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SERIES M: TELECOMMUNICATION MANAGEMENT, INCLUDING TMN AND NETWORK MAINTENANCE

Telecommunications management network

Generic information model for on-site telecommunication smart maintenance

Recommendation ITU-T M.3164

International Telecommunication Union

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Recommendation ITU-T M.3164

Generic information model for on-site telecommunication smart maintenance

Summary

Recommendation ITU-T M.3164 introduces the generic information model for on-site telecommunication smart maintenance. In this Recommendation, the definition and description of the generic information object classes, attributes and the relationships between object classes are provided. This Recommendation also provides examples of each information object class and a diagram of all the example instances.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T M.3164	2020-07-14	2	11.1002/1000/14319

Keywords

Information model, telecommunication smart maintenance.

* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

FOREWORD

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The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

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Recommendation ITU-T M.3164

Generic information model for on-site telecommunication smart maintenance

1 Scope

This Recommendation builds a generic information model for on-site telecommunication smart maintenance. It identifies object classes that are common to telecommunication smart maintenance systems, or that are of a generic type that can be used in telecommunication smart maintenance systems at a technology-independent level. The main content in this Recommendation includes the definition and description of generic information model object classes, attributes and the relationship between object classes.

This Recommendation addresses generically the abstractions of those aspects related to telecommunication smart maintenance systems.

The generic information model provided in this Recommendation follows the [ITU-T M.3020] interface specification methodology on the analysis phase, and is developed in a protocol-neutral manner, which can be mapped to multiple protocol-specific information models.

This Recommendation applies to the design and development of telecommunication smart maintenance systems.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; user of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T M.3020] Recommendation ITU-T M.3020 (2017), *Management interface specification methodology.*

[ITU-T M.3040] Recommendation ITU-T M.3040 (2019), *Principles for on-site telecommunication smart maintenance.*

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 information object class [ITU-T M.3020]: Describes the information that can be passed/used in management interfaces and is modelled using the stereotype "Class" in the UML meta-model.

3.1.2 telecommunication smart maintenance [ITU-T M.3040]: The maintenance carried out with advanced technology-based (IoT, AR, wearable technology, etc.) toolkit and system, which can provide strong human-computer interaction capabilities and online guidance to personnels, to achieve higher efficiency and precision of actions.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 attribute property: Specification attribute qualification and value range.

NOTE – Based on [ITU-T M.3020].

3.2.2 class diagram: A diagram that describes classes, interfaces, collaborations, and relationships between them to show the static structure of each class in the system.

NOTE – Based on [ITU-T M.3020].

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ID Identifier

MAC Media Access Control

RAM Random Access Memory

ROM Read Only Memory

SMAT Smart Maintenance Assistant Toolkit

TSMS Telecommunication Smart Maintenance System

UML Unified Modeling Language

5 Conventions

None.

6 Information model for telecommunication smart maintenance

6.1 Top-level object class relationship diagram

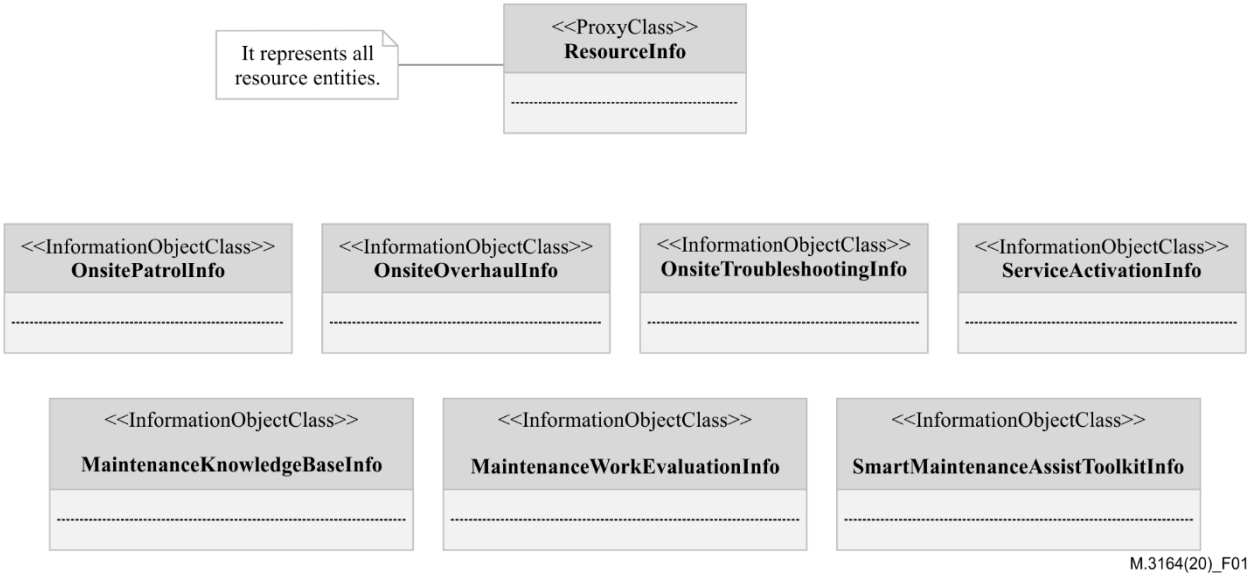

Figure 1 – Relationship class diagram between the top-level object classes

As shown in Figure 1, the top level classes of the information model for the telecommunication smart maintenance system (TSMS) include ResourceInfo, OnsitePatrolInfo, OnsiteOverhaulInfo, OnsiteTroubleshootingInfo, ServiceActivationInfo, MaintenanceKnowledgeBaseInfo, MaintenanceWorkEvaluationInfo, SmartMaintenanceAssistToolkitInfo, and these top-level classes contain concrete information object classes.

6.2 Resource management information model

Referring to [ITU-T M.3020], this Recommendation defines the top-level class about resource management (ResourceInfo) as a proxy class "ProxyClass", which represents all resource entity classes "InformationObjectClass". The proxy class encapsulates the properties, methods (or notifications) that exist in the entity class it represents, and all its behavior appears in the entity class it represents. Since the proxy class is just a representation of other classes, this class cannot define its own behavior except for the classes that have been defined by the indicated "InformationObjectClass". So, this Recommendation defines properties and methods about resource proxy class. The information model related to the top-level class about resource management is shown in Figure 2, where the Note is a comment for the proxy class.

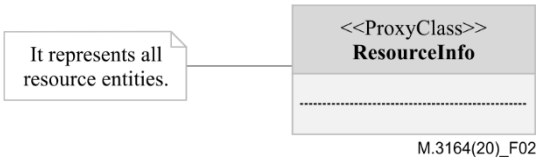

Figure 2 – Information model related to ResourceInfo

The information model about network resources of a specific network refers to relevant existing standards.

6.3 On-site patrol information model

6.3.1 Relationship class diagram between object classes

The Relationship class diagram between object classes related to on-site patrol is shown in Figure 3.

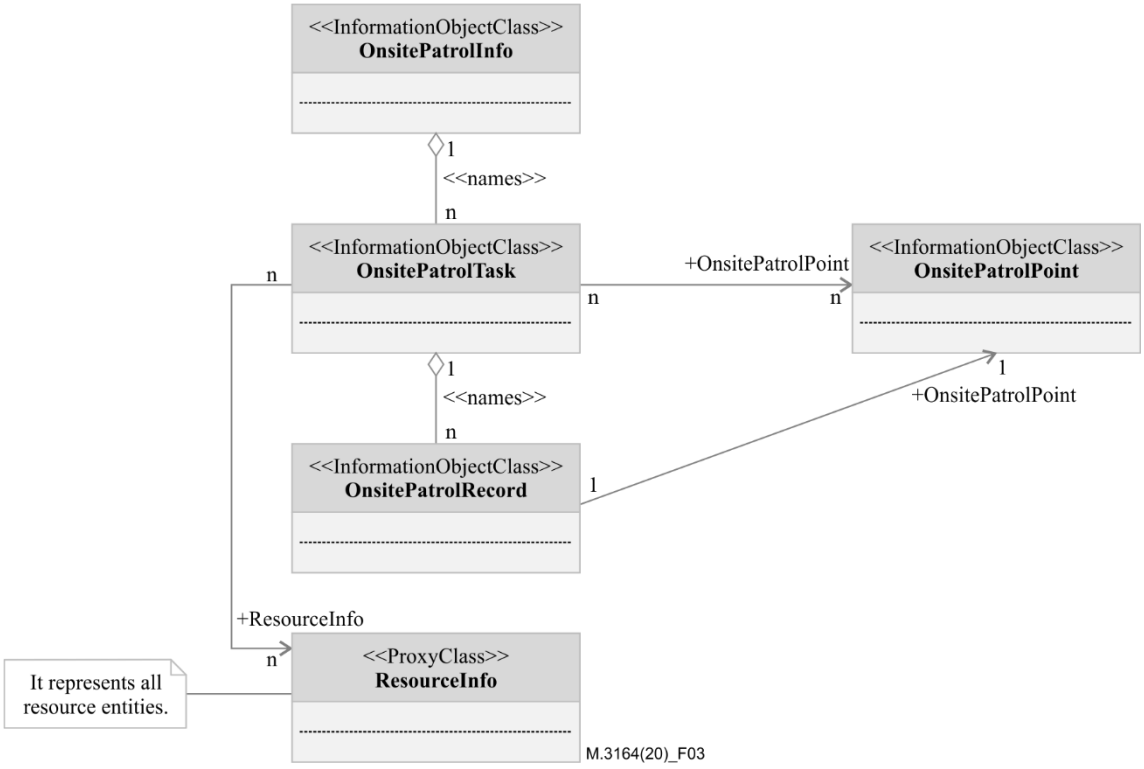

Figure 3 – Relationship class diagram between object classes related to on-site patrol

In Figure 3, the information object classes related to on-site patrol include OnsitePatrolTask, OnsitePatrolPoint, and OnsitePatrolRecord. The patrol activity is related to patrol multiple

resources, and these resources are at different sites, so that OnsitePatrolTask and OnsitePatrolPoint and ResourceInfo are many-to-many and one-way association relationships. On-site maintenance personnel records information about and generates patrol records when performing patrol activity at each patrol point, so that OnsitePatrolTask and OnsitePatrolRecord are a one-to-many containment relationship, and OnsitePatrolRecord and OnsitePatrolPoint is a one-to-one and one-way association relationship.

6.3.2 Object class information model and attribute description

6.3.2.1 Information object class related to on-site patrol (OnsitePatrolInfo)

6.3.2.1.1 Definition

The *OnsitePatrolInfo* management entity describes basic information related to the top-level class about on-site patrol.

6.3.2.1.2 Attributes

Table 1 describes the attribute properties related to OnsitePatrolInfo:

Table 1

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
patrolInfoID	M	M	–	–	M
patrolTaskList	M	M	M	O	M

Table 2 shows the specific description of the attributes related to OnsitePatrolInfo:

Table 2

Attribute name	Type	Explanation
patrolInfoID	String	Unique identifier related to OnsitePatrolInfo
patrolTaskList	SEQUENCE OF String	List of on-site patrol activities

6.3.2.1.3 Notifications

Table 3 shows the specific description of notifications related to OnsitePatrolInfo:

Table 3

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.3.2.2 Information object class related to patrol activity (OnsitePatrolTask)

The information model related to OnsitePatrolTask is shown in Figure 4.

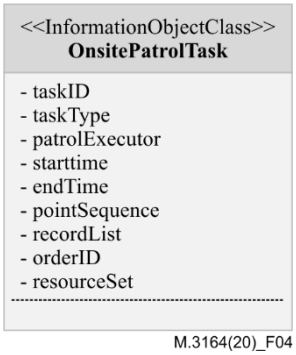

Figure 4 – Information model related to OnsitePatrolTask

6.3.2.2.1 Definition

This management entity describes relevant information related to patrol activity. The use made of individual attributes and notification is detailed below:

– taskType: The patrol activities are divided into multiple types according to different situations, and the attribute indicates the type of the activity;

– taskStatus: Representing the state in which the patrol activity is located;

– pointSequence: It consists of the location where patrol objects are located, and represents the order of patrol in this activity;

– orderID: The order is the information related to maintenance tasks sent from TSMS, including maintenance task types, maintenance objects, serial numbers, etc. OrderID represents the serial number of the order about the patrol activity;

– resourceSet: Representing equipment related to patrol activity.

An attribute value change notification shall be emitted when the value of the taskID, the taskType, the taskStatus, the patrolExecutor, the pointSequence, the recordList, the orderID or the resourceSet is changed.

6.3.2.2.2 Attributes

Table 4 describes the attribute properties related to OnsitePatrolTask:

Table 4

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
taskID	M	M	–	–	M
taskType	M	M	M	O	M
taskStatus	M	M	M	O	M
patrolExecutor	M	M	M	O	M
startTime	O	M	M	O	–
endTime	O	M	M	O	–
pointSequence	M	M	M	O	M
recordList	M	M	M	O	M
orderID	M	M	M	O	M
resourceSet	M	M	M	O	M

Table 5 shows the specific description of the attributes related to OnsitePatrolTask:

Table 5

Attribute name	Type	Explanation
taskID	String	Unique identifier, Patrol activity number
taskType	ENUM	[routine|temporary|else]
taskStatus	ENUM	[notready|ready |doing|finished]
patrolExecutor	String	Personnel ID, drone number, robot number, etc. responsible for patrol activity
startTime	Date	The start time of patrol activity
endTime	Date	The end time of patrol activity
pointSequence	SEQUENCE OF String	List of location to be patrolled
recordList	SEQUENCE OF String	List of record while patrolling
orderID	String	Order number related to patrol activity
resourceSet	SET OF String	Equipment related to patrol activity

6.3.2.2.3 Notifications

Table 6 shows the specific description of notifications of the site patrol activity:

Table 6

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.3.2.3 Information object class related to patrol point (OnsitePatrolPoint)

The information model related to OnsitePatrolPoint is shown in Figure 5.

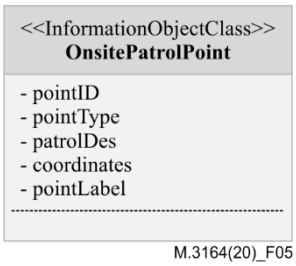

Figure 5 – Information model related to OnsitePatrolPoint

6.3.2.3.1 Definition

This management entity describes relevant information related to patrol point. The use made of individual attributes and notification is detailed below:

– pointType: Patrol points are divided into multiple types according to different patrol objects, and the attribute indicates the type about patrol point;

– patrolDes: Specifies the specific content about patrol to patrol point;

– coordinates: The spatial position coordinates of patrol points, include latitude, longitude, altitude and coordinate system. Among them, the coordinate system indicates the "geodetic coordinate system" that the coordinates are using, such as WGS84, IIRS, Krasovsky_1940, GCS_CN_2000, etc.

– pointLabel: Represents special mark about patrol point;

An attribute value change notification shall be emitted when the value of the pointID, the pointType, the patrolDes, the coordinates or the pointLabel is changed.

6.3.2.3.2 Attributes

Table 7 describes the attribute properties related to OnsitePatrolPoint:

Table 7

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
pointID	M	M	-	-	M
pointType	M	M	M	O	M
patrolDes	M	M	M	O	M
coordinates	M	M	M	O	M
pointLabel	M	M	M	O	M

Table 8 shows the specific description of the attributes related to OnsitePatrolPoint:

Table 8

Attribute Name	Type	Explanation
pointID	String	Unique identifier, patrol point number
pointType	ENUM	[building|device|else]
patrolDes	String	Patrol point detail description
coordinates	SET OF CoordinateType	The spatial position coordinates of patrol point, include latitude, longitude, altitude and coordinate system. CoordinateType ::= SET { latitude REAL, longitude REAL, altitude REAL, coordinateSystem String}
pointLabel	String	Patrol point label

6.3.2.3.3 Notifications

Table 9 shows the specific description of notifications related to OnsitePatrolPoint:

Table 9

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.3.2.4 Information object class related to patrol record (OnsitePatrolRecord)

The information model related to OnsitePatrolRecord is shown in Figure 6.

Figure 6 – Information model related to OnsitePatrolRecord

6.3.2.4.1 Definition

This management entity describes record information related to an on-site patrol process. The use made of individual attributes and notification is detailed below:

– pointID: Represents the patrol point to which the record information belongs;

– status: Represents the status about recorded patrol point;

– recordExecutor: Represents the executor who made the patrol record;

– recordInfo: Represents important information recorded by the on-site patrol executor during the patrol process.

An attribute value change notification shall be emitted when the value of the recordID, the pointID, the status or the recordInfo is changed.

6.3.2.4.2 Attributes

Table 10 describes the attribute properties related to OnsitePatrolRecord:

Table 10

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
recordID	M	M	–	–	M
recordExecutor	O	M	M	O	–
recordTime	O	M	M	O	–
status	M	M	M	O	M
recordInfo	M	M	M	O	M
pointID	M	M	M	O	M

Table 11 shows the specific description of the attributes related to OnsitePatrolRecord:

Table 11

Attribute Name	Type	Explanation
recordID	String	Unique identifier, patrol record number
recordExecutor	String	Personnel ID, drone number, robot number, etc. for recording
recordTime	Date	Patrol record time
status	ENUM	Status about recorded patrol point [normal|abnormal|notCheck]
recordInfo	String	Specific information about record
pointID	String	The patrol record corresponds to identifier related to patrol point

6.3.2.4.3 Notifications

Table 12 shows the specific description of notifications related to OnsitePatrolRecord:

Table 12

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.4 On-site overhaul information model

6.4.1 Relationship class diagram between object classes

The Relationship class diagram between object classes related to on-site overhaul is shown in Figure 7.

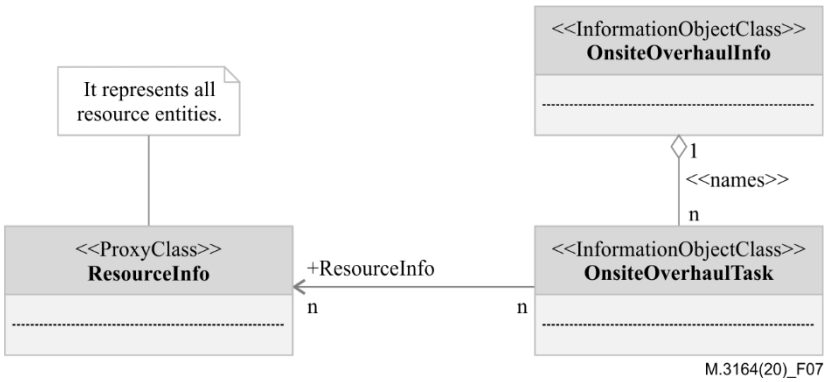

Figure 7 – Relationship class diagram between object classes related to on-site overhaul

In Figure 7, the information object classes related to on-site overhaul include OnsiteOverhaulTask, OnsiteOverhaulTask is contained in OnsiteOverhaulInfo. The overhaul object contains one or more resources, so that OnsiteOverhaulTask and ResourceInfo are many-to-many and one-way association relationships.

6.4.2 Object class information model and attribute description

6.4.2.1 Information object class related to on-site overhaul (OnsiteOverhaulInfo)

6.4.2.1.1 Definition

The *OnsiteOverhaulInfo* management entity describes basic information related to top-level class about on-site overhaul.

6.4.2.1.2 Attributes

Table 13 describes the attribute properties related to OnsiteOverhaulInfo:

Table 13

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
overhaulInfoID	M	M	–	–	M
overhaulTaskList	M	M	M	O	M

Table 14 shows the specific description of the attributes related to OnsiteOverhaulInfo:

Table 14

Attribute name	Type	Explanation
overhaulInfoID	String	Unique identifier related to OnsiteOverhaulInfo
overhaulTaskList	SEQUENCE OF String	List of on-site overhaul activities

6.4.2.1.3 Notifications

Table 15 shows the specific description of notifications related to OnsiteOverhaulInfo:

Table 15

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.4.2.2 Information object class related to overhaul activity (OnsiteOverhaulTask)

The information model related to OnsiteOverhaulTask is shown in Figure 8.

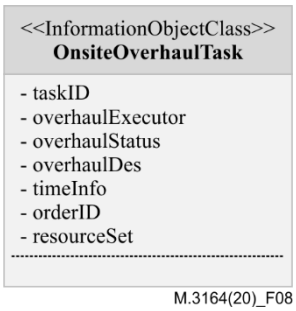

Figure 8 – Information model related to OnsiteOverhaulTask

6.4.2.2.1 Definition

This management entity describes basic information related to on-site overhaul activity. The use made of individual attributes and notification is detailed below:

– overhaulStatus: Represents implementation about on-site overhaul activity;

– overhaulDes: Represents specific content about overhaul;

– orderID: The order is the information related to maintenance task sent from TSMS, including maintenance task types, maintenance objects, serial numbers, etc. OrderID represents the serial number of the order about the overhaul activity;

– resourceSet: Represents equipment about overhaul activity.

An attribute value change notification shall be emitted when the value of the taskID, the overhaulStatus, the overhaulDes, the orderID or the resourceSet is changed.

6.4.2.2.2 Attributes

Table 16 describes the attribute properties related to OnsiteOverhaulTask:

Table 16

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
taskID	M	M	–	–	M
overhaulExecutor	O	M	M	O	–
overhaulStatus	M	M	M	O	M
overhaulDes	M	M	M	O	M
timeInfo	O	M	M	O	–
orderID	M	M	M	O	M
resourceSet	M	M	M	O	M

Table 17 shows the specific description of the attributes related to OnsiteOverhaulTask:

Table 17

Attribute name	Type	Explanation
taskID	String	Unique identifier, overhaul activity number
overhaulExecutor	String	Personnel ID or robot number responsible for overhaul activity
overhaulStatus	ENUM	[notStart|doing|finished]
overhaulDes	String	Specific overhaul content description
timeInfo	SEQUENCE OF TimeInfoType	Start time and end time of overhaul activity. TimeInfoType ::= SEQUENCE { startTime GeneralizedTime, endTime GeneralizedTime}
orderID	String	Task order number related to overhaul activity
resourceSet	SET OF String	Equipment related to overhaul activity

6.4.2.2.3 Notifications

Table 18 shows the specific description of notifications related to OnsiteOverhaulTask:

Table 18

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.5 On-site troubleshooting information model

6.5.1 Relationship class diagram between object classes

The relationship class diagram between object classes related to on-site troubleshooting is shown in Figure 9.

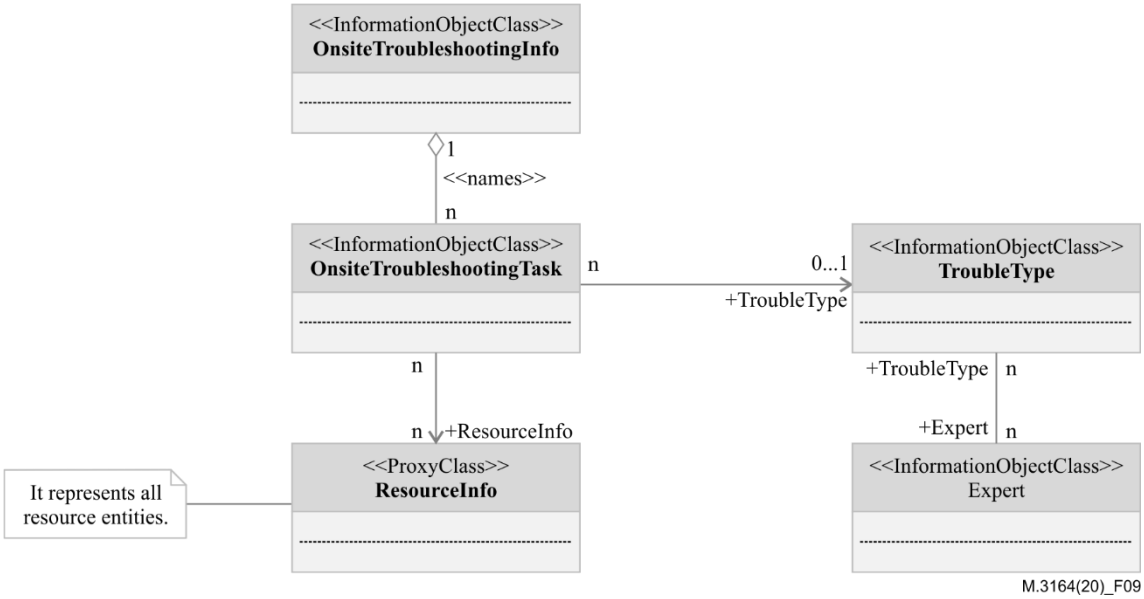

Figure 9 – Relationship class diagram between object classes related to on-site troubleshooting

In Figure 9, the information object classes related to on-site troubleshooting include OnsiteTroubleshootingTask, TroubleType and Expert. The object related to the trouble is a resource, and the trouble handling tasks are classified according to the known trouble type, and a trouble handling task belongs to a certain type or a currently unknown type. At the same time, experts can solve one or more types of trouble based on their expertise. Therefore, OnsiteTroubleshootingTask and ResourceInfo are many-to-many and one-way association relationships, and TroubleType are many-to-zero or one and one-way association relationships, and TroubleType and Expert are many-to-many and two-way association relationships.

6.5.2 Object class information model and attribute description

6.5.2.1 Information object class related to on-site troubleshooting (OnsiteTroubleshootingInfo)

6.5.2.1.1 Definition

The *OnsiteTroubleshootingInfo* management entity describes basic information related to top-level class about on-site troubleshooting.

6.5.2.1.2 Attributes

Table 19 describes the attribute properties related to OnsiteTroubleshootingInfo:

Table 19

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
troubleshootingInfoID	M	M	–	–	M
troubleshootingTaskList	M	M	M	O	M

Table 20 shows the specific description of the attributes related to OnsiteTroubleshootingInfo:

Table 20

Attribute Name	Type	Explanation
troubleshootingInfoID	String	Unique identifier related to OnsiteTroubleshootingInfo
troubleshootingTaskList	SEQUENCE OF String	List of on-site troubleshooting activities

6.5.2.1.3 Notifications

Table 21 shows the specific description of notifications of the on-site troubleshooting top-level class:

Table 21

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.5.2.2 Information object class related to troubleshooting task (OnsiteTroubleshootingTask)

The information model related to OnsiteTroubleshootingTask is shown in Figure 10.

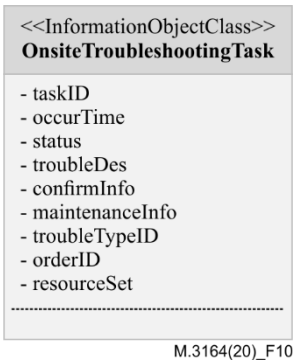

Figure 10 – Information model related to OnsiteTroubleshootingTask

6.5.2.2.1 Definition

This management entity describes basic information related to on-site troubleshooting activity. The use made of individual attributes and notification is detailed below:

– status: Represents execution about on-site troubleshooting activity;

– troubleDes: This attribute describes specific information about trouble, such as the location information;

– troubleTypeID: Represents the type to which the trouble belongs;

– orderID: The order is the information related to maintenance task sent from TSMS, including maintenance tasks types, maintenance objects, serial numbers, etc. OrderID represents the serial number of the order about the on-site troubleshooting activity;

– resourceSet: Represents equipment about on-site troubleshooting activity.

An attribute value change notification shall be emitted when the value of the taskID, the status, the troubleDes, the troubleTypeID, the orderID or the resourceSet is changed.

6.5.2.2.2 Attributes

Table 22 describes the attribute properties related to OnsiteTroubleshootingTask:

Table 22

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
taskID	M	M	–	–	M
occurTime	O	M	M	O	–
status	M	M	M	O	M
troubleDes	M	M	M	O	M
confirmInfo	O	M	M	O	–
maintenanceInfo	O	M	M	O	–
troubleTypeID	M	M	M	O	M
orderID	M	M	M	O	M
resourceSet	M	M	M	O	M

Table 23 shows the specific description of the attributes related to OnsiteTroubleshootingTask:

Table 23

Attribute name	Type	Explanation
taskID	String	Unique identifier, troubleshooting activity number
occurTime	Date	Time of occurrence
status	ENUM	[notstart|doing|finished]
troubleDes	String	Description about trouble
confirmInfo	SET OF ConfirmInfoType	Including name about confirmer, confirmation time. ConfirmInfoType ::= SET { confirmer String, confirmTime GeneralizedTime}
maintenanceInfo	SET OF ConfirmInfoType	Including name about maintenance personnel, maintenance plan, maintenance time. MaintenanceInfoType ::= SET { maintainExecutor String, maintainPlan String, maintainTime GeneralizedTime}
troubleTypeID	String	Identifier of the type of trouble number, if the association can be established.
orderID	String	Activity order number of the source related to troubleshooting activity
resourceSet	SET OF String	Equipment related to troubleshooting activity

6.5.2.2.3 Notifications

Table 24 shows the specific description of notifications related to OnsiteTroubleshootingTask:

Table 24

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.5.2.3 Information object class related to type of trouble (TroubleType)

The information model related to TroubleType is shown in Figure 11.

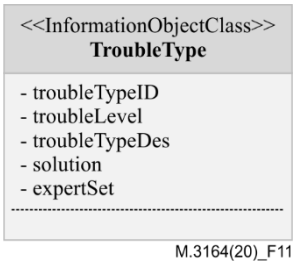

Figure 11 – Information model related to TroubleType

6.5.2.3.1 Definition

This management entity describes basic information related to the type of trouble. The use made of individual attributes and notification is detailed below:

– troubleLevel: Troubles are classified into different levels according to severity about trouble. This attribute represents trouble level;

– troubleTypeDes: This attribute specifies specific information about type of trouble;

– solution: This attribute describes specific processing solution about trouble;

– expertSet: Represents these experts with the ability to process the trouble;

An attribute value change notification shall be emitted when the value of the troubleTypeID, the troubleLevel, the troubleDes, the solution or the expertSet is changed.

6.5.2.3.2 Attributes

Table 25 describes the attribute properties related to TroubleType:

Table 25

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
troubleTypeID	M	M	–	–	M
troubleLevel	M	M	M	O	M
troubleTypeDes	M	M	M	O	M
solution	M	M	M	O	M
expertSet	M	M	M	O	M

Table 26 shows the specific description of the attributes related to TroubleType:

Table 26

Attribute name	Type	Explanation
troubleTypeID	String	Unique identifier,The type of trouble number
troubleLevel	ENUM	[urgent|serious|warn|common]
troubleTypeDes	String	Trouble description
solution	String	Troubleshooting solution
expertSet	SET OF String	Remotely assisted expert identification set

6.5.2.3.3 Notifications

Table 27 shows the specific description of notifications related to TroubleType:

Table 27

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.5.2.4 Information object class related to expert (Expert)

The information model related to Expert is shown in Figure 12.

Figure 12 – Information model related to Expert

6.5.2.4.1 Definition

This management entity describes basic information related to an expert who can remotely assist with troubleshooting. The use made of individual attributes and notification is detailed below:

– expertGroup: Represents expert group to which expert belongs;

– email: Represents contact method about the expert;

– skillArea: Represents a special field about the expert, corresponding to type of maintenance task;

An attribute value change notification shall be emitted when the value of the expertID, the expertGroup, the email, the skillArea or the availableRate is changed.

6.5.2.4.2 Attributes

Table 28 describes the attribute properties related to Expert:

Table 28

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
expertID	M	M	–	–	M
expertAddtionInfo	O	M	M	O	–
expertGroup	M	M	M	O	M
expertDepartment	O	M	M	O	–
email	M	M	M	O	M
skillArea	M	M	M	O	M
availableRate	M	M	M	O	M

Table 29 shows the specific description of the attributes related to Expert:

Table 29

Attribute Name	Type	Explanation
expertID	String	Unique identifier, Expert number
expertAddtionInfo	SET OF String	Including the name, gender and birth year. ExpertAddtionInfoType ::= SET { name String, gender ENUMERATED, birthYear GeneralizedTime }
expertGroup	String	Name of expert group
expertDepartment	String	Expert department
email	String	Contact method is mainly mailbox
skillArea	String	On-site maintenance personnel match the expert's special field according to type of trouble
availableRate	Double	The probability that the expert can provide online services. An on-site maintenance executor may select experts with high availableRate

6.5.2.4.3 Notifications

Table 30 shows the specific description of notifications related to Expert:

Table 30

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.6 Service activation information model

6.6.1 Relationship class diagram between object classes

The relationship class diagram between object classes related to service activation is shown in Figure 13.

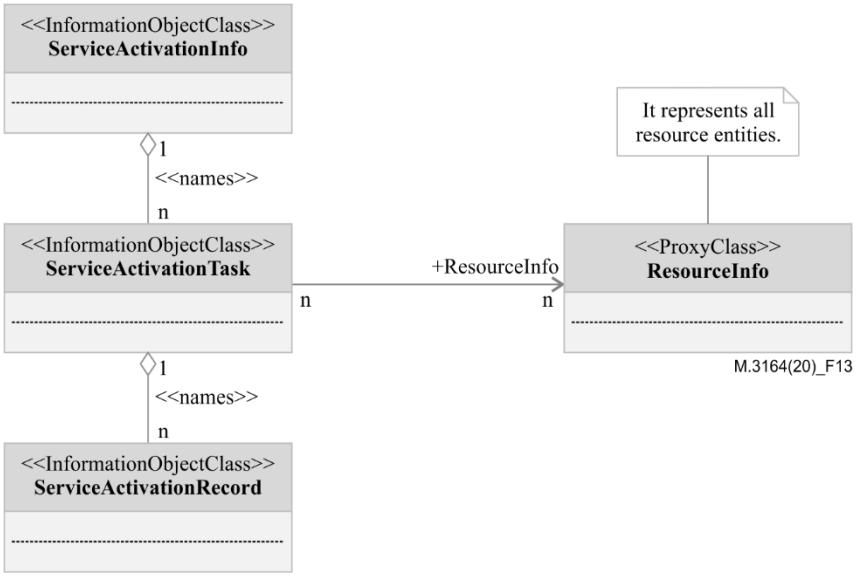

Figure 13 – Relationship class diagram between object classes related to service activation

In Figure 13, the information object classes related to service activation include ServiceActivationTask and ServiceActivationRecord. The object related to service activation activities is one or more resources. On-site maintenance executor will record relevant information when performing service activation activities. Therefore, ServiceActivationTask and ResourceInfo are many-to-many and one-way association relationships. ServiceActivationTask contains a number of ServiceActivationRecord.

6.6.2 Object class information model and attribute description

6.6.2.1 Information object class related to service activation (ServiceActivationInfo)

6.6.2.1.1 Definition

The *ServiceActivationInfo* management entity describes basic information related to the top-level class about service activation.

6.6.2.1.2 Attributes

Table 31 describes the attribute properties related to ServiceActivationInfo:

Table 31

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
serviceActInfoID	M	M	–	–	M
serviceActTaskList	M	M	M	O	M

Table 32 shows the specific description of the attributes related to ServiceActivationInfo:

Table 32

Attribute Name	Type	Explanation
serviceActInfoID	String	Unique identifier related to ServiceActivationInfo
serviceActTaskList	SEQUENCE OF String	List of Service activation tasks

6.6.2.1.3 Notifications

Table 33 shows the specific description of notifications related to ServiceActivationInfo:

Table 33

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.6.2.2 Information object class related to service activation activity (ServiceActivationTask)

The information model related to ServiceActivationTask is shown in Figure 14.

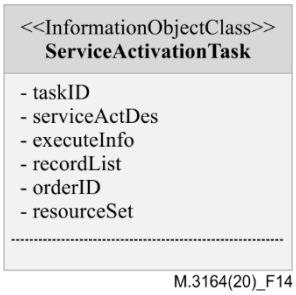

Figure 14 – Information model related to ServiceActivationTask

6.6.2.2.1 Definition

This managed entity describes basic information related to service activation activity. The use made of individual attributes and notification is detailed below:

– serviceActDes: This attribute records details about service activation activity;

– executeInfo: Document relevant information about execution;

– recordList: Represents information records of the service activation activity execution process;

– orderID: The order is the information related to maintenance task sent from TSMS, including maintenance tasks types, maintenance objects, serial numbers, etc. OrderID represents the serial number of the order about the service activation activity;

– resourceSet: Represents equipment about service activation activity.

An attribute value change notification shall be emitted when the value of the taskID, the serviceActDes, the executeInfo, the recordList, the orderID or the resourceSet is changed.

6.6.2.2.2 Attributes

Table 34 describes the attribute properties related to ServiceActivationTask:

Table 34

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
taskID	M	M	–	–	M
serviceActDes	M	M	M	O	M
executeInfo	M	M	M	O	M
recordList	M	M	M	O	M
orderID	M	M	M	O	M
resourceSet	M	M	M	O	M

Table 35 shows the specific description of the attributes related to ServiceActivationTask:

Table 35

Attribute Name	Type	Explanation
taskID	String	Unique identifier, service activation activity number
serviceActDes	String	Description of specific contents about service activation activity
executeInfo	SET OF ExecuteInfoType	Including executor, execution time, execution results. ExecuteInfoType ::= SET { executor String, executionTime GeneralizedTime, executionResults String}
recordList	SEQUENCE OF String	List of record identifiers for activity execution process
orderID	String	Task order number of the source related to service activation activity
resourceSet	SET OF String	Equipment related to service activation activity

6.6.2.2.3 Notifications

Table 36 shows the specific description of notifications related to ServiceActivationTask:

Table 36

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.6.2.3 Information object class related to record of Service activation (ServiceActivationRecord)

The information model related to ServiceActivationRecord is shown in Figure 15.

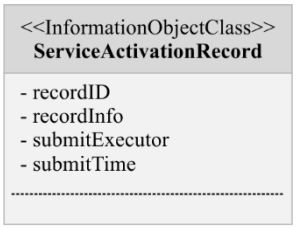

Figure 15 – Information model related to ServiceActivationRecord

6.6.2.3.1 Definition

This management entity describes information about record of service activation. The use made of individual attributes and notification is detailed below:

– recordInfo: This attribute records details about service activation activity;

An attribute value change notification shall be emitted when the value of the recordID or the recordInfo is changed.

6.6.2.3.2 Attributes

Table 37 describes the attribute properties related to ServiceActivationRecord:

Table 37

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
recordID	M	M	–	–	M
recordInfo	M	M	M	O	M
submitExecutor	O	M	M	O	–
submitTime	O	M	M	O	–

Table 38 shows the specific description of the attributes related to ServiceActivationRecord:

Table 38

Attribute Name	Type	Explanation
recordID	String	Unique identifier, record of service activation number
recordInfo	String	Specific content about record
submitExecutor	String	Personnel ID, robot number, etc. for submitting records
submitTime	Date	Time of submission about records

6.6.2.3.3 Notifications

Table 39 shows the specific description of notifications related to ServiceActivationRecord:

Table 39

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.7 Maintenance knowledge base information model

6.7.1 Relationship class diagram between object classes

The relationship class diagram between object classes related to maintenance knowledge base is shown in Figure 16.

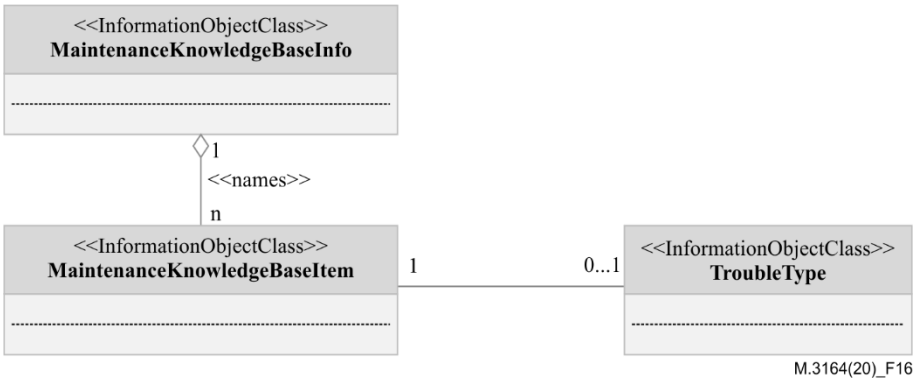

Figure 16 – Relationship class diagram between object classes related to maintenance knowledge base

In Figure 16, the information object classes related to maintenance knowledge base include MaintenanceKnowledgeBaseItem. Maintenance knowledge items can be organized by operating steps that are more efficient in processing maintenance activities, including on-site patrol, on-site overhaul, on-site troubleshooting, service activation, etc. At the same time, relevant guidance may be obtained from the maintenance knowledge base when dealing with maintenance activities. Therefore, MaintenanceKnowledgeBaseItem and TroubleType are one-to-zero or one and two-way association relationship.

6.7.2 Object class information model and attribute description

6.7.2.1 Information object class related to maintenance knowledge base (MaintenanceKnowledgeBaseInfo)

6.7.2.1.1 Definition

The *MaintenanceKnowledgeBaseInfo* management entity describes basic information related to top-level class about maintenance knowledge base.

6.7.2.1.2 Attributes

Table 40 describes the attribute properties related to MaintenanceKnowledgeBaseInfo:

Table 40

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
maintenanceKnowledge BaseInfoID	M	M	–	–	M
maintenanceKnowledge BaseItemList	M	M	M	O	M

Table 41 shows the specific description of the attributes related to MaintenanceKnowledgeBaseInfo:

Table 41

Attribute name	Type	Explanation
maintenanceKnowledgeBaseInfoID	String	Unique identifier related to MaintenanceKnowledgeBaseInfo
maintenanceKnowledgeBaseItemList	SEQUENCE OF String	List of Maintenance knowledge base items

6.7.2.1.3 Notifications

Table 42 shows the specific description of notifications related to MaintenanceKnowledgeBaseInfo:

Table 42

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.7.2.2 Information object class related to maintenance knowledge item (MaintenanceKnowledgeBaseItem)

The information model related to MaintenanceKnowledgeBaseItem is shown in Figure 17.

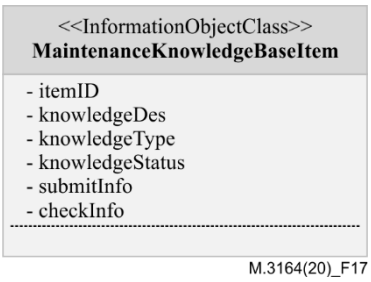

Figure 17 – Information model related to MaintenanceKnowledgeBaseItem

6.7.2.2.1 Definition

This management entity describes basic information related to maintenance knowledge item.The use made of individual attributes and notification is detailed below:

– knowledgeDes: Describe specific content about knowledge;

– knowledgeType: Represents type of maintenance knowledge item;

– knowledgeStatus: Represents check status about knowledge.

An attribute value change notification shall be emitted when the value of the itemID, the knowledgeDes, the knowledgeType or the knowledgeStatus is changed.

6.7.2.2.2 Attributes

Table 43 describes the attribute properties related to MaintenanceKnowledgeBaseItem:

Table 43

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
itemID	M	M	–	–	M
knowledgeDes	M	M	M	O	M
knowledgeType	M	M	M	O	M
knowledgeStatus	M	M	M	O	M
submitInfo	O	M	M	O	–
checkInfo	O	M	M	O	–

Table 44 shows the specific description of the attributes related to MaintenanceKnowledgeBaseItem:

Table 44

Attribute name	Type	Explanation
itemID	String	Unique identifier, Maintenance knowledge item
knowledgeDes	String	Description of knowledge content. For example, it describes a specific high-efficiency process for a certain type of trouble.
knowledgeType	ENUM	[patrol|overhaul|troubleshoo|serviceAct]
knowledgeStatus	ENUM	[submiting|notCheck|checking| checkedOK|checkedFail]
submitInfo	SET OF SubmitInfoType	Information about the submission of knowledge, including the submitter and the time of submission. SubmitInfoType ::= SET { submitterID String, submitTime GeneralizedTime}
checkInfo	SET OF CheckInfoType	Information about the check of knowledge, including the checker and the time of check. CheckInfoType ::= SET { checkerID String, checkerTime GeneralizedTime}

6.7.2.2.3 Notifications

Table 45 shows the specific description of notifications related to MaintenanceKnowledgeBaseItem:

Table 45

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.8 Maintenance work evaluation information model

6.8.1 Relationship class diagram between object classes

The relationship class diagram between object classes related to maintenance work evaluation is shown in Figure 18.

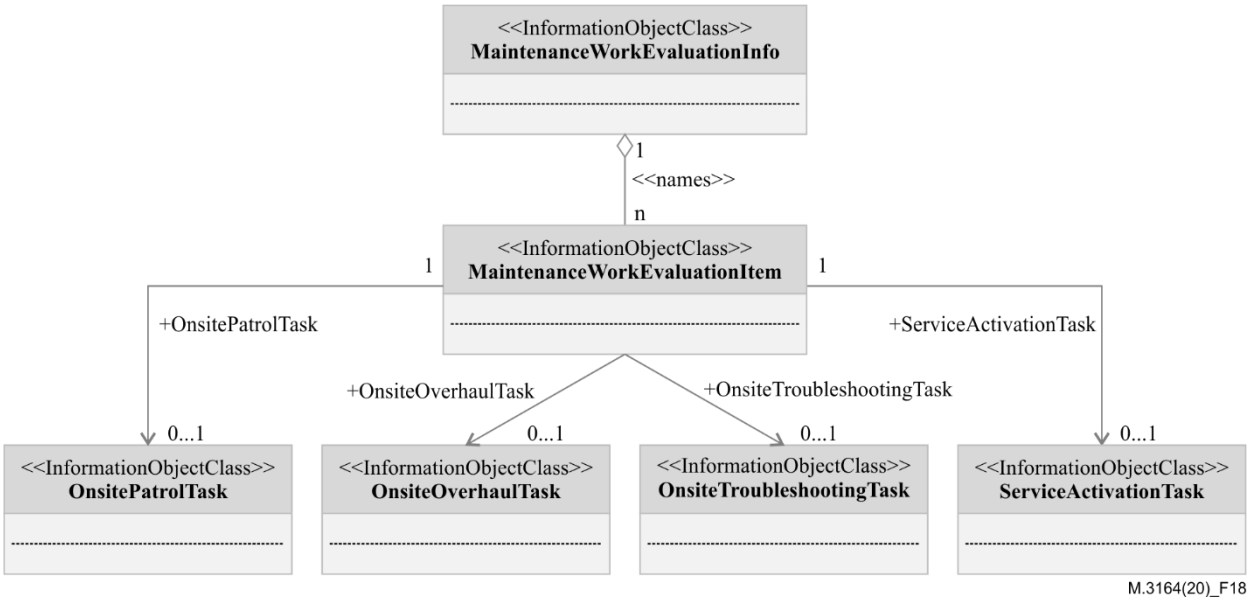

Figure 18 – Relationship class diagram between the object classes related to maintenance work evaluation

In Figure 18, the information object classes related to maintenance work evaluation include MaintenanceWorkEvaluationItem and objects related to maintenance work evaluation, that is, on-site patrol activities, on-site overhaul activities, on-site troubleshooting activities, and service activation activities. Each evaluation item corresponds to a activity, therefore, MaintenanceWorkEvaluationItem and OnsitePatrolTask, OnsiteOverhaulTask, OnsiteTroubleshootingTask, ServiceActivationTask are one-to-one and one-way relationships.

6.8.2 Object class information model and attribute description

6.8.2.1 Top-level class about maintenance work evaluation (MaintenanceWorkEvaluationInfo)

6.8.2.1.1 Definition

The *MaintenanceWorkEvaluationInfo* management entity describes basic information related to top-level class about maintenance work evaluation.

6.8.2.1.2 Attributes

Table 46 describes the attribute properties related to MaintenanceWorkEvaluationInfo:

Table 46

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
maintenanceWorkEvalInfoID	M	M	–	–	M
maintenanceWorkEvalItemList	M	M	M	O	M

Table 47 shows the specific description of the attributes related to MaintenanceWorkEvaluationInfo:

Table 47

Attribute name	Type	Explanation
maintenanceWorkEvalInfoID	String	Unique identifier related to MaintenanceworkEvalutionInfo
maintenanceWorkEvalItemList	SEQUENCE OF String	List of maintenance work evaluation items

6.8.2.1.3 Notifications

Table 48 shows the specific description of notifications related to MaintenanceWorkEvaluationInfo:

Table 48

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.8.2.2 Information object class related to maintenance work evaluation item (MaintenanceWorkEvaluationItem)

The information model related to MaintenanceWorkEvaluationItem is shown in Figure 19.

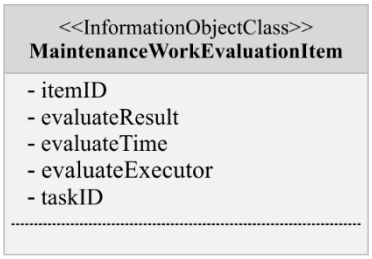

Figure 19 – Information model related to MaintenanceWorkEvaluationItem

6.8.2.2.1 Definition

This management entity describes basic information about evaluating maintenance work.The use made of individual attributes and notification is detailed below:

– evaluateResult: Represents results about evaluation of maintenance work;

– taskID: Represents task objects to be evaluated.

An attribute value change notification shall be emitted when the value of the itemID, the evaluateResult or the taskID is changed.

6.8.2.2.2 Attributes

Table 49 describes the attribute properties related to MaintenanceWorkEvaluationItem:

Table 49

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
itemID	M	M	–	–	M
evaluateResult	M	M	M	O	M
evaluateTime	M	M	M	O	M
evaluateExecutor	M	M	M	O	M
taskID	O	M	M	O	–

Table 50 shows the specific description of the attributes related to MaintenanceWorkEvaluationItem:

Table 50

Attribute name	Type	Explanation
itemID	String	Unique identifier, Maintenance work evaluation item
evaluateResult	String	Result of evaluation, expressed in stars
evaluateTime	Date	Time of evaluation
evaluateExecutor	String	Personnel ID, robot number, etc. for evaluation
taskID	String	Corresponding activity identification for evaluation, can be patrol, overhaul, troubleshooting, or service activation task

6.8.2.2.3 Notifications

Table 51 shows the specific description of notifications related to MaintenanceWorkEvaluationItem:

Table 51

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.9 Smart maintenance assistant toolkit management information model

6.9.1 Relationship class diagram between object classes

The relationship class diagram between object classes related to management of smart maintenance assistant toolkit (SMAT) is shown in Figure 20.

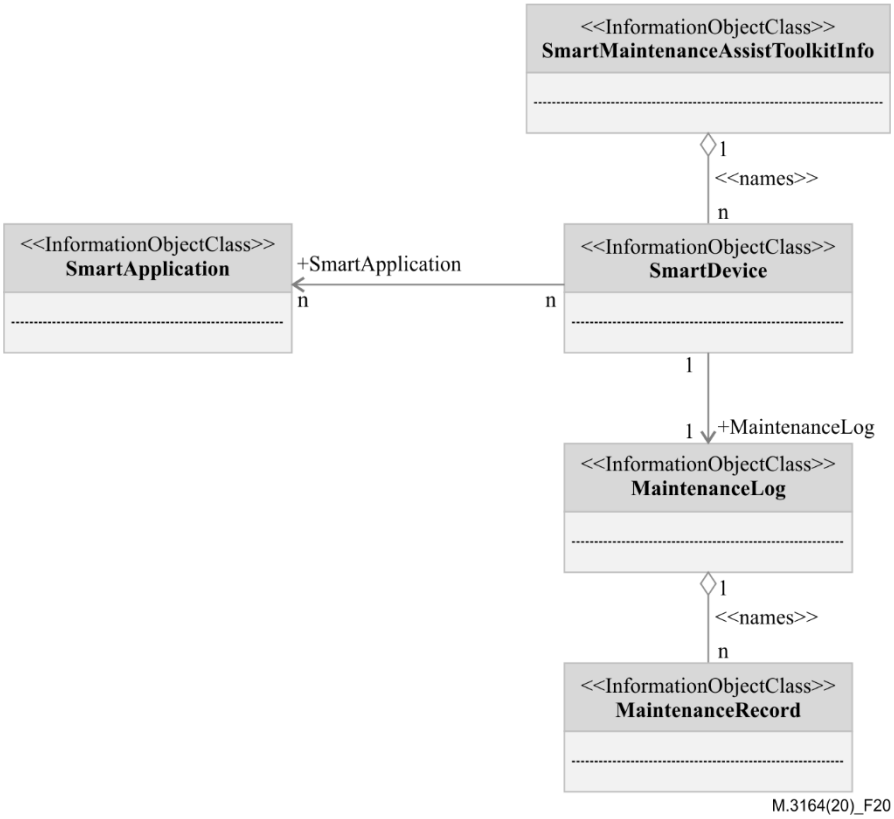

Figure 20 – Relationship class diagram between the object classes related to management of SMAT

In Figure 20, the information object classes related to management of SMAT include SmartDevice, SmartApplication, MaintenanceLog and MaintenanceRecord. Multiple smart applications are install on smart devices. Each smart device is associated with a maintenance log. Each time smart device is maintained, one or more records are added to the log. Therefore, SmartDevice and SmartApplication are many-to-many and one-way association relationships, and SmartDevice and MaintenanceLog are one-to-one and one-way association relationship. MaintenanceLog and MaintenanceRecord are one-to-many contain relationships.

6.9.2 Object class information model and attribute description

6.9.2.1 Information object class related to smart maintenance assistant toolkit management (SmartMaintenanceAssistToolkitInfo)

6.9.2.1.1 Definition

The *SmartMaintenanceAssistToolkitInfo* management entity describes basic information related to the top-level class about SMAT management.

6.9.2.1.2 Attributes

Table 52 describes the attribute properties related to SmartMaintenanceAssistToolkitInfo:

Table 52

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
smartMATInfoID	M	M	–	–	M
deviceSet	M	M	M	O	M

Table 53 shows the specific description of the attributes related to SmartMaintenanceAssistToolkitInfo:

Table 53

Attribute name	Type	Explanation
smartMATInfoID	String	Unique identifier related to SmartMaintenanceAssistToolkitInfo
deviceSet	SET OF String	Smart device set contained in SMAT

6.9.2.1.3 Notifications

Table 54 shows the specific description of notifications related to SmartMaintenanceAssistToolkitInfo:

Table 54

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.9.2.2 Information object class related to smart devices (SmartDevice)

The information model related to SmartDevice is shown in Figure 21.

Figure 21 – Information model related to SmartDevice

6.9.2.2.1 Definition

This managed entity describes basic information related to smart devices.

An attribute value change notification shall be emitted when the value of the deviceID, the devType, the devName, the devModele, the devAddress, the devSerialnum, the systemVersion, the currentStatus, the logID or applicationSet is changed.

6.9.2.2.2 Attributes

Table 55 describes the attribute properties related to SmartDevice:

Table 55

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
deviceID	M	M	–	–	M
devType	M	M	M	O	M
devName	M	M	M	O	M
devModele	M	M	M	O	M
devAddress	M	M	M	O	M
devSerialnum	M	M	M	O	M
devStorage	M	M	M	O	M
systemVersion	M	M	M	O	M
currentStatus	M	M	M	O	M
logID	M	M	M	O	M
applicationSet	M	M	M	O	M

Table 56 shows the specific description of the attributes related to SmartDevice:

Table 56

Attribute name	Type	Explanation
deviceID	String	Unique identifier, Device number
devType	ENUM	[handhold|headwear|else]
devName	String	Name of smart device
devModele	String	Modele of smart device
devAddress	String	Address of smart device, such as MAC
devSerialnum	String	Serial number of smart device
devStorage	String	Includes device RAM, ROM and storage capacity
systemVersion	ENUM	[android|ios|linux|windowMobile|else]
currentStatus	ENUM	[used|unused]
logID	String	Maintenance log ID of smart device
applicationSet	SET OF String	Application set in smart device

6.9.2.2.3 Notifications

Table 57 shows the specific description of notifications related to SmartDevice:

Table 57

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.9.2.3 Information object class related to smart application (SmartApplication)

The information model related to SmartApplication is shown in Figure 22.

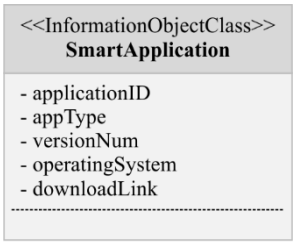

Figure 22 – Information model related to SmartApplication

6.9.2.3.1 Definition

This managed entity describes basic information related to smart application.

An attribute value change notification shall be emitted when the value of the applicationID, the appType, the versionNum, the operatingSystem or the downloadLink is changed.

6.9.2.3.2 Attributes

Table 58 describes the attribute properties related to SmartApplication:

Table 58

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
applicationID	M	M	–	–	M
appType	M	M	M	O	M
versionNum	M	M	M	O	M
operatingSystem	M	M	M	O	M
downloadLink	M	M	M	O	M

Table 59 shows the specific description of the attributes related to SmartApplication:

Table 59

Attribute Name	Type	Explanation
applicationID	String	Unique identifier, Application number
appType	ENUM	[handhold|headwear|else]
versionNum	String	Major version number
operatingSystem	ENUM	[android|ios|linux|windowMobile|else]
downloadLink	String	Download link address of installation package

6.9.2.3.3 Notifications

Table 60 shows the specific description of notifications related to SmartApplication:

Table 60

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.9.2.4 Information object class related to maintenance log of smart devices (MaintenanceLog)

The information model related to MaintenanceLog is shown in Figure 23.

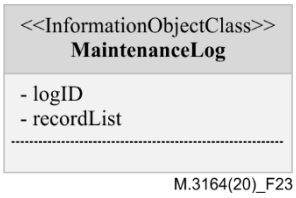

Figure 23 – Information model related to MaintenanceLog

6.9.2.4.1 Definition

This managed entity describes information related to the log for maintaining smart devices. The use made of individual attributes and notification is detailed below:

– recordList: Represents items in log.

An attribute value change notification shall be emitted when the value of the logID or the recordList is changed.

6.9.2.4.2 Attributes

Table 61 describes the attribute properties related to MaintenanceLog:

Table 61

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
logID	M	M	–	–	M
recordList	M	M	M	O	M

Table 62 shows the specific description of the attributes related to MaintenanceLog:

Table 62

Attribute name	Type	Explanation
logID	String	Unique identifier, Log of maintenance number
recordList	SEQUENCE OF String	List of records

6.9.2.4.3 Notifications

Table 63 shows the specific description of notifications related to MaintenanceLog:

Table 63

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

6.9.2.5 Information object class related to maintenance record of smart devices (MaintenanceRecord)

The information model related to MaintenanceRecord is shown in Figure 24.

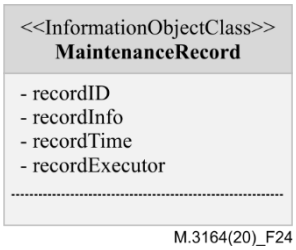

Figure 24 – Information model related to MaintenanceRecord

6.9.2.5.1 Definition

This managed entity describes information about the record for maintaining smart devices. The use made of individual attributes and notification is detailed below:

– recordInfo: Represents specific record information.

An attribute value change notification shall be emitted when the value of the recordID or the recordInfo is changed.

6.9.2.5.2 Attributes

Table 64 describes the attribute properties related to MaintenanceRecord:

Table 64

Attribute name	Support qualifier	Read qualifier	Write qualifier	Invariant qualifier	Note qualifier
recordID	M	M	–	–	M
recordInfo	M	M	M	O	M
recordTime	O	M	M	O	–
recordExecutor	O	M	M	O	–

Table 65 shows the specific description of the attributes related to MaintenanceRecord:

Table 65

Attribute name	Type	Explanation
recordID	String	Unique identifier, Maintenance record number
recordInfo	String	Recorded specific information
recordTime	Date	Time of record
recordExecutor	String	Personnel ID, robot number, etc. for recording

6.9.2.5.3 Notifications

Table 66 shows the specific description of notifications related to MaintenanceRecord:

Table 66

Name	Qualifier	Description
objectCreation	M	create object
objectDeletion	M	delete object
attributeValueChange	O	change the value of attribute

Appendix I

Examples of instances for information object classes

(This appendix does not form an integral part of this Recommendation.)

According to the definition of objects in each module in clause 6, examples of instances for each information object class are provided in the following clauses.

I.1 Overview of all the instances

Figure I.1 gives an overview of the relationships among all the example instances.

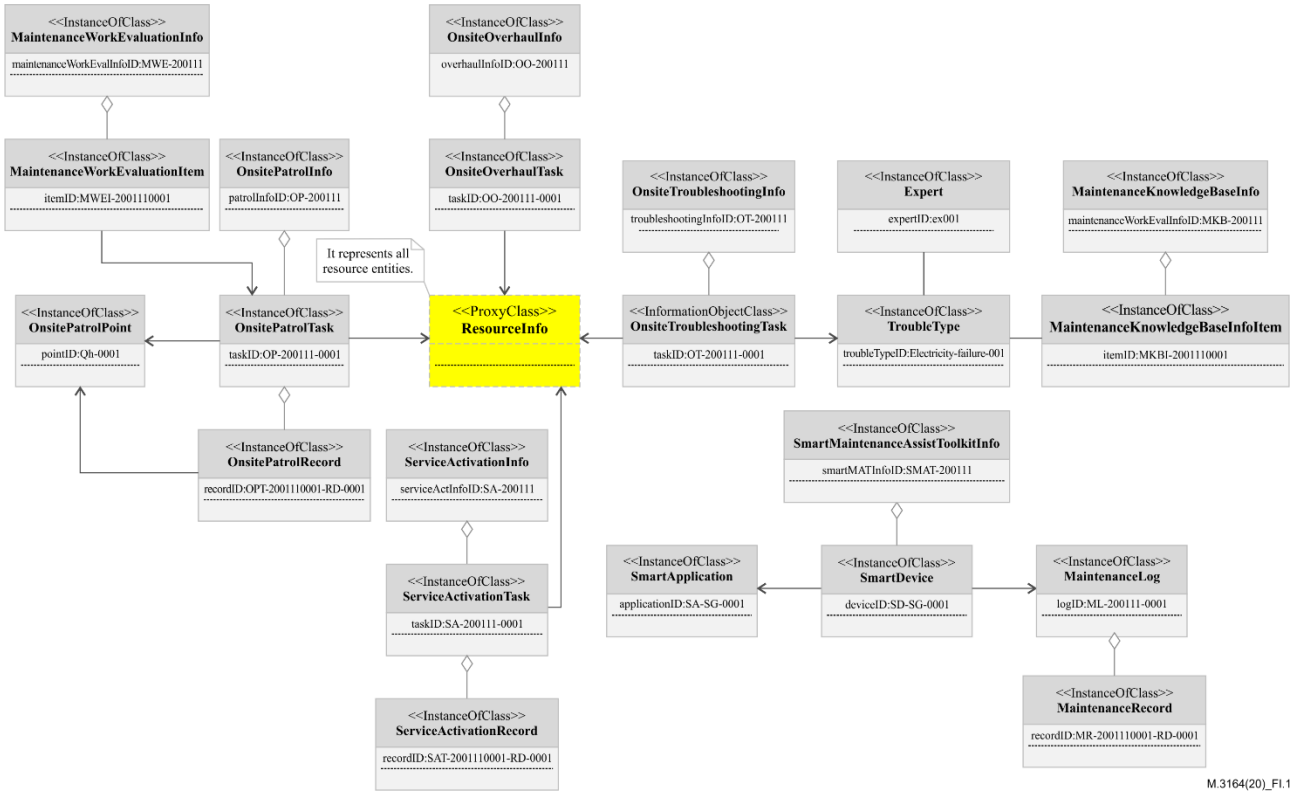

Figure I.1 – Relationship diagram for all the example instances

I.2 Examples related to on-site patrol information model

I.2.1 OnsitePatrolInfo

Table I.1 shows an instance of OnsitePatrolInfo:

Table I.1

OnsitePatrolInfo	
Attribute name	**Attribute value**
patrolInfoID	OP-200111
patrolTaskList	[OPT-200111-0001, OPT-200111-0002]

I.2.2 OnsitePatrolTask

Table I.2 shows an instance of OnsitePatrolTask:

Table I.2

OnsitePatrolTask	
Attribute name	**Attribute value**
taskID	OPT-200111-0001
taskType	routine
taskStatus	finished
patrolExecutor	czl0001
startTime	2020-01-11 09:17
endTime	2020-01-11 09:30
pointSequence	[Qionghai Station, Wenchang Station]
recordList	[OPT-200111-0001-RD-0001, OPT-200111-0001-RD-0002]
orderID	TQX-HN-SY-2001110001
resourceSet	{Intermediate adjustment 1705 computer room at Qionghai station (rack: 3-B-06, network element code: intermediate adjustment 2), intermediate adjustment battery room at Wenchang station (rack: 4-A-05, network element code: ATC Communication power cabinet)}

I.2.3 OnsitePatrolPoint

Table I.3 shows an instance of OnsitePatrolPoint:

Table I.3

OnsitePatrolPoint	
Attribute name	**Attribute value**
pointID	Qh-0001
pointType	device
patrolDes	Patrol the power status of the equipment in the 1705 computer room at Qionghai station (rack: 3-B-06, network element code: intermediate adjustment 2) to ensure the normal link between Qionghai Station and Wenchang Station
coordinates	{19.2273, 110.4690, 13.0000, GCS_CN_2000}
pointLabel	The QR code of reck (3-B-06)

I.2.4 OnsitePatrolRecord

Table I.4 shows an instance of OnsitePatrolRecord:

Table I.4

OnsitePatrolRecord	
Attribute name	**Attribute value**
recordID	OPT-200111-0001-RD-0001
recordExecutor	czl0001
recordTime	2020-01-11 09:20
status	normal
recordInfo	Intermediate adjustment 1705 computer room at Qionghai station (rack: 3-B-06, network element code: intermediate adjustment 2): when the device is in operation and the power switch on the PIU power board is turn off, the voltage values viewed are within the allowed range
pointID	Qh-0001

I.3 Examples related to on-site overhaul information model

I.3.1 OnsiteOverhaulInfo

Table I.5 shows an instance of OnsiteOverhaulInfo:

Table I.5

OnsiteOverhaulInfo	
Attribute name	**Attribute value**
overhaulInfoID	OO-200111
overhaulTaskList	[OOT-200111-0001, OOT-200111-0002]

I.3.2 OnsiteOverhaulTask

Table I.6 shows an instance of OnsiteOverhaulTask:

Table I.6

OnsiteOverhaulTask	
Attribute name	**Attribute value**
taskID	OOT-200111-0001
overhaulExecutor	czl0001
overhaulStatus	finished
overhaulDes	Overhaul the abnormal power state of the equipment in the intermediate adjustment 1705 computer room at Qionghai Station (rack: 3-B-06, network element code: intermediate adjustment 2) to restore the normal link between Qionghai Station and Wenchang Station
timeInfo	{2020-01-11 10:00, 2020-01-11 10:30}
orderID	TQX-HN-SY-2001110002
resourceSet	{Intermediate adjustment 1705 computer room at Qionghai station (rack: 3-B-06, network element code: intermediate adjustment 2), intermediate adjustment battery room at Wenchang station (rack: 4-A-05, network element code: ATC Communication power cabinet)}

I.4 Examples related to on-site troubleshooting information model

I.4.1 OnsiteTroubleshootingInfo

Table I.7 shows an instance of OnsiteTroubleshootingInfo:

Table I.7

OnsiteTroubleshootingInfo	
Attribute name	**Attribute value**
troubleshootingInfoID	OT-200111
troubleshootingTaskList	[OTT-200111-0001, OTT-200111-0002]

I.4.2 OnsiteTroubleshootingTask

Table I.8 shows an instance of OnsiteTroubleshootingTask:

Table I.8

OnsiteTroubleshootingTask	
Attribute name	**Attribute value**
taskID	OTT-200111-0001
occurTime	2020-01-11 10:00
status	finished
troubleDes	Intermediate adjustment 1705 computer room at Qionghai station (rack: 3-B-06, network element code: intermediate adjustment 2): Power is disconnected and business is interrupted
confirmInfo	{lxm, 2020-01-11 10:10}
maintenanceInfo	{czl0001, Disconnect the power switch to check the internal power supply equipment and cables, 2020-01-11 10:30}
troubleTypeID	electricity failure-001
orderID	TQX-HN-SY-2001110003
resourceSet	{Intermediate adjustment 1705 computer room at Qionghai station (rack: 3-B-06, network element code: intermediate adjustment 2), intermediate adjustment battery room at Wenchang station (rack: 4-A-05, network element code: ATC Communication power cabinet)}

I.4.3 TroubleType

Table I.9 shows an instance of TroubleType:

Table I.9

TroubleType	
Attribute name	**Attribute value**
troubleTypeID	Electricity-failure-001
troubleLevel	common
troubleTypeDes	The power supply fuse is damaged
solution	Turn off the power, find out the reason for the fuse and replace with a new fuse
expertSet	{ex001, ex002}

I.4.4 Expert

Table I.10 shows an instance of Expert:

Table I.10

Expert	
Attribute name	**Attribute value**
expertID	ex001
expertAddtionInfo	{Wang Gang, male, 1976}
expertGroup	OT group
expertDepartment	power supply department
email	Wanggang123@163.com
skillArea	power supply area
availableRate	0.85

I.5 Examples related to service activation information model

I.5.1 ServiceActivationInfo

Table I.11 shows an instance of ServiceActivationInfo:

Table I.11

ServiceActivationInfo	
Attribute name	**Attribute value**
serviceActInfoID	SA-200111
serviceActTaskList	[SAT-200111-0001, SAT-200111-0002]

I.5.2 ServiceActivationTask

Table I.12 shows an instance of ServiceActivationTask:

Table I.12

ServiceActivationTask	
Attribute name	**Attribute value**
taskID	SAT-200111-0001
serviceActDes	unplug and insert fiber
executeInfo	{czl0001, 2020-01-11 10:30, finished}
recordList	[SAT-2001110001-RD-0001: Pull out the fiber jumper, SAT-2001110001-RD-0002: Insert fiber jumper]
orderID	TQX-HN-SY-2001110004
resourceSet	{Intermediate adjustment 1705 computer room at Qionghai station (rack: 3-B-06, network element code: intermediate adjustment 2), intermediate adjustment battery room at Wenchang station (rack: 4-A-05, network element code: ATC Communication power cabinet)}

I.5.3 ServiceActivationRecord

Table I.13 shows an instance of ServiceActivationRecord:

Table I.13

ServiceActivationRecord	
Attribute name	**Attribute value**
recordID	SAT-2001110001-RD-0001
recordInfo	Intermediate adjustment 1705 computer room at Qionghai Station (rack: 3-B-06, network element code: middle transfer 2): Unplug and insert the optical fiber of the relevant equipment
submitExecutor	czl0001
submitTime	2020-01-11 11:00

I.6 Examples related to maintenance knowledge base information model

I.6.1 MaintenanceKnowledgeBaseInfo

Table I.14 shows an instance of MaintenanceKnowledgeBaseInfo:

Table I.14

MaintenanceKnowledgeBaseInfo	
Attribute name	**Attribute value**
maintenanceKnowledgeBaseInfoID	MKB-200111
maintenanceKnowledgeBaseItemList	[MKBI-200111-0001, MKBI-200111-0002]

I.6.2 MaintenanceKnowledgeBaseItem

Table I.15 shows an instance of MaintenanceKnowledgeBaseItem:

Table I.15

MaintenanceKnowledgeBaseInfo	
Attribute name	**Attribute value**
itemID	MKBI-200111-0001
knowledgeDes	This knowledge item is suitable for power failure detection
knowledgeType	troubleshoot
knowledgeStatus	checkedOK
submitInfo	{czl0001, 2020-01-11 10:25}
checkInfo	{zs00001, 2020-01-11 13:00}

I.7 Examples related to maintenance work evaluation information model

I.7.1 MaintenanceWorkEvaluationInfo

Table I.16 shows an instance of MaintenanceWorkEvaluationInfo:

Table I.16

MaintenanceWorkEvaluationInfo	
Attribute name	**Attribute value**
maintenanceWorkEvalInfoID	MWE-200111
maintenanceWorkEvalItemList	[MWEI-200111-0001, MWEI-200111-0002]

I.7.2 MaintenanceWorkEvaluationItem

Table I.17 shows an instance of MaintenanceWorkEvaluationItem:

Table I.17

MaintenanceWorkEvaluationItem	
Attribute name	**Attribute value**
itemID	MWEI-200111-0001
evaluateResult	****
evaluateTime	2020-01-11 12:00
evaluateExecutor	ls0001
taskID	OPT-200111-0001

I.8 Examples related to smart maintenance assistant toolkit management information model

I.8.1 SmartMaintenanceAssistToolkitInfo

Table I.18 shows an instance of SmartMaintenanceAssistToolkitInfo:

Table I.18

SmartMaintenanceAssistToolkitInfo	
Attribute name	**Attribute value**
smartMATInfoID	SMAT-200111
deviceSet	{SD-SG-0001, SD-SG-0002, SD-SG-0003, SD-SG-0004}

I.8.2 SmartDevice

Table I.19 shows an instance of SmartDevice:

Table I.19

SmartDevice	
Attribute name	**Attribute value**
deviceID	SD-SG-0001
devType	headwear
devName	smart glasses
devModele	AR Smart Model
devAddress	MAC: 08:00:20:0A:8C:6D
devSerialNum	074416Z31580093AE
devStorage	RAM:4GB ROM:32GB storage capability:32G
systemVersion	android
currentStatus	used
logID	ML-200111-0001
applicationSet	{SA-SG-0001, SA-SG-0002}

I.8.3 SmartApplication

Table I.20 shows an instance of SmartApplication:

Table I.20

SmartApplication	
Attribute name	**Attribute value**
applicationID	SA-SG-0001
appType	headwear
versionNum	2.0
operatingSystem	android
downloadLink	https://ai.baidu.com/easydl/lite?track=cp:ainsem|pf:pc|pp:easyDL|pu:easyDL-tuxiang-tuozhan|ci:|kw:10001404

I.8.4 MaintenanceLog

Table I.21 shows an instance of MaintenanceLog:

Table I.21

MaintenanceLog	
Attribute name	**Attribute value**
logID	ML-200111-0001
recordList	[ML-200111-0001-RD-0001, ML-200111-0001-RD-0002]

I.8.5 MaintenanceRecord

Table I.22 shows an instance of MaintenanceRecord:

Table I.22

MaintenanceRecord	
Attribute name	**Attribute value**
recordID	ML-200111-0001-RD-0001
recordInfo	Smart glasses take pictures of the device and upload them
recordTime	2020-01-11 13:00
recordExecutor	czl0001

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