



Time Service Facility SCA PSM Specification

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Software Defined Systems Committee
Time Service SCA PSM
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Time Service Facility SCA PSM Specification

1 Introduction

This document WINNF-TS-3004-App02 is the *SCA PSM specification* of *WInnForum Time Service Facility V1.1.0*.

It derives from *Time Service Facility PIM Specification* [Ref1] in accordance with *Principles for WInnForum Facility Standards* [Ref2].

It addresses the *Software Communications Architecture* (SCA) [Ref3] programming paradigm, applying the mapping rules of the SCA section of *WInnForum Facilities PSMs Mapping Rules* [Ref4] and specifically reporting any deviation to those rules.

The following figure positions the interfaces addressed by the *SCA PSM specification*:

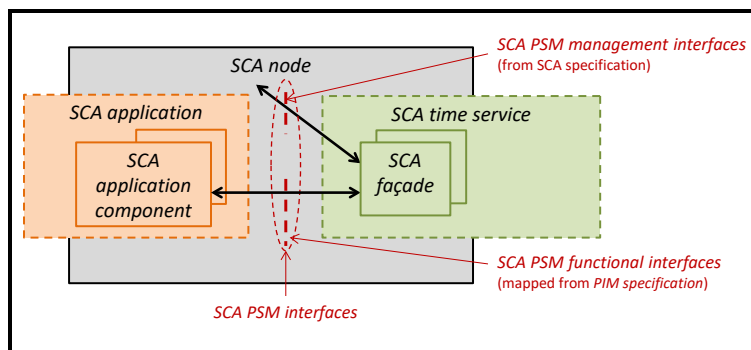


Figure 1 Interfaces addressed by *Time Service Facility SCA PSM specification*

As depicted, the *SCA PSM specification* addresses the *SCA PSM management interfaces* and *SCA PSM functional interfaces* of *time services*, positioned, within an *SCA node*, between the *SCA application components* of *SCA applications* and *SCA façades* of *SCA time services*.

It addresses version 2.2.2 [Ref5] and version 4.1 [Ref6] of the SCA.

It uses the abbreviation “tsf” to identify *time service facility* in formal identifiers.

1.1 Reference definitions

The *Time Service Facility SCA PSM specification* applies the following definitions from *Time Service Facility PIM Specification* [Ref1]:

Topic	Used definitions
Time service concepts	<i>time service, Time Service Facility, terminal time, system time, specific time, standard time</i>

Table 1 Definitions from *Time Service Facility PIM Specification*

The *Time Service Facility SCA PSM specification* applies the following definitions from *Principles for WinForum Facility Standards* [Ref2]:

Topic	Used definitions
Base concepts	<i>radio application</i>
Architecture concepts	<i>façade</i>
WinForum facility	<i>facility, PIM specification</i>
Services	<i>service, service interface, provide service, use service, services group</i>
Primitives	<i>primitive, type, exception</i>
Attributes	<i>attribute, property, capability</i>

Table 2 Definitions from *Principles for WinForum Facility Standards*

The *Time Service Facility SCA PSM specification* applies the following definitions from the SCA section of *WinForum Facilities PSMs Mapping Rules* [Ref4]:

Topic	Used definitions
Specification purpose	<i>SCA PSM specification, SCA PSM functional interfaces, SCA PSM management interfaces</i>
Software architecture	<i>SCA node, SCA façade, SCA application, SCA application component</i>
SCA ports	<i>SCA functional port, service-wise assignment, services group-wise assignment</i>
SCA properties	<i>SCA PSM property</i>

Table 3 Definitions from SCA section of *WinForum Facilities PSMs Mapping Rules*

The term “*unspecified*” indicates an aspect explicitly left to implementer’s decisions.

1.2 Conformance

1.2.1 Radio platform items

An *SCA façade* of a *time service* implementation **is conformant with** the *Time Service Facility SCA PSM specification* if it provides an SCA implementation of related *service interfaces*.

An *SCA time service* **is defined as** a *time service* implementation with all of its *SCA façades* being conformant with the *SCA PSM specification*.

1.2.2 Radio application items

An *SCA application component* of a *radio application* **is conformant with** the *Time Service Facility SCA PSM specification* if it can use *SCA façades* conformant with the *SCA PSM specification*, without using any non-standard *service interface* for the *time service*.

1.3 Document structure

Section 2 specifies the normative content for the *SCA PSM management interfaces*.

Section 3 specifies the normative classes for the *SCA PSM functional interfaces*.
Section 4 specifies the standard IDL files for the *SCA PSM functional interfaces*.
Section 5 specifies the *SCA PSM properties*.

2 SCA PSM management interfaces

The *SCA PSM management interfaces* specified in the SCA section of *WInnForum Facilities PSMs Mapping Rules* [Ref4] are applicable.

The property **TsfScaVersion** (see section 5.2.2) indicates the used SCA version.

3 SCA PSM functional interfaces and ports

This normative section specifies the *SCA PSM functional interfaces* for *time service*, according to the SCA section of *WInnForum Facilities PSMs Mapping Rules* [Ref4].

3.1 Provide and Use Services Interfaces

The *service interfaces* for the *provide services* of the *SCA PSM functional interfaces* are specified by the following table:

PIM service interface (in <code>TimeService::</code>)	PIM section	SCA PSM service interface (in <code>WInnF_Sca::TimeService::</code>)
<code>TerminalTime::TerminalTimeAccess</code>	3.1.2	<code>TerminalTime::TerminalTimeAccess</code>
<code>SystemTime::SystemTimeAccess</code>	3.1.3	<code>SystemTime::SystemTimeAccess</code>
<code>SystemTime::StandardTimeProvision</code>	3.1.4	<code>SystemTime::StandardTimeProvision</code>
<code>SpecificTimes::SpecificTimeHandling</code>	3.1.6	<code>SpecificTimes::SpecificTimeHandling</code>

Table 4 Provide services functional interfaces

The *service interfaces* for the *use services* of the *SCA PSM functional interfaces* are specified by the following table:

PIM service interface (in <code>TimeService::</code>)	PIM section	SCA PSM service interface (in <code>WInnF_Sca::TimeService::</code>)
<code>StandardTimes::ReferencesNotification</code>	3.1.5	<code>StandardTimes::ReferencesNotification</code>
<code>SpecificTimes::SettingsNotification</code>	3.1.7	<code>SpecificTimes::SettingsNotification</code>

Table 5 Use services functional interfaces

3.2 Mapping of int type

The *PIM specification* uses the *type* “int” for two parameters, although “int” is not an IDL *type*.

The following mapping is applied: unsigned 16-bit for *SpecificTimeId* and unsigned 8-bit for *SourceId*.

3.3 SCA PSM functional ports

This normative section specifies the *SCA functional port* for the two possible assignment strategies.

3.3.1 Service-wise assignment

The following figure illustrates the *SCA functional ports* with *service-wise assignment*:

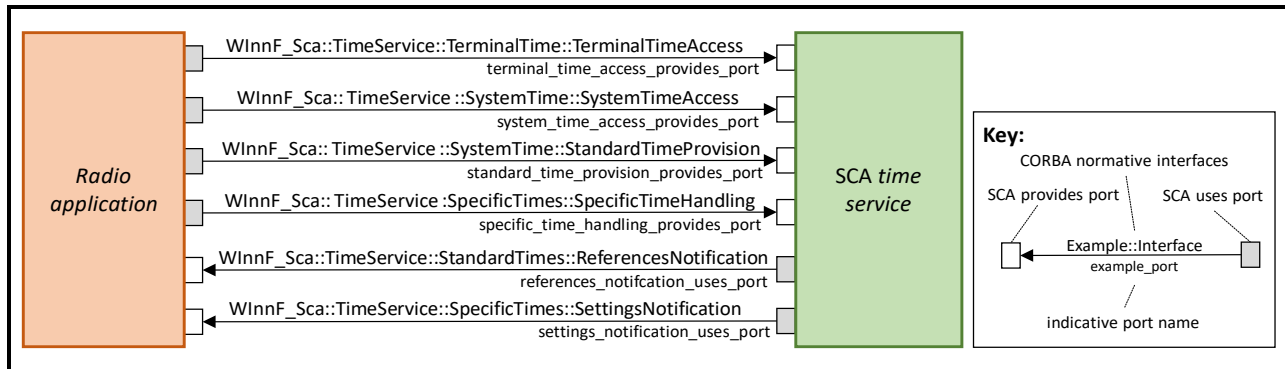


Figure 2 SCA time service with service-wise assignment

3.3.2 Services group-wise assignment

The following figure illustrates the *SCA functional ports* with *services group-wise assignment*:

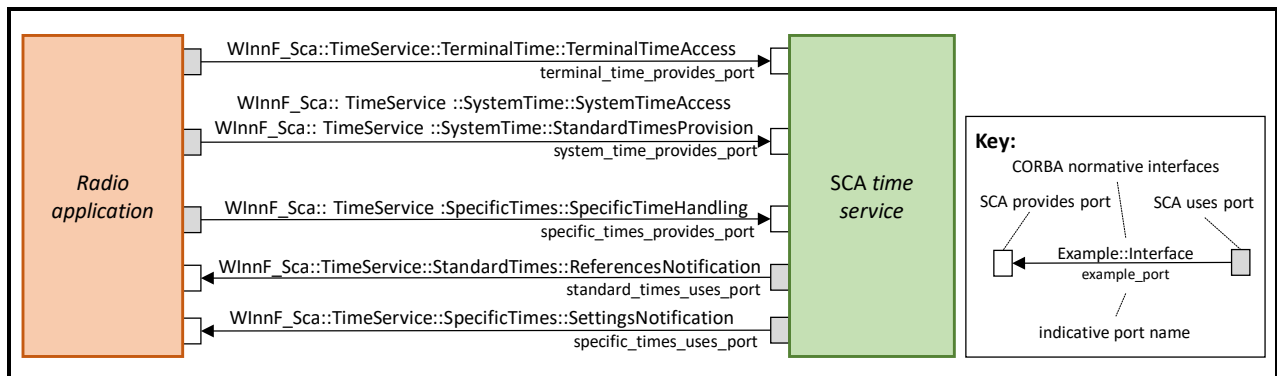


Figure 3 SCA time service with services group-wise assignment

4 SCA PSM IDL files

This normative section specifies the standard IDL files (**.idl**) to be used by conformant (see section 1.2) *SCA façades* and *SCA application components*.

The IDL files are processed by an IDL compiler to generate source code in a specific programming language from which the implementation is developed.

The specified IDL files have been successfully compiled using:

- TAO™ v2.5.0,
- ORBexpress® RT C++ v3.0.3.

4.1 Common

4.1.1 *ScaTsfTypes.idl*

The ***ScaTsfTypes.idl*** file is specified as the IDL file that declares the *types* specified by section 3.4 of *Time Service Facility PIM Specification* [Ref1].

The content of ***ScaTsfTypes.idl*** is specified as:

```
#ifndef __SCA_TSF_TYPES_DEFINED
#define __SCA_TSF_TYPES_DEFINED

#include "ScaTsfExceptions.idl"

module Winnf_Sca
{
    module TimeService
    {
        // SourceId (signed int in the [PIM] and uint8_t in Header file of the
        // Native C++ PSM)
        typedef octet SourceId;

        // SpecificTimeId (signed int in the [PIM] and uint16_t in Header file of
        // the Native C++ PSM)
        typedef unsigned short SpecificTimeId;

        // TimeValue (section 3.4.1 of [PIM])
        struct TimeValue
        {
            unsigned long seconds; // in seconds
            unsigned long nanoseconds; // in nanoseconds (<1.000.000.000)
        };

        // PIM structure constant decomposed in two scalar constants
        const unsigned long Undefinedseconds = 4294967295; //0xFFFFFFFF;
        const unsigned long Undefinednanoseconds = 4294967295; //0xFFFFFFFF;

        // TimeUncertainty (section 3.4.2 of [PIM])
        typedef long TimeUncertainty;

        const TimeUncertainty Beyond2SecTimeUncertainty = -16; // 0xFFFFFFFF0
        const TimeUncertainty Beyond4SecTimeUncertainty = -15; // 0xFFFFFFFF1
        const TimeUncertainty Beyond8SecTimeUncertainty = -14; // 0xFFFFFFFF2
        const TimeUncertainty Beyond16SecTimeUncertainty = -13; // 0xFFFFFFFF3
        const TimeUncertainty Beyond32SecTimeUncertainty = -12; // 0xFFFFFFFF4
    }
}

```

```

const TimeUncertainty Beyond64SecTimeUncertainty = -11; // 0xFFFFFFFF5
const TimeUncertainty Beyond128SecTimeUncertainty = -10; // 0xFFFFFFFF6
const TimeUncertainty Beyond256SecTimeUncertainty = -9; // 0xFFFFFFFF7
const TimeUncertainty Beyond512SecTimeUncertainty = -8; // 0xFFFFFFFF8
const TimeUncertainty Beyond1024SecTimeUncertainty = -7; // 0xFFFFFFFF9
const TimeUncertainty Beyond2048SecTimeUncertainty = -6; // 0xFFFFFFFFA
const TimeUncertainty Beyond4096SecTimeUncertainty = -5; // 0xFFFFFFFFB
const TimeUncertainty Beyond8192SecTimeUncertainty = -4; // 0xFFFFFFFFC
const TimeUncertainty Beyond16384SecTimeUncertainty = -3; // 0xFFFFFFFFD

const TimeUncertainty UnknownTimeUncertainty = -2; // 0xFFFFFFFFE
const TimeUncertainty UndefinedTimeUncertainty = -1; // 0xFFFFFFFFF

// RateUncertainty (section 3.4.3 of [PIM])
typedef long RateUncertainty;

const RateUncertainty UnknownRateUncertainty = -1; // 0xFFFFFFFFF
};
};
#endif // __SCA_TSF_TYPES_DEFINED

```

4.1.2 ScaTsfExceptions.idl

The **ScaTsfExceptions.idl** file is specified as the IDL file that declares the *exceptions* specified by section 3.2 of *Time Service Facility PIM Specification* [Ref1].

The content of **ScaTsfExceptions.idl** is specified as:

```

#ifndef __SCA_TSF_EXCEPTIONS_DEFINED
#define __SCA_TSF_EXCEPTIONS_DEFINED

module Winnf_Sca
{
    module TimeService
    {
        exception FutureTimeStamp
        {
        };

        exception InvalidSpecificTimeId
        {
        };

        exception UnavailableService
        {
        };
    };
};
#endif // __SCA_TSF_EXCEPTIONS_DEFINED

```

4.2 TerminalTime services group

4.2.1 ScaTsfTerminalTimeAccess.idl

The **ScaTsfTerminalTimeAccess.idl** file is specified as the IDL file specifying the *terminal time* access specified by section 3.1.2 of *Time Service Facility PIM Specification* [Ref1].

The content of **ScaTsfTerminalTimeAccess.idl** is specified as:

```
#ifndef __SCA_TSF_TERMINAL_TIME_ACCESS_DEFINED
#define __SCA_TSF_TERMINAL_TIME_ACCESS_DEFINED

#include "ScaTsfTypes.idl"

module Winnf_Sca
{
    module TimeService
    {
        module TerminalTime
        {
            interface TerminalTimeAccess
            {
                void getTerminalTime(out TimeValue terminalTime)
                    raises(UnavailableService);

                void getTerminalTimeRateUncertainty(out RateUncertainty
terminalTimeRateUncertainty)
                    raises(UnavailableService);
            };
        };
    };
};

#endif // __SCA_TSF_TERMINAL_TIME_ACCESS_DEFINED
```

4.3 SystemTime services group

4.3.1 ScaTsfSystemTimeAccess.idl

The **ScaTsfSystemTimeAccess.idl** file is specified as the IDL file specifying the *system time* access specified by section 3.1.3 of *Time Service Facility PIM Specification* [Ref1].

The content of **ScaTsfSystemTimeAccess.idl** is specified as:

```
#ifndef __SCA_TSF_TERMINAL_TIME_ACCESS_DEFINED
#define __SCA_TSF_TERMINAL_TIME_ACCESS_DEFINED

#include "ScaTsfTypes.idl"

module Winnf_Sca
{
    module TimeService
    {
        module SystemTime
        {
            interface SystemTimeAccess
```

```

    {
        void getCurrentTAI(out TimeValue currentTAI,
                          out TimeValue timeStamp,
                          out TimeUncertainty time_Uncertainty)
            raises(UnavailableService);

        void getCurrentUTC(out TimeValue currentUTC,
                           out TimeValue timeStamp,
                           out TimeUncertainty time_Uncertainty)
            raises(UnavailableService);

        void getLastUpdateTAI(out TimeValue lastUpdateTAI,
                               out TimeValue timeStamp,
                               out TimeUncertainty time_Uncertainty)
            raises(UnavailableService);

        void getLastUpdateUTC(out TimeValue lastUpdateUTC,
                               out TimeValue timeStamp,
                               out TimeUncertainty time_Uncertainty)
            raises(UnavailableService);
    };
};
};
};

#endif // __SCA_TSF_TERMINAL_TIME_ACCESS_DEFINED

```

4.3.2 ScaTsfStandardTimeProvision.idl

The [ScaTsfStandardTimeProvision.idl](#) file is specified as the IDL file specifying the *standard time* provision specified by section 3.1.4 of *Time Service Facility PIM Specification* [Ref1].

The content of [ScaTsfStandardTimeProvision.idl](#) is specified as:

```

#ifndef __SCA_TSF_STANDARD_TIME_PROVISION_DEFINED
#define __SCA_TSF_STANDARD_TIME_PROVISION_DEFINED

#include "ScaTsfTypes.idl"

module Winnf_Sca
{
    module TimeService
    {
        module SystemTime
        {
            interface StandardTimeProvision
            {
                void provideTAI(in TimeValue providedTAI,
                               in TimeValue timeStamp,
                               in TimeUncertainty time_Uncertainty,
                               in SourceId source_Id)
                    raises(FutureTimeStamp,
                           UnavailableService);

                void provideUTC(in TimeValue providedUTC,
                               in TimeValue timeStamp,
                               in TimeUncertainty time_Uncertainty,
                               in SourceId source_Id)
            };
        };
    };
};

```



```

        raises(FutureTimeStamp,
              UnavailableService);
    };
};
};
};
#endif // __SCA_TSF_STANDARD_TIME_PROVISION_DEFINED

```

4.4 SpecificTime services group

4.4.1 ScaTsfSpecificTimeHandling.idl

The **ScaTsfSpecificTimeHandling.idl** file is specified as the IDL file specifying the *specific time* handling specified by section 3.1.6 of *Time Service Facility PIM Specification* [Ref1].

The content of **ScaTsfSpecificTimeHandling.idl** is specified as:

```

#ifndef __SCA_TSF_SPECIFIC_TIME_HANDLING_DEFINED
#define __SCA_TSF_SPECIFIC_TIME_HANDLING_DEFINED

#include "ScaTsfTypes.idl"

module Winnf_Sca
{
    module TimeService
    {
        module SpecificTimes
        {
            interface SpecificTimeHandling
            {
                void setSpecificTime(in SpecificTimeId specific_TimeId,
                                    in TimeValue specificTime,
                                    in TimeValue timeStamp,
                                    in TimeUncertainty time_Uncertainty)
                    raises(FutureTimeStamp,
                          InvalidSpecificTimeId,
                          UnavailableService);

                void getSpecificTime(in SpecificTimeId specific_TimeId,
                                    out TimeValue specificTime,
                                    out TimeValue timeStamp,
                                    out TimeUncertainty time_Uncertainty)
                    raises(InvalidSpecificTimeId,
                          UnavailableService);
            };
        };
    };
};

#endif // __SCA_TSF_SPECIFIC_TIME_HANDLING_DEFINED

```

4.4.2 *ScaTsfSettingsNotification.idl*

The ***ScaTsfSettingsNotification.idl*** file is specified as the IDL file specifying the *specific time* settings notifications specified by section 3.1.7 of *Time Service Facility PIM Specification* [Ref1].

The content of ***ScaTsfSettingsNotification.idl*** is specified as:

```
#ifndef __SCA_TSF_SETTINGS_NOTIFICATION_DEFINED
#define __SCA_TSF_SETTINGS_NOTIFICATION_DEFINED

#include "ScaTsfTypes.idl"

module Winnf_Sca
{
    module TimeService
    {
        module SpecificTimes
        {
            interface SettingsNotification
            {
                void notifySpecificTimeSetting(in SpecificTimeId specific_TimeId,
                                               in TimeValue specificTime,
                                               in TimeValue timeStamp,
                                               in TimeUncertainty time_Uncertainty)

                raises(UnavailableService);
            };
        };
    };
};

#endif // __SCA_TSF_SETTINGS_NOTIFICATION_DEFINED
```

4.5 *StandardTimes services group*

4.5.1 *ScaTsfReferenceNotification.idl*

The ***ScaTsfReferenceNotification.idl*** file is specified as the IDL file specifying the *standard times* reference notifications specified by section 3.1.5 of *Time Service Facility PIM Specification* [Ref1].

The content of ***ScaTsfReferenceNotification.idl*** is specified as:

```
#ifndef __SCA_TSF_REFERENCE_NOTIFICATION_DEFINED
#define __SCA_TSF_REFERENCE_NOTIFICATION_DEFINED

#include "ScaTsfTypes.idl"

module Winnf_Sca
{
    module TimeService
    {
        module StandardTimes
        {
            interface ReferencesNotification
            {
                void notifyStandardTimeReference(in TimeValue referenceTAI,
```

```
        in TimeValue referenceUTC,  
        in TimeValue timeStamp,  
        in TimeUncertainty time_Uncertainty,  
        in SourceId source_Id)  
    raises(UnavailableService);  
};  
};  
};  
};  
#endif // __SCA_TSF_REFERENCE_NOTIFICATION_DEFINED
```

5 SCA PSM Properties

This normative section specifies the *SCA PSM properties*.

5.1 Nature of SCA PSM properties

Only one nature of *SCA PSM properties* is considered: *SCA capability properties*.

An *SCA capability property* **is defined as** an SCA property of kind “allocation” with an action type other than “external”.

SCA capability properties enable to check that an *SCA time service* can support the needs of a *radio application*.

They are specified by the domain profiles (.prf) of both the *radio application* and the *radio platform*:

- The .prf of the *radio application* specifies the desired value,
- The .prf of the *SCA time service* specifies the list of possible values,
- For instantiation of a *radio application*, the Core Framework checks if the desired value belongs to the list of possible values. If not, the instantiation aborts.

5.2 Version properties

5.2.1 PIM version

The **TsfPimVersion** *SCA PSM property* **is specified as** an integer indicating the version of *Time Service Facility PIM Specification* [Ref1] from which the *SCA PSM specification* is derived.

The defined values for **TsfPimVersion** **are specified as**:

PIM specification version	Value
V1.0.0	0x010000
V1.1.0	0x010100

Table 6 TsfPimVersion defined values

TsfPimVersion is equal to 0x010100.

5.2.2 SCA version

The **TsfScaVersion** *SCA PSM property* **is specified as** an integer indicating the used SCA version.

The defined values for **TsfScaVersion** **are specified as**:

SCA version	Value
V2.2.2	0x020202
V4.1	0x040100

Table 7 TsfScaVersion defined values

5.3 PIM-derived SCA PSM properties

The PIM-derived *SCA PSM properties* are intended to support instantiation of SCA applications, and may be used for other purposes.

The section 3.3 *Attributes of Time Service Facility PIM Specification* [Ref1] only specifies *capabilities* (constant over the lifetime of a *time service* implementation), which map to *SCA capability properties*.

5.3.1 PIM general capabilities

The PIM general capabilities **map to** the following *SCA capability properties*:

PIM general capability	SCA capability property	SCA type
<code>terminalTimeRateMaxUncertainty</code>	<code>terminalTimeRateMaxUncertainty</code>	<i>unsigned long</i>
<code>maxSpecificTimes</code>	<code>maxSpecificTimes</code>	<i>unsigned long</i>
<code>stampingUncertainty</code>	<code>stampingUncertainty</code>	<i>unsigned long</i>
<code>selectedOptionalServices</code>	<code>has_StandardTimeProvision</code> <code>has_SpecificTimeHandling</code> <code>has_ReferencesNotification</code> <code>has_SettingsNotification</code>	<i>boolean</i>
<code>exceptionsActive</code>	Not mapped because SCA implementations always support exceptions.	
<code>supportedExceptions</code>	<code>has_FutureTimeStamp</code> <code>has_InvalidSpecificTimeId</code>	<i>boolean</i>

Table 8 *SCA capability properties* for PIM general capabilities

An *SCA time service* has to implement all *SCA capability properties* mapped from PIM general properties.

The `has_xxx` *SCA capability properties* are not used during deployment.

No `has_UnavailableService` *SCA capability property* is specified since the related *exception* is always supported by *SCA façades*.

5.3.2 PIM real-time capabilities

The optional `WCET` and `WCEET` real-time capabilities of the *PIM specification* can map to *SCA capability properties* named `<primitive_name>_WCET` and `<primitive_name>_WCEET`, of type *unsigned long* (values in ns).

6 References

6.1 Referenced documents

- [Ref1] *Time Service Facility PIM Specification*, The Wireless Innovation Forum, WINNF-TS-3004, V1.1.1, 18 January 2022
<https://sds.wirelessinnovation.org/specifications-and-recommendations>
https://winnf.memberclicks.net/assets/work_products/Specifications/WINNF-TS-3004-V1.1.1.pdf
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