

International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

M.3164

(07/2020)

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

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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

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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:

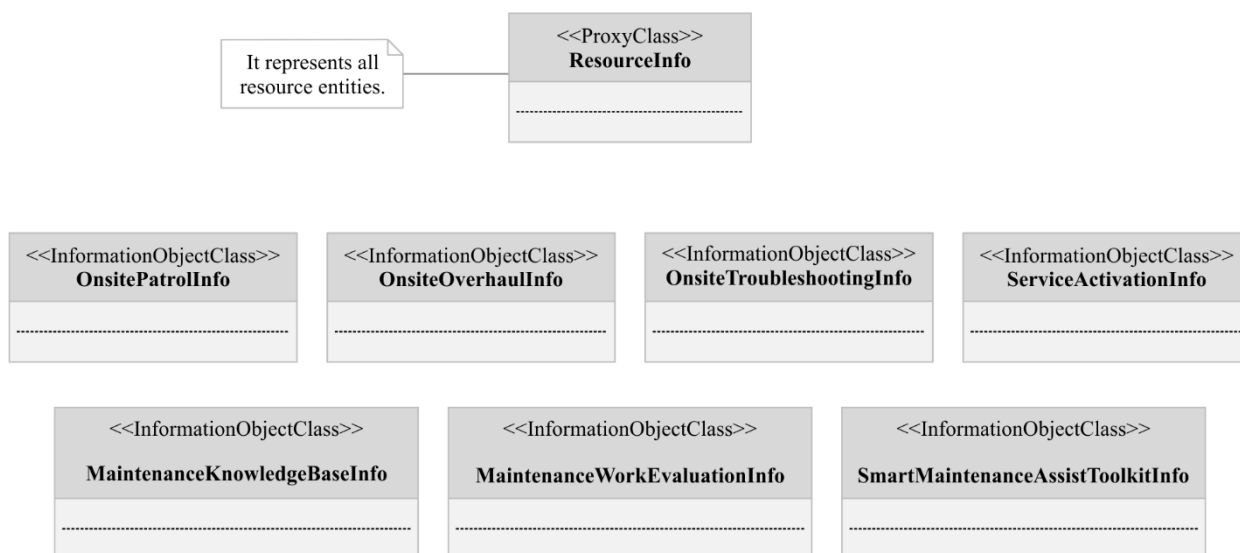
ID	Identifier
MAC	Media Access Control
RAM	Random Access Memory
ROM	Read Only Memory
SMAT	Smart Maintenance Assistant Toolkit
TSMS	Telecommunication Smart Maintenance System
UML	Unified Modeling Language

5 Conventions

None.

6 Information model for telecommunication smart maintenance

6.1 Top-level object class relationship diagram



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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.

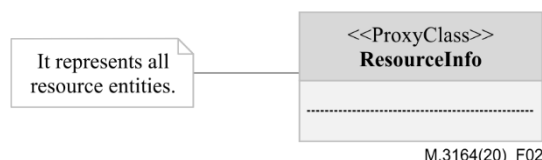


Figure 2 – Information model related to ResourceInfo

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.

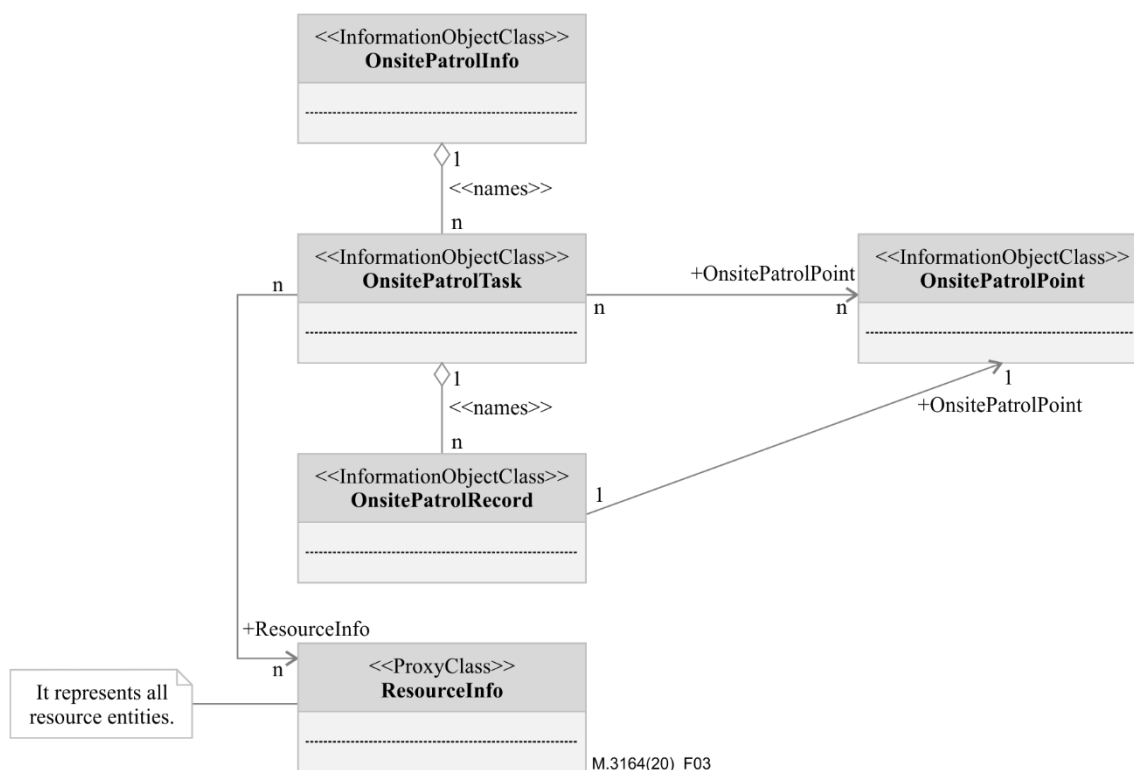


Figure 3 – Relationship class diagram between object classes related to on-site patrol

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.

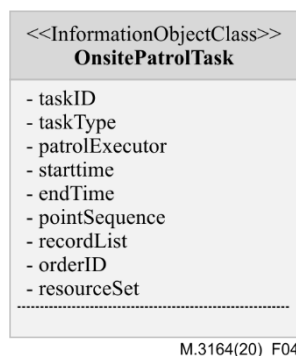


Figure 4 – Information model related to OnsitePatrolTask

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

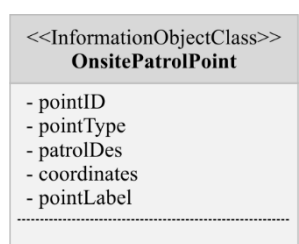
Table 6 shows the specific description of notifications of the site patrol activity:

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.



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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.



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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.

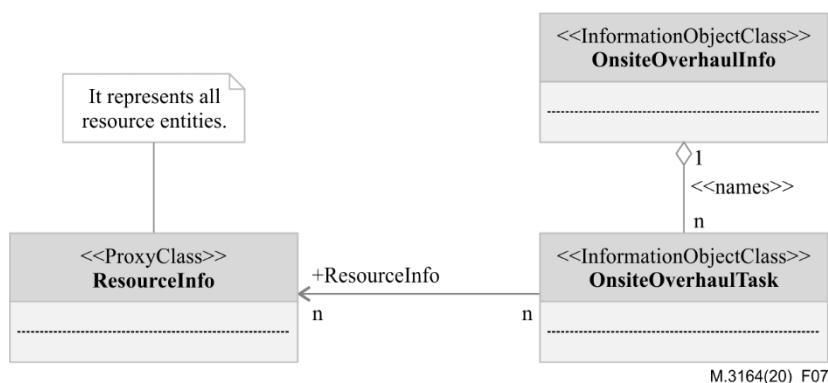


Figure 7 – Relationship class diagram between object classes related to on-site overhaul

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.

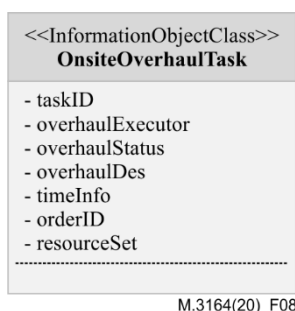


Figure 8 – Information model related to OnsiteOverhaulTask

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: