Time Service Facility SCA PSM Specification

Document WINNF-TS-3004-App02

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Contributors

The following individuals and their organization of affiliation are credited as Contributors to development of the specification, for having been involved in the work group that developed the draft then approved by WInnForum member organizations:

- Marc Adrat, Fraunhofer FKIE,
- Guillaume Delbarre, DGA,
- David Hagood, Cynosure,
- Olivier Kirsch, KEREVAL,
- Francois Levesque, NordiaSoft,
- Charles Linn, L3Harris,
- David Murotake, HiKE,
- Eric Nicollet, Thales,
- Kevin Richardson, MITRE.
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:

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]:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Used definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time service concepts</td>
<td>time service, Time Service Facility, terminal time, system time, specific time, standard time</td>
</tr>
</tbody>
</table>

Table 1 Definitions from Time Service Facility PIM Specification
The *Time Service Facility SCA PSM specification* applies the following definitions from *Principles for WINnForum Facility Standards* [Ref2]:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Used definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base concepts</td>
<td>radio application</td>
</tr>
<tr>
<td>Architecture concepts</td>
<td>façade</td>
</tr>
<tr>
<td>WINnForum facility</td>
<td>facility, PIM specification</td>
</tr>
<tr>
<td>Services</td>
<td>service, service interface, provide service, use service, services group</td>
</tr>
<tr>
<td>Primitives</td>
<td>primitive, type, exception</td>
</tr>
<tr>
<td>Attributes</td>
<td>attribute, property, capability</td>
</tr>
</tbody>
</table>

*Table 2 Definitions from Principles for WINnForum Facility Standards*

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

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

*Table 3 Definitions from SCA section of WINnForum 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:

<table>
<thead>
<tr>
<th>PIM service interface (in TimeService::)</th>
<th>PIM section</th>
<th>SCA PSM service interface (in WInnF_Sca::TimeService::)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TerminalTime::TerminalTimeAccess</td>
<td>3.1.2</td>
<td>TerminalTime::TerminalTimeAccess</td>
</tr>
<tr>
<td>SystemTime::SystemTimeAccess</td>
<td>3.1.3</td>
<td>SystemTime::SystemTimeAccess</td>
</tr>
<tr>
<td>SystemTime::StandardTime Provision</td>
<td>3.1.4</td>
<td>SystemTime::StandardTime Provision</td>
</tr>
<tr>
<td>SpecificTimes::SpecificTime Handling</td>
<td>3.1.6</td>
<td>SpecificTimes::SpecificTime Handling</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>PIM service interface (in TimeService::)</th>
<th>PIM section</th>
<th>SCA PSM service interface (in WInnF_Sca::TimeService::)</th>
</tr>
</thead>
<tbody>
<tr>
<td>StandardTimes::ReferencesNotification</td>
<td>3.1.5</td>
<td>StandardTimes::ReferencesNotification</td>
</tr>
<tr>
<td>SpecificTimes::SettingsNotification</td>
<td>3.1.7</td>
<td>SpecificTimes::SettingsNotification</td>
</tr>
</tbody>
</table>

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:

![Diagram showing service-wise assignment](image)

**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:

![Diagram showing group-wise assignment](image)

**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:

```idl
#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; // 0xFFFFFFF0
        const TimeUncertainty Beyond4SecTimeUncertainty     = -15; // 0xFFFFFFF1
        const TimeUncertainty Beyond8SecTimeUncertainty     = -14; // 0xFFFFFFF2
        const TimeUncertainty Beyond16SecTimeUncertainty    = -13; // 0xFFFFFFF3
        const TimeUncertainty Beyond32SecTimeUncertainty    = -12; // 0xFFFFFFF4
    }
}
#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:

```idl
#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:

```idl
#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:

```idl
#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
        }
    }
}
#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:

```idl
#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:

```idl
#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:

```idl
#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 time_stamp, 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:

```idl
#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:

<table>
<thead>
<tr>
<th>PIM specification version</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.0.0</td>
<td>0x010000</td>
</tr>
<tr>
<td>V1.1.0</td>
<td>0x010100</td>
</tr>
</tbody>
</table>

*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:

<table>
<thead>
<tr>
<th>SCA version</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>V2.2.2</td>
<td>0x020202</td>
</tr>
<tr>
<td>V4.1</td>
<td>0x040100</td>
</tr>
</tbody>
</table>

*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:

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

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

  https://sds.wirelessinnovation.org/specifications-and-recommendations
  https://winnf.memberclicks.net/assets/work_products/Specifications/WINNF-TS-3004-V1.1.1.pdf

  https://sds.wirelessinnovation.org/specifications-and-recommendations

[Ref3] *Software Communications Architecture*
  https://www.jtnc.mil/Resources-Catalog/Category/16990/sca/

  https://sds.wirelessinnovation.org/specifications-and-recommendations
  https://winnf.memberclicks.net/assets/work_products/Reports/WINNF-TR-2008-V1.0.1.pdf

  https://www.jtnc.mil/Resources-Catalog/Category/16990/sca/

[Ref6] *The Software Communications Architecture Specification, version 4.1*, Joint Tactical Networking Center (JTNC), 20 August 2015
  https://www.jtnc.mil/Resources-Catalog/Category/16990/sca/

The URLs above were successfully accessed at release date.
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