ed) for DoC, or conjunctive (to be AND'ed) for CoD requests.

4 Data Types

The CMPI data types are the C data types that Management Instrumentations (Mis) should use in their code in order to encapsulate the specifics of the C data type. They are used in the data manipulation functions, in Management Broker (MB) services, and in the MI functions.

4.1 CMPI Encapsulated Data Types

A major requirement for CMPI is to hide implementation details of MB-specific data structures. CMPI uses pointers to opaque structures containing the MB-specific implementations, including a function pointer table providing type-specific support. This table, among others, contains MB-specific memory management support functions. In this document, the symbol <**E-Type**> is used to generically refer to the encapsulated types listed in the following table:

Table 1: Encapsulated Data Types

CMPI Data Type <E-Type>	C Data Type
CMPIInstance	struct _CMPIInstance
CMPIObjectPath	struct _CMPIObjectPath
CMPIArgs	struct _CMPIArgs
CMPIEnumeration	struct _CMPIEnumeration
CMPIArray	struct _CMPIArray
CMPISelectExp	struct _CMPISelectExp
CMPISelectCond	struct _CMPISelectCond
CMPISubCond	struct _CMPISubCond
CMPIPredicate	struct _CMPIPredicate
CMPIDateTime	struct _CMPIDateTime
CMPIContext	struct _CMPIContext
CMPIResult	struct _CMPIResult

```
struct _CMPIInstance;
struct _CMPIObjectPath;
struct _CMPIArgs;
struct _CMPIEnumeration;
struct _CMPIArray;
struct _CMPISelectExp;
struct _CMPISelectCond;
struct _CMPISubCond;
struct _CMPIPredicate;
struct _CMPIDateTime;
struct _CMPIContext;
struct _CMPIResult;
```

```
typedef CMPIInstance     struct _CMPIInstance;
typedef CMPIObjectPath   struct _CMPIObjectPath;
typedef CMPIArgs         struct _CMPIArgs;
typedef CMPIEnumeration  struct _CMPIEnumeration;
typedef CMPIArray        struct _CMPIArray;
typedef CMPISelectExp    struct _CMPISelectExp;
typedef CMPISelectCond   struct _CMPISelectCond;
typedef CMPISubCond      struct _CMPISubCond;
typedef CMPIPredicate    struct _CMPIPredicate;
typedef CMPIContext      struct _CMPIContext;
typedef CMPIResult       struct _CMPIResult
```

4.2 CMPI String Data

For string data, two formats are supported, depending on usage: input to CMPI functions is as ordinary zero-terminated UTF-8 character arrays, and strings generated by CMPI functions are returned as pointers to **CMPIString** structures.

The reason for differentiating here is a matter of convenience and technical necessity:

1. Specifying a property name as input to a function using **CMPIString** would require using a **CMPIString** factory without any visible and/or measurable advantage.
2. Strings being returned from CMPI are dynamic in nature and minimally require memory management support. Therefore they follow the encapsulation concept.

Accessing the zero-terminated UTF-8 character arrays portion of a **CMPIString** is supported by a simple macro invocation.

Table 2: String Data Types

CMPI Data Type	C Data Type
CMPIString	struct _CMPIString

```
struct _CMPIString;
typedef _CMPIString struct CMPIString;
```

4.3 CMPI Simple Data Types

Most of the CMPI data type manipulation functions use as input and return simple data items such as integers, booleans, and floating-point numbers. All simple CIM types are supported via a convenience layer. The following is a mapping of simple CIM data types to the corresponding simple CMPI data types.

Table 3: Simple CMPI Data Types

Simple CIM Data Type	CMPI Data Type <C-Type>	C Data Type
boolean	CMPIBoolean	unsigned char (0: false, any other value: true)
char16	CMPIChar16	16-bit unsigned integer

Simple CIM Data Type	CMPI Data Type <C-Type>	C Data Type
uint8	CMPIUint8	8-bit unsigned integer
uint16	CMPIUint16	16-bit unsigned integer
uint32	CMPIUint32	32-bit unsigned integer
uint64	CMPIUint64	64-bit unsigned integer
sint8	CMPISint8	8-bit integer
sint16	CMPISint16	16-bit integer
sint32	CMPISint32	32-bit integer
sint64	CMPISint64	64-bit integer
real32	CMPIReal32	32-bit floating-point
real64	CMPIReal64	64-bit floating-point
string	CMPIString[2] char*	Encapsulated string type Zero-terminated UTF-8 char array
datetime	CMPIDateTime [3]	Date/time structure

```
typedef unsigned char           CMPIBoolean;
typedef unsigned short          CMPIChar16;
typedef unsigned char           CMPIUint8;
typedef unsigned short          CMPIUint16;
typedef unsigned long           CMPIUint32;
typedef unsigned long long      CMPIUint64;
typedef signed char             CMPISint8;
typedef short                   CMPISint16;
typedef long                    CMPISint32;
typedef long long               CMPISint64;
typedef float                   CMPIReal32;
typedef double                  CMPIReal64;
```

For the moment, it is assumed that compilers support 64-bit arithmetic data types and operations.[4]

As to the floating-point declarations, it is assumed that MBs and MIs will use standard float/double ANSI C declarations and operations. Where there are compiler options/restrictions to the binary representations, MIs must follow MB implementation specifications.

[2] For this discussion, **CMPIString** is considered to be a simple CIM data type, although it is an encapsulated type. See Section 4.2 for declaration and rationale.
[3] **CMPIDateTime** is implemented as an encapsulated data type.
[4] For situations where this is not the case, the **CMPIxint64** declarations may need to be conditional so that externally definable constructs can be used instead, assuming that the MB and MI can agree on a common format and the use of a common 64-bit emulation package.

Ultimately, when floating numbers have to be exposed to the outside world via DMTF-defined specifications, the MB has to transform these numbers into UTF-8 character strings as floating-point constants according to ANSI/IEEE Std 754-1985.

The same applies for little/big-endian dependencies.

4.4 CMPI Miscellaneous Data Types

CMPIValuePtr is used for context data only. It is used to describe raw unformatted data areas. It points to a data area and contains the length of the area.

Table 4: Miscellaneous Data Types

CMPI Data Type	C Data Type
CMPIValuePtr	struct _CMPIValuePtr

```
typedef struct _CMPIValuePtr {
    void *ptr;
    unsigned int length;
} CMPIValuePtr;

typedef CMPIValuePtr struct _CMPIValuePtr;
```

4.5 CMPI Types and Values

Three components are used to define value, state, and type (**CMPIValue**, **CMPIValueState**, and **CMPIType**). The value and type components are used by MIs when transferring property data to the MB (set operations). All three components are returned to an MI by the MB when accessing properties; in which case they are bundled in a structure called **CMPIData**.

4.5.1 CMPIData

CMPIData is a structure that holds all three components returned to an MI when accessing property data using functions like *getProperty*().

```
typedef struct _CMPIData {
    CMPIType type;
    CMPIValueState state;
    CMPIValue value;
} CMPIData;
```

The *type* parameter is set to reflect the property type as defined in the schema, the *state* parameter indicates whether a value is set (not a NULL value) or originates from a **CMPIObjectPath** key-value, and the *value* parameter contains the actual value if not a NULL value.

4.5.2 CMPIType

A type discriminator (**CMPIType**) is used to define data types of corresponding values. It is used either as part of a **CMPIData** structure, or as an additional parameter when setting property values.

```
typedef unsigned short CMPIType;
```

```
#define CMPI_SIMPLE       (2)
#define CMPI_boolean      (2+0)
#define CMPI_char16       (2+1)

#define CMPI_REAL         ((2)<<2)
#define CMPI_real32       ((2+0)<<2)
#define CMPI_real64       ((2+1)<<2)

#define CMPI_UINT         ((8)<<4)
#define CMPI_uint8        ((8+0)<<4)
#define CMPI_uint16       ((8+1)<<4)
#define CMPI_uint32       ((8+2)<<4)
#define CMPI_uint64       ((8+3)<<4)
#define CMPI_SINT         ((8+4)<<4)
#define CMPI_sint8        ((8+4)<<4)
#define CMPI_sint16       ((8+5)<<4)
#define CMPI_sint32       ((8+6)<<4)
#define CMPI_sint64       ((8+7)<<4)
#define CMPI_INTEGER      ((CMPI_UINT | CMPI_SINT))

#define CMPI_ENC          ((16)<<8)
#define CMPI_instance     ((16+0)<<8)
#define CMPI_ref          ((16+1)<<8)
#define CMPI_args         ((16+2)<<8)
#define CMPI_class        ((16+3)<<8)
#define CMPI_filter       ((16+4)<<8)
#define CMPI_enumeration  ((16+5)<<8)
#define CMPI_string       ((16+6)<<8)
#define CMPI_chars        ((16+7)<<8)
#define CMPI_dateTime     ((16+8)<<8)
#define CMPI_ptr          ((16+9)<<8)

#define CMPI_ARRAY        ((1)<<13)
#define CMPI_SIMPLEA      (CMPI_ARRAY | CMPI_SIMPLE)
#define CMPI_booleanA     (CMPI_ARRAY | CMPI_boolean)
#define CMPI_char16A      (CMPI_ARRAY | CMPI_char16)

#define CMPI_REALA        (CMPI_ARRAY | CMPI_REAL)
#define CMPI_real32A      (CMPI_ARRAY | CMPI_real32)
#define CMPI_real64A      (CMPI_ARRAY | CMPI_real64)

#define CMPI_UINTA        (CMPI_ARRAY | CMPI_UINT)
#define CMPI_uint8A       (CMPI_ARRAY | CMPI_uint8)
#define CMPI_uint16A      (CMPI_ARRAY | CMPI_uint16)
#define CMPI_uint32A      (CMPI_ARRAY | CMPI_uint32)
#define CMPI_uint64A      (CMPI_ARRAY | CMPI_uint64)
#define CMPI_SINTA        (CMPI_ARRAY | CMPI_SINT)
#define CMPI_sint8A       (CMPI_ARRAY | CMPI_sint8)
#define CMPI_sint16A      (CMPI_ARRAY | CMPI_sint16)
#define CMPI_sint32A      (CMPI_ARRAY | CMPI_sint32)
#define CMPI_sint64A      (CMPI_ARRAY | CMPI_sint64)
#define CMPI_INTEGERA     (CMPI_ARRAY | CMPI_INTEGER)

#define CMPI_ENCA         (CMPI_ARRAY | CMPI_ENC)
#define CMPI_stringA      (CMPI_ARRAY | CMPI_string)
#define CMPI_charsA       (CMPI_ARRAY | CMPI_chars)
#define CMPI_dateTimeA    (CMPI_ARRAY | CMPI_dateTime
```

```
// The following are CMPIObjectPath key-type synonyms
// and are valid only when CMPI_keyValue of
// CMPIValueState is set.

#define CMPI_keyInteger   (CMPI_sint64)
#define CMPI_keyString    (CMPI_string)
#define CMPI_keyBoolean   (CMPI_boolean)
#define CMPI_keyRef       (CMPI_ref)

// The following are predicate types only.

#define CMPI_charString      (CMPI_string)
#define CMPI_numericString   (CMPI_string | CMPI_sint64)
#define CMPI_booleanString   (CMPI_string | CMPI_boolean)
#define CMPI_dateTimeString  (CMPI_string | CMPI_dateTime)
#define CMPI_classNameString (CMPI_string | CMPI_class)
```

Notice that CMPI_null is never returned by CMPI; it is used only by the MI with property setting operations to indicate a NULL value being set.

4.5.3 CMPIValueState

CMPIValueState describes the state of the actual value, whether it is set (not a NULL value) or emanated from a **CMPIObjectPath** key value.

```
typedef unsigned short CMPIValueState;

#define CMPI_nullValue (1<<8)
#define CMPI_keyValue  (2<<8)
#define CMPI_badValue  (0x80<<8)
```

4.5.4 CMPIValue

CMPIValue is a union that can hold any of the data types defined in CMPI.

```
typedef union _CMPIValue {
    CMPIBoolean            boolean;
    CMPIChar16             char16;
    CMPIUint8              uint8;
    CMPIUint16             uint16;
    CMPIUint32             uint32;
    CMPIUint64             uint64;
    CMPISint8              sint8;
    CMPISint16             sint16;
    CMPISint32             sint32;
    CMPISint64             sint64;
    CMPIReal32             real32;
    CMPIReal64             real64;

    CMPIInstance*          inst;
    CMPIObjectPath*        ref;
    CMPIArgs*              args;
    CMPISelectExp*         filter;
    CMPIEnumeration*       Enum;
    CMPIArray*             array;
    CMPIString*            string;
    char*                  chars;
    CMPIDateTime*          dateTime;
    CMPIValuePtr           dataPtr;
```

```
        CMPISint8               Byte;
        CMPISint16              Short;
        CMPISint32              Int;
        CMPISint64              Long;
        CMPIReal32              Float;
        CMPIReal64              Double;
    } CMPIValue;
```

4.6 Null Value Specification

As mentioned in Section 3.1.3, CMPI supports the notion of NULL values. In the case that CMPI returns a **CMPIData** structure with **CMPIValue** set to all binary zeros, the **CMPI_nullValue** flag of **CMPIValueState** indicates that no value is available and **CMPIType** contains a valid type.

For transfer into CMPI two forms are supported: using a NULL pointer as a **CMPIValue** pointer, or having a NULL pointer in **CMPIValue** for an encapsulated data type pointer.

Examples

```
CMPIInstance* ci;
CMPIValue val;

// Returning a simple NULL data item:
CMSetProperty(ci,”propName1”,NULL,CMPI_sint32);

// Returning a NULL array data type:
CMSetProperty(ci,”propName2”,NULL,CMPI_sint32A);

// Returning a pointer to a NULL array data type:
val.array=NULL;
CMSetProperty(ci,”propName2”,&val,CMPI_sint32A);
```

5 MI Function Signatures

Management Implementation (MI) as used in this document corresponds to what is commonly known as a "Provider" in the CIMOM world. In the past, it has been common practice to subdivide functions offered via Providers into optional groups of related functions. CMPI supports five related groups of functions as follows:[5]

- Instance MI
- Association MI
- Property MI
- Method MI
- Indication MI

The related groups are usually linked together in a dynamically loadable library that is known by the Management Broker (MB) using a naming convention. Every group is identifiable by the following duet:

```
load-lib-name
mi-name
```

The MB will determine these names either by convention or via "provider registration". *Load-lib-name* is used by the MB to load a library where it expects to find MI groups defined above.

Mi-name, which is normally the same as the schema or class name, is used to locate the initializing functions within the library. This function is called to initialize the individual MI groups and returns the function table for this group.

Notice that all functions of implemented groups *must* be presented as valid entry points (not as a NULL pointer). When there are legitimate reasons not to support a specific function, a [CMPI_ERR_NOT_SUPPORTED] return code must be used to indicate this.

The signatures correspond largely with the similar constructs found in most CIM Object Manager implementations. CMPI has adopted the Pegasus Provider-2 concepts of handling return values. See Section 5.8 for more details.

All functions use CMPIrc enum as the return value. CMPI_RC_OK is considered successful completion. A positive value is considered an exceptional situation and will initiate an MB-specific error process.

[5] Pegasus supports the notion of Class Providers. Though this in itself is a useful concept, it is assumed for the moment that this falls outside of the category of Providers providing MIand therefore will not be supported by CMPI.

5.1 MI Factory

MIs are loaded by the MB and instantiated by the MI factory which is invoked by an MB after it is loaded. The MI is represented by a **CMPI<mi-type>MI**[6] structure. This structure has to be returned by the MI factory. Its major component is the function table representing the functions repertoire and a **void** pointer for CMPI implementation purposes.

CMPI<mi-type>MI can be extended by MIs for maintaining MI-specific data across MI function invocations. It should be noted, however, that MIs can be unloaded by an MB at any time.

5.1.1 <mi-name>_Create<mi-type>MI

```
CMPIInstanceMI*
    <mi-name>_CreateInstanceMI(CMPIBroker*,CMPIContext*);

CMPIAssociationMI*
    <mi-name>_CreateAssociationMI(CMPIBroker*,CMPIContext*);

CMPIMethodMI*
    <mi-name>_CreateMethodMI(CMPIBroker*,CMPIContext*);

CMPIPropertyMI*
    <mi-name>_CreatePropertyMI(CMPIBroker*,CMPIContext*);

CMPIIndicationMI*
    <mi-name>_CreateIndicationMI(CMPIBroker*,CMPIContext*);
```

The **CMPIContext** object is used to pass context information to the initializing function for optimization purposes. Currently the optional context property **CMPIInitNameSpace** has been defined to signal the MI for which namespace initialization is to be performed.

Each function returns a pointer to its respective **CMPI<mi-type>MIFT** function table structure.

5.1.2 CMPI_MIType_xxx

```
#define CMPI_MIType_Instance     1
#define CMPI_MIType_Association  2
#define CMPI_MIType_Method       4
#define CMPI_MIType_Property     8
#define CMPI_MIType_Indication  16
```

5.1.3 CMPIInstanceMIFT

```
struct _CMPIInstanceMIFT {
    int ftVersion;
    int miVersion;
    char *miName;
    CMPIStatus (*cleanup)
        (CMPIInstanceMI*,CMPIContext*);
    CMPIStatus (*enumInstanceNames)
```

[6] The <**mi-type**> value can be either Instance, Association, Property, Method, or Indication.

```
            (CMPIInstanceMI*,CMPIContext*,CMPIResult*,
             CMPIObjectPath*);
        CMPIStatus (*enumInstances)
            (CMPIInstanceMI*,CMPIContext*,CMPIResult*,
             CMPIObjectPath*,char**);
        CMPIStatus (*getInstance)
            (CMPIInstanceMI*,CMPIContext*,CMPIResult*,
             CMPIObjectPath*,char**);
        CMPIStatus (*createInstance)
            (CMPIInstanceMI*,CMPIContext*,CMPIResult*,
             CMPIObjectPath*,CMPIInstance*);
        CMPIStatus (*setInstance)
            (CMPIInstanceMI*,CMPIContext*,CMPIResult*,
             CMPIObjectPath*,CMPIInstance*);
        CMPIStatus (*deleteInstance)
            (CMPIInstanceMI*,CMPIContext*,CMPIResult*,
             CMPIObjectPath*);
        CMPIStatus (*execQuery)
            (CMPIInstanceMI*,CMPIContext*,CMPIResult*,
             CMPIObjectPath*,char*,char*);
};
```

5.1.4 CMPIAssociationMIFT

```
struct _CMPIAssociationsMIFT {
    int ftVersion;
    int miVersion;
    char *miName;
    CMPIStatus (*cleanup)
        (CMPIAssociationMI*,CMPIContext*);
    CMPIStatus (*associators)
        (CMPIAssociationMI*,CMPIContext*,CMPIResult*,
         CMPIObjectPath*,char*,char*,
         char*,char*,char**);
    CMPIStatus (*associatorNames)
        (CMPIAssociationMI*,CMPIContext*,CMPIResult*,
         CMPIObjectPath*,char*,char*,
         char*,char*);
    CMPIStatus (*references)
        (CMPIAssociationMI*,CMPIContext*,CMPIResult*,
         CMPIObjectPath*,char*,char*,char**);
    CMPIStatus (*referenceNames)
        (CMPIAssociationMI*,CMPIContext*,CMPIResult*,
         CMPIObjectPath*,char*,char*);
};
```

5.1.5 CMPIMethodMIFT

```
struct _CMPIMethodMIFT {
    int ftVersion;
    int miVersion;
    char *miName;
    CMPIStatus (*cleanup)
        (CMPIMethodMI*,CMPIContext*);
    CMPIStatus (*invokeMethod)
        (CMPIMethodMI*,CMPIContext*,CMPIResult*,
         CMPIObjectPath*,char*,CMPIArgs*,CMPIArgs*);
};
```

5.1.6 CMPIPropertyMIFT

```
struct _CMPIPropertyMIFT {
    int ftVersion;
    int miVersion;
    char *miName;
    CMPIStatus (*cleanup)
        (CMPIPropertyMI*,CMPIContext*);
    CMPIStatus (*setProperty)
        (CMPIPropertyMI*,CMPIContext*,CMPIResult*,
         CMPIObjectPath*,char*,CMPIValue*,CMPIType);
    CMPIStatus (*getProperty)
        (CMPIPropertyMI*,CMPIContext*,CMPIResult*,
         CMPIObjectPath*,char*);
};
```

5.1.7 CMPIIndicationMIFT

```
struct _CMPIIndicationMIFT {
    int ftVersion;
    int miVersion;
    char *miName;
    CMPIStatus (*cleanup)
        (CMPIIndicationMI*,CMPIContext*);
    CMPIStatus (*authorizeFilter)
        (CMPIIndicationMI*,CMPIContext*,CMPIResult*,
         CMPISelectExp*,char*,CMPIObjectPath*,char*);
    CMPIStatus (*mustPoll)
        (CMPIIndicationMI*,CMPIContext*,CMPIResult*,
         CMPISelectExp*,char*,CMPIObjectPath*);v
    CMPIStatus (*activateFilter)
        (CMPIIndicationMI*,CMPIContext*,CMPIResult*,
       CMPISelectExp*,char*,CMPIObjectPath*,CMPIBoolean);
    CMPIStatus (*deActivateFilter)
        (CMPIIndicationMI*,CMPIContext*,CMPIResult*,
         CMPISelectExp*,char*,CMPIObjectPath*,CMPIBoolean);
};
```

5.1.8 Functions

The MI Factory is accessed through the following function.

CMPIAssociationMIFT.cleanup()

NAME

CMPIAssociationMIFT.cleanup – perform cleanup prior to unloading the Association provider

SYNOPSIS

```
CMPIStatus CMPIAssociationMIFT.cleanup(
    CMPIAssociationMI* mi,
    CMPIContext* ctx
);
```

DESCRIPTION

The *CMPIAssociationMIFT.cleanup*() function shall perform any necessary cleanup operationd prior to the unloading of the library of which this MI group is part. This function is called prior to the unloading of the provider.

The *mi* argument is a pointer to a **CMPIAssociationMI** structure. The *ctx* argument is a pointer to a **CMPIContext** structure containing the Invocation Context.

RETURN VALUE

The *CMPIAssociationMIFT.cleanup*() function returns a **CMPIStatus** structure.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIIndicationMIFT.cleanup()

NAME

CMPIIndicationMIFT.cleanup – perform cleanup prior to unloading the Indication provider

SYNOPSIS

```
CMPIStatus CMPIIndication.cleanup(
    CMPIIndicationMI* mi,
    CMPIContext* ctx
);
```

DESCRIPTION

The *CMPIIndicationMIFT.cleanup*() function shall perform any necessary cleanup operationd prior to the unloading of the library of which this MI group is part. This function is called prior to the unloading of the provider.

The *mi* argument is a pointer to a **CMPIIndicationMI** structure. The *ctx* argument is a pointer to a **CMPIContext** structure containing the Invocation Context.

RETURN VALUE

The *CMPIIndicationMIFT.cleanup*() function returns a **CMPIStatus** structure.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIInstanceMIFT.cleanup()

NAME

CMPIInstanceMIFT.cleanup – perform cleanup prior to unloading the Instance provider

SYNOPSIS

```
CMPIStatus CMPIInstanceMIFT.cleanup(
    CMPIInstanceMI* mi,
    CMPIContext* ctx
);
```

DESCRIPTION

The *CMPIInstanceMIFT.cleanup*() function shall perform any necessary cleanup operationd prior to the unloading of the library of which this MI group is part. This function is called prior to the unloading of the provider.

The *mi* argument is a pointer to a **CMPIInstanceMI** structure. The *ctx* argument is a pointer to a **CMPIContext** structure containing the Invocation Context.

RETURN VALUE

The *CMPIInstanceMIFT.cleanup*() function returns **CMPIStatus** structure.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIMethodMIFT.cleanup()

NAME

CMPIMethodMIFT.cleanup – perform cleanup prior to unloading the Method provider

SYNOPSIS

```
CMPIStatus CMPIMethodMIFT.cleanup(
    CMPIMethodMI* mi,
    CMPIContext* ctx
);
```

DESCRIPTION

The *CMPIMethodMIFT.cleanup*() function shall perform any necessary cleanup operationd prior to the unloading of the library of which this MI group is part. This function is called prior to the unloading of the provider.

The *mi* argument is a pointer to a **CMPIMethodMI** structure. The *ctx* argument is a pointer to a **CMPIContext** structure containing the Invocation Context.

RETURN VALUE

The *CMPIMethodMIFT.cleanup*() function returns a **CMPIStatus** structure.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIPropertyMIFT.cleanup()

NAME

CMPIPropertyMIFT.cleanup – perform cleanup prior to unloading the Property provider

SYNOPSIS

```
CMPIStatus CMPIPropertyMIFT.cleanup(
    CMPIPropertyMI* mi,
    CMPIContext* ctx
);
```

DESCRIPTION

The *CMPIPropertyMIFT.cleanup*() function shall perform any necessary cleanup operationd prior to the unloading of the library of which this MI group is part. This function is called prior to the unloading of the provider.

The *mi* argument is a pointer to a **CMPIPropertyMI** structure. The *ctx* argument is a pointer to a **CMPIContext** structure containing the Invocation Context.

RETURN VALUE

The *CMPIPropertyMIFT.cleanup*() function returns a **CMPIStatus** structure.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

5.2 Instance MI Signatures

5.2.1 CMPIFlags

The **CMPIFlags** type is used to inform MI functions about options specified by the client and passed on to the MI for certain requests. Normally, MIs will ignore these flags; however, these flags can be useful when MB services are invoked, or an external MB is contacted. **CMPIFlags** are not passed to MIs directly. MIs can use **CMPIContext** services to gain access under the name **CMPIInvocationFlags**.

```
typedef unsigned int CMPIFlags;

#define CMPI_FLAG_LocalOnly 1
#define CMPI_FLAG_DeepInheritance 2
#define CMPI_FLAG_IncludeQualifiers 4
#define CMPI_FLAG_IncludeClassOrigin 8
```

5.2.2 Functions

The Instance MI is accessed through the following functions.

CMPIInstanceMIFT.createInstance()

NAME

CMPIInstanceMIFT.createInstance – create an Instance using an ObjectPath as reference

SYNOPSIS

```
CMPIStatus CMPIInstanceMIFT.createInstance(
    CMPIInstanceMI* mi,
    CMPIContext* ctx,
    CMPIResult* rslt,
    CMPIObjectPath* op,
    CMPIInstance* inst
);
```

DESCRIPTION

The *CMPIInstanceMIFT.createInstance*() function shall create an Instance using an ObjectPath as reference.

The *mi* argument is a pointer to a **CMPIInstanceMI** structure. The *ctx* argument is a pointer to a **CMPIContext** structure containing the Invocation Context.

The *rslt* argument is a pointer to a **CMPIResult** structure that is the result data container.

The *op* argument is a pointer to a **CMPIObjectPath** structure containing namespace, classname, and key components.

The *inst* argument is a pointer to the created Instance.

RETURN VALUE

The *CMPIInstanceMIFT.createInstance*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

returnData()

CHANGE HISTORY

None.

CMPIInstanceMIFT.deleteInstance()

NAME

CMPIInstanceMIFT.deleteInstance – delete an Instance defined by an ObjectPath

SYNOPSIS

```
CMPIStatus CMPIInstanceMIFT.deleteInstance(
    CMPIInstanceMI* mi,
    CMPIContext* ctx,
    CMPIResult* rslt,
    CMPIObjectPath* op
);
```

DESCRIPTION

The *CMPIInstanceMIFT.deleteInstance*() function shall create an Instance using an ObjectPath as reference.

The *mi* argument is a pointer to a **CMPIInstanceMI** structure. The *ctx* argument is a pointer to a **CMPIContext** structure containing the Invocation Context.

The *rslt* argument is a pointer to a **CMPIResult** structure that is the result data container.

The *op* argument is a pointer to a **CMPIObjectPath** structure containing namespace, classname, and key components.

RETURN VALUE

The *CMPIInstanceMIFT.deleteInstance*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIInstanceMIFT.enumInstanceNames()

NAME

CMPIInstanceMIFT.enumInstanceNames – enumerate the ObjectPaths of Instances serviced by this provider

SYNOPSIS

```
CMPIStatus CMPIInstanceMIFT.enumInstanceNames(
    CMPIInstanceMI* thisMI,
    CMPIContext* ctx,
    CMPIResult* rslt,
    CMPIObjectPath* op
);
```

DESCRIPTION

None.

RETURN VALUE

The *CMPIInstanceMIFT.enumInstanceNames*() function shall enumerate the ObjectPaths of Instances serviced by this provider.

The *mi* argument is a pointer to a **CMPIInstanceMI** structure. The *ctx* argument is a pointer to a **CMPIContext** structure containing the Invocation Context.

The *rslt* argument is a pointer to a **CMPIResult** structure that is the result data container.

The *op* argument is a pointer to a **CMPIObjectPath** structure containing namespace and classname components.

ERRORS

The *CMPIInstanceMIFT.enumInstanceNames*() function shall return a **CMPIStatus** structure containing the service return status.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

returnData()

CHANGE HISTORY

None.

CMPIInstanceMIFT.enumInstances()

NAME

CMPIInstanceMIFT.enumInstances – enumerate the Instances serviced by this provider

SYNOPSIS

```
CMPIStatus CMPIInstanceMIFT.enumInstances(
    CMPIInstanceMI* thisMI,
    CMPIContext* ctx,
    CMPIResult* rslt,
    CMPIObjectPath* op,
    char** properties
);
```

DESCRIPTION

The *CMPIInstanceMIFT.enumInstances*() function shall enumerate the ObjectPaths of Instances serviced by this provider.

The *mi* argument is a pointer to a **CMPIInstanceMI** structure. The *ctx* argument is a pointer to a **CMPIContext** structure containing the Invocation Context.

The *rslt* argument is a pointer to a **CMPIResult** structure that is the result data container.

The *op* argument is a pointer to a **CMPIObjectPath** structure containing namespace and classname components.

The *properties* argument, if not NULL, is an array of elements defining one or more Property names. Each returned Object must not include elements for any Properties missing from this list.

RETURN VALUE

The *CMPIInstanceMIFT.enumInstances*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

returnData()

CHANGE HISTORY

None.

CMPIInstanceMIFT.execQuery()

NAME

CMPIInstanceMIFT.execQuery – query the enumeration of Instances of the class (and subclass) defined by an ObjectPath

SYNOPSIS

```
CMPIStatus CMPIInstanceMIFT.execQuery(
    CMPIInstanceMI* mi
    CMPIContext* ctx,
    CMPIResult* rslt,
    CMPIObjectPath* op,
    char* query,
    char* lang
);
```

DESCRIPTION

The *CMPIInstanceMIFT.execQuery*() function shall query the enumeration of Instances of the class (and subclass) defined by an ObjectPath.

The *mi* argument is a pointer to a **CMPIInstanceMI** structure. The *ctx* argument is a pointer to a **CMPIContext** structure containing the Invocation Context.

The *rslt* argument is a pointer to a **CMPIResult** structure that is the result data container.

The *op* argument is a pointer to a **CMPIObjectPath** structure containing namespace and classname components.

The *query* argument is a pointer to a string containing the select expression. The *lang* argument is a pointer to a string containing the query language.

RETURN VALUE

The *CMPIInstanceMIFT.execQuery*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

returnData()

CHANGE HISTORY

None.

CMPIInstanceMIFT.getInstance()

NAME

CMPIInstanceMIFT.getInstance – get the Instances defined by an ObjectPath

SYNOPSIS

```
CMPIStatus CMPIInstanceMIFT.getInstance(
    CMPIInstanceMI* thisMI,
    CMPIContext* ctx,
    CMPIResult* rslt,
    CMPIObjectPath* op,
    char **properties
);
```

DESCRIPTION

The *CMPIInstanceMIFT.getInstance*() function shall get the Instances defined by an ObjectPath.

The *mi* argument is a pointer to a **CMPIInstanceMI** structure. The *ctx* argument is a pointer to a **CMPIContext** structure containing the Invocation Context.

The *rslt* argument is a pointer to a **CMPIResult** structure that is the result data container.

The *op* argument is a pointer to a **CMPIObjectPath** structure containing namespace and classname components.

The *properties* argument, if not NULL, is an array of elements defining one or more Property names. Each returned Object must not include elements for any Properties missing from this list.

RETURN VALUE

The *CMPIInstanceMIFT.getImstance*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

returnData()

CHANGE HISTORY

None.

CMPIInstanceMIFT.setInstance()

NAME

CMPIInstanceMIFT.setInstance – replace an existing Instance using an ObjectPath as reference

SYNOPSIS

```
CMPIStatus CMPIInstanceMIFT.setInstance(
    CMPIInstanceMI* mi,
    CMPIContext* ctx,
    CMPIResult* rslt,
    CMPIObjectPath* op,
    CMPIInstance* inst,
    char** properties
);
```

DESCRIPTION

The *CMPIInstanceMIFT.getInstance*() function shall replace an existing Instance using an ObjectPath as reference.

The *mi* argument is a pointer to a **CMPIInstanceMI** structure. The *ctx* argument is a pointer to a **CMPIContext** structure containing the Invocation Context.

The *rslt* argument is a pointer to a **CMPIResult** structure that is the result data container.

The *op* argument is a pointer to a **CMPIObjectPath** structure containing namespace, classname, and key components.

The *inst* argument is a pointer to a **CMIPInstance** structure containing the Instance.

The *properties* argument, if not NULL, is an array of elements defining one or more Property names. The process must not replace elements for any Properties missing from this list. If NULL all properties will be replaced.

RETURN VALUE

The *CMPIInstanceMIFT.getInstance*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

5.3 Association MI Signatures

The Association MI is accessed using the following functions.

CMPIAssociationMIFT.associatorNames()

NAME

CMPIAssociationMIFT.associatorNames – enumerate ObjectPaths associated with an Instance

SYNOPSIS

```
CMPIStatus CMPIAssociationMIFT.associatorNames(
    CMPIAssociationMI* mi,
    CMPIContext* ctx,
    CMPIResult* rslt,
    CMPIObjectPath* op,
    char* assocClass,
    char* resultClass,
    char* role,
    char* resultRole
);
```

DESCRIPTION

The *CMPIAssociationMIFT.associatorNames*() function shall enumerate ObjectPaths associated with an Instance.

The *mi* argument points to an Association Instance. The *ctx* argument points to the Invocation Context, and the *rslt* argument points to the result data container. The *op* argument points to the source ObjectPath containing namespace, classname, and key components.

The *assocClass* argument, if not NULL, shall be a valid Association Class name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be associated to the source Object via an Instance of this Class or one of its subclasses.

The *resultclass* argument, if not NULL, shall be a valid Class name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be either an Instance of this Class (or one of its subclasses).

The *role* argument, if not NULL, shall be a valid Property name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be associated to the source Object via an Association in which the source Object plays the specified role (i.e. the name of the Property in the Association Class that refers to the source Object must match the value of this parameter).

The *resultrole* argument, if not NULL, shall be a valid Property name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be associated to the source Object via an Association in which the returned Object plays the specified role (i.e. the name of the Property in the Association Class that refers to the returned Object must match the value of this parameter).

RETURN VALUE

The *CMPIAssociationMIFT.associatorNames*()shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

CHANGE HISTORY

None.

CMPIAssociationMIFT.associators()

NAME

CMPIAssociationMIFT.associators – enumerate Object Paths associated with an Instance

SYNOPSIS

```
CMPIStatus CMPIAssociationMIFT.associators(
    CMPIAssociationMI* mi,
    CMPIContext* ctx,
    CMPIResult* rslt,
    CMPIObjectPath* objName,
    char* assocClass,
    char* resultClass,
    char* role,
    char* resultRole,
    char** properties
);
```

DESCRIPTION

The *CMPIAssociationMIFT.associators*() function shall enumerate ObjectPaths associated with an Instance.

The *mi* argument points to an Association Instance. The *ctx* argument points to the Invocation Context, and the *rslt* argument points to the result data container. The *op* argument points to the source ObjectPath containing namespace, classname, and key components.

The *assocClass* argument, if not NULL, shall be a valid Association Class name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be associated to the source Object via an Instance of this Class or one of its subclasses.

The *resultclass* argument, if not NULL, shall be a valid Class name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be either an Instance of this Class (or one of its subclasses).

The *role* argument, if not NULL, shall be a valid Property name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be associated to the source Object via an Association in which the source Object plays the specified role (i.e. the name of the Property in the Association Class that refers to the source Object must match the value of this parameter).

The *resultrole* argument, if not NULL, shall be a valid Property name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be associated to the source Object via an Association in which the returned Object plays the specified role (i.e. the name of the Property in the Association Class that refers to the returned Object must match the value of this parameter).

The *properties* argument, if not NULL, is an array of elements defining one or more Property names. Each returned Object must not include elements for any Properties missing from this list. If NULL all properties must be returned. The returned Object must match the value of this parameter).

RETURN VALUE

The *CMPIAssociationMIFT. associatorNames*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

CHANGE HISTORY

None.

CMPIAssociationMIFT.referenceNames()

NAME

CMPIAssociationMIFT.referenceNames – enumerate the association ObjectPaths that refer to an Instance

SYNOPSIS

```
CMPIStatus CMPIAssociationMIFT.referenceNames(
    CMPIAssociationMI* mi,
    CMPIContext* ctx,
    CMPIResult* rslt,
    CMPIObjectPath* op,
    char* role,
    char* resultRole
);
```

DESCRIPTION

The *CMPIAssociationMIFT.referenceNames*() function shall enumerate the association ObjectPaths associated with an Instance.

The *mi* argument points to an Association Instance. The *ctx* argument points to the Invocation Context, and the *rslt* argument points to the result data container. The *op* argument points to the source ObjectPath containing namespace, classname, and key components.

The *resultclass* argument, if not NULL, shall be a valid Class name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be either an Instance of this Class (or one of its subclasses).

The *role* argument, if not NULL, shall be a valid Property name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be associated to the source Object via an Association in which the source Object plays the specified role (i.e. the name of the Property in the Association Class that refers to the source Object must match the value of this parameter).

RETURN VALUE

The *CMPIAssociationMIFT.referenceNames*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

CHANGE HISTORY

None.

CMPIAssociationMIFT.references()

NAME

CMPIAssociationMIFT.references – enumerate the association ObjectPaths that refer to an Instance

```
CMPIStatus CMPIAssociationMIFT.references(
    CMPIAssociationMI* mi,
    CMPIContext* ctx,
    CMPIResult* rslt,
    CMPIObjectPath* objName,
    char* role,
    char* resultRole,
    char** properties
);
```

DESCRIPTION

The *CMPIAssociationMIFT.reference*() function shall enumerate the association ObjectPaths associated with an Instance.

The *mi* argument points to an Association Instance. The *ctx* argument points to the Invocation Context, and the *rslt* argument points to the result data container. The *op* argument points to the source ObjectPath containing namespace, classname, and key components.

The *resultclass* argument, if not NULL, shall be a valid Class name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be either an Instance of this Class (or one of its subclasses).

The *role* argument, if not NULL, shall be a valid Property name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be associated to the source Object via an Association in which the source Object plays the specified role (i.e. the name of the Property in the Association Class that refers to the source Object must match the value of this parameter).

The *properties* argument, if not NULL, is an array of elements defining one or more Property names. Each returned Object must not include elements for any Properties missing from this list

RETURN VALUE

The *CMPIAssociationMIFT.references*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

CHANGE HISTORY

None.

5.4 Property MI Signatures

The Property MI is accessed using the following functions.

CMPIPropertyMIFT.getProperty()

NAME

CMPIPropertyMIFT.getProperty – get a named property value of an Instance defined by an ObjectPath

SYNOPSIS

```
CMPIStatus CMPIPropertyMIFT.getProperty(
    CMPIPropertyMI* mi,
    CMPIContext* ctx,
    CMPIResult* rslt,
    CMPIObjectPath* op,
    char *name
);
```

DESCRIPTION

None.

RETURN VALUE

The *CMPIPropertyMIFT.*getProperty() function shall get a named property of an Instance defined by an ObjectPath.

The *mi* argument points to a **CMPIPropertyMI** structure.

The *ctx* argument points to a **CMPIContext** structure containing the Invocation Context.

The *rslt* argument points to a **CMPIResult** structure which is the result data container.

The *op* argument points to a **CMPIObjectPath** structure containing namespace, classname, and key components.

The *name* argument is a string containing the property name.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

The *CMPIPropertyMIFT.*getProperty() function shall return a **CMPIStatus** structure containing the service return status.

SEE ALSO

returnData()

CHANGE HISTORY

None.

CMPIPropertyMIFT.setProperty()

NAME

CMPIPropertyMIFT.setProperty – set a named property value of an Instance defined by an ObjectPath

SYNOPSIS

```
CMPIStatus CMPIPropertyMIFT.setProperty(
    CMPIPropertyMI* mi,
    CMPIContext* ctx,
    CMPIResult* rslt,
    CMPIObjectPath* op,
    char* name,
    CMPIData data
);
```

DESCRIPTION

The *CMPIPropertyMIFT*.setProperty() function shall set a named property of an Instance defined by an ObjectPath.

The *mi* argument points to a **CMPIPropertyMI** structure.

The *ctx* argument points to a **CMPIContext** structure containing the Invocation Context.

The *rslt* argument points to a **CMPIResult** structure which is the result data container.

The *op* argument points to a **CMPIObjectPath** structure containing namespace, classname, and key components.

The *name* argument is a string containing the property name.

The *data* argument points to a **CMPIData** structure containing the new property value.

{Ed: Should this function have a **CMPIResult** argument? What does it return?}

RETURN VALUE

The *CMPIPropertyMIFT.* setProperty() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

5.5 Method MI Signatures

The Method MI is accessed using the following function.

CMPIMethodMIFT.invokeMethod()

NAME

CMPIMethodMIFT.invokeMethod – invoke a named, extrinsic method of an Instance defined by an ObjectPath

SYNOPSIS

```
CMPIStatus CMPIMethodMIFT.invokeMethod(
    CMPIMethodMI* mi,
    CMPIContext* ctx,
    CMPIResult* rslt,
    CMPIObjectPath* op,
    char* method,
    CMPIArg* in,
    CMPIArg* out
);
```

DESCRIPTION

The *CMPIMethodMIFT.invokeMethod*() function shall invoke a named, extrinsic method of an instance defined by a specified ObjectPath.

The *mi* argument points to a **CMPIMethodMI** object. . The *ctx* argument points to the Invocation Context object, and the *op* argument points to the source ObjectPath containing namespace, classname, and key elements.

The *method* argument points to a string containing the method name. The *in* argument points to a **CMPIArgs** structure containing the input parameters. The *out* argument points to a **CMPIArgs** structure containing the output parameters.

RETURN VALUE

The *CMPIMethodMIFT.invokeMethod*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

CMPIArgsFT.getArg(), *CMPIArgsFT.setArg*(), *returnData*()

CHANGE HISTORY

None.

5.6 Indication MI Signatures

The functions defined here are largely modeled after existing CIMOM implementations (Sun WBEMServices and The Open Group OpenCimom). They are, at the moment, the most widely used and therefore a *de facto* standard.

The Indication MI is accessed using the following functions.

CMPIIndicationMIFT.activateFilter()

NAME

CMPIIndicationMIFT.activateFilter – ????

SYNOPSIS

```
CMPIStatus CMPIIndicationMIFT.activateFilter(
    CMPIIndicationMI* thisMI,
    CMPIContext* ctx,
    CMPIResult* rslt,
    CMPISelectExp* filter,
    char *eventType,
    CMPIObjectPath* classPath,
    int firstActivation
);
```

DESCRIPTION

The *filter* parameter contains the filter specification for this subscription to become active. This parameter can be passed back via the *CMPIBrokerFT.deliverIndication*() call enabling optimization of Indication delivery processing.

RETURN VALUE

This function returns nothing.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

CMPIBrokerFT.deliverIndication()

CHANGE HISTORY

None.

CMPIIndicationMIFT.authorizeFilter()

NAME

CMPIIndicationMIFT.authorizeFilter – ????

SYNOPSIS

```
CMPIStatus CMPIIndicationMIFT.authorizeFilter(
    CMPIIndicationMI* thisMI,
    CMPIContext* ctx,
    CMPIResult* rslt,
    CMPISelectExp* filter,
    Char *eventType,
    CMPIObjectPath* classPath,
    char *owner
);
```

DESCRIPTION

None.

RETURN VALUE

This function returns **CMPIBoolean** using *returnData*().

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

returnData()

CHANGE HISTORY

None.

CMPIIndicationMIFT.deActivateFilter()

NAME

CMPIIndicationMIFT.deActivateFilter – ????

SYNOPSIS

```
CMPIStatus CMPIIndicationMIFT.deActivateFilter(
    CMPIIndicationMI* thisMI,
    CMPIContext* ctx,
    CMPIResult* rslt,
    CMPISelectExp* filter,
    char *eventType,
    CMPIObjectPath* classPath,
    int lastActivation
);
```

DESCRIPTION

None.

RETURN VALUE

This function returns nothing.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIIndicationMIFT.mustPoll()

NAME

CMPIIndicationMIFT.mustPoll – ????

SYNOPSIS

```
CMPIStatus CMPIIndicationMIFT.mustPoll(
    CMPIIndicationMI* thisMI,
    CMPIContext* ctx,
    CMPIResult* rslt,
    CMPISelectExp* filter,
    char *eventType,
    CMPIObjectPath* classPath
);
```

DESCRIPTION

This function enables very simple MIs to support indications without providing a complete indication support implementation. When true is returned, the MB will enumerate the instances of this MI at regular intervals and apply indication filters.

RETURN VALUE

This function returns **CMPIBoolean** using *returnData*().

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

returnData()

CHANGE HISTORY

None.

5.7 CMPI Return Codes

The following return codes are recognized:

```
typedef enum _CMPIrc {
    CMPI_RC_OK                              =0,
    CMPI_RC_ERR_FAILED                      =1,
    CMPI_RC_ERR_ACCESS_DENIED               =2,
    CMPI_RC_ERR_INVALID_NAMESPACE           =3,
    CMPI_RC_ERR_INVALID_PARAMETER           =4,
    CMPI_RC_ERR_INVALID_CLASS               =5,
    CMPI_RC_ERR_NOT_FOUND                   =6,
    CMPI_RC_ERR_NOT_SUPPORTED               =7,
    CMPI_RC_ERR_CLASS_HAS_CHILDREN          =8,
    CMPI_RC_ERR_CLASS_HAS_INSTANCES         =9,
    CMPI_RC_ERR_INVALID_SUPERCLASS          =10,
    CMPI_RC_ERR_ALREADY_EXISTS              =11,
    CMPI_RC_ERR_NO_SUCH_PROPERTY            =12,
    CMPI_RC_ERR_TYPE_MISMATCH               =13,
    CMPI_RC_ERR_QUERY_LANGUAGE_NOT_SUPPORTED =14,
    CMPI_RC_ERR_INVALID_QUERY               =15,
    CMPI_RC_ERR_METHOD_NOT_AVAILABLE        =16,
    CMPI_RC_ERR_METHOD_NOT_FOUND            =17,
} CMPIrc;
```

5.8 CMPI Result Data Support

CMPI follows the Pegasus Provider 2 concept of returning result data. All return data produced by MI functions must be returned using the *CMPIResultFT.returnData*() function. Enumerating calls must use a series of these calls. Returning data must always be terminated via the *CMPIResultFT.returnDone*() function.

An example for *getProperty*() (all examples use the convenience macros):

```
CMPIStatus sample_getProperty(
    CMPIPropertyMI* thisMI,
    CMPIContext* ctx,
    CMPIResult* rslt,
    CMPIObjectPath* cop,
    char *name)
{
    int rv=4711;
    CMReturnData(rslt,&rv,CMPI_sint32);
    CMReturn(CMPI_RC_OK);
}
```

An example for *enumInstanceNames*() returning a **CMPIObjectPath** enumeration:

```
CMPIBroker *broker;     // Set in <mi-name>_CreateInstanceMI.

CMPIStatus sample_enumInstanceNames(
    CMPIPropertyMI* thisMI,
    CMPIContext* ctx,
    CMPIResult* rslt,
    CMPIObjectPath* cop,
    char* *properties)
{
```

```
1               CMPIObjectPath *p1;
2               CMPIString ns;
3
4               for (int i=0; i<3; i++) {
5                   ns=CMGetNameSpace(cop);
6                   p1=CMNewObjectPath(broker,CMGetCharPtr(ns),"myClass",&rc);
7               CMAddKey(p1,"id",&i,CMPI_sint32);
8               CMReturnObjectPath(rslt,p1);
9           }
10              CMReturnDone(rslt);
11              CMReturn(CMPI_RC_OK);
12          }
```

CMPIResultFT.returnData()

NAME

CMPIResultFT.returnData – return a value/type pair

SYNOPSIS

```
CMPIStatus CMPIResultFT.returnData(
    CMPIResult* rslt,
    CMPIValue *value,
    CMPIType type
);
```

DESCRIPTION

The *CMPIResultFT.returnData*() function shall return a value/type pair from a **CMPIResult** structure.

The *rslt* argument points to a **CMPIResult** structure containing results to be returned.

The *value* argument points to a **CMPIValue** structure to contain the returned value.

The *type* argument points to a **CMPIType** structure to contain the returned type.

RETURN VALUE

The *CMPIResultFT.returnData*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIResultFT.returnDone()

NAME

CMPIResultFT.returnDone – indicate no further data is to be returned

SYNOPSIS

```
CMPIStatus CMPIResultFT.returnDone(
    CMPIResult* rslt
);
```

DESCRIPTION

The *CMPIResultFT.returnDone*() function shall indicate no further data is to be returned.

The *rslt* argument points to a **CMPIResult** structure containing results to be returned.

{Ed: IS this function used to indicate to the run time system that the application has finished with the **CMPIResult** structure, or by the program to test if there are no further values to return?}

RETURN VALUE

The *CMPIResultFT.returnData*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

CMPIResultFT.returnData(), *invokeMethod*()

CHANGE HISTORY

None.

CMPIResultFT.returnInstance()

NAME

CMPIResultFT.returnInstance – return an Instance object

SYNOPSIS

```
CMPIStatus CMPIResultFT.returnInstance(
    CMPIResult *rslt,
    CMPIInstance* inst
);
```

DESCRIPTION

The *CMPIResultFT.returnInstance*() function shall return an Instance object from a **CMPIResult** structure.

The *rslt* argument points to a **CMPIResult** structure containing results to be returned.

The *inst* argument points to a **CMPIInstance** structure to contain the returned value.

RETURN VALUE

The *CMPIResultFT.returnInstance*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIResultFT.returnObjectPath()

NAME

CMPIResultFT.returnObjectPath – return an ObjectPath object

SYNOPSIS

```
CMPIStatus CMPIResultFT.returnInstance(
    CMPIResult* rslt,
    CMPIObjectPath* ref
);
```

DESCRIPTION

The *CMPIResultFT.returnObjectPath*() function shall return an ObjectPath object from a **CMPIResult** structure.

The *rslt* argument points to a **CMPIResult** structure containing results to be returned.

The *ref* argument points to a **CMPIObjectPath** structure to contain the returned value.

RETURN VALUE

The *CMPIResultFT.returnInstance*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

5.9 Context Data Support

As defined by Pegasus, an MB can pass unstructured data to the MI. The data is organized as name-value pairs. Arrays are supported, but not for type **CMPI_ptr**. Context data support is an optional feature; requests can be terminated by returning [CMPI_RC_ERR_NOT_SUPPORTED].

CMPIContext can also be used by MBs to carry the MB internal security context. In case MIs use threading and issue CMPI calls from threads, then *CMPIBrokerFT.prepareAttachThread*() and *CMPIBrokerFT.attachThread*() must be issued. This enables the MB to set up the correct security context for foreign threads.

Currently, two **CMPIContext** entry names are defined:

CMPIInitNameSpace	CMPI_string	Namespace for which the MI is started.
CMPIInvocationFlags	CMPI_uint32	**CMPIFlags** – invocation flags as specified by the client.

CMPIContextFT.addEntry()

NAME

CMPIContextFT.addEntry – adds/replaces a named Context entry

SYNOPSIS

```
CMPIStatus CMPIContextFT.addEntry(
    CMPIContext* ctx,
    char* name;
    CMPIValue* data,
    CMPIType type
);
```

DESCRIPTION

The *CMPIContextFT.addEntry*() function shall add or replace a named Context entry.

The *ctx* argument points to a **CMPIContext** structure. The *name* argument is a string containing the context entry name. The *data* argument points to a **CMPIData** structure containing the data to be assigned to the context entry. The *type* argument is a **CMPIType** that defines the type of the data.

RETURN VALUE

The *CMPIContextrFT.addEntry*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIContextFT.getEntry()

NAME

CMPIContextFT.getEntry – get a Context entry by name

SYNOPSIS

```
CMPIData CMPIContextFT.getEntry(
    CMPIContext* ctx,
    char *name,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIContextFT.getEntry*() function shall get a named Context entry.

The *ctx* argument points to a **CMPIContext** structure. The *name* argument is a string containing the context entry name.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIContextFT.getEntry*() function shall return a **CMPIData** structure containing the Context entry value.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIContextFT.getEntryAt()

NAME

CMPIContextFT.getEntryAt – get a Context entry defined by its index

SYNOPSIS

```
CMPIData CMPIContextFT.getEntryAt(
    CMPIContext* ctx,
    unsigned int index,
    CMPIString** name,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIContextFT.getEntryAt* () function shall get a Context defined by its index.

The *ctx* argument points to a **CMPIContext** structure.

The *index* argument defines the position of the entry in the internal data array.

The *name* argument points to a **CMPIString** structure that is updated with the name of the returned Context entry.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIContextFT.getEntryAt*() function shall return a **CMPIData** structure containing the Context entry value.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIContextFT.getEntryCount()

NAME

CMPIContextFT.getEntryAt – get the number of entries contained in a context

SYNOPSIS

```
unsigned int CMPIContextFT.getEntryAt(
    CMPIContext* ctx,
);
```

DESCRIPTION

The *CMPIContextFT.getEntryCount*() function shall get a the number of entries contained in a context.

The *ctx* argument points to a **CMPIContext** structure.

{ED: Should there not be a *CMPIStatus argument to return a status value in cases of error, such as the *ctx* pointer being invalid.}

RETURN VALUE

The *CMPIContextFT.getEntryCount*() function shall return a count of the number of entries in the Context.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

6 Data Type Manipulation Functions

Data Type Manipulation support is used to encapsulate Management Broker (MB)-specific implementation details. Support is provided for the following data types:

```
CMPIInstance
CMPIObjectPath
CMPIArgs
CMPIEnumeration
CMPISelectExp
CMPISelectCond
CMPISubCond
CMPIPredicate
```

The factories for the CMPI data types are available via **CMPIBrokerEncFT**.

```
struct _CMPIBrokerEncFT {
    int ftVersion;
    CMPIInstance* CMPIBrokerEncFT.newInstance
        (CMPIBroker*,CMPIContext*,
         CMPIObjectPath*,CMPIStatus*);
    CMPIObjectPath* (*newObjectPath)
        (CMPIBroker*,char*,char*,CMPIStatus*);
    CMPIArgs* (*newArgs)
        (CMPIBroker*,CMPIStatus*);
    CMPIString* (*newString)
        (CMPIBroker*,char*,CMPIStatus*);
    CMPIArray* (*newArray)
        (CMPIBroker*,CMPICount,CMPIStatus*);
    CMPIDateTime* (*newDateTime)
        (CMPIBroker*,CMPIStatus*);
    CMPIDateTime* (*newDateTimeFromBinary)
        (CMPIBroker*,CMPIUint64,CMPIBoolean,CMPIStatus*);
    CMPIDateTime* (*newDateTimeFromChars)
        (CMPIBroker*,char*,CMPIStatus*);
    CMPISelectExp* (*newSelectExp)
       (CMPIBroker*,char*,char*,CMPIArray**,CMPIStatus*);
    CMPIBoolean (*classPathIsA)
        (CMPIBroker*,CMPIObjectPath*,
         char*,CMPIStatus*);

// Debugging support

    CMPIString* (*toString)
        (CMPIBroker*,void*,CMPIStatus*);
    CMPIBoolean (*isOfType)
        (CMPIBroker*,void*,char*,CMPIStatus*);
    CMPIString* (*getType)
        (CMPIBroker*,void*,CMPIStatus*);
    CMPIStatus  (*logMessage)
        (CMPIBorker*,int,int,char*);
} CMPIBrokerEncFT;
```

6.1 Miscellaneous Services

The following miscellaneous services are defined.

CMPIArgsFT.clone()

NAME

CMPIArgsFT.clone – create an independent copy of an Args object

SYNOPSIS

```
CMPIArgs* CMPIArgsFT.clone(
    CMPIArgs* as,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIArgsFT.clone*() function shall create an independent copy of an Args object.

The *as* argument points to the **CMPIArgs** structure to be copied.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

The resulting Args object must be explicitly released.

RETURN VALUE

The *CMPIArgsFT.clone*() function shall return a pointer to the copied Args object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIArgsFT.release()

NAME

CMPIArgsFT.release – the Args object will not be used any further and my be freed by the CMPI run time system

SYNOPSIS

```
CMPIStatus CMPIArgsFT.release(
    CMPIArgs* as
);
```

DESCRIPTION

The *CMPIArgsFT.release*() function shall indicate to that an Args object will not be used any further, and may be freed by the CMPI run time system.

The *as* argument points to a **CMPIArgs** structure.

RETURN VALUE

The *CMPIArgsFT.release*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIArrayFT.clone()

NAME

CMPIArrayFT.clone – create an independent copy of an Array object

SYNOPSIS

```
CMPIArray* CMPIArrayFT.clone(
    CMPIArray* ar,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIArrayFT.clone*() function shall create an independent copy of an Array object.

The *ar* argument points to the **CMPIArray** structure to be copied.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

The resulting Array object must be explicitly released.

RETURN VALUE

The *CMPIArrayFT.clone*() function shall return a pointer to the copied Array object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIArrayFT.release()

NAME

CMPIArrayFT.release – the Array object will not be used any further and my be freed by the CMPI run time system

SYNOPSIS

```
CMPIStatus CMPIArrayFT.release(
    CMPIArray* ar
);
```

DESCRIPTION

The *CMPIArrayFT.release*() function shall indicate to that an Array object will not be used any further, and may be freed by the CMPI run time system.

The *ar* argument points to a **CMPIArray** structure.

RETURN VALUE

The *CMPIArrayFT.release*() function shall return the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerEncFT.classPathIsA()

NAME

CMPIBrokerFT.classpathIsA – determines whether a CIM class is of a specified type or any of its subclasses

SYNOPSIS

```
CMPIBoolean CMPIBrokerEncFT.classPathIsA(
    CMPIBroker* mb,
    CMPIObjectPath* op,
    char* type,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerEncFT.classpathIsA*() function shall determine whether a CIM class is of a specified type or any of that type's subclasses.

The *mb* argument points to a **CMPIBroker** structure. The *op* argument points to a **CMPIObjectPath** structure. The *type* argument points to the type to be tested for.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIBrokerEncFT.classPathIsA*() function shall return true if the test is successful.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerEncFT.getType()

NAME

CMPIBrokerEncFT.getType – retrieves the CMPI type of an object

SYNOPSIS

```
CMPIString* CMPIBrokerEncFT.getType(
    CMPIBroker* mb,
    void* object,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerEncFT.getType*() function shall return the CMPI type of an object.

The *mb* argument points to a ***CMPIBroker*** structure. The *object* argument is a pointer to a valid CMPI object.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

This function is intended for debugging purposes only.

RETURN VALUE

The *CMPIBrokerEncFT.getType*() function shall return a pointer to a **CMPIString** structure containing the encapsulated object type.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerEncFT.isOfType()

NAME

CMPIBrokerFT.isOfType – verify whether an onject is of a specified CMPI type.

```
CMPIBoolean *CMPIBrokerEncFT.isOfType(
    CMPIBroker* mb,
    void* object,
    char* type,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerEncFT.isOfType*() function shall return verify whether an object is of a specified CMPI type.

The *mb* argument points to a **CMPIBroker** structure. The *object* argument is a pointer to a valid CMPI object. The *type* argument points to a string specifying a valid CMPI object type to be tested for.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

This function is intended for debugging purposes only.

RETURN VALUE

The *CMPIBrokerEncFT.isOfType*() function shall return true if the test is successful.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerEncFT.toString()

NAME

CMPIBrokerEncFT.toString – attempts to transform a CMPI object into an implementation-specific string representation

SYNOPSIS

```
CMPIString* CMPIBrokerEncFT.toString(
    CMPIBroker* broker,
    void* object,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerEncFT.toString*() function attempts to transform a string into an implementation-specific string representation.

The *mb* argument is a pointer to a **CMPIBroker** structure. The *object* argument is a pointer to a valid CMPI object.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

RETURN VALUE

The *CMPIBrokerEncFT.toString*() function returns a pointer to a **CMPIString** structure containing the string representation. Output will vary depending on the specific implementation.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIContextFT.clone()

NAME

CMPIContextFT.clone – create an independent copy of an Context object

SYNOPSIS

```
CMPIContext* CMPIContextFT.clone(
    CMPIContext* ctx,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIContextFT.clone*() function shall create an independent copy of an Context object.

The *ctx* argument points to the **CMPIContext** structure to be copied.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

The resulting Context object must be explicitly released.

RETURN VALUE

The *CMPIContextFT.clone*() function shall return a pointer to the copied Context object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIContextFT.release()

NAME

CMPIContextFT.release – the Context object will not be used any further and my be freed by the CMPI run time system

SYNOPSIS

```
CMPIStatus CMPIContextFT.release(
    CMPIContext* ctx
);
```

DESCRIPTION

The *CMPIContextFT.release*() function shall indicate to that an Context object will not be used any further, and may be freed by the CMPI run time system.

The *ctx* argument points to a **CMPIContext** structure.

RETURN VALUE

The *CMPIContextFT.release*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIDateTimeFT.clone()

NAME

CMPIDateTimeFT.clone – create an independent copy of an DateTime object

SYNOPSIS

```
CMPIDateTime* CMPIDateTimeFT.clone(
    CMPIDateTime* dt,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIDateTimeFT.clone*() function shall create an independent copy of an DateTime object.

The *dt* argument points to the **CMPIDateTime** structure to be copied. The *rc* argument points to a **CMPIStatus** structure containing the service return status.

The resulting DateTime object must be explicitly released.

RETURN VALUE

The *CMPIDateTimeFT.clone*() function shall return a pointer to the copied DateTime object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIDateTimeFT.release()

NAME

CMPIDateTimeFT.release – the DateTime object will not be used any further and my be freed by the CMPI run time system

SYNOPSIS

```
CMPIStatus CMPIDateTimeFT.release(
    CMPIDateTime* dt
);
```

DESCRIPTION

The *CMPIDateTimeFT.release*() function shall indicate to that an DateTime object will not be used any further, and may be freed by the CMPI run time system.

The *dt* argument points to a **CMPIDateTime** structure.

RETURN VALUE

The *CMPIDateTimeFT.release*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIEnumerationFT.clone()

NAME

CMPIEnumerationFT.clone – create an independent copy of an Enumeration object

SYNOPSIS

```
CMPIEnumeration* CMPIEnumerationFT.clone(
    CMPIEnumeration* en,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIEnumerationFT.clone*() function shall create an independent copy of an Enumeration object.

The *en* argument points to the **CMPIEnumeration** structure to be copied. The *rc* argument points to a **CMPIStatus** structure containing the service return status.

The resulting Enumeration object must be explicitly released.

RETURN VALUE

The *CMPIEnumerationFT.clone*() function shall return a pointer to the copied Enumeration object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIEnumerationFT.release()

NAME

CMPIEnumerationFT.release – the Enumeration object will not be used any further and my be freed by the CMPI run time system

SYNOPSIS

```
CMPIStatus CMPIEnumerationFT.release(
    CMPIEnumeration* en
);
```

DESCRIPTION

The *CMPIEnumerationFT.release*() function shall indicate to that an Enumeration object will not be used any further, and may be freed by the CMPI run time system.

The *en* argument points to a **CMPIEnumeration** structure.

RETURN VALUE

The *CMPIEnumerationFT.release*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIInstanceFT.clone()

NAME

CMPIInstanceFT.clone – create an independent copy of an Instance object

SYNOPSIS

```
CMPIInstance* CMPIInstanceFT.clone(
    CMPIInstance* inst,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIInstanceFT.clone*() function shall create an independent copy of an Instance object.

The *inst* argument points to the **CMPIInstance** structure to be copied. The *rc* argument points to a **CMPIStatus** structure containing the service return status.

The resulting Instance object must be explicitly released.

RETURN VALUE

The *CMPIInstanceFT.clone*() function shall return a pointer to the copied Instance object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIInstanceFT.release()

NAME

CMPIInstanceFT.release – the Instance object will not be used any further and my be freed by the CMPI run time system

SYNOPSIS

```
CMPIStatus CMPIInstanceFT.release(
    CMPIInstance* inst
);
```

DESCRIPTION

The *CMPIInstanceFT.release*() function shall indicate to that an Instance object will not be used any further, and may be freed by the CMPI run time system.

The *inst* argument points to a **CMPIInstance** structure.

RETURN VALUE

The *CMPIInstanceFT.release*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIObjectPathFT.clone()

NAME

CMPIObjectPathFT.clone – create an independent copy of an ObjectPath object

SYNOPSIS

```
CMPIObjectPath* CMPIObjectPathFT.clone(
    CMPIObjectPath* op,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIObjectPathFT.clone*() function shall create an independent copy of an ObjectPath object.

The *op* argument points to the **CMPIObjectPath** structure to be copied. The *rc* argument points to a **CMPIStatus** structure containing the service return status.

The resulting ObjectPath object must be explicitly released.

RETURN VALUE

The *CMPIObjectPathFT.clone*() function shall return a pointer to the copied ObjectPath object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIObjectPathFT.release()

NAME

CMPIObjectPathFT.release – the ObjectPath object will not be used any further and my be freed by the CMPI run time system

SYNOPSIS

```
CMPIStatus CMPIObjectPathFT.release(
    CMPIObjectPath* op
);
```

DESCRIPTION

The *CMPIObjectPathFT.release*() function shall indicate to that an ObjectPath object will not be used any further, and may be freed by the CMPI run time system.

The *op* argument points to a **CMPIObjectPath** structure.

RETURN VALUE

The *CMPIObjectPathFT.release*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIPredicateFT.clone()

NAME

CMPIPredicateFT.clone – create an independent copy of an Predicate object

SYNOPSIS

```
CMPIPredicate* CMPIPredicateFT.clone(
    CMPIPredicate* pr,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIPredicateFT.clone*() function shall create an independent copy of an Predicate object.

The *pr* argument points to the **CMPIPredicate** structure to be copied. The *rc* argument points to a **CMPIStatus** structure containing the service return status.

The resulting Predicate object must be explicitly released.

RETURN VALUE

The *CMPIPredicateFT.clone*() function shall return a pointer to the copied Predicate object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIPredicateFT.release()

NAME

CMPIPredicateFT.release – the Predicate object will not be used any further and my be freed by the CMPI run time system

SYNOPSIS

```
CMPIStatus CMPIPredicateFT.release(
    CMPIPredicate* pr
);
```

DESCRIPTION

The *CMPIPredicateFT.release*() function shall indicate to that an Predicate object will not be used any further, and may be freed by the CMPI run time system.

The *pr* argument points to a **CMPIPredicate** structure.

RETURN VALUE

The *CMPIPredicateFT.release*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIResultFT.clone()

NAME

CMPIResultFT.clone – create an independent copy of an Result object

SYNOPSIS

```
CMPIResult* CMPIResultFT.clone(
    CMPIResult* rslt,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIResultFT.clone*() function shall create an independent copy of an Result object.

The *rslt* argument points to the **CMPIResult** structure to be copied. The *rc* argument points to a **CMPIStatus** structure containing the service return status.

The resulting Result object must be explicitly released.

RETURN VALUE

The *CMPIResultFT.clone*() function shall return a pointer to the copied Result object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIResultFT.release()

NAME

CMPIResultFT.release – the Result object will not be used any further and my be freed by the CMPI run time system

SYNOPSIS

```
CMPIStatus CMPIResultFT.release(
    CMPIResult* rslt
);
```

DESCRIPTION

The *CMPIResultFT.release*() function shall indicate to that an Result object will not be used any further, and may be freed by the CMPI run time system.

The *rslt* argument points to a **CMPIResult** structure.

RETURN VALUE

The *CMPIResultFT.release*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPISelectCondFT.clone()

NAME

CMPISelectCondFT.clone – create an independent copy of an SelectCond object

SYNOPSIS

```
CMPISelectCond* CMPISelectCondFT.clone(
    CMPISelectCond* sc,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPISelectCondFT.clone*() function shall create an independent copy of an SelectCond object.

The *sc* argument points to the **CMPISelectCond** structure to be copied. The *rc* argument points to a **CMPIStatus** structure containing the service return status.

The resulting SelectCond object must be explicitly released.

RETURN VALUE

The *CMPISelectCondFT.clone*() function shall return a pointer to the copied SelectCond object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPISelectCondFT.release()

NAME

CMPISelectCondFT.release – the SelectCond object will not be used any further and my be freed by the CMPI run time system

SYNOPSIS

```
CMPIStatus CMPISelectCondFT.release(
    CMPISelectCond* sc
);
```

DESCRIPTION

The *CMPISelectCondFT.release*() function shall indicate to that an SelectCond object will not be used any further, and may be freed by the CMPI run time system.

The *sc* argument points to a **CMPISelectCond** structure.

RETURN VALUE

The *CMPISelectCondFT.release*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPISelectExpFT.clone()

NAME

CMPISelectExpFT.clone – create an independent copy of an SelectExp object

SYNOPSIS

```
CMPISelectExp* CMPISelectExpFT.clone(
    CMPISelectExp* se,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPISelectExpFT.clone*() function shall create an independent copy of an SelectExp object.

The *se* argument points to the **CMPISelectExp** structure to be copied. The *rc* argument points to a **CMPIStatus** structure containing the service return status.

The resulting SelectExp object must be explicitly released.

RETURN VALUE

The *CMPISelectExpFT.clone*() function shall return a pointer to the copied SelectExp object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPISelectExpFT.release()

NAME

CMPISelectExpFT.release – the SelectExp object will not be used any further and my be freed by the CMPI run time system

SYNOPSIS

```
CMPIStatus CMPISelectExpFT.release(
    CMPISelectExp* se
);
```

DESCRIPTION

The *CMPISelectExpFT.release*() function shall indicate to that an SelectExp object will not be used any further, and may be freed by the CMPI run time system.

The *se* argument points to a **CMPISelectExp** structure.

RETURN VALUE

The *CMPISelectExpFT.release*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIStringFT.clone()

NAME

CMPIStringFT.clone – create an independent copy of an String object

SYNOPSIS

```
CMPIString* CMPIStringFT.clone(
    CMPIString* st,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIStringFT.clone*() function shall create an independent copy of an String object.

The *st* argument points to the **CMPIString** structure to be copied. The *rc* argument points to a **CMPIStatus** structure containing the service return status.

The resulting String object must be explicitly released.

RETURN VALUE

The *CMPIStringFT.clone*() function shall return a pointer to the copied String object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIStringFT.release()

NAME

CMPIStringFT.release – the String object will not be used any further and my be freed by the CMPI run time system

SYNOPSIS

```
CMPIStatus CMPIStringFT.release(
    CMPIString* st
);
```

DESCRIPTION

The *CMPIStringFT.release*() function shall indicate to that an String object will not be used any further, and may be freed by the CMPI run time system.

The *st* argument points to a **CMPIString** structure.

RETURN VALUE

The *CMPIStringFT.release*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPISubCondFT.clone()

NAME

CMPISubCondFT.clone – create an independent copy of an SubCond object

SYNOPSIS

```
CMPISubCond* CMPISubCondFT.clone(
    CMPISubCond* sc,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPISubCondFT.clone*() function shall create an independent copy of an SubCond object.

The *sc* argument points to the **CMPISubCond** structure to be copied.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

The resulting SubCond object must be explicitly released.

RETURN VALUE

The *CMPISubCondFT.clone*() function shall return a pointer to the copied SubCond object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPISubCondFT.release()

NAME

CMPISubCondFT.release – the SubCond object will not be used any further and my be freed by the CMPI run time system

SYNOPSIS

```
CMPIStatus CMPISubCondFT.release(
    CMPISubCond* sc
);
```

DESCRIPTION

The *CMPISubCondFT.release*() function shall indicate to that an SubCond object will not be used any further, and may be freed by the CMPI run time system.

The *sc* argument points to a **CMPISubCond** structure.

RETURN VALUE

The *CMPISubCondFT.release*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

6.2 CMPIString Support

CMPIString support is provided by the following function.

CMPIBrokerEncFT.newString()

NAME

CMPIBrokerEncFT.newString – create a new String object

SYNOPSIS

```
CMPIString* CMPIBrokerEncFT.newString(
    CMPIBroker* mb,
    char* data,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerEncFT.newString*() function shall return a new **CMPIString** object.

The *mb* argument points to a **CMPIBroker** object. The *data* argument is a pointer to the data to initialize the new **CMPIString** structure.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIBrokerEncFT.newString*() function shall return a pointer to a new **CMPIString** object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIStringFT.getCharPtr()

NAME

CMPIStringFT.getCharPtr – get a pointer to a C language string representation of a String

SYNOPSIS

```
char* CMPIStringFT.getCharPtr(
    CMPIString* st,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIStringFT.getCharPtr*() function shall return a C language character pointer representation of the string contained in a **CMPISTring** structure.

The *st* argument is a pointer to a **CMPIString** structure.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIStringFT.getCharPtr*() function shall return a character pointer to a C language string.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

6.3 CMPIArray Support

CMPIArrays encapsulate arrays of values of the same base types; however, some of them can be CIM NULL values. Property retrieval operations can return **CMPIArray** objects. MIs can produce **CMPIArrays** and use them in *setProperty*() operations. **CMPIArrays** are produced using a broker factory *CMPIBrokerFT.newArray*() function. The *CMPIArrayFT.getElementAt*() and *CMPIArrayFT.setElementAt*() functions are used to retrieve and set individual array elements.

CMPIArray support is provided by the following functions.

CMPIArrayFT.getElementAt()

NAME

CMPIArrayFT.getElementAt – gets an element value defined by its index

SYNOPSIS

```
CMPIData CMPIArrayFT.getElementAt(
    CMPIArray* ar,
    CMPICount index,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIArrayFT.getElementAt*() function shall return an element of an array, which can be a CIM NULL value.

The *ar* argument points to a **CMPIArray** structure. The *index* argument specifies the position of the element in the internal data array.

RETURN VALUE

The *CMPIArrayFT.getElementAt*() function shall return a **CMPIData** structure containing the value of the specified element.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIArrayFT.getSimpleType()

NAME

CMPIArrayFT.getSimpleType – gets an the element type

SYNOPSIS

```
CMPIType CMPIArrayFT.getSimpleType(
    CMPIArray* ar,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIArrayFT.getSimpleType*() function shall return the type of the elements of an Array object.

The *ar* argument points to a **CMPIArray** structure.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

RETURN VALUE

The *CMPIArrayFT.getElementAt*() function shall return a **CMPIType** structure containing the type of the Array elements.

{Ed: The CMPI web pages say that getSimpleType returns the number of elements. This seems to be in conflict with the rest of the description and the name.}

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIArrayFT.getSize()

NAME

CMPIArrayFT.getSize – gets the number of elements in an Array

SYNOPSIS

```
CMPICount CMPIArrayFT.getSize(
    CMPIArray* ar,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIArrayFT.getSize*() function shall return the number of elements in an Array object.

The *ar* argument points to a **CMPIArray** structure.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

RETURN VALUE

The *CMPIArrayFT.getSize*() function shall return a **CMPICount** structure containing the number of the Array elements.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIArrayFT.setElementAt()

NAME

CMPIArrayFT.setElementAt – sets an element defined by its index

SYNOPSIS

```
CMPIStatus CMPIArrayFT.setElementAt(
    CMPIArray* ar,
    CMPICount index,
    CMPIValue* value,
    CMPIType type
);
```

DESCRIPTION

The *CMPIArrayFT.setElementAt*() function sets an element of an Array, which can be a CIM NULL value.

The *ar* argument points to a **CMPIArray** structure. The *index* argument specifies the position of the element in the internal data array. The *value* argument points to a **CMPIValue** structure contining the value to be assigned to the element. The *type* argument must either be the base type of the array or *CMPI_null*.

RETURN VALUE

The *CMPIArrayFT.setElementAt*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerEncFT.newArray()

NAME

CMPIBrokerEncFT.newArray – create a new Array object

SYNOPSIS

```
CMPIArray* CMPIBrokerEncFT.newArray(
    CMPIBroker* mb,
    CMPICount max,
    CMPIType type,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerEncFT.newArray*() function shall return a new **CMPIArray** object.

The *mb* argument points to a **CMPIBroker** object. The *max* argument specifies the maximum number of elements. The *type* argument specifies the element type.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIBrokerEncFT.newArray*() function shall return a pointer to a new **CMPIArray** object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

6.4 CMPIEnumeration Support

CMPIEnumerations are not directly created by an MI. MIs indirectly create enumerations by using successive *CMPIResultFT.returnData*() calls during execution of one of the enumerating MI functions. MIs, however, can request the MB to generate enumerations of other objects. In that case a **CMPIEnumeration** is returned.

In general, this support allows iteration through a **CMPIEnumeration**.

CMPIEnumeration support is provided by the following functions.

CMPIEnumerationFT.getNext()

NAME

CMPIEnumerationFT.getNext – get the next element for an Enumeration

SYNOPSIS

```
CMPIData CMPIEnumerationFT.getNext(
    CMPIEnumeration* en,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIEnumerationFT.*getNext() function shall return the next element for an Enumeration.

The *en* argument points to the **CMPIEnumeration** structure.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIEnumerationFT.* getNext() function shall return a **CMPIData** structure containing the element.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

CMPIEnumerationFT.hasNext()

CHANGE HISTORY

None.

CMPIEnumerationFT.hasNext()

NAME

CMPIEnumerationFT.hasNext – test for any elements left in an Enumeration

SYNOPSIS

```
CMPIBoolean CMPIEnumerationFT.hasNext(
    CMPIEnumeration* en,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIEnumerationFT.hasNext*() function shall test for any elements remaining in an Enumeration.

The *en* argument points to the **CMPIEnumeration** structure.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIEnumerationFT.hasNext*() function shall return a **CMPIBoolean** structure which is true if the Enumeration has more elements to retrieve.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIEnumerationFT.toArray()

NAME

CMPIEnumerationFT.toArray – converts an Enumeration to an Array

SYNOPSIS

```
CMPIArray* CMPIEnumerationFT.toArray(
    CMPIEnumeration* en,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIEnumerationFT.toArray*() function converts a **CMPIEnumeration** structure into a **CMPIArray** structure.

The *en* argument points to the **CMPIEnumeration** structure.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIEnumerationFT.toArray*() function shall return a pointer to a **CMPIArray** structure containing the elements from the Enumeration.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

6.5 CMPIInstance Support

CMPIInstance support is provided by the following functions.

CMPIBrokerEncFT.newInstance()

NAME

CMPIBrokerEncFT.newInstance – create a new Instance object

SYNOPSIS

```
CMPIInstance* CMPIBrokerEncFT.newInstance(
    CMPIBroker* mb,
    CMPIObjectPath* op,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerEncFT.newInstance*() function shall return a new **CMPIInstance** object.

The *mb* argument points to a **CMPIBroker** object. The *op* argument points to a **CMPIObjectPath** structure cointining the namespace and classname.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIBrokerEncFT.newInstance*() function shall return a pointer to a new **CMPIInstance** object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIInstanceFT.getObjectPath()

NAME

CMPIInstanceFT.getObjectPath – generate an ObjectPath from the namespace, classname, and key properties of an Instance

SYNOPSIS

```
CMPIObjectPath* CMPIInstanceFT.getObjectPath(
    CMPIInstance* inst,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIInstanceFT.getObjectPath*() function shall return an ObjectPath generated from the namespace, classname, and key properties of an Instance.

The *inst* argument is a pointer to the **CMPIInstance** structure.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIInstanceFT.getObjectPath*() function shall return a pointer to a **CMPIObjectPath** structure.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIInstanceFT.getProperty()

NAME

CMPIInstanceFT.getProperty – get a named Property value

SYNOPSIS

```
CMPIData CMPIInstanceFT.getProperty(
    CMPIInstance* inst,
    char* name,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIInstanceFT.getProperty*() function shall return named Property value.

The *inst* argument is a pointer to the **CMPIInstance** structure.

The *name* argument is a string containing the property name.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIInstanceFT.getProperty*() function shall return a **CMPIData** structure containing the named Property value.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIInstanceFT.getPropertyAt()

NAME

CMPIInstanceFT.getPropertyAt – get a Property value defined by its index

SYNOPSIS

```
CMPIData CMPIInstanceFT.getPropertyAt(
    CMPIInstance* inst,
    unsigned int index,
    CMPIString** name,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIInstanceFT.getPropertyAt*() function shall return a Property value defined by its index.

The *inst* argument is a pointer to the **CMPIInstance** structure.

The *index* argument contains the index number of the Property in the internal data array.

The *name* argument is a pointer to a pointer to a **CMPIString** structure which is updated to containi the property name.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIInstanceFT.getProperyAt*() function shall return a **CMPIData** structure containing the Property value.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIInstanceFT.getPropertyCount()

NAME

CMPIInstanceFT.getPropertyCount – get the count of Properties contained in an Instance

SYNOPSIS

```
unsigned int CMPIInstanceFT.getPropertyCount(
    CMPIInstance* inst,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIInstanceFT.getPropertyAt*() function shall return the count of Properties contained in an Instance.

The *inst* argument is a pointer to the **CMPIInstance** structure.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIInstanceFT.getProperyAt*() function shall return the count of Properties in the Instance.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIInstanceFT.setProperty()

NAME

CMPIInstanceFT.setProperty – add/replace a named Property

SYNOPSIS

```
CMPIStatus CMPIInstanceFT.setProperty(
    CMPIInstance* inst,
    char *name,
    CMPIValue* value,
    CMPIType type
);
```

DESCRIPTION

The *CMPIInstanceFT.setProperty*() function shall add or replace a named property within an Instance.

The *inst* argument is a pointer to the **CMPIInstance** structure.

The *name* argument is a string containing the Property name.

The *value* argument points to a **CMPIValue** structure containing the value to be assigned to the Property.

The *type* argument is a **CMPIType** structure defining the type of the value.

RETURN VALUE

The *CMPIInstanceFT.setProperty*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

6.6 CMPIObjectPath Support

CMPIObjectPath support is provided by the following functions.

CMPIBrokerEncFT.newObjectPath()

NAME

CMPIBrokerEncFT.newObjectPath – create a new ObjectPath object

SYNOPSIS

```
CMPIObjectPath* CMPIBrokerEncFT.newObjectPath(
    CMPIBroker* mb,
    char* ns,
    char* cn,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerEncFT.newObjectPath*() function shall return a new **CMPIObjectPath** object.

The *mb* argument points to a **CMPIBroker** object. The *ns* argument points to a string containing the namespace. The *cn* argument points to a string containing the classname.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIBrokerEncFT.newObjectPath*() function shall return a pointer to a new **CMPIObjectPath** object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIObjectPathFT.addKey()

NAME

CMPIObjectPathFT.addKey – add/replace a named key property

SYNOPSIS

```
CMPIStatus CMPIObjectPathFT.addKey(
    CMPIObjectPath* op,
    char* key,
    CMPIValue *value,
    CMPIType type
);
```

DESCRIPTION

The *CMPIObjectPathFT.addKey*() function shall add/replace a named key property.

The *op* argument points to a **CMPIObjectPath** structure.

The *key* argument points to a string containing the key property name.

The *value* argument is a pointer to a **CMPIValue** structure contining the value to be assigned to the key property.

The *type* argument is a **CMPIType** structure defining the type of the value to be assigned.

RETURN VALUE

The *CMPIObjectPathFT.addKey*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIObjectPathFT.getClassName()

NAME

CMPIObjectPathFT.getClassName – get the classname component

SYNOPSIS

```
CMPIString* CMPIObjectPathFT.getClassName(
    CMPIObjectPath *op,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIObjectPathFT.getClassName*() function shall get the classname component of an ObjectPath.

The *op* argument points to a **CMPIObjectPath** structure.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

RETURN VALUE

The *CMPIObjectPathFT.getClassName*() function shall return a pointer to a **CMPIString** structure containing the classname component.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIObjectPathFT.getHostname()

NAME

CMPIObjectPathFT.getHostname – get the hostname component

SYNOPSIS

```
CMPIString* CMPIObjectPathFT.getHostname(
    CMPIObjectPath *op,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIObjectPathFT.getHostname*() function shall get the hostname component of an ObjectPath.

The *op* argument points to a **CMPIObjectPath** structure.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

RETURN VALUE

The *CMPIObjectPathFT.getHostname*() function shall return a pointer to a **CMPIString** structure containing the hostname component.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIObjectPathFT.getKey()

NAME

CMPIObjectPathFT.getKey – get a named key property value

SYNOPSIS

```
CMPIData CMPIObjectPathFT.getKey(
    CMPIObjectPath* op,
    char* key,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIObjectPathFT.getKey*() function shall get a named key property value.

The *op* argument points to a **CMPIObjectPath** structure.

The *key* argument points to a string containing the key name.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

CIMXML does not prescribe transportation of precise key value types. There are only four types that can be returned by this operation. They are part of the **CMPIType** definition and are as follows:

```
#define CMPI_keyInteger   (CMPI_sint64)
#define CMPI_keyString    (CMPI_string)
#define CMPI_keyBoolean   (CMPI_boolean)
#define CMPI_keyRef       (CMPI_ref)
```

In addition, the **CMPI_keyValue** flag of **CMPIValueState** is set to indicate that the value is emanating from a **CMPIObjectPath**.

RETURN VALUE

The *CMPIObjectPathFT.getKey*() function shall return a **CMPIData** structure containing the named key value.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIObjectPathFT.getKeyAt()

NAME

CMPIObjectPathFT.getKeyAt – gets a key property value defined by its index

SYNOPSIS

```
CMPIData CMPIObjectPathFT.getKeyAt(
    CMPIObjectPath* copThis,
    unsigned int *index,
    CMPIString** name,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIObjectPathFT.getKeAty*() function shall get a key property value defined by its index.

The *op* argument points to a **CMPIObjectPath** structure.

The *index* argument specifies the index of the key property value within the internal data array

The *name* argument is a pointer to a **CMPIstring** structure which is updated with the name of the key property.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

CIMXML does not prescribe transportation of precise key value types. There are only four types that can be returned by this operation. They are part of the **CMPIType** definition and are as follows:

```
#define CMPI_keyInteger   (CMPI_sint64)
#define CMPI_keyString    (CMPI_string)
#define CMPI_keyBoolean   (CMPI_boolean)
#define CMPI_keyRef       (CMPI_ref)
```

In addition, the **CMPI_keyValue** flag of **CMPIValueState** is set to indicate that the value is emanating from a **CMPIObjectPath**.

RETURN VALUE

The *CMPIObjectPathFT.getKeyAt*() function shall return a **CMPIData** structure containing the named key value.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIObjectPathFT.getKeyCount()

NAME

CMPIObjectPathFT.getKeyCount – get the number of key properties

SYNOPSIS

```
unsigned int CMPIObjectPathFT.getKeyCount(
    CMPIObjectPath* op,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIObjectPathFT.getKeyCount*() function shall get the the number of key properties contained in an ObjectPath.

The *op* argument points to a **CMPIObjectPath** structure.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

RETURN VALUE

The *CMPIObjectPathFT.getKeyCount*() function shall return the muber of key properties.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIObjectPathFT.getNameSpace()

NAME

CMPIObjectPathFT.getNameSpace – get the namespace component

SYNOPSIS

```
CMPIString* CMPIObjectPathFT.getNameSpace(
    CMPIObjectPath* op,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIObjectPathFT.getNameSpace*() function shall get the namespace component of an ObjectPath.

The *op* argument points to a **CMPIObjectPath** structure.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

RETURN VALUE

The *CMPIObjectPathFT.getNameSpace*() function shall return a pointer to a **CMPIString** structure containing the namespace component.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIObjectPathFT.setHostname()

NAME

CMPIObjectPathFT.setHostname – set/replace the hostname component

SYNOPSIS

```
CMPIStatus CMPIObjectPathFT.setNameSpace(
    CMPIObjectPath* op,
    char *hn
);
```

DESCRIPTION

The *CMPIObjectPathFT.getNameSpace*() function shall get the namespace component of an ObjectPath.

The *op* argument points to a **CMPIObjectPath** structure.

The *hn* argument is a string containing the new hostname.

RETURN VALUE

The *CMPIObjectPathFT.setHostname*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIObjectPathFT.setNameSpace()

NAME

CMPIObjectPathFT.setNameSpace – set the namespace component

SYNOPSIS

```
CMPIStatus CMPIObjectPathFT.setNameSpace(
    CMPIObjectPath* op,
    char *ns
);
```

DESCRIPTION

The *CMPIObjectPathFT.setNameSpace*() function shall get the namespace component of an ObjectPath.

The *op* argument points to a **CMPIObjectPath** structure.

The *ns* argument is a string containing the new namespace.

RETURN VALUE

The *CMPIObjectPathFT.setNameSpace*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIObjectPathFT.setNameSpaceFromObjectPath()

NAME

CMPIObjectPathFT.setNameSpaceFromObjectPath – set/replace the namespace and classname components from an ObjectPath

SYNOPSIS

```
CMPIStatus CMPIObjectPathFT.setNameSpaceFromObjectPath(
    CMPIObjectPath* op,
    CMPIObjectPath* src
);
```

DESCRIPTION

The *CMPIObjectPathFT.setNameSpaceFromObjectPath*() function shall set/replace the namespace and classname components from an ObjectPath.

The *op* argument points to a **CMPIObjectPath** structure to be modified.

The *src* argument points to a **CMPIObjectPath** structure used as the source for the new namespace and classname components.

RETURN VALUE

The *CMPIObjectPathFT.setNameSpaceFromObjectPath*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIObjectPathFT.setHostAndNameSpaceFromObjectPath()

NAME

CMPIObjectPathFT.setHostAndNameSpaceFromObjectPath – set/replace the hostname, namespace, and classname components from an ObjectPath

SYNOPSIS

```
CMPIStatus CMPIObjectPathFT.setHostAndNameSpaceFromObjectPath(
    CMPIObjectPath* op,
    CMPIObjectPath* src
);
```

DESCRIPTION

The *CMPIObjectPathFT.seHostAndtNameSpaceFromObjectPath*() function shall set/replace the namespace and classname components from an ObjectPath.

The *op* argument points to a **CMPIObjectPath** structure to be modified.

The *src* argument points to a **CMPIObjectPath** structure used as the source for the new hostname, namespace, and classname components.

RETURN VALUE

The *CMPIObjectPathFT.setHostAndNameSpaceFromObjectPath*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

6.7 CMPIArgs Support

CMPIArgs is a container used to capture arguments for *invokeMethod*() functions.

CMPIArgs support is provided by the following functions:

CMPIArgsFT.addArg()

NAME

CMPIArgsFT.addArg – Adds/replaces a named argument

SYNOPSIS

```
CMPIStatus CMPIArgsFT.addArg(
    CMPIArgs* as,
    char *name,
    CMPIValue *value,
    CMPIType type
);
```

DESCRIPTION

The *CMPIArgsFT.addArg*() function shall add or replace a named argument within an Args structure.

The *as* argument points to an **CMPIArgs** structure. The *name* argument is a string containing the name of the argument to be added or replaced. The *value* argument points to a **CMPIValue** structure containing to be assigned to the argument. The *type* argument identifies the type of the argument. The following types are supported:

```
CMPIBoolean
CMPIChar16
CMPIUint8
CMPIUint16
CMPIUint32
CMPIUint64
CMPISint8
CMPISint16
CMPISint32
CMPISint64
CMPIReal32
CMPIReal64
CMPIString*
CMPIObjectPath*
```

RETURN VALUE

The *CMPIArgsFT.addArg*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIArgsFT.getArg()

NAME

CMPIArgsFT.getArg – gets a named argument value

SYNOPSIS

```
CMPIData CMPIArgsFT.getArg(
    CMPIArgs* as,
    char *name,
    CMPIStatus* rc
);
```

DESCRIPTION

The CMPIArgsFT.getArg*()* function shall return the value of a named argument.

The *as* argument points to an **CMPIArgs** structure. The *name* argument is a string containing the name of the argument.to be retrieved.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

RETURN VALUE

The *CMPIArgsFT.getArg*() function shall return a **CMPIData** structure containing the value of the named argument.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIArgsFT.getArgAt()

NAME

CMPIArgsFT.getArgAt – gets an argument value defined by its index

SYNOPSIS

```
CMPIData CMPIArgsFT.getArgAt(
    CMPIArgs* as,
    unsigned int index,
    CMPIString** name,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIArgsFT.getArgAt*() function shall return the value of an argument defined by its index in the internal data array.

The *as* argument points to a **CMPIArgs** structure. The *index* argument specifies the index in the internal data array.

The *nam*e argument points to a pointer to a **CMPIString** structure used to return the argument name.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

RETURN VALUE

The *CMPIArgsFT.getArgAt*() function shall return a **CMPIData** structure containing the value of the specified argument.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIArgsFT.getArgCount()

NAME

CMPIArgsFT.getArgCount – gets the number of arguments contained in an Args structure

SYNOPSIS

```
unsigned int CMPIArgsFT.getArgCount(
    CMPIArgs* as,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIArgsFT.getArgCount*() function gets the number of arguments contained in an Args structure.

The *as* argument points to a **CMPIArgs** structure.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

RETURN VALUE

The *CMPIArgsFT.getArgCount*() function shall return the number of arguments contained in the Args structure.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerEncFT.newArgs()

NAME

CMPIBrokerEncFT.newArgs – create a new Args object

SYNOPSIS

```
CMPIArgs* CMPIBrokerEncFT.newArgs(
    CMPIBroker* mb,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerEncFT.newArgs*() function shall return a new **CMPIArgs** object.

The *mb* argument points to a **CMPIBroker** object.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIBrokerEncFT.newArgs*() function shall return a pointer to a new **CMPIArgs** object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

6.8 CMPIDateTime Support

In order to be platform-independent, **CMPIDateTime** is implemented as an encapsulated type. It supports two ways of expressing time in binary form using a **long long** C type and as a **CMPIString** using CIM datetime fixed string format. Time can be set by asking for the current time of day or by using any of the two formats defined before as input. **CMPIDateTime** supports the UTC notion of interval *versus* time of date values.

CMPIDateTime support is provided by the following functions.

CMPIBrokerEncFT.newDateTime()

NAME

CMPIBrokerEncFT.newDateTime – create a new DateTime object initialized to the current date and time

SYNOPSIS

```
CMPIDateTime* CMPIBrokerEncFT.newDateTime(
    CMPIBroker* mb,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerEncFT.newDateTime*() function shall return a new **CMPIDateTime** object initialized with the current date and time.

The *mb* argument points to a **CMPIBroker** object.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIBrokerEncFT.newDateTime*() function shall return a pointer to a new **CMPIDateTime** object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerEncFT.newDateTimeFromBinary()

NAME

CMPIBrokerEncFT.newDateTimeFromBinary – create a new DateTime object initialized to a specified value

SYNOPSIS

```
CMPIDateTime* CMPIBrokerEncFT.newDateTimeFromBinary(
    CMPIBroker* mb,
    CMPIUint64 binTime,
    CMPIBoolean interval,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerEncFT.newDateTimeFromBinary*() function shall return a new **CMPIDateTime** object initialized with the specified date and time.

The *binTime* argument contains a Date/Time value expressed as a 64-bit unsigned integer in microseconds starting since 00:00:00 GMT, Jan 1, 1970.

The *mb* argument points to a **CMPIBroker** object.

The *interval* argument, if true, indicates that the *binTime* argument is considered to be a time interval in microseconds.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

{Ed: The original text seemed clearer. The definitions of *binTime* and *interval* are somewhat unclear. If *interval* is true, is *binTime* still measured from the epoch?}

RETURN VALUE

The *CMPIBrokerEncFT.newDateTimeFromBinary*() function shall return a pointer to a new **CMPIDateTime** object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerEncFT.newDateTimeFromChars()

NAME

CMPIBrokerEncFT.newDateTimeFromChars – create a new DateTime object initialized to a specified value

SYNOPSIS

```
CMPIDateTime* CMPIBrokerEncFT.newDateTimeFromChars(
    CMPIBroker* mb,
    char* utcTime,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerEncFT.newDateTimeFromChars*() function shall return a new **CMPIDateTime** object initialized with the specified date and time..

The *utcTime* argument contains a Date/Time value expressed in UTC format. {Ed: Need a reference here.}

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIBrokerEncFT.newDateTimeFromChars*() function shall return a pointer to a new **CMPIDateTime** object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIDateTimeFT.getBinaryFormat()

NAME

CMPIDateTimeFT.getBinaryFormat – get a DateTime value in binary format

SYNOPSIS

```
CMPIUint64 CMPIDateTimeFT.getBinaryFormat(
    CMPIDateTime* dt,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIDateTimeFT.getBinaryFormat*() function shall return the value of a DateTime object as a 64-bit unsigned integer in microseconds starting since 00:00:00 GMT, Jan 1, 1970, or as an interval, depending on how the **CMPIDateTime** object was created.

The *dt* argument is a pointer the **CMPIDateTime** structure.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIDateTimeFT.getBinaryFormat*() function shall return a **CMPIUint64** structure containing the DateTime value in binary format.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIDateTimeFT.getStringFormat()

NAME

CMPIDateTimeFT.getStringFormat – get a DateTime value in UTC string format

SYNOPSIS

```
CMPIString* CMPIDateTimeFT.getStringFormat(
    CMPIDateTime* dt,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIDateTimeFT.getStringFormat*() function shall return the value of a DateTime as a string formatted using the UTC fixed string format: `yyymmddhhmmss.mmmmmmsutc` (year, month, day, hour, minute, second, microseconds, and signed UTC offset). Interval times are indicated by `:000` for the signed UTC offset.

The *dt* argument is a pointer the **CMPIDateTime** structure.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIDateTimeFT.getStringFormat*() function shall return a pointer to a **CMPIString** structure containing the DateTime value in UTC string format.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIDateTimeFT.isInterval()

NAME

CMPIDateTimeFT.isInterval – test whether a DateTime object is an interval value

SYNOPSIS

```
CMPIBoolean CMPIDateTimeFT.isInterval(
    CMPIDateTime* dt,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIDateTimeFT.isInterval*() function shall test whether a DateTime object is an interval value.

The *dt* argument is a pointer the **CMPIDateTime** structure.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIDateTimeFT.isInterval*() function shall return a **CMPIBoolean** structure with the value true iv the DateTime object is an interval value.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

6.9 CMPISelectExp Support

CMPISelectExp support is provided by the following functions.

CMPIBrokerEncFT.newSelectExp()

NAME

CMPIBrokerEncFT.newSelectExp – create a new SelectExp object

SYNOPSIS

```
CMPISelectExp* CMPIBrokerEncFT.newSelectExp(
    CMPIBroker* mb,
    char* query,
    char* lang,
    CMPIArray** projection,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerEncFT.newSelectExp*() function shall return a new **CMPISelectExp** object.

The *mb* argument points to a **CMPIBroker** object. The *query* argument is a pointer to a string containing the select expression. The *lang* argument is a pointer to a string containing the query language.

The *projection* argument is a pointer to a pointer to a **CMPIArray** structure that is updated with the projection specification.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIBrokerEncFT.newSelectExp*() function shall return a pointer to a new **CMPISelectExp** object.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPISelectExpFT.evaluate()

NAME

CMPISelectExpFT.evaluate – evaluate an Instance using a Select Expression

SYNOPSIS

```
CMPIBoolean CMPISelectExpFT.evaluate(
    CMPISelectExp* se,
    CMPIInstance* inst,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPISelectExpFT.evaluate*() function shall evaluate an Instance using a Select Expression.

The *se* argument is a pointer to a **CMPISelectExp** structure containing the Select Expression.

The *inst* argument is a pointer to a **CMPIInstance** structure containing the Instance to be evaluated.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPISelectExpFT.evaluate*() function shall return a **CMPIBoolean** structure indicating the result of the evaluation.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPISelectExpFT.getCOD()

NAME

CMPISelectExpFT.getCOD – return a selection as a conjunction of disjunctions

SYNOPSIS

```
CMPISelectCond* CMPISelectExpFT.getCOD(
    CMPISelectExp* se,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPISelectExpFT.getCOD*) function shall return the selection as a conjunction of disjunctions. This function transforms the filter's *where* clause into a canonical Conjunction of Disjunctions form (AND or OR'ed comparison expressions). This enables handling of the *where* expression more easily than using a tree form.

The *se* argument is a pointer to a **CMPISelectExp** structure containing the Select Expression.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

Support for this function is optional. Availability of this support is indicated by the **CMPI_MB_Supports_QueryNormalization** flag in *CMPIBrokerFT.classification*.

RETURN VALUE

The *CMPISelectExpFT.getCOD*) function shall return a pointer to a **CMPISelectCond** structure cointaining the transformed selection.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPISelectExpFT.getDOC()

NAME

CMPISelectExpFT.getDOC – return a selection as a disjunction of conjunctions

SYNOPSIS

```
CMPISelectCond* CMPISelectExpFT.getDOC(
    CMPISelectExp* se,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPISelectExpFT.getDOC*() function shall return the selection as a conjunction of disjunctions. This function transforms the filter's *where* clause into a canonical Disjunction of Conjunctions form (OR or AND'ed comparison expressions). This enables handling of the *where* expression more easily than using a tree form.

The *se* argument is a pointer to a **CMPISelectExp** structure containing the Select Expression.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

Support for this function is optional. Availability of this support is indicated by the **CMPI_MB_Supports_QueryNormalization** flag in *CMPIBrokerFT.classification*.

RETURN VALUE

The *CMPISelectExpFT.getDOC*() function shall return a pointer to a **CMPISelectCond** structure cointaining the transformed selection.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPISelectExpFT.getString()

NAME

CMPISelectExpFT.getString – return a Select Expression in string format

SYNOPSIS

```
CMPIString* CMPISelectExpFT.getString(
    CMPISelectExp* se,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPISelectExpFT.getString*() function shall return the selection as a string.

The *se* argument is a pointer to a **CMPISelectExp** structure containing the Select Expression.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPISelectExpFT.getSTring*() function shall return a pointer to a **CMPIString** structure cointaining the Select Expression in string format.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

6.10 CMPISelectCond Support

CMPISelectCond support is optional. Availability of this support is indicated by the **CMPI_MB_Supports_QueryNormalization** flag in *CMPIBrokerFT.classification*().

CMPISelectCondSupport is provided by the following functions.

CMPISelectCondFT.getCountAndType()

NAME

CMPISelectCondFT.getCountAndType – return the number and type of subconditions that are part of a SelectCond oblect

SYNOPSIS

```
CMPICount CMPISelectCondFT.getCountAndType(
    CMPISelectCond* sc,
    int *type,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPISelectCondFT.getCountAndType*() function shall return the count and type of the subconditions that are part of a SelectCond object.

The *sc* argument points to a **CMPISelectCond** structure.

The *type* argument is a pointer to an integer which is updated with the SelectCond type. A value of 0 indicates a DOC type, and a value of 1 indicates a COD type. If *type* is NULL no type information is returned.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPISelectCondFT.getCountAndType*() function shall return a pointer to a **CMPICount** structure containing the number of subconditions

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPISelectCondFT.getExpAt()

NAME

CMPISelectCondFT.getExpAt – return a SubCond element based on its index

SYNOPSIS

```
CMPISubCond* CMPISelectCondFT.getExpAt(
    CMPISelectCond* sc,
    unsigned int index,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPISelectCondFT.getExpAt*() function shall return the count and type of the subconditions that are part of a SelectCond object.

The *sc* argument points to a **CMPISelectCond** structure.

The *index* argument is an integer specifying the position of the SubCOnd element in the internal data array.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPISelectCondFT.getExpAt*() function shall return a pointer to a **CMPISubCond** structure containing the SubCond element.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

6.11 CMPISubCond Support

CMPISubCond support is optional. Availability of this support is indicated by the **CMPI_MB_Supports_QueryNormalization** flag in *CMPIBrokerFT.classification*.

CMPISubCond support is provided by the following functions.

CMPISubCondFT.getCount()

NAME

CMPISubCondFT.getCount – return the number of predicates that are part of a subcondition.

SYNOPSIS

```
CMPICount CMPISubCondFT.getCount(
    CMPISelectCond* sc,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPISubCondFT.getCount*() function shall return the number of predicates that are part of a subcondition.

The *sc* argument is a pointer to a **CMPISubCondFT** structure containing the subcondition.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPISubCondFT.getCount*() function shall return a pointer to a **CMPICount** structure containing the number of predicates.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPISubCondFT.getPredicate()

NAME

CMPISubCondFT.getPredicate – return a named predicate element

SYNOPSIS

```
CMPIPredicate* CMPISubCondFT.getPredicate(
    CMPISubCond* sc,
    char* name,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPISubCondFT.getPredicate*() function shall return the a named predicate from a subcondition. This function treats the list of predicates as a list of named entries and enables getting a particular predicate by name.

The *sc* argument is a pointer to a **CMPISubCondFT** structure containing the subcondition.

The *name* argument is a string containing the predicate name. The name is the left-hand side of the predicate.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPISubCondFT.getPredicate*() function shall return a pointer to a **CMPIPredicate** structure containing the named predicate.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPISubCondFT.getPredicateAt()

NAME

CMPISubCondFT.getPredicateAt – return a predicate based on its index

SYNOPSIS

```
CMPIPredicate* CMPISubCondFT.getPredicateAt(
    CMPISubCond* sc,
    int index,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPISubCondFT.getPredicatAte*() function shall return the a predicate from a subcondition based on its index. The *sc* argument is a pointer to a **CMPISubCondFT** structure containing the subcondition.

The *index* argument is an integer specifying the index of the predicate in the internal data array.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

The name is the left-hand side of the predicate.

RETURN VALUE

The *CMPISubCondFT.getPredicate*() function shall return a pointer to a **CMPIPredicate** structure containing the predicate.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

6.12 CMPIPredicate Support

CMPIPredicate support is optional. Availability of this support is indicated by the **CMPI_MB_Supports_QueryNormalization** flag in *CMPIBrokerFT.classification*.

CMPIPredicate support is provided by the following functions.

CMPIPredicateFT.evaluate()

NAME

CMPIPredicateFT.evaluate – evaluate a predicate using a specific value

SYNOPSIS

```
int CMPIPredicateFT.evaluate(
    CMPIPredicate* pr,
    CMPIValue* value,
    CMPIType type,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIPredicateFT.evaluate*() function shall evaluate a predicate using a specific value.

The *pr* argument points to a **CMPIPredicate** structure to be evaluated.

{Ed: The web documentation had the *type* argument duplicated. I have deleted one copy. Is this correct?}

The *value* argument points to a **CMPIValue** structure containing the value to be used to evaluate the predicate.

The *type* argument is a **CMPIType** structure defining the type of the value.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIPredicateFT.evaluate*() function shall return an integer containing the evaluation result.

{Ed: Are the only results **TRUE** or **FALSE**? If so, should this be returning a **CMPIBoolean**.}

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIPredicateFT.getData()

NAME

CMPIPredicateFT.getData – get the predicate components

SYNOPSIS

```
CMPIStatus CMPIPredicateFT.getData(
    CMPIPredicate* pr,
    CMPIType* type,
    CMPIPredOp *op,
    CMPIString** lhs,
    CMPIString** rhs
);
```

DESCRIPTION

The *CMPIPredicateFT.getData*() function shall get the predicate components.

The *pr* argument points to a **CMPIPredicate** structure to be evaluated.

The *type* argument points to a **CMPIType** structure defining the property type.

The *op* argument points to a **CMPIPredOp** structure containing the predicate operation.

The *lhs* argument points to a **CMPIString** structure that is updated with the left hand side of the predicate.

The *rhs* argument points to a **CMPIString** structure that is updated with the right hand side of the predicate.

RETURN VALUE

The *CMPIPredicateFT.getData*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

7 Qualifier Support

Qualifier support is an optional feature of CMPI. Availability of this support is indicated by the **CMPI_MB_Supports_Qualifier** flag in *CMPIBrokerFT.classification*.

Qualifier support is a subset of full schema support. It entails read-only access to CIM type qualifiers of class definitions and its components. Qualifier support is an extension to the **CMPIObjectPath** encapsulated object. The model path portion to the **CMPIObjectPath** is used to identify the object.

Qualifier support is provided by the following functions.

CMPIObjectPathFT.getClassQualifier()

NAME

CMPIObjectPathFT.getClassQualifier – get the class qualifier value

SYNOPSIS

```
CMPIData CMPIObjectPathFT.getClassQualifier(
    CMPIObjectPath* op,
    char* qName,
    CMPIStatus *rc
);
```

DESCRIPTION

The *CMPIObjectPathFT.getClassQualifier*() function shall return the class qualifier value of an ObjectPath.

The *op* argument points to a **CMPIObjectPath** structure.

The *qName* argument is a string containing the qualifier name.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

RETURN VALUE

The *CMPIObjectPathFT.getClassQualifier*() function shall return a **CMPIData** structure containing the qualifier value.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIObjectPathFT.getMethodQualifier()

NAME

CMPIObjectPathFT.getMethodQualifier – get the method qualifier value

SYNOPSIS

```
CMPIData CMPIObjectPathFT.getMethodQualifier(
    CMPIObjectPath* op,
    char* mName,
    char* qName,
    CMPIStatus *rc
);
```

DESCRIPTION

The *CMPIObjectPathFT.getMethodQualifier*() function shall return the class qualifier value of an ObjectPath.

The *op* argument points to a **CMPIObjectPath** structure.

The *nName* argument is a string containing the method name.

The *qName* argument is a string containing the qualifier name.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

RETURN VALUE

The *CMPIObjectPathFT.getMethodQualifier*() function shall return a **CMPIData** structure containing the qualifier value.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIObjectPathFT.getParameterQualifier()

NAME

CMPIObjectPathFT.getParameterQualifier – get the method parameter qualifier value

SYNOPSIS

```
CMPIData CMPIObjectPathFT.getParameterQualifier(
    CMPIObjectPath* op,
    char* mName,
    char* pName,
    char* qName,
    CMPIStatus *rc
);
```

DESCRIPTION

The *CMPIObjectPathFT.getParamaterQualifier*() function shall return the class qualifier value of an ObjectPath.

The *op* argument points to a **CMPIObjectPath** structure.

The *mName* argument is a string containing the method name.

The *pName* argument is a string containing the parameter name.

The *qName* argument is a string containing the qualifier name.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

RETURN VALUE

The *CMPIObjectPathFT.getParameterQualifier*() function shall return a **CMPIData** structure containing the qualifier value.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIObjectPathFT.getPropertyQualifier()

NAME

CMPIObjectPathFT.getPropertyQualifier – ????

SYNOPSIS

```
CMPIData CMPIObjectPathFT.getPropertyQualifier(
    CMPIObjectPath* op,
    char* pName,
    char* qName,
    CMPIStatus *rc
);
```

DESCRIPTION

The *CMPIObjectPathFT.getPropertyQualifier*() function shall return the class qualifier value of an ObjectPath.

The *op* argument points to a **CMPIObjectPath** structure.

The *pName* argument is a string containing the property name.

The *qName* argument is a string containing the qualifier name.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

RETURN VALUE

The *CMPIObjectPathFT.getPropertyQualifier*() function shall return a **CMPIData** structure containing the qualifier value.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

8 Schema Support

Schema support is an optional feature of CMPI.. Availability of this support is indicated by the **CMPI_MB_Supports_Schema** flag in *CMPIBrokerFT.classification*().

Schema support enables full support for creation, update, and access to class definitions and its components.

TO BE COMPLETED.

9 MB Services

Management Broker (MB) Services are part of CMPI support. In general, the services correspond with most of the services either available via a **CIMClient** interface or via various **CIMOMProviderHandle** implementations.

9.1 Minimal Services

In theory, MBs do not need to support some or all of the services; after all, it is acceptable for CIM clients to get a [CIM_ERR_NOT_SUPPORTED] exception for client calls. Still, writing Management Instrumentation (MI) in such unpredictable environments is a hassle.

We should consider making a few services mandatory. The following services have proven to be useful in the past and should be looked at more closely:[7]

- Enumerate Instances/InstanceNames
- Enumerate Associators/AssociatorNames
- Create/Get/Set/DeleteInstance
- InvokeMethod
- DeliverIndication
- Get/SetProperty[8]

There is some redundancy in these services, meaning with a smaller list most services are still available somehow. When we ignore *DeliverIndication*, then Enumerate *InstanceNames*() and *GetInstance*() should be the absolute minimal set.

9.2 MB Classification and Optional Feature Support

MBs not supporting these minimal services are called Class 0 MBs. MBs supporting the minimal set are called Class 1 MBs. The next higher level is Class 2, supporting all services. Notice that individual MIs (but not a Class 2 MB itself) still can reject a Get/SetProperty operation.

MIs can query the MB classification and decide to refuse to operate in a less-than-needed environment, or curtail its functionality. This can be done by the MI factory by returning [CMPI_RC_ERR_NOT_SUPPORTED].

[7] This list is almost as complete as the usual **CIMClient** repertoire, except for Qualifier services.
[8] Could be done using Get/SetInstance.

In addition, the MB exposes which optional features of CMPI are supported. The following are valid values for *CMPIBrokerFT.classification*():

```
#define CMPI_MB_Class_0     0x00000001
#define CMPI_MB_Class_1     0x00000003
#define CMPI_MB_Class_2     0x00000007

#define CMPI_MB_Supports_PropertyMI         0x00000100
#define CMPI_MB_Supports_IndicationMI       0x00000200
#define CMPI_MB_Supports_IndicationPolling  0x00000400
#define CMPI_MB_Supports_QueryNormalization 0x00000800
#define CMPI_MB_Supports_Qualifier          0x00001000
#define CMPI_MB_Supports_Schema             0x00003000
```

9.3 Class 0 Services

Class 0 services are provided by the following functions.

CMPIBrokerFT.deliverIndication()

NAME

CMPIBrokerFT.deliverIndication – request delivery of an Indication

SYNOPSIS

```
CMPIStatus CMPIBrokerFT.deliverIndication(
    CMPIBroker* mb,
    CMPIContext* ctx,
    char* ns,
    CMPIInstance* ind
);
```

DESCRIPTION

The *CMPIBrokerFT.deliverIndication*() requests the delivery of an Indication. The CIMOM will locate pertinent subscribers and notify them about the event..

The *mb* argument points to a **CMPIBroker** structure. The *ctx* argument points to the context object.

The *ns* argument is a pointer to the Namespace.

The *ind* argument is a pointer to a **CMPIInstance** object containing the Indication.

RETURN VALUE

The *CMPIBrokerFT.deliverInstance*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

9.4 Class 1 Services

Class 1 services are provided by the following functions.

CMPIBrokerFT.enumInstanceNames()

NAME

CMPIBrokerFT.enumInstanceNames – enumerate the Instance Names of the class (and subclasses) defined by an ObjectPath

SYNOPSIS

```
CMPIEnumeration* CMPIBrokerFT.enumInstanceNames(
    CMPIBroker* mb,
    CMPIContext *ctx,
    CMPIObjectPath* op,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerFT.enumerateInstanceNames*() function shall enumerate the Instance Names of the class (and subclasses) defined by the specified ObjectPath. Instance structure can be controled using the **CMPIInvocationFlags** entry in *ctx*.

The *mb* argument points to a **CMPIBroker** structure. The *ctx* argument points to the context object, and the *op* argument points to the source ObjectPath containing namespace and classname elements.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

RETURN VALUE

The *CMPIBrokerFT.enumInstanceNames*() function shall return a pointer to a **CMPIEnumeration** structure containing the ObjectPaths.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerFT.getInstance()

NAME

CMPIBrokerFT.getInstance – get an Instance using an ObjectPath as a reference

SYNOPSIS

```
CMPIInstance* CMPIBrokerFT.getInstance(
    CMPIBroker* mb,
    CMPIContext *ctx,
    CMPIObjectPath* op,
    char** properties,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerFT.getInstance*() function shall retrieve an Instance using an ObjectPath as a reference.

The *mb* argument points to a **CMPIBroker** structure. The *ctx* argument points to the context object, and the *op* argument points to the source ObjectPath containing namespace, classname, and key components.

The *properties* argument, if not NULL, is an array of elements defining one or more Property names. Each returned Object must not include elements for any Properties missing from this list.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

RETURN VALUE

The *CMPIBrokerFT.getInstance*() returns a pointer to a **CMPIInstance** structure.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

9.5 Class 2 Services

Class 2 services are provided by the following functions.

CMPIBrokerFT.associatorNames()

NAME

CMPIBrokerFT.associatorNames – enumerates ObjectPaths associated with an Instance

SYNOPSIS

```
CMPIEnumeration* CMPIBrokerFT.associatorNames(
    CMPIBroker* mb
    CMPIContext *ctx,
    CMPIObjectPath* op,
    char* assocClass,
    char* resultClass,
    char* role,
    char* resultRole,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerFT.associatorNames*() function shall enumerate ObjectPaths associated with an Instance.

The *mb* argument points to a **CMPIBroker** structure. The *ctx* argument points to the context object, and the *op* argument points to the source ObjectPath containing namespace, classname, and key components.

The *assocClass* argument, if not NULL, shall be a valid Association Class name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be associated to the source Object via an Instance of this Class or one of its subclasses.

The *resultclass* argument, if not NULL, shall be a valid Class name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be either an Instance of this Class (or one of its subclasses).

The *role* argument, if not NULL, shall be a valid Property name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be associated to the source Object via an Association in which the source Object plays the specified role (i.e. the name of the Property in the Association Class that refers to the source Object must match the value of this parameter).

The *resultrole* argument, if not NULL, shall be a valid Property name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be associated to the source Object via an Association in which the returned Object plays the specified role (i.e. the name of the Property in the Association Class that refers to the returned Object must match the value of this parameter).

RETURN VALUE

The *CMPIBrokerFT.associatorNames*() function shall return a pointer to a **CMPIEnumeration** structure containing the enumeration of the ObjectPaths.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerFT.associators()

NAME

CMPIBrokerFT.associators – enumerates Instances associated with an Instance

SYNOPSIS

```
CMPIEnumeration* CMPIBrokerFT.associators(
    CMPIBroker* mb,
    CMPIContext *ctx,
    CMPIObjectPath* op,
    char* assocClass,
    char* resultClass,
    char* role,
    char* resultRole,
    char** properties,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerFT.associators*() function shall enumerate Instances associated with an Instance.

The *mb* argument points to a **CMPIBroker** structure. The *ctx* argument points to the context object, and the *op* argument points to the source ObjectPath containing namespace, classname, and key components.

The *assocClass* argument, if not NULL, shall be a valid Association Class name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be associated to the source Object via an Instance of this Class or one of its subclasses.

The *resultclass* argument, if not NULL, shall be a valid Class name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be either an Instance of this Class (or one of its subclasses).

The *role* argument, if not NULL, shall be a valid Property name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be associated to the source Object via an Association in which the source Object plays the specified role (i.e. the name of the Property in the Association Class that refers to the source Object must match the value of this parameter).

The *resultrole* argument, if not NULL, shall be a valid Property name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be associated to the source Object via an Association in which the returned Object plays the specified role (i.e. the name of the Property in the Association Class that refers to the returned Object must match the value of this parameter).

The *properties* argument, if not NULL, is an array of elements defining one or more Property names. Each returned Object must not include elements for any Properties missing from this list.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

RETURN VALUE

The *CMPIBrokerFT.associators*() function shall return a pointer to a **CMPIEnumeration** structure containing the enumeration of the Instances.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerFT.attachThread()

NAME

CMPIBrokerFT.attachThread – inform the CMPI run time system that the current thread will begin using CMPI services

SYNOPSIS

```
CMPIStatus CMPIBrokerFT.attachThread(
    CMPIBroker* mb,
    CMPIContext* ctx
);
```

DESCRIPTION

The *CMPIBrokerFT.attachThread*() function shall inform the CMPI run time system that the curret thread with the specified context will begin using CMPI services.

The *mb* argument points to a **CMPIBroker** structure. The *ctx* argument points to the context object.

RETURN VALUE

The *CMPIBrokerFT.attachThread*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

CMPIBrokerFT.detachThread(), *CMPIBrokerFT.prepareAttachThread*()

CHANGE HISTORY

None.

CMPIBrokerFT.createInstance()

NAME

CMPIBrokerFT.createInstance – create an Instance using a specified ObjectPath as a reference

SYNOPSIS

```
CMPIObjectPath* CMPIBrokerFT.createInstance(
    CMPIBroker* mb,
    CMPIContext* ctx,
    CMPIOjectPath* op,
    CMPIInstance* inst,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerFTcreateInstance*() function shall create an Instance using a specified Object Path as a reference.

The *mb* argument points to a **CMPIBroker** structure. The *ctx* argument points to the context object, and the *op* argument points to the source ObjectPath containing namespace, classname, and key components.

The *inst* argument points to a **CMPIInstance** structure.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

RETURN VALUE

The *CMPIBrokerFT.createInstance*() function shall return a pointer to the assigned Instance reference.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerFT.deleteInstance()

NAME

CMPIBrokerFT.deleteInstance – deletes an existing Instance using a specified ObjectPath as a reference

SYNOPSIS

```
CMPIStatus CMPIBrokerFT.deleteInstance(
    CMPIBroker* mb,
    CMPIContext *ctx,
    CMPIObjectPath* op
);
```

DESCRIPTION

The *CMPIBrokerFTdeleteInstance*() function shall delete an existing Instance using a specified Object Path as a reference.

The *mb* argument points to a **CMPIBroker** structure. The *ctx* argument points to the context object, and the *op* argument points to the source ObjectPath containing namespace, classname, and key components.

RETURN VALUE

The *CMPIBrokerFT.deleteInstance*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerFT.detachThread()

NAME

CMPIBrokerFT.detachThread – inform the CMPI run time system that the current thread will no longer be using CMPI services

SYNOPSIS

```
CMPIStatus CMPIBrokerFT.detachThread(
    CMPIBroker* mb,
    CMPIContext* ctx
);
```

DESCRIPTION

The *CMPIBrokerFTdettachThread*() function shall inform the CMPI run time system that the curret thread will no longer be using CMPI services.

The *mb* argument points to a **CMPIBroker** structure. The *ctx* argument points to the context object.

RETURN VALUE

The *CMPIBrokerFTdettachThread*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerFT.enumInstances()

NAME

CMPIBrokerFT.enumInstances – enumerate Instances of the class (and subclasses) defined by an ObjectPath

SYNOPSIS

```
CMPIEnumeration* CMPIBrokerFT.enumInstances(
    CMPIBroker* mb,
    CMPIContext *ctx,
    CMPIObjectPath* op,
    char** properties;
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerFT.enumInstances*() function shall enumerate the Instance Names of the class (and subclasses) defined by the specified ObjectPath. Instance structure can be controled using the **CMPIInvocationFlags** entry in *ctx*.

The *mb* argument points to a **CMPIBroker** structure. The *ctx* argument points to the context object, and the *op* argument points to the source ObjectPath containing namespace and classname elements.

The *properties* argument, if not NULL, is an array of elements defining one or more Property names. Each returned Object must not include elements for any Properties missing from this list.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

RETURN VALUE

The *CMPIBrokerFT.enumInstances*() function shall return a pointer to a **CMPIEnumeration** structure containing the ObjectPaths.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerEncFT.execQuery()

NAME

CMPIBrokerEncFT.execQuery – query the enumeration of instances of the class (and subclasses) defined by an ObjectPath using a query expression

SYNOPSIS

```
CMPIEnumeration* CMPIBrokerEncFT.execQuery(
    CMPIBroker* mb,
    CMPIContext* ctx,
    CMPIObjectPath* op,
    char* query,
    char* lang,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerEncFT.execQuery*() function shall return a new **CMPISelectExp** object.

The *mb* argument points to a **CMPIBroker** object. . The *ctx* argument points to the context object, and the *op* argument points to the source ObjectPath containing namespace and classname elements.

The *query* argument is a pointer to a string containing the select expression. The *lang* argument is a pointer to a string containing the query language.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIBrokerEncFT.execQuery*() function shall return a pointer to a **CMPIEnumeration** object containing the Instances.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerFT.getProperty()

NAME

CMPIBrokerFT.getProperty – get the named property value of an Instance defined by an ObjectPath

SYNOPSIS

```
CMPIData CMPIBrokerFT.getProperty(
    CMPIBroker* mb,
    CMPIContext *ctx,
    CMPIObjectPath* op,
    char* name,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerFT.getProperty*() function shall get the named property value of an Instance defined by an ObjectPath.

The *mb* argument points to a **CMPIBroker** object. . The *ctx* argument points to the context object, and the *op* argument points to the source ObjectPath containing namespace, classname, and key elements.

The *name* argument points to a string containing the property name.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIBrokerFT.getProperty*() shall return a **CMPIData** structure containing the requested property value.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerFT.invokeMethod()

NAME

CMPIBrokerFT.invokeMethod – invoke a named, extrinsic method of an Instance defined by an ObjectPath

SYNOPSIS

```
CMPIData CMPIBrokerFT.invokeMethod(
    CMPIBroker* mb,
    CMPIContext* ctx,
    CMPIObjectPath* op,
    char* method,
    CMPIArgs* in,
    CMPIArgs* out,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerFT.invokeMethod*() function shall invoke a named, extrinsic method of an instance defined by a specified ObjectPath.

The *mb* argument points to a **CMPIBroker** object. . The *ctx* argument points to the context object, and the *op* argument points to the source ObjectPath containing namespace, classname, and key elements.

The *method* argument points to a string containing the method name. The *in* argument points to a **CMPIArgs** structure containing the input parameters. The *out* argument points to a **CMPIArgs** structure containing the output parameters.

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIBrokerFT.invokeMethod*() function shall return a **CMPIData** structure containing the method return value.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerFT.prepareAttachThread()

NAME

CMPIBrokerFT.prepareAttachThread – prepares the CMPI run time system to accept a thread that will be usine CMPI services

SYNOPSIS

```
CMPIContext* CMPIBrokerFT.prepareAttachThread(
    CMPIBroker* mb,
    CMPIContext* ctx
);
```

DESCRIPTION

The *CMPIBrokerFT.attachThread*() function shall prepare the CMPI run time system to accept a thread that will be usine CMPI services.

The *mb* argument points to a **CMPIBroker** structure. The *ctx* argument points to the context object.

The returned **CMPIContext** object must be used by the subsequent *attachThread*() and *detachThread*() invocations.

RETURN VALUE

The *CMPIBrokerFT.attachThread*() function shall return a pointer to a **CMPIContext** structure to be used by the thread to be attached..

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

CMPIBrokerFT.attachthread(), *CMPIBrokerFT.detachThread*()

CHANGE HISTORY

None.

CMPIBrokerFT.referenceNames()

NAME

CMPIBrokerFT.referenceNames – enumerates the association ObjectPaths that refer to an Instance defined by an ObjectPath

SYNOPSIS

```
CMPIEnumeration* CMPIBrokerFT.referenceNames(
    CMPIBroker* mb
    CMPIContext *ctx,
    CMPIObjectPath* op,
    char* resultClass,
    char* role,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerFT.referenceNames*() function shall enumerate the association ObjectPaths that refer to an Instance defined by an ObjectPath.The *mb* argument points to a **CMPIBroker** structure. The *ctx* argument points to the context object, and the *op* argument points to the source ObjectPath containing namespace, classname, and key components.

The *resultclass* argument, if not NULL, shall be a valid Class name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be either an Instance of this Class (or one of its subclasses).

The *role* argument, if not NULL, shall be a valid Property name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be associated to the source Object via an Association in which the source Object plays the specified role (i.e. the name of the Property in the Association Class that refers to the source Object must match the value of this parameter).

The *rc* argument points to a **CMPIStatus** structure containing the service return status.

RETURN VALUE

The *CMPIBrokerFT.referenceNames*() function shall return a pointer to a **CMPIEnumeration** structure containing the enumeration of the ObjectPaths.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerFT.references()

NAME

CMPIBrokerFT.references – enumerates the association Instances that refer to an Instance defined by an ObjectPath

SYNOPSIS

```
CMPIEnumeration* CMPIBrokerFT.references(
    CMPIBroker* mb,
    CMPIContext *ctx,
    CMPIObjectPath* op,
    char* resultClass,
    char* role,
    char** properties,
    CMPIStatus* rc
);
```

DESCRIPTION

The *CMPIBrokerFT.references*() function shall enumerate the association Instances that refer to an Instance defined by an ObjectPath.

The *mb* argument points to a **CMPIBroker** structure. The *ctx* argument points to the context object, and the *op* argument points to the source ObjectPath containing namespace, classname, and key components.

The *resultclass* argument, if not NULL, shall be a valid Class name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be either an Instance of this Class (or one of its subclasses).

The *role* argument, if not NULL, shall be a valid Property name. It acts as a filter on the returned set of Objects by mandating that each returned Object must be associated to the source Object via an Association in which the source Object plays the specified role (i.e. the name of the Property in the Association Class that refers to the source Object must match the value of this parameter).

The *properties* argument, if not NULL, is an array of elements defining one or more Property names. Each returned Object must not include elements for any Properties missing from this list.

The *rc* argument points to a **CMPIStatus** structure used to return the service return code.

RETURN VALUE

The *CMPIBrokerFT.references*() function shall return a pointer to a **CMPIEnumeration** structure containing the enumeration of the ObjectPaths.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerFT.setInstance()

NAME

CMPIBrokerFT.setInstance – replace an existing Instance using an Object Path as reference

SYNOPSIS

```
CMPIStatus* CMPIBrokerFT.setInstance(
    CMPIBroker* mb,
    CMPIContext* ctx,
    CMPIObjectPath* op,
    CMPIInstance* inst
);
```

DESCRIPTION

The *CMPIBrokerFT.setInstance*() function shall replace an existing Instance using an ObjectPath as a reference.

The *mb* argument points to a **CMPIBroker** structure. The *ctx* argument points to the context object, and the *op* argument points to the source ObjectPath containing namespace, classname, and key components.

The *inst* argument points to a **CMPIInstance** structure containing a complete instance.

RETURN VALUE

The *CMPIBrokerFT.setInstance*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

CMPIBrokerFT.setProperty()

NAME

CMPIBrokerFT.setProperty – set the named property value of an Instance defined by an ObjectPath

SYNOPSIS

```
CMPIStatus CMPIBrokerFT.setProperty(
    CMPIBroker* mb,
    CMPIContext *context,
    CMPIObjectPath* op,
    char* name,
    CMPIValue *value,
    CMPIType type
);
```

DESCRIPTION

The *CMPIBrokerFT.setProperty*() function shall set the named property value of an Instance defined by an ObjectPath.

The *mb* argument points to a **CMPIBroker** structure. The *ctx* argument points to the context object, and the *op* argument points to the source ObjectPath containing namespace, classname, and key components.

The *name* argument points to a string containing the property name.

The *value* argument points to a **CMPIValue** structure containing the value to be assigned to the property.

The *type* argument points to a **CMPIType** structure which defines the type of *value*.

RETURN VALUE

The *CMPIBrokerFT.setProperty*() function shall return a **CMPIStatus** structure containing the service return status.

ERRORS

None.

EXAMPLES

None.

APPLICATION USAGE

None.

SEE ALSO

None.

CHANGE HISTORY

None.

9.6 Accessing MB Services

The MB service routines outlined above are made available by the MB to MIs via the **CMPIBroker** structure. **CMPIBrokerFT.bft** points to the **_CMPIBrokerFT** structure

9.6.1 CMPIBrokerFT

Conceptually the structure is as follows:

```
typedef struct _CMPIBrokerFT {
    int brokerClassification;
    int brokerVersion;
    char *brokerName;
    CMPIStatus (*deliverIndication)
        (CMPIBroker*,CMPIContext*,
         CMPIObjectPath*,char*,CMPIInstance*,
         CMPISelectExp*);
    CMPIEnumeration* (*enumInstanceNames)
        (CMPIBroker*,CMPIContext*,
         CMPIObjectPath*,CMPIStatus*);
    CMPIInstance* (*getInstance)
        (CMPIBroker*,CMPIContext*,
         CMPIObjectPath*,char**,CMPIStatus*);
    CMPIObjectPath* (*createInstance)
        (CMPIBroker*,CMPIContext*,CMPIOBjectPath*
         CMPIInstance*,CMPIStatus*);
    CMPIStatus (*setInstance)
        (CMPIBroker*,CMPIContext*,
         CMPIObjectPath*,CMPIInstance*);
    CMPIStatus (*deleteInstance)
        (CMPIBroker*,CMPIContext*,
         CMPIObjectPath*);
    CMPIEnumeration* (*execQuery)
        (CMPIBroker*,CMPIContext*,
         CMPIObjectPath*,char*,char*,CMPIStatus*);
    CMPIEnumeration* (*enumInstances)
        (CMPIBroker*,CMPIContext*,
         CMPIObjectPath*,char**,CMPIStatus*);
    CMPIEnumeration* (*associators)
        (CMPIBroker*,CMPIContext*,
         CMPIObjectPath*,char*,char*,char*,char*,char**,
         CMPIStatus*);
    CMPIEnumeration* (*associatorNames)
        (CMPIBroker*,CMPIContext*,
         CMPIObjectPath*,char*,char*,char*,char*,
         CMPIStatus*);
    CMPIEnumeration* (*references)
        (CMPIBroker*,CMPIContext*,
         CMPIObjectPath*,char*,char*,char**,
         CMPIStatus*);
    CMPIEnumeration* (*referenceNames)
        (CMPIBroker*,CMPIContext*,
         CMPIObjectPath*,char*,char*,
         CMPIStatus*);
    CMPIData (*invokeMethod)
        (CMPIBroker*,CMPIContext*,
         CMPIObjectPath*,char*,CMPIArgs*,CMPIArgs*,
```

```
            CMPIStatus*);
        CMPIStatus (*setProperty)
            (CMPIBroker*,CMPIContext*,
             CMPIObjectPath*,char*,CMPIValue*,CMPIType);
        CMPIData (*getProperty)
            (CMPIBroker*,CMPIContext*,
             CMPIObjectPath*,char,CMPIrc*);
} CMPIBrokerFT;
```

Convenience macros:

```
define CBDeliverIndication(mb,ctx,ns,ci,se) \
    ((mb)->eft->deliverIndication((mb),(ctx), \
    (ns),(ci),(se)))
...
#define CBSetProperty(mb,ctx,cop,name,val,type) \
    ((mb)->eft->setProperty((mb),(ctx),(cop), \
    (name),(val),(type)))
#define CBGetProperty(mb,ctx,cop,name,type,rc) \
    ((mb)->eft->getProperty((mb),(ctx),(cop), \
    (val),(type),(rc)))
...
}
```

A Header Files

A.1 Data Types (<cmpidt.h>)

```
/*
 * cmpidt.h
 * Copyright \(co 2002, International Business Machines Corporation
 * THIS FILE IS PROVIDED UNDER THE TERMS OF THE COMMON PUBLIC
 * LICENSE (“AGREEMENT"). ANY USE, REPRODUCTION, OR DISTRIBUTION
 * OF THIS FILE CONSTITUTES THE RECIPIENT’S ACCEPTANCE OF THE
 * AGREEMENT.
 * A current copy of the Common Public License is available from:
 * oss.software.ibm.com/developerworks/opensource/license-cpl.html.
 * Author: Adrian Schuur <schuur@de.ibm.com>
 * Description: CMPI data types
 */

#ifndef _CMPIDT_H_
#define _CMPIDT_H_

#include <stdio.h>

#ifdef __cplusplus
extern "C" {
#endif

#define CMPIVersion051 51     //  0.51
#define CMPICurrentVersion CMPIVersion051

struct _CMPIBroker;
struct _CMPIInstance;
struct _CMPIObjectPath;
struct _CMPIArgs;
struct _CMPISelectExp;
struct _CMPISelectCond;
struct _CMPISubCond;
struct _CMPIPredicate;
struct _CMPIEnumeration;
struct _CMPIArray;
struct _CMPIString;
struct _CMPIResult;
struct _CMPIContext;
struct _CMPIDateTime;

typedef struct _CMPIBroker         CMPIBroker;
typedef struct _CMPIInstance       CMPIInstance;
typedef struct _CMPIObjectPath     CMPIObjectPath;
typedef struct _CMPIArgs           CMPIArgs;
typedef struct _CMPISelectExp      CMPISelectExp;
typedef struct _CMPISelectCond     CMPISelectCond;
typedef struct _CMPISubCond        CMPISubCond;
typedef struct _CMPIPredicate      CMPIPredicate;
```

```
typedef struct _CMPIEnumeration    CMPIEnumeration;
typedef struct _CMPIArray          CMPIArray;
typedef struct _CMPIString         CMPIString;
typedef struct _CMPIResult         CMPIResult;
typedef struct _CMPIContext        CMPIContext;
typedef struct _CMPIDateTime       CMPIDateTime;

struct _CMPIBrokerFT;
struct _CMPIBrokerEncFT;
struct _CMPIInstanceFT;
struct _CMPIObjectPathFT;
struct _CMPIArgsFT;
struct _CMPISelectExpFT;
struct _CMPISelectCondFT;
struct _CMPISelectCondDocFT;
struct _CMPISelectCondCodFT;
struct _CMPISubCondFT;
struct _CMPIPredicateFT;
struct _CMPIEnumerationFT;
struct _CMPIArrayFT;
struct _CMPIStringFT;
struct _CMPIresultFT;
struct _CMPIContextFT;
struct _CMPIDateTimeFT;

typedef struct _CMPIBrokerFT       CMPIBrokerFT;
typedef struct _CMPIBrokerEncFT    CMPIBrokerEncFT;
typedef struct _CMPIInstanceFT     CMPIInstanceFT;
typedef struct _CMPIObjectPathFT   CMPIObjectPathFT;
typedef struct _CMPIArgsFT         CMPIArgsFT;
typedef struct _CMPISelectExpFT    CMPISelectExpFT;
typedef struct _CMPISelectCondFT   CMPISelectCondFT;
typedef struct _CMPISubCondFT      CMPISubCondFT;
typedef struct _CMPIPredicateFT    CMPIPredicateFT;
typedef struct _CMPIEnumerationFT  CMPIEnumerationFT;
typedef struct _CMPIArrayFT        CMPIArrayFT;
typedef struct _CMPIStringFT       CMPIStringFT;
typedef struct _CMPIResultFT       CMPIResultFT;
typedef struct _CMPIContextFT      CMPIContextFT;
typedef struct _CMPIDateTimeFT     CMPIDateTimeFT;

typedef unsigned char              CMPIBoolean;
typedef unsigned short             CMPIChar16;
typedef unsigned char              CMPIUint8;
typedef unsigned short             CMPIUint16;
typedef unsigned long              CMPIUint32;
typedef unsigned long long         CMPIUint64;
typedef signed char                CMPISint8;
typedef short                      CMPISint16;
typedef long                       CMPISint32;
typedef long long                  CMPISint64;
typedef float                      CMPIReal32;
typedef double                     CMPIReal64;

typedef struct _CMPIValuePtr {
    void *ptr;
    unsigned int length;
} CMPIValuePtr;
```

```
typedef union _CMPIValue {
    CMPIBoolean          boolean;
    CMPIChar16           char16;
    CMPIUint8            uint8;
    CMPIUint16           uint16;
    CMPIUint32           uint32;
    CMPIUint64           uint64;
    CMPISint8            sint8;
    CMPISint16           sint16;
    CMPISint32           sint32;
    CMPISint64           sint64;
    CMPIReal32           real32;
    CMPIReal64           real64;

    CMPIInstance*        inst;
    CMPIObjectPath*      ref;
    CMPIArgs*            args;
    CMPISelectExp*       filter;
    CMPIEnumeration*     Enum;
    CMPIArray*           array;
    CMPIString*          string;
    char*                chars;
    CMPIDateTime*        dateTime;
    CMPIValuePtr         dataPtr;

    CMPISint8            Byte;
    CMPISint16           Short;
    CMPISint32           Int;
    CMPISint64           Long;
    CMPIReal32           Float;
    CMPIReal64           Double;
} CMPIValue;

typedef unsigned short CMPIType;

#define CMPI_SIMPLE       (2)
#define CMPI_boolean      (2+0)
#define CMPI_char16       (2+1)

#define CMPI_REAL         ((2)<<2)
#define CMPI_real32       ((2+0)<<2)
#define CMPI_real64       ((2+1)<<2)

#define CMPI_UINT         ((8)<<4)
#define CMPI_uint8        ((8+0)<<4)
#define CMPI_uint16       ((8+1)<<4)
#define CMPI_uint32       ((8+2)<<4)
#define CMPI_uint64       ((8+3)<<4)
#define CMPI_SINT         ((8+4)<<4)
#define CMPI_sint8        ((8+4)<<4)
#define CMPI_sint16       ((8+5)<<4)
#define CMPI_sint32       ((8+6)<<4)
#define CMPI_sint64       ((8+7)<<4)
#define CMPI_INTEGER      ((CMPI_UINT | CMPI_SINT))

#define CMPI_ENC          ((16)<<8)
#define CMPI_instance     ((16+0)<<8)
#define CMPI_ref          ((16+1)<<8)
#define CMPI_args         ((16+2)<<8)
```

```
#define CMPI_class        ((16+3)<<8)
#define CMPI_filter       ((16+4)<<8)
#define CMPI_enumeration  ((16+5)<<8)
#define CMPI_string       ((16+6)<<8)
#define CMPI_chars        ((16+7)<<8)
#define CMPI_dateTime     ((16+8)<<8)
#define CMPI_ptr          ((16+9)<<8)

#define CMPI_ARRAY        ((1)<<13)
#define CMPI_SIMPLEA      (CMPI_ARRAY | CMPI_SIMPLE)
#define CMPI_booleanA     (CMPI_ARRAY | CMPI_boolean)
#define CMPI_char16A      (CMPI_ARRAY | CMPI_char16)

#define CMPI_REALA        (CMPI_ARRAY | CMPI_REAL)
#define CMPI_real32A      (CMPI_ARRAY | CMPI_real32)
#define CMPI_real64A      (CMPI_ARRAY | CMPI_real64)

#define CMPI_UINTA        (CMPI_ARRAY | CMPI_UINT)
#define CMPI_uint8A       (CMPI_ARRAY | CMPI_uint8)
#define CMPI_uint16A      (CMPI_ARRAY | CMPI_uint16)
#define CMPI_uint32A      (CMPI_ARRAY | CMPI_uint32)
#define CMPI_uint64A      (CMPI_ARRAY | CMPI_uint64)
#define CMPI_SINTA        (CMPI_ARRAY | CMPI_SINT)
#define CMPI_sint8A       (CMPI_ARRAY | CMPI_sint8)
#define CMPI_sint16A      (CMPI_ARRAY | CMPI_sint16)
#define CMPI_sint32A      (CMPI_ARRAY | CMPI_sint32)
#define CMPI_sint64A      (CMPI_ARRAY | CMPI_sint64)
#define CMPI_INTEGERA     (CMPI_ARRAY | CMPI_INTEGER)

#define CMPI_ENCA         (CMPI_ARRAY | CMPI_ENC)
#define CMPI_stringA      (CMPI_ARRAY | CMPI_string)
#define CMPI_charsA       (CMPI_ARRAY | CMPI_chars)
#define CMPI_dateTimeA    (CMPI_ARRAY | CMPI_dateTime

// The following are CMPIObjectPath key-type synonyms and
// are valid only when CMPI_keyValue of CMPIValueState is set:

#define CMPI_keyInteger   (CMPI_sint64)
#define CMPI_keyString    (CMPI_string)
#define CMPI_keyBoolean   (CMPI_boolean)
#define CMPI_keyRef       (CMPI_ref)

// The following are predicate types only:

#define CMPI_charString      (CMPI_string)
#define CMPI_numericString   (CMPI_string | CMPI_sint64)
#define CMPI_booleanString   (CMPI_string | CMPI_boolean)
#define CMPI_dateTimeString  (CMPI_string | CMPI_dateTime)
#define CMPI_classNameString (CMPI_string | CMPI_class)

typedef unsigned short CMPIValueState;
#define CMPI_nullValue (1<<8)
#define CMPI_keyValue  (2<<8)
#define CMPI_badValue  (0x80<<8)

typedef struct _CMPIData {
    CMPIType type;
    CMPIValueState state;
    CMPIValue value;
```

```
} CMPIData;

#ifndef CMPI_NO_SYNONYM_SUPPORT
#define CMPI_Byte    CMPI_sint8
#define CMPI_Short   CMPI_sint16
#define CMPI_Int     CMPI_sint32
#define CMPI_Long    CMPI_sint64
#define CMPI_Float   CMPI_real32
#define CMPI_Double  CMPI_real64

#define CMPI_ByteA   CMPI_sint8A
#define CMPI_ShortA  CMPI_sint16A
#define CMPI_IntA    CMPI_sint32A
#define CMPI_LongA   CMPI_sint64A
#define CMPI_FloatA  CMPI_real32A
#define CMPI_DoubleA CMPI_real64A
#endif // CMPI_NO_SYNONYM_SUPPORT

typedef unsigned int CMPICount;

typedef unsigned int CMPIFlags;

#define CMPI_FLAG_LocalOnly          1
#define CMPI_FLAG_DeepInheritance    2
#define CMPI_FLAG_IncludeQualifiers  4
#define CMPI_FLAG_IncludeClassOrigin 8

#define CMPIInvocationFlags "CMPIInvocationFlags"

typedef enum _CMPIrc {
    CMPI_RC_OK                              =0,
    CMPI_RC_ERR_FAILED                      =1,
    CMPI_RC_ERR_ACCESS_DENIED               =2,
    CMPI_RC_ERR_INVALID_NAMESPACE           =3,
    CMPI_RC_ERR_INVALID_PARAMETER           =4,
    CMPI_RC_ERR_INVALID_CLASS               =5,
    CMPI_RC_ERR_NOT_FOUND                   =6,
    CMPI_RC_ERR_NOT_SUPPORTED               =7,
    CMPI_RC_ERR_CLASS_HAS_CHILDREN          =8,
    CMPI_RC_ERR_CLASS_HAS_INSTANCES         =9,
    CMPI_RC_ERR_INVALID_SUPERCLASS          =10,
    CMPI_RC_ERR_ALREADY_EXISTS              =11,
    CMPI_RC_ERR_NO_SUCH_PROPERTY            =12,
    CMPI_RC_ERR_TYPE_MISMATCH               =13,
    CMPI_RC_ERR_QUERY_LANGUAGE_NOT_SUPPORTED =14,
    CMPI_RC_ERR_INVALID_QUERY               =15,
    CMPI_RC_ERR_METHOD_NOT_AVAILABLE        =16,
    CMPI_RC_ERR_METHOD_NOT_FOUND            =17,
    CMPI_RC_ERROR_SYSTEM                    =100,
    CMPI_RC_ERROR                           =200,
} CMPIrc;

typedef struct _CMPIStatus {
    CMPIrc rc;
    CMPIString *msg;
} CMPIStatus;
```

```
/* Management Instrumentation type */

#define CMPI_MIType_Instance    1
#define CMPI_MIType_Association 2
#define CMPI_MIType_Method      4
#define CMPI_MIType_Property    8
#define CMPI_MIType_Indication 16

/* Management Broker classification and feature support */

#define CMPI_MB_Class_0     0x00000001
#define CMPI_MB_Class_1     0x00000003
#define CMPI_MB_Class_2     0x00000007

#define CMPI_MB_Supports_PropertyMI         0x00000100
#define CMPI_MB_Supports_IndicationMI       0x00000200
#define CMPI_MB_Supports_IndicationPolling  0x00000400
#define CMPI_MB_Supports_QueryNormalization 0x00000800
#define CMPI_MB_Supports_Qualifier          0x00001000
#define CMPI_MB_Supports_Schema             0x00003000

/* Query Predicate operations */

typedef enum _CMPIPredOp {
    CMPI_PredOp_Equals              =1,
    CMPI_PredOp_NotEquals           =2,
    CMPI_PredOp_LessThan            =3,
    CMPI_PredOp_GreaterThanOrEquals =4,
    CMPI_PredOp_GreaterThan         =5,
    CMPI_PredOp_LessThanOrEquals    =6,
    CMPI_PredOp_Isa                 =7,
    CMPI_PredOp_NotIsa              =8,
    CMPI_PredOp_Like                =9,
    CMPI_PredOp_NotLike             =10,
} CMPIPredOp;

#ifdef __cplusplus
 };
#endif

#endif // _CMPIDT_H_
```

A.2 Function Tables (<cmpift.h>)

```
/*
 * cmpift.h
 * Copyright \(co 2002, International Business Machines Corporation
 * THIS FILE IS PROVIDED UNDER THE TERMS OF THE COMMON PUBLIC
 * LICENSE ("AGREEMENT"). ANY USE, REPRODUCTION, OR DISTRIBUTION
 * OF THIS FILE CONSTITUTES THE RECIPIENT'S ACCEPTANCE OF THE
 * AGREEMENT.
 * A current copy of the Common Public License is available from:
 * oss.software.ibm.com/developerworks/opensource/license-cpl.html.
 * Author: Adrian Schuur <schuur@de.ibm.com>
 * Description: CMPI encapsulated types function tables
 */

#ifndef _CMPIFT_H_
#define _CMPIFT_H_

#include <cmpidt.h>
#include <cmpimacs.h>

#ifdef __cplusplus
extern "C" {
#endif

struct _CMPIBrokerEncFT {
    int ftVersion;
    CMPIInstance* (*newInstance)
        (CMPIBroker*,CMPIObjectPath*,CMPIStatus*);
    CMPIObjectPath* (*newObjectPath)
        (CMPIBroker*,char*,char*,CMPIStatus*);
    CMPIArgs* (*newArgs)
        (CMPIBroker*,CMPIStatus*);
    CMPIString* (*newString)
        (CMPIBroker*,char*,CMPIStatus*);
    CMPIArray* (*newArray)
        (CMPIBroker*,CMPICount,CMPIType,CMPIStatus*);
    CMPIDateTime* (*newDateTime)
        (CMPIBroker*,CMPIStatus*);
    CMPIDateTime* (*newDateTimeFromBinary)
        (CMPIBroker*,CMPIUint64,CMPIBoolean,CMPIStatus*);
    CMPIDateTime* (*newDateTimeFromChars)
        (CMPIBroker*,char*,CMPIStatus*);
    CMPISelectExp* (*newSelectExp)
        (CMPIBroker*,char*,char*, CMPIArray**,CMPIStatus*);

    CMPIString* (*toString)
        (CMPIBroker*,void*,CMPIStatus*);
    CMPIBoolean (*isOfType)
        (CMPIBroker*,void*,char*,CMPIStatus*);
    CMPIString* (*getType)
        (CMPIBroker*,void*,CMPIStatus*);
    CMPIStatus  (*logMessage)
        (CMPIBorker*,int,int,char*);
};

```

```
struct _CMPIBrokerFT {
    unsigned long brokerClassification;
    int brokerVersion;
    char *brokerName;
    CMPIContext* (*prepareAttachThread)
        (CMPIBroker*,CMPIContext*);
    CMPIStatus (*attachThread)
        (CMPIBroker*,CMPIContext*);
    CMPIStatus (*detachThread)
        (CMPIBroker*,CMPIContext*);

// class 0 services
    CMPIStatus (*deliverIndication)
        (CMPIBroker*,CMPIContext*,
            char*,CMPIInstance*,CMPISelectExp*);
// class 1 services
    CMPIEnumeration* (*enumInstanceNames)
        (CMPIBroker*,CMPIContext*, CMPIObjectPath*,CMPIStatus*);
    CMPIInstance* (*getInstance)
        (CMPIBroker*,CMPIContext*,
            CMPIObjectPath*,char**,CMPIStatus*);
// class 2 services
    CMPIObjectPath* (*createInstance)
        (CMPIBroker*,CMPIContext*, CMPIInstance*,CMPIStatus*);
    CMPIStatus (*setInstance)
        (CMPIBroker*,CMPIContext*,CMPIInstance*);
    CMPIStatus (*deleteInstance)
        (CMPIBroker*,CMPIContext*, CMPIObjectPath*);
    CMPIEnumeration* (*execQuery)
        (CMPIBroker*,CMPIContext*,
            CMPIObjectPath*,char*,char*,CMPIStatus*);
    CMPIEnumeration* (*enumInstances)
        (CMPIBroker*,CMPIContext*,
            CMPIObjectPath*,char**,CMPIStatus*);
    CMPIEnumeration* (*associators)
        (CMPIBroker*,CMPIContext*,
            CMPIObjectPath*,char*,char*,char*,char*,char**,
            CMPIStatus*);
    CMPIEnumeration* (*associatorNames)
        (CMPIBroker*,CMPIContext*,
            CMPIObjectPath*,char*,char*,char*,char*,CMPIStatus*);
    CMPIEnumeration* (*references)
        (CMPIBroker*,CMPIContext*,
            CMPIObjectPath*,char*,char*,char**,
            CMPIStatus*);
    CMPIEnumeration* (*referenceNames)
        (CMPIBroker*,CMPIContext*,CMPIObjectPath*
            ,char*,char*,CMPIStatus*);
    CMPIData (*invokeMethod) (CMPIBroker*,CMPIContext*,
    CMPIObjectPath*,char*,CMPIArgs*,CMPIArgs*,CMPIStatus*);
    CMPIStatus (*setProperty)
        (CMPIBroker*,CMPIContext*, CMPIObjectPath*,char*,
            CMPIValue*, CMPIType);
    CMPIData (*getProperty)
        (CMPIBroker*,CMPIContext*,
             CMPIObjectPath*,char*,CMPIStatus*);
};
```

```
struct _CMPIBroker {
    void *hdl;
    CMPIBrokerFT *bft;
    CMPIBrokerEncFT *eft;
};

struct _CMPIContextFT {
    int ftVersion;
    CMPIStatus (*release)
        (CMPIContext*);
    CMPIContext* (*clone)
        (CMPIContext*,CMPIStatus*);
    void*  (*reserved1)
        (CMPIContext*,CMPIStatus*);
    CMPIData (*getEntry)
        (CMPIContext*,char*,CMPIStatus*);
    CMPIData (*getEntryAt)
        (CMPIContext*,unsigned int,CMPIString**,CMPIStatus*);
    unsigned int (*getEntryCount)
        (CMPIContext*,CMPIStatus*);
    CMPIStatus (*addEntry)
        (CMPIContext*,char*,CMPIValue*,CMPIType);
};

struct _CMPIContext {
    void *hdl;
    CMPIContextFT *ft;
};

struct _CMPIResult {
    void *hdl;
    CMPIResultFT *ft;
};

struct _CMPIResultFT {
    int ftVersion;
    CMPIStatus (*release)
        (CMPIResult*);
    CMPIResult* (*clone)
        (CMPIResult*,CMPIStatus*);
    void* (*reserved1)
        (CMPIResult*,CMPIStatus*);
    CMPIStatus (*returnData)
        (CMPIResult*,CMPIValue*,CMPIType);
    CMPIStatus (*returnInstance)
        (CMPIResult*,CMPIInstance*);
    CMPIStatus (*returnObjectPath)
        (CMPIResult* eRes, CMPIObjectPath* eRef);
    CMPIStatus (*returnDone)
        (CMPIResult*);
};

struct _CMPIInstance {
    void *hdl;
    CMPIInstanceFT* ft;
};

struct _CMPIInstanceFT {
    int ftVersion;
```

```
    CMPIStatus (*release)
        (CMPIInstance*);
    CMPIInstance* (*clone)
        (CMPIInstance*,CMPIStatus*);
    void* (*reserved1)
        (CMPIInstance*,CMPIStatus*);
    CMPIData (*getProperty)
        (CMPIInstance*,char*,CMPIStatus*);
    CMPIData (*getPropertyAt)
        (CMPIInstance*,unsigned int,CMPIString**,CMPIStatus*);
    unsigned int (*getPropertyCount)
        (CMPIInstance*,CMPIStatus*);
    CMPIStatus (*setProperty)
        (CMPIInstance*,char*, CMPIValue*,CMPIType);
    CMPIObjectPath* (*getObjectPath)
        (CMPIInstance*,CMPIStatus*);
    CMPIBoolean (*classIsA)
        (CMPIInstance*,char*,CMPIStatus*);
};

struct _CMPIObjectPath {
    void *hdl;
    CMPIObjectPathFT* ft;
    #ifdef __cplusplusb
    #endif
};

struct _CMPIObjectPathFT {
    int ftVersion;
    CMPIStatus (*release) (CMPIObjectPath*);
    CMPIObjectPath* (*clone) (CMPIObjectPath*,CMPIStatus*);
    void* (*reserved1) (CMPIObjectPath*,CMPIStatus*);
    CMPIStatus (*setNameSpace) (CMPIObjectPath*,char*);
    CMPIString* (*getNameSpace) (CMPIObjectPath*,CMPIStatus*);
    CMPIStatus (*setClassName) (CMPIObjectPath*,char*);
    CMPIString* (*getClassName) (CMPIObjectPath*,CMPIStatus*);
    CMPIStatus (*addKey) (CMPIObjectPath*,char*,
        CMPIValue*,CMPIType);
    CMPIData (*getKey) (CMPIObjectPath*,char*,CMPIStatus*);
    CMPIData (*getKeyAt)
        (CMPIObjectPath*,unsigned int,CMPIString**,CMPIStatus*);
    unsigned int (*getKeyCount) (CMPIObjectPath*,CMPIStatus*);
    CMPIStatus (*setNameSpaceFromObjectPath)
        (CMPIObjectPath* opThis, CMPIObjectPath* src);
    CMPIBoolean (*classPathIsA)
        (CMPIObjectPath*,char*,CMPIStatus*);

    CMPIData (*getClassQualifier)  /* optional qualifier support */
        (CMPIObjectPath* opThis, char *qualifierName,
             CMPIStatus *rc);
    CMPIData (*getPropertyQualifier) (CMPIObjectPath* opThis,
        char *propertyName, CMPIStatus *rc);
    CMPIData (*getMethodQualifier) (CMPIObjectPath* opThis,
        char *methodName, CMPIStatus *rc);
    CMPIData (*getParameterQualifier) (CMPIObjectPath* opThis,
        char *methodName, char *paremeterName, CMPIStatus *rc);
};
```

```
struct _CMPISelectExp {
    void *hdl;
    CMPISelectExpFT* ft;
};

struct _CMPISelectExpFT {
    int ftVersion;
    CMPIStatus (*release)
        (CMPISelectExp*);
    CMPISelectExp* (*clone)
        (CMPISelectExp*,CMPIStatus*);
    void* (*reserved1)
        (CMPISelectExp*,CMPIStatus*);
    CMPIBoolean (*evaluate)
        (CMPISelectExp*,CMPIInstance*,CMPIStatus*);
    CMPIString* (*getString)
        (CMPISelectExp*,CMPIStatus*);
    CMPISelectCond* (*getDOC)
        (CMPISelectExp*,CMPIStatus*);
    CMPISelectCond* (*getCOD)
        (CMPISelectExp*,CMPIStatus*);
};

struct _CMPISelectCond {
    void *hdl;
    CMPISelectCondFT* ft;
};

struct _CMPISelectCondFT {
    int ftVersion;
    CMPIStatus (*release)
        (CMPISelectCond*);
    CMPISelectCond* (*clone)
        (CMPISelectCond*,CMPIStatus*);
    void* (*reserved1)
        (CMPISelectCond*,CMPIStatus*);
    CMPICount (*getCountAndType)
        (CMPISelectCond*,int*,CMPIStatus*);
    CMPISubCond* (*getSubCondAt)
        (CMPISelectCond*,unsigned int,CMPIStatus*);
};

struct _CMPISubCond {
    void *hdl;
    CMPISubCondFT* ft;
};

struct _CMPISubCondFT {
    int ftVersion;
    CMPIStatus (*release)
        (CMPISubCond*);
    CMPISubCond* (*clone)
        (CMPISubCond*,CMPIStatus*);
    void* (*reserved1)
        (CMPISubCond*,CMPIStatus*);
    CMPICount (*getCount)
        (CMPISubCond*,CMPIStatus*);
    CMPIPredicate* (*getPredicateAt)
        (CMPISubCond*,unsigned int,CMPIStatus*);
```

```
    CMPIPredicate* (*getPredicate)
        (CMPISubCond*,char*,CMPIStatus*);
};

struct _CMPIPredicate {
    void *hdl;
    CMPIPredicateFT* ft;
};

struct _CMPIPredicateFT {
    int ftVersion;
    CMPIStatus (*release) (CMPIPredicate*);
    CMPIPredicate* (*clone) (CMPIPredicate*,CMPIStatus*);
    void* (*reserved1) (CMPIPredicate*,CMPIStatus*);
    CMPIStatus (*getData) (CMPIPredicate*,CMPIType*,
        CMPIPredOp*,CMPIString**,CMPIString**);
    int (*evaluate) (CMPIPredicate*,CMPIValue*,
        CMPIType,CMPIStatus*);
};

struct _CMPIArgs {
    void *hdl;
    CMPIArgsFT* ft;
};

struct _CMPIArgsFT{
    int ftVersion;
    CMPIStatus (*release) (CMPIArgs*);
    CMPIArgs* (*clone) (CMPIArgs*,CMPIStatus*);
    void* (*reserved1) (CMPIArgs*,CMPIStatus*);
    CMPIStatus (*addArg)
        (CMPIArgs*,char*,CMPIValue*, CMPIType);
    CMPIData (*getArg) (CMPIArgs*,char*,CMPIStatus*);
    CMPIData (*getArgAt)
        (CMPIArgs*,unsigned int,CMPIString**,CMPIStatus*);
    unsigned int (*getArgCount) (CMPIArgs*,CMPIStatus*);
};

struct _CMPIString {
    void *hdl;
    CMPIStringFT* ft;
};

struct _CMPIStringFT {
    int ftVersion;
    CMPIStatus (*release) (CMPIString*);
    CMPIString* (*clone) (CMPIString*,CMPIStatus*);
    void* (*reserved1) (CMPIString*,CMPIStatus*);
    char* (*getCharPtr) (CMPIString*,CMPIStatus*);
};

struct _CMPIArray {
    void *hdl;
    CMPIArrayFT* ft;
};

struct _CMPIArrayFT {
    int ftVersion;
    CMPIStatus (*release) (CMPIArray*);
```

```
    CMPIArray* (*clone) (CMPIArray*,CMPIStatus*);
    void* (*reserved1) (CMPIArray*,CMPIStatus*);
    CMPICount (*getSize) (CMPIArray*,CMPIStatus*);
    CMPIType (*getSimpleType) (CMPIArray*,CMPIStatus*);
    CMPIData (*getElementAt)
        (CMPIArray*,CMPICount,CMPIStatus*);
    CMPIStatus (*setElementAt)
        (CMPIArray*,CMPICount,CMPIValue*,CMPIType);
};

struct _CMPIEnumeration {
    void *hdl;
    CMPIEnumerationFT* ft;
};

struct _CMPIEnumerationFT {
    int ftVersion;
    CMPIStatus (*release) (CMPIEnumeration*);
    CMPIEnumeration* (*clone) (CMPIEnumeration*,CMPIStatus*);
    CMPIStatus (*reserved1)
        (CMPIEnumeration*,CMPIEnumeration*,CMPIStatus*);
    CMPIData (*getNext) (CMPIEnumeration*,CMPIStatus*);
    CMPIBoolean (*hasNext) (CMPIEnumeration*,CMPIStatus*);
    CMPIArray* (*toArray) (CMPIEnumeration*,CMPIStatus*);
};

struct _CMPIDateTime {
    void *hdl;
    CMPIDateTimeFT *ft;
};

struct _CMPIDateTimeFT {
    int ftVersion;
    CMPIStatus (*release) (CMPIDateTime*);
    CMPIDateTime* (*clone) (CMPIDateTime*,CMPIStatus*);
    void* (*reserved1) (CMPIDateTime*,CMPIStatus*);
    CMPIUint64 (*getBinaryFormat) (CMPIDateTime*,CMPIStatus*);
    CMPIString* (*getStringFormat) (CMPIDateTime*,CMPIStatus*);
    CMPIBoolean (*isInterval) (CMPIDateTime*,CMPIStatus*);
};

typedef struct _CMPIInstanceMIFT CMPIInstanceMIFT;
typedef struct _CMPIInstanceMI {
    void *hdl;
    CMPIInstanceMIFT *ft;
} CMPIInstanceMI;

struct _CMPIInstanceMIFT {
    int ftVersion;
    int miVersion;
    char *miName;
    CMPIStatus (*cleanup) (CMPIInstanceMI*,CMPIContext*);
    CMPIStatus (*enumInstanceNames)
        (CMPIInstanceMI*,CMPIContext*,CMPIResult*,
           CMPIObjectPath*);
    CMPIStatus (*enumInstances)
        (CMPIInstanceMI*,CMPIContext*,CMPIResult*,
           CMPIObjectPath*,char**);
    CMPIStatus (*getInstance)
```

```
            (CMPIInstanceMI*,CMPIContext*,CMPIResult*,
                CMPIObjectPath*,char**);
        CMPIStatus (*createInstance)
            (CMPIInstanceMI*,CMPIContext*,CMPIResult*,
                CMPIObjectPath*,CMPIInstance*);
        CMPIStatus (*setInstance)
            (CMPIInstanceMI*,CMPIContext*,CMPIResult*,
                CMPIObjectPath*,CMPIInstance*,char**);
        CMPIStatus (*deleteInstance)
            (CMPIInstanceMI*,CMPIContext*,CMPIResult*,CMPIObjectPath*);
        CMPIStatus (*execQuery)
            (CMPIInstanceMI*,CMPIContext*,CMPIResult*,
                CMPIObjectPath*,char*,char*);
    };

    typedef struct _CMPIAssociationMIFT CMPIAssociationMIFT;
    typedef struct _CMPIAssociationMI {
        void *hdl;
        CMPIAssociationMIFT *ft;
    } CMPIAssociationMI;

    struct _CMPIAssociationMIFT {
        int ftVersion;
        int miVersion;
        char *miName;
        CMPIStatus (*cleanup)
            (CMPIAssociationMI*,CMPIContext*);
        CMPIStatus (*associators)
            (CMPIAssociationMI*,CMPIContext*,CMPIResult*,
                CMPIObjectPath*,char*,char*,char*,char*,char**);
        CMPIStatus (*associatorNames)
            (CMPIAssociationMI*,CMPIContext*,CMPIResult*,
                CMPIObjectPath*,char*,char*,char*,char*);
        CMPIStatus (*references)
            (CMPIAssociationMI*,CMPIContext*,CMPIResult*,
                CMPIObjectPath*,char*,char*,char**);
        CMPIStatus (*referenceNames)
            (CMPIAssociationMI*,CMPIContext*,CMPIResult*,
                CMPIObjectPath*,char*,char*);
    };

    typedef struct _CMPIMethodMIFT CMPIMethodMIFT;
    typedef struct _CMPIMethodMI {
        void *hdl;
        CMPIMethodMIFT *ft;
    } CMPIMethodMI;

    struct _CMPIMethodMIFT {
        int ftVersion;
        int miVersion;
        char *miName;
        CMPIStatus (*cleanup)
            (CMPIMethodMI*,CMPIContext*);
        CMPIStatus (*invokeMethod)
            (CMPIMethodMI*,CMPIContext*,CMPIResult*,
                CMPIObjectPath*,char*,CMPIArgs*,CMPIArgs*);
    };
```

```
typedef struct _CMPIPropertyMIFT CMPIPropertyMIFT;
typedef struct _CMPIPropertyMI {
    void *hdl;
    CMPIPropertyMIFT *ft;
} CMPIPropertyMI;

struct _CMPIPropertyMIFT {
    int ftVersion;
    int miVersion;
    char *miName;
    CMPIStatus (*cleanup)
        (CMPIPropertyMI*,CMPIContext*);
    CMPIStatus (*setProperty)
        (CMPIPropertyMI*,CMPIContext*,CMPIResult*,
            CMPIObjectPath*,char*,CMPIData);
    CMPIStatus (*getProperty)
        (CMPIPropertyMI*,CMPIContext*,CMPIResult*,
            CMPIObjectPath*,char*);
};

typedef struct _CMPIIndicationMIFT CMPIIndicationMIFT;
typedef struct _CMPIIndicationMI {
    void *hdl;
    CMPIIndicationMIFT *ft;
} CMPIIndicationMI;

struct _CMPIIndicationMIFT {
    int ftVersion;
    int miVersion;
    char *miName;
    CMPIStatus (*cleanup)
        (CMPIIndicationMI*,CMPIContext*);
    CMPIStatus (*authorizeFilter)
        (CMPIIndicationMI*,CMPIContext*,CMPIResult*,
            CMPISelectExp*,char*,CMPIObjectPath*,char*);
    CMPIStatus (*mustPoll)
        (CMPIIndicationMI*,CMPIContext*,CMPIResult*,
            CMPISelectExp*,char*,CMPIObjectPath*);
    CMPIStatus (*activateFilter)
        (CMPIIndicationMI*,CMPIContext*,CMPIResult*,
            CMPISelectExp*,char*,CMPIObjectPath*,CMPIBoolean);
    CMPIStatus (*deActivateFilter)
        (CMPIIndicationMI*,CMPIContext*,CMPIResult*,
            CMPISelectExp*,char*,CMPIObjectPath*,CMPIBoolean);
};

#ifdef __cplusplus
 };
#endif

#endif // _CMPIFT_H_
```

B MI Convenience Support

B.1 C++ Convenience Classes

THIS SECTION IS INCOMPLETE.

CmpiString

```
/*
 * CmpiString.h
 * THIS FILE IS PROVIDED UNDER THE TERMS OF THE COMMON PUBLIC
 * LICENSE ("AGREEMENT"). ANY USE, REPRODUCTION, OR DISTRIBUTION
 * OF THIS FILE CONSTITUTES THE RECIPIENT'S ACCEPTANCE OF THE
 * AGREEMENT.
 * A current copy of the Common Public License is available from:
 * oss.software.ibm.com/developerworks/opensource/license-cpl.html.
 * Author: Adrian Schuur <schuur@de.ibm.com>
 * Description: CMPI string provider wrapper
 */

#ifndef _CmpiString_h_
#define _CmpiString_h_

#include "cmpisrv.h"

class CmpiContext;
class CmpiResult;
class CmpiObjectPath;
class CmpiInstance;
class CmpiBroker;
class CmpiString;
class CmpiResult;
class CmpiContext;

class CmpiString {
    friend class CmpiBroker;
    friend class CmpiData;
    protected:
    CMPIString *enc;
    private:
    public:
    void makeGlobal(const CmpiString) {}
    CmpiString(const CmpiString& s) { enc=s.enc->ft
        ->clone(s.enc,NULL); }
    CmpiString()              { enc=NULL; }
    CmpiString(CMPIString* c) { enc=c; }
    char* charPtr()           { if (enc) return (char*)enc->hdl;
        else return NULL; }
};

#endif
```

CmpiData

```
/*
 * CmpiData.h
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 * A current copy of the Common Public License is available from:
 * oss.software.ibm.com/developerworks/opensource/license-cpl.html.
 * Author: Adrian Schuur <schuur@de.ibm.com>
 * Description: CMPI C++ helper class
 */

#ifndef _CmpiData_h_
#define _CmpiData_h_

#include "cmpidt.h"
#include "CmpiString.h"

class CmpiData {
    public:
    CMPIValue data;
    CMPIType type;
    CMPICount count;
    CmpiData() {}
    CmpiData(CmpiString& d) {data.chars=d.charPtr();
        type=CMPI_chars; count=-1;}
    CmpiData(char* d)      {data.chars=d; type=CMPI_chars;
        count=-1;}
    CmpiData(CMPISint8 d)  {data.sint8=d; type=CMPI_sint8;
        count=-1;}
    CmpiData(CMPISint16 d) {data.sint16=d; type=CMPI_sint16;
        count=-1;}
    CmpiData(CMPISint32 d) {data.sint32=d; type=CMPI_sint32;
        count=-1;}
    CmpiData(CMPISint64 d) {data.sint64=d; type=CMPI_sint64;
        count=-1;}
    CmpiData(CMPIUint8 d)  {data.sint8=d; type=CMPI_sint8;
        count=-1;}
    CmpiData(CMPIUint16 d) {data.sint16=d; type=CMPI_sint16;
        count=-1;}
    CmpiData(CMPIUint32 d) {data.sint32=d; type=CMPI_sint32;
        count=-1;}
    CmpiData(CMPIUint64 d) {data.sint64=d; type=CMPI_sint64;
        count=-1;}
};
```

CmpiObjectPath

```
/*
 * CmpiObjectPath.h
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 * A current copy of the Common Public License is available from:
 * oss.software.ibm.com/developerworks/opensource/license-cpl.html.
```

```
 * Author: Adrian Schuur <schuur@de.ibm.com>
 * Description: CMPI C++ ObjectPath wrapper
 */

#ifndef _CmpiObjectPath_h_
#define _CmpiObjectPath_h_

#include "cmpisrv.h"

#include "CmpiData.h"

class CmpiObjectPath {
    friend class CmpiBroker;
    friend class CmpiResult;
    protected:
    CMPIObjectPath *enc;
    private:
    CmpiObjectPath() {}
    public:
    void makeGlobal() {};
    CmpiObjectPath(CMPIObjectPath* c) { enc=c; }
    CmpiString getNameSpace() {
        CMPIrc rc;
        CMPIString *s=enc->ft->getNameSpace(enc,&rc);
        if (rc!=CMPI_RC_OK) throw rc;
        return *new CmpiString(s);
    }
    void setNameSpace(CmpiString ns) { setNameSpace(ns.charPtr()); }
    void setNameSpace(char* ns) {
        CMPIrc rc=enc->ft->setNameSpace(enc,ns);
        if (rc!=CMPI_RC_OK) throw rc;
    }
    CmpiString getClassName() {
        CMPIrc rc;
        CMPIString *s=enc->ft->getClassName(enc,&rc);
        if (rc!=CMPI_RC_OK) throw rc;
        return *new CmpiString(s);
    }
    CmpiData getnKey(char* name) {
        CmpiData d;
        CMPIrc rc;
        d.data=enc->ft->getKey(enc,name,&d.type,&rc);
        if (rc!=CMPI_RC_OK) throw rc;
        return d;
    }
    unsigned int getKeyCount() {
        CMPIrc rc;
        unsigned int c=enc->ft->getKeyCount(enc,&rc);
        if (rc!=CMPI_RC_OK) throw rc;
        return c;
    }
    CmpiData getKey(int pos, CmpiString *name=NULL) {
        CmpiData d;
        CMPIrc rc;
        CMPIString *s;
        d.data=enc->ft->getKeyAt(enc,pos,&s,&d.type,&rc);
        if (rc!=CMPI_RC_OK) throw rc;
        if (name) *name=*(new CmpiString(s));
        return d;
```

```
    };
    void addKey(char* name, CmpiData& data) {
        CMPIrc rc=enc->ft->
            addKey(enc,name,&data.data,data.type,data.count);
        if (rc!=CMPI_RC_OK) throw rc;
    }
};

#endif
```

CmpiInstance

```
/*
 * CmpiInstance.h
 * THIS FILE IS PROVIDED UNDER THE TERMS OF THE COMMON PUBLIC
 * LICENSE ("AGREEMENT"). ANY USE, REPRODUCTION, OR DISTRIBUTION
 * OF THIS FILE CONSTITUTES THE RECIPIENT'S ACCEPTANCE OF THE
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 * A current copy of the Common Public License is available from:
 * oss.software.ibm.com/developerworks/opensource/license-cpl.html.
 * Author: Adrian Schuur <schuur@de.ibm.com>
 * Description: CMPI C++ Instance wrapper
 */

#ifndef _CmpiInstance_h_
#define _CmpiInstance_h_

#include "cmpisrv.h"

#include "CmpiObjectPath.h"

class CmpiInstance {
    friend class CmpiBroker;
    friend class CmpiResult;
    protected:
    CMPIInstance *enc;
    private:
    CmpiInstance() {}
    public:
    void makeGlobal() {}
    CmpiInstance(CMPIInstance* enc)  { this->enc=enc; }
    CmpiData getProperty(char* name) {
        CmpiData d;
        CMPIrc rc;
        d.data=enc->ft->getProperty(enc,name,&d.type,&rc);
        if (rc!=CMPI_RC_OK) throw rc;
        return d;
    }
    CmpiData getProperty(int pos, CmpiString *name=NULL) {
        CmpiData d;
        CMPIrc rc;
        CMPIString *s;
        d.data=enc->ft->getPropertyAt(enc,pos,&s,&d.type,&rc);
        if (rc!=CMPI_RC_OK) throw rc;
        if (name) *name=*(new CmpiString(s));
        return d;
    };
```

```
    unsigned int getPropertyCount() {
        CMPIrc rc;
        unsigned int c=enc->ft->getPropertyCount(enc,&rc);
        if (rc!=CMPI_RC_OK) throw rc;
        return c;
    }
    void setProperty(char* name, CmpiData data) {
        CMPIrc rc=enc->ft->setProperty
            (enc,name,&data.data,data.type,data.count);
        if (rc!=CMPI_RC_OK) throw rc;
    }
    CmpiObjectPath getObjectPath() {
        CMPIrc rc;
        CmpiObjectPath cop(enc->ft->getObjectPath(enc,&rc));
        if (rc!=CMPI_RC_OK) throw rc;
        return cop;
    }
};

#endif
```

CmpiSelectExp

TBD

CmpiSelectCond

TBD

CmpiSubCond

TBD

CmpiPredicate

TBD

CmpiArray

TBD

CmpiArgs

TBD

CmpiDateTime

TBD

CmpiResult

```
/*
 * CmpiResult.h
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 * A current copy of the Common Public License is available from:
 * oss.software.ibm.com/developerworks/opensource/license-cpl.html.
 * Author: Adrian Schuur <schuur@de.ibm.com>
 * Description: CMPI C++ result wrapper
 */

#ifndef _CmpiResult_h_
#define _CmpiResult_h_

#include "cmpisrv.h"

#include "CmpiData.h"
#include "CmpiInstance.h"
#include "CmpiObjectPath.h"

class CmpiResult {
    protected:
    CMPIResult *enc;
    private:
    CmpiResult() {}
    public:
    void makeGlobal() {}
    CmpiResult(CMPIResult* r) { enc=r; }
    void returnData(CmpiData d) {
        CMPIrc rc=enc->ft->returnData(enc,&d.data,d.type,d.count);
        if (rc!=CMPI_RC_OK) throw rc;
    }
    void returnData(CmpiInstance d) {
        CMPIrc rc=enc->ft->returnInstance(enc,d.enc);
        if (rc!=CMPI_RC_OK) throw rc;
    }
    void returnData(CmpiObjectPath d) {
        CMPIrc rc=enc->ft->returnObjectPath(enc,d.enc);
        if (rc!=CMPI_RC_OK) throw rc;
    }
    void returnDone() {
        CMPIrc rc=enc->ft->returnDone(enc);
        if (rc!=CMPI_RC_OK) throw rc;
    }
};

#endif
```

CmpiContext

```
/*
 * CmpiContext.h
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 * A current copy of the Common Public License is available from:
 * oss.software.ibm.com/developerworks/opensource/license-cpl.html.
 * Author: Adrian Schuur <schuur@de.ibm.com>
 * Description: CMPI C++ context provider wrapper
 */

#ifndef _CmpiContext_h_
#define _CmpiContext_h_

#include "cmpisrv.h"

#include "CmpiString.h"
#include "CmpiData.h"
#include "CmpiObjectPath.h"
#include "CmpiInstance.h"

class CmpiContext {
    protected:
    CMPIContext *enc;
    private:
    CmpiContext() {}
    public:
    void makeGlobal() {}
    CmpiContext(CMPIContext* r) { enc=r; }
};

#endif
```

CmpiEnumeration

TBD

CmpiBroker

```
/*
 * CmpiBroker.h
 * THIS FILE IS PROVIDED UNDER THE TERMS OF THE COMMON PUBLIC
 * LICENSE ("AGREEMENT"). ANY USE, REPRODUCTION, OR DISTRIBUTION
 * OF THIS FILE CONSTITUTES THE RECIPIENT'S ACCEPTANCE OF THE
 * AGREEMENT.
 * A current copy of the Common Public License is available from:
 * oss.software.ibm.com/developerworks/opensource/license-cpl.html.
 * Author: Adrian Schuur <schuur@de.ibm.com>
 * Description: CMPI C++ magement broker wrapper
 */

#ifndef _CmpiBroker_h_
#define _CmpiBroker_h_

#include "cmpisrv.h"

#include "CmpiString.h"
#include "CmpiData.h"
#include "CmpiObjectPath.h"
#include "CmpiInstance.h"
#include "CmpiContext.h"

class CmpiBroker {
    protected:
    CMPIBroker *enc;
    private:
    CmpiBroker() {}
    public:
    CmpiBroker(CMPIBroker* b) { enc=b; }
    CmpiInstance newInstance(CmpiObjectPath cop) {
        CMPIrc rc;
        CMPIInstance *inst=enc->eft->newInstance(enc,cop.enc,&rc);
        if (rc!=CMPI_RC_OK) throw rc;
        return CmpiInstance(inst);
    }
    //
    // To be extended with remaining Management Broker methods.
    //
};

#endif
```

CmpiInstanceMI

```
/*
 * CmpiInstanceMI.h
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 * LICENSE ("AGREEMENT"). ANY USE, REPRODUCTION OR DISTRIBUTION
 * OF THIS FILE CONSTITUTES THE RECIPIENT'S ACCEPTANCE OF THE
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 * A current copy of the Common Public License is available from:
 * oss.software.ibm.com/developerworks/opensource/license-cpl.html.
 * Author: Adrian Schuur <schuur@de.ibm.com>
 * Description: CMPI C++ instance provider wrapper
 */

#ifndef _CmpiInstanceMI_h_
#define _CmpiInstanceMI_h_

#include "cmpisrv.h"
#include "CmpiString.h"
#include "CmpiData.h"
#include "CmpiObjectPath.h"
#include "CmpiInstance.h"
#include "CmpiResult.h"
#include "CmpiContext.h"
#include "CmpiBroker.h"

class CmpiInstanceMI {
    protected:
    CMPIInstanceMI *mi;
    CmpiInstanceMI() {}
    CmpiInstanceMI(CmpiInstanceMI&) {}
    private:
    public:
    CmpiBroker *mb;
    CmpiInstanceMI() {}
    CmpiInstanceMI(CMPIInstanceMI* mi, CmpiBroker* mb);
    void initialize();
    void cleaup();
    virtual CMPIrc enumInstanceNames
        (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop)=0;
    virtual CMPIrc enumInstances
        (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop,
               char* *properties)=0;
    virtual CMPIrc getInstance
        (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop,
            char* *properties)=0;
    virtual CMPIrc createInstance
        (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop,
            CmpiInstance& inst)=0;
    virtual CMPIrc setInstance
        (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop,
            CmpiInstance& inst)=0;
    virtual CMPIrc deleteInstance
        (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop)=0;
    virtual CMPIrc execQuery
        (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop,
            char* language, char* query)=0;
```

```
};

extern "C" {
    CMPIrc driveCleanup
        (CMPIInstanceMI*);
    CMPIrc driveEnumInstanceNames
        (CMPIInstanceMI*,CMPIContext*,CMPIResult*,CMPIObjectPath*);
    CMPIrc driveEnumInstances
        (CMPIInstanceMI*,CMPIContext*,CMPIResult*,
            CMPIObjectPath*,char**);
    CMPIrc driveGetInstance
        (CMPIInstanceMI*,CMPIContext*,CMPIResult*,
            CMPIObjectPath*,char**);
    CMPIrc driveCreateInstance
        (CMPIInstanceMI*,CMPIContext*,CMPIResult*,CMPIObjectPath*,
            CMPIInstance*);
    CMPIrc driveSetInstance
        (CMPIInstanceMI*,CMPIContext*,CMPIResult*,CMPIObjectPath*,
            CMPIInstance*);
    CMPIrc driveDeleteInstance
        (CMPIInstanceMI*,CMPIContext*,CMPIResult*,CMPIObjectPath*);
    CMPIrc driveExecQuery
        (CMPIInstanceMI*,CMPIContext*,CMPIResult*,CMPIObjectPath*,
            char*,char*);
};

#endif
```

CmpiAssociationMI

TBD

CmpiMethodMI

TBD

CmpiPropertyMI

TBD

CmpiIndicationMI

TBD

B.2 Convenience Macros

THIS SECTION IS INCOMPLETE.

```
/*
 * cmpimacs.h
 * Copyright(\(co) 2002, International Business Machines
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 * LICENSE ("AGREEMENT"). ANY USE, REPRODUCTION OR DISTRIBUTION
 * OF THIS FILE CONSTITUTES THE RECIPIENT'S ACCEPTANCE OF THE
 * AGREEMENT.
 * A current copy of the Common Public License is available from:
 * oss.software.ibm.com/developerworks/opensource/license-cpl.html.
 * Author: Adrian Schuur <schuur@de.ibm.com>
 * Description: CMPI Encapsulated types function tables
 */

#ifndef _CMPIMACS_H_
#define _CMPIMACS_H_

// Various return helper macros
#define CMReturn(rc) \
    { CMPIStatus stat={(rc),NULL}; \
    return stat; }

#define CMReturnWithString(rc,str) \
    { CMPIStatus stat={(rc),(str)}; \
    return stat; }

#define CMReturnWithChars(b,rc,chars) \
    { CMPIStatus stat={(rc),NULL}; \
    stat.msg=(b)->eft->newString((b),(chars),NULL)) \
    return stat; }

#define CMSetStatus(st,rcc) \
    { (st)->rc=(rcc); (st)->msg=NULL; }

#define CMSetStatusWithString(st,rcc,str) \
    { (st)->rc=(rcc); (st)->msg=(str); }

#define CMSetStatusWithChars(b,st,rcc,chars) \
    { (st)->rc=(rcc); \
    (st)->msg=(b)->eft->newString((b),(chars),NULL); }

#ifndef CMPI_NO_CONVENIENCE_SUPPORT

#ifdef __cplusplus
    #define EXTERN_C extern "C"
#else
    #define EXTERN_C
#endif

#define CMIsNullObject(o)  ((o)==NULL || *((void**)(o))==NULL)
#define CMIsNullValue(v)   ((v.state) & CMPI_nullValue)
#define CMIsKeyValue(v)    ((v.state) & CMPI_keyValue)
#define CMIsArray(v)       ((v.type) & CMPI_ARRAY)

```

```
1           // Lifecycle macros
2
3           #define CMClone(o,rc)         ((o)->ft->clone((o),(rc)))
4           #define CMRelease(o)          ((o)->ft->release((o)))
5
6           // CMPIBroker factory macros
7
8           #define CMNewInstance(b,c,rc) ((b)->eft->newInstance((b),(c),(rc)))
9           #define CMNewObjectPath(b,n,c,rc) \
10              ((b)->eft->newObjectPath((b),(n),(c),(rc)))
11          #define CMNewString(b,s,rc)   ((b)->eft->newString((b),(s),(rc)))
12          #define CMNewDateTime(b,rc)   ((b)->eft->newDateTime((b),(rc)))
13
14          #define CMLoadMi(b,n,rc)      ((b)->eft->loadMI((b),(n),(rc)))
15          #define CMNewArray(b,c,t,rc)  ((b)->eft->newArray((b),(c),(t),(rc)))
16          #define CMNewArgs(b,rc)       ((b)->eft->newArgs((b),(rc)))
17          #define CMNewDateTime(b,rc)   ((b)->eft->newDateTime((b),(rc)))
18          #define CMNewPIDateTimeFromBinary(b,d,i,rc) \
19              ((b)->ft->newDateTimeFromBinary((b),(d),(i),(rc)))
20          #define CMNewDateTimeFromChars(b,d,rc) \
21              ((b->eft->newDateTimeFromChars((b),(d),(rc)))
22          #define CMNewSelectExp(b,l,x,rc) \
23              ((b)->eft->*newSelectExp((b),(l),(x),)rc)))
24
25          // Debugging macros
26
27          #define CDToString(b,o,rc) ((b)->eft->toString((b),(void*)(o),(rc)))
28          #define CDIsOfType(b,o,t,rc) \
29              (b)->eft->isOfType((b),(void*)(o),(t),(rc)))
30          #define CDgetType(b,o,rc)  ((b)->eft->getTpye((b),(void*)(o),(rc)))
31
32          // CMPIInstance macros
33
34          #define CMGetProperty(i,n,rc) \
35              ((i)->ft->getProperty((i),(n),(rc)))
36          #define CMSetProperty(i,n,v,t) \
37              ((i)->ft->setProperty((i),(n),(CMPIValue*)(v),(t)))
38          #define CMGetPropertyCount(i,c) \
39              ((i)->ft->setPropertyCount((i),(rc)))
40          #define CMGetObjectPath(i,rc)  ((i)->ft->getObjectPath((i),(rc)))
41
42          // CMPIObjectPath macros
43
44          #define CMSetNameSpace(p,n)     ((p)->ft->setNameSpace((p),(n)))
45          #define CMGetNameSpace(p,rc)    ((p)->ft->getNameSpace((p),(rc)))
46          #define CMSetClassName(p,n)     ((p)->ft->setClassName((p),(n)))
47          #define CMGetClassName(p,rc)    ((p)->ft->getClassName((p),(rc)))
48          #define CMAddKey(p,n,v,t) \
49              ((p)->ft->addKey((p),(n),(CMPIValue*)(v),(t)))
50          #define CMGetKey(p,n,rc)        ((p)->ft->getKey((p),(n),(rc)))
51          #define CMGetKeyCount(p,rc)     ((p)->ft->getKeyCount((p),(rc)))
52          #define CMClassPathIsA(p,pn,rc) \
53              ((p)->ft->classPathIsA((p),(pn),(rc)))
54
55          // CMPIArray macros
56
57          #define CMGetArrayCount(a,rc)   ((a)->ft->getSize((a),(rc)))
58          #define CMGetArrayType(a,rc)    ((a)->ft->getSimpleType((a),(rc)))
59          #define CMGetArrayElementAt(a,n,rc) \
```

```
    ((a)->ft->getElementAt((a),(n),(rc)))
#define CMSetArrayElementAt(a,n,v,t) \
    ((a)->ft->setElementAt((a),(n),(CMPIValue*)(v),(t)))

// CMPISelectExp macros

#define CMGetSelExpString(s,rc) ((s)->ft->getString((s),(rc)))
#define CMEvaluateSelExp(s,i,r) ((s)->ft->evaluate((s),(i),(r)))
#define CMGetDoc(s,rc)          ((s)->ft->getDOC((s),(rc)))
#define CMGetCod(s,rc)          ((s)->ft->getCOD((s),(rc)))

// CMPISelectCond macros

#define CMGetSubCondCount(c,rc) \
    ((c)->ft->getCountAndType((c),NULL,(rc)))
#define CMGetSubCondCountAndType(c,t,rc) \
    ((c)->ft->getCountAndType((c),(t),(rc)))
#define CMGetSubCondAt(c,p,rc) \
    ((c)->ft->getSubCondAt((c),(p),(rc)))

// CMPISubCond macros

#define CMGetPredicateCount(s,rc) \
    ((s)->ft->getCount((s),(rc)))
#define CMGetPredicateAt(s,p,rc) \
    ((s)->ft->getPredicateAt((s),(p),(rc)))
#define CMGetPredicate(s,n,rc) \
    ((s)->ft->getPredicate((s),(n),(rc)))

// CMPIPredicate macros

#define CMGetPredicateData(p,t,o,n,v) \
    ((p)->ft->getData((p),(t),(o),(n),(v)))

// CMPIDateTime macros

#define CMGetStringFormat(d,rc) \
    ((d)->ft->getStringFormat((d),(rc)))
#define CMGetBinaryFormat(d,rc) \
    ((d)->ft->getBinaryFormat((d),(rc)))
#define CMIsInterval(d,rc)   ((d)->ft->isInterval((d),(rc)))

// CMPIARgs macros

#define CMAddArg(a,n,v,t) \
    ((a)->ft->addArg((a),(n),(CMPIValue*)(v),(t)))
#define CMGetArg(a,n,rc)     ((a)->ft->getArg((a),(n),(rc)))
#define CMGetArgAt(a,p,n,rc) ((a)->f->getArgAt((a),(p),(n),(rc)))
#define CMGetArgCount(a,rc)  ((a)->ft->getArgCount((a),(rc)))

// CMPIString macros

#define CMGetCharPtr(s)      ((char*)s->hdl)

// CMPIEnumeration macros

#define CMGetNext(n,rc)      ((n)->ft->getNext((n),(rc)))
#define CMHasNext(n,rc)      ((n)->ft->hasNext((n),(rc)))
```

```
1           // CMPIResult macros
2
3           #define CMReturnData(r,v,t) \
4               ((r)->ft->returnData((r),(CMPIValue*)(v),(t)))
5           #define CMReturnInstance(r,i)   ((r)->ft->returnInstance((r),(i)))
6           #define CMReturnObjectPath(r,o) ((r)->ft->returnObjectPath((r),(o)))
7           #define CMReturnDone(r)         ((r)->ft->returnDone((r)))
8
9           // CMPIContext macros
10
11          #define CMAddContextEntry(c,n,v,t) \
12              ((c)->ft->addEntry((c),(n),(CMPIValue*)(v),(t)))
13          #define CMGetContextEntry(c,n,rc) \
14              ((c)->ft->getEntry((c),(n),(rc)))
15          #define CMGetContextEntryAt(e,p,n,d,rc) \
16              ((c)->ft->addEntry((c),(p),(n),(d),(rc)))
17          #define CMGetContextEntryCount(c,rc) \
18              ((c)->ft->getEntryCount((c),(rc)))
19
20          // CMPIBroker macros
21
22          #define CBGetClassification(b) ((b)->bft->brokerClassification)
23          #define CBBrokerVersion(b)     ((b)->bft->brokerVersion)
24          #define CBBrokerName(b)        ((b)->bft->brokerName)
25          #define CBPrepareAttachThread(b,c) \
26              ((b)->bft->prepareAttachThread((b),(c)))
27          #define CBAttachThread(b,c)    ((b)->bft->attachThread((b),(c)))
28          #define CBDetachThread(b,c)    ((b)->bft->detachThread((b),(c)))
29          #define CBDeliverIndication(b,c,n,i,s) \
30              (b)->bft->deliverIndication((b),(c),(n),(i),(s)))
31          #define CBEnumInstanceNames(b,c,p,rc) \
32              ((b)->bft->enumInstanceNames((b),(c),(p),(rc)))
33          #define CBEnumInstances(b,c,p,pr,rc) \
34              ((b)->bft->enumInstances((b),(c),(p),(pr),(rc)))
35          #define CBGetInstance(b,c,p,pr,rc) \
36              ((b)->bft->getInstance((b),(c),(p),(pr),(rc)))
37          #define CBCreateInstance(b,p,i,rc) \
38              ((b)->bft->createInstance((b),(p),(i),(rc)))
39          #define CBSetInstance(b,p,i)   ((b)->bft->_setInstance((b),(p),(i)))
40          #define CBDeleteInstance(b,p)  ((b)->bft->deleteInstance((b),(p)))
41          #define CBExecQuery(b,p,q,l,c,rc) \
42              ((b)->fb->execQuery((b),(q),(l),(c),(rc)))
43          #define CBAssociators(b,a,p,r,rr,pr,rc) \
44              ((b)->bft->associators((b),(a),(p),(rr),(pr),(rc)))
45          #define CBAssociatorNames(b,a,p,r,rr,rc) \
46              ((b)->bft->associatorNames((b),(a),(p),(r),(rr),(rc)))
47          #define CBInvokeMethod(b,m,ai,ao,rc) \
48              ((b)->bft->invokeMethod((b),(m),(ai),(ao),(rc)))
49          #define CBSetProperty(b,n,v,t) \
50              ((b)->bft->setProperty((b),(n),(CMPIValue*)(v),(t)))
51          #define CBGetProperty(b,n,rc)  (b)->bft->getProperty((b),(n),(rc))
52
53          // MI factory stubs
54
55          #define CMNoHook if (brkr)
56
57          #define CMInstanceMIStub(cn,pfx,broker,hook) \
58              static CMPIInstanceMIFT instMIFT__={ \
59              CMPICurrentVersion, \
```

```
            CMPICurrentVersion, \
            "instance" #cn, \
            pfx##Cleanup, \
            pfx##EnumInstanceNames, \
            pfx##EnumInstances, \
            pfx##GetInstance, \
            pfx##CreateInstance, \
            pfx##SetInstance, \
            pfx##DeleteInstance, \
            pfx##ExecQuery, \
            }; \
            EXTERN_C \
            CMPIInstanceMI* cn##_Create_InstanceMI(CMPIBroker* \
            brkr,CMPIContext *ctx) { \
                static CMPIInstanceMI mi={ \
                NULL, \
                &instMIFT__, \
            }; \
            broker=brkr; \
            hook; \
            return &mi; \
        }

        #define CMAssociationMIStub(cn,pfx,broker,hook) \
            static CMPIAssociationMIFT assocMIFT__={ \
            CMPICurrentVersion, \
            CMPICurrentVersion, \
            "asscociation" #cn, \
            pfx##AssociationCleanup, \
            pfx##Associators, \
            pfx##AssociatorNames, \
            pfx##References, \
            pfx##ReferenceNames, \
            }; \
            EXTERN_C \
            CMPIAssociationMI* cn##_Create_AssociationMI(CMPIBroker* \
            brkr,CMPIContext *ctx) { \
            static CMPIAssociationMI mi={ \
                NULL, \
                &assocMIFT__, \
            }; \
            broker=brkr; \
            hook; \
            return &mi;  \
        }

        #define CMMethodMIStub(cn,pfx,broker,hook) \
            static CMPIMethodMIFT methMIFT__={ \
            CMPICurrentVersion, \
            CMPICurrentVersion, \
            "method" #cn, \
            pfx##MethodCleanup, \
            pfx##InvokeMethod, \
            }; \
            EXTERN_C \
            CMPIMethodMI* cn##_Create_MethodMI(CMPIBroker* \
            brkr,CMPIContext *ctx) { \
            static CMPIMethodMI mi={ \
                NULL, \
```

```
            &methMIFT__, \
        }; \
        broker=brkr; \
        hook; \
        return &mi; \
    }

    #define CMPropertyMIStub(cn,pfx,broker,hook) \
        static CMPIPropertyMIFT propMIFT__={ \
        CMPICurrentVersion, \
        CMPICurrentVersion, \
        "property" #cn, \
        pfx##PropertyCleanup, \
        pfx##SetProperty, \
        pfx##GetProperty, \
        }; \
        EXTERN_C \
        CMPIPropertyMI* cn##_Create_PropertyMI(CMPIBroker* \
        brkr,CMPIContext *ctx) { \
        static CMPIPropertyMI mi={ \
            NULL, \
            &propMIFT__, \
        }; \
        broker=brkr; \
        hook; \
        return &mi; \
    }

    #define CMIndicationMIStub(cn,pfx,broker,hook) \
        static CMPIIndicationMIFT indMIFT__={ \
        CMPICurrentVersion, \
        CMPICurrentVersion, \
        "Indication" #cn, \
        pfx##IndicationCleanup, \
        pfx##AuthorizeFilter, \
        pfx##MustPoll, \
        pfx##ActivateFilter, \
        pfx##DeActivateFilter, \
        }; \
        EXTERN_C \
        CMPIIndicationMI* cn##_Create_IndicationMI(CMPIBroker* \
        brkr,CMPIContext *ctx) { \
        static CMPIIndicationMI mi={ \
            NULL, \
            &indMIFT__, \
        }; \
        broker=brkr; \
        hook; \
        return &mi; \
    }

    #endif // CMPI_NO_CONVENIENCE_SUPPORT
    #endif // _CMPIMACS_H_
```

C Sample Instance MI

THIS SECTION IS INCOMPLETE.

```
/*
 * CmpiInstanceMI.cpp
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 * A current copy of the Common Public License is available from:
 * oss.software.ibm.com/developerworks/opensource/license-cpl.html
 * Author: Adrian Schuur <schuur@de.ibm.com>
 * Description: CMPI sample MI method drivers
 */

#include "CmpiInstanceMI.h"

extern "C" {
    CMPIrc driveCleanup
        (CMPIInstanceMI* mi)
    {
    return CMPI_RC_OK;
    }

    CMPIrc driveEnumInstanceNames
        (CMPIInstanceMI* mi,CMPIContext* eCtx, CMPIResult* eRslt,
         CMPIObjectPath* eCop)
    {
    CmpiContext ctx(eCtx);
    CmpiResult rslt(eRslt);
    CmpiObjectPath cop(eCop);
    return((CmpiInstanceMI*)mi->hdl)->
        enumInstanceNames(ctx,rslt,cop);
    }

    CMPIrc driveEnumInstances
        (CMPIInstanceMI* mi, CMPIContext* eCtx, CMPIResult* eRslt,
         CMPIObjectPath* eCop, char* *properties)
    {
    CmpiContext ctx(eCtx);
    CmpiResult rslt(eRslt);
    CmpiObjectPath cop(eCop);
    return ((CmpiInstanceMI*)mi->hdl)->enumInstances
        (ctx,rslt,cop,properties);
    }

    CMPIrc driveGetInstance
        (CMPIInstanceMI* mi, CMPIContext* eCtx, CMPIResult* eRslt,
         CMPIObjectPath* eCop, char* *properties)
    {
    CmpiContext ctx(eCtx);
    CmpiResult rslt(eRslt);
    CmpiObjectPath cop(eCop);
```

```
            return ((CmpiInstanceMI*)mi->hdl)->getInstance
                (ctx,rslt,cop,properties);
            }

            CMPIrc driveCreateInstance
                (CMPIInstanceMI* mi, CMPIContext* eCtx, CMPIResult* eRslt,
                 CMPIObjectPath* eCop, CMPIInstance* eInst)
            {
            CmpiContext ctx(eCtx);
            CmpiResult rslt(eRslt);
            CmpiObjectPath cop(eCop);
            CmpiInstance inst(eInst);
            return ((CmpiInstanceMI*)mi->hdl)->
                createInstance(ctx,rslt,cop,inst);
            }

            CMPIrc driveSetInstance
                (CMPIInstanceMI* mi, CMPIContext* eCtx, CMPIResult* eRslt,
                 CMPIObjectPath* eCop, CMPIInstance* eInst)
            {
            CmpiContext ctx(eCtx);
            CmpiResult rslt(eRslt);
            CmpiObjectPath cop(eCop);
            CmpiInstance inst(eInst);
            return ((CmpiInstanceMI*)mi->hdl)->
                setInstance(ctx,rslt,cop,inst);
            }

            CMPIrc driveDeleteInstance
                (CMPIInstanceMI* mi, CMPIContext* eCtx, CMPIResult* eRslt,
                 CMPIObjectPath* eCop)
            {
            CmpiContext ctx(eCtx);
            CmpiResult rslt(eRslt);
            CmpiObjectPath cop(eCop);
            return ((CmpiInstanceMI*)mi->hdl)->
                deleteInstance(ctx,rslt,cop);
            }

            CMPIrc driveExecQuery
                (CMPIInstanceMI* mi, CMPIContext* eCtx, CMPIResult* eRslt,
                 CMPIObjectPath* eCop, char* language ,char* query)
            {
            CmpiContext ctx(eCtx);
            CmpiResult rslt(eRslt);
            CmpiObjectPath cop(eCop);
            return ((CmpiInstanceMI*)mi->hdl)->
                execQuery(ctx,rslt,cop, language,query);
            }
        }
```

```
/*
 * cmpiTestProvider.cpp
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 * AGREEMENT.
 * A current copy of the Common Public License is available from:
 * oss.software.ibm.com/developerworks/opensource/license-cpl.html.
 * Author: Adrian Schuur <schuur@de.ibm.com>
 * Description: CMPI sample provider
 */

#include "CmpiInstanceMI.h"

class CmpiTestProvider : public CmpiInstanceMI {
    private:
    CmpiTestProvider() {}
    CmpiTestProvider(CmpiTestProvider&) {}
   ~CmpiTestProvider() {}
    public:
    CmpiTestProvider(CMPIInstanceMI* ) { mi=p; }
    void initialize();
    void cleaup();
    CMPIrc enumInstanceNames
        (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop);
    CMPIrc enumInstances
        (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop,
            char* *properties);
    CMPIrc getInstance
        (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop,
            char* *properties);
    CMPIrc createInstance
        (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop,
            CmpiInstance& inst);
    CMPIrc setInstance
        (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop,
            CmpiInstance& inst);
    CMPIrc deleteInstance
        (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop);
    CMPIrc execQuery
        (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop,
            char* language, char* query);
};

extern "C" {
    static CMPIInstanceMIFT instMIFT={
        CMPIVersion050,
        CMPIVersion050,
        "TestProvider cmpiTestProvider",
        driveCleanup,
        driveEnumInstanceNames,
        driveEnumInstances,
        driveGetInstance,
        driveCreateInstance,
        driveSetInstance,
        driveDeleteInstance,
    };

    CMPIInstanceMI* TestProvider_Create_InstanceMI(CMPIBroker*
```

```
        broker)
    {
    static CMPIInstanceMI mi={
        NULL,
        &instMIFT,
        };
    mi.hdl=new CmpiTestProvider(&mi);
    ((CmpiInstanceMI*)(mi.hdl))->mb=new CmpiBroker(broker);
    return &mi;
    }
}

// Routines supporting a simple data store.

int addToStore(CmpiString *k, CmpiString *d);
int getFromStore(CmpiString *k, CmpiString *d),
int remFromStore(CmpiString *k);

CMPIrc CmpiTestProvider::enumInstanceNames
    (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop)
{
    return CMPI_RC_ERR_NOT_SUPPORTED;
}

CMPIrc CmpiTestProvider::enumInstances
    (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop,
        char* *properties)
{
    return CMPI_RC_ERR_NOT_SUPPORTED;
}

CMPIrc CmpiTestProvider::getInstance
    (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop,
         char* *properties)
{
    CmpiString d,k;

    k=cop.getKey("Identifier").data.string;

    if (getFromStore(&k,&d)) {
        CmpiInstance inst=mb->newInstance(cop);
        inst.setProperty("Identifier",CmpiData(k));
        inst.setProperty("data",CmpiData(d));
        rslt.returnData(inst);
    }
    else {
        return CMPI_RC_ERR_NOT_FOUND;
    }

    rslt.returnDone();
    return CMPI_RC_OK;
}

CMPIrc CmpiTestProvider::createInstance
    (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop,
        CmpiInstance& inst)
{
    CmpiString k,d;

```

```
    k=inst.getProperty("Identifier").data.string;
    d=inst.getProperty("data").data.string;

    if (addToStore(&k,&d)==0) return CMPI_RC_ERR_ALREADY_EXISTS;

    rslt.returnData(cop);
    return CMPI_RC_OK;
}

CMPIrc CmpiTestProvider::setInstance
    (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop,
        CmpiInstance& inst) {
    return CMPI_RC_ERR_NOT_SUPPORTED;
}

CMPIrc CmpiTestProvider::deleteInstance
    (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop) {
    return CMPI_RC_ERR_NOT_SUPPORTED;
}

CMPIrc CmpiTestProvider::execQuery
    (CmpiContext& ctx, CmpiResult& rslt, CmpiObjectPath& cop,
        char* language, char* query) {
    return CMPI_RC_ERR_NOT_SUPPORTED;
}
```

Glossary

Term Definition

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