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Internet of Things (IoT) – Underwater acoustic sensor network (UWASN) – Network management system – Part 2: Underwater management information base (u-MIB)

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INTERNET OF THINGS (IoT) – UNDERWATER ACOUSTIC SENSOR NETWORK (UWASN) – NETWORK MANAGEMENT SYSTEM –

Part 2: Underwater management information base (u-MIB)

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The text of this International Standard is based on the following documents:

Draft	Report on voting
JTC1-SC41/288/FDIS	JTC1-SC41/296/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1, available at www.iec.ch/members_experts/refdocs and www.iso.org/directives.

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A list of all parts in the ISO/IEC 30142 series, published under the general title *Internet of Things (IoT) – Underwater acoustic sensor network (UWASN) – Network management system*, can be found on the IEC website.

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INTRODUCTION

Water covers approximately 70 % of the surface of the Earth. Modern technologies introduce new methods to monitor the body of water, such as pollution monitoring and detection. Underwater data gathering techniques require exploring the water environment, which can be most effectively performed by underwater acoustic sensor networks (UWASNs). Applications developed for the UWASNs can record underwater climate, detect and control water pollution, monitor marine biology, discover natural resources, detect pipeline leakages, monitor and find underwater intruders, perform strategic surveillance, and so on.

To build and apply the UWASN technology, most suitable methods for managing the network have been developed based on the ISO/IEC 30140 series. This document describes the network management outline and requirements appropriate to the UWASN under the constraints of an underwater physical environment.

The ISO/IEC 30142 series provides information such as requirements of an underwater network management system (U-NMS), functions supporting U-NMS, and components required for U-NMS in UWASN.

This document provides the underwater management information base (u-MIB) for the U-NMS. u-MIB is a hierarchical database specifically designed for managing the networks or devices in the underwater network management system of UWASN.

Various technical standards derived from the R&D results of the technical areas under the UWASN and underwater communication fields not covered by the ISO/IEC 30140 series are continuously proposed and developed.

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INTERNET OF THINGS (IoT) – UNDERWATER ACOUSTIC SENSOR NETWORK (UWASN) – NETWORK MANAGEMENT SYSTEM –

Part 2: Underwater management information base (u-MIB)

1 Scope

This document provides the underwater management information base (u-MIB) of the underwater network management system (U-NMS). It specifies the following:

– general requirements for constructing u-MIB in U-NMS;
– designing the managed objects of the manager and agent u-MIB;
– integrating the managed objects of the manager and agent u-MIB.

2 Normative references

There are no normative references in this document.

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3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
managed object
abstract representation of an underwater object or resource in u-MIB that is managed using an underwater network management system

3.2
managed objects
collection of underwater objects or resources that are defined in the underwater management information base (u-MIB)

Note 1 to entry: The managed objects (MOs) are the component used for exchanging the information between manager and agent in U-NMS.

3.3
management protocol
protocol used for carrying information between the manager and agent in U-NMS

3.4
TABLE
data type that holds a collection of information related to underwater networks and underwater devices

EXAMPLE The notification record.

3.5
OBJID
data type that holds the unique identity of each managed object

4 Abbreviated terms

MO	managed object
MOs	managed objects
MIB	management information base
OID	object identifier
u-MIB	underwater management information base
U-NMS	underwater network management system
UUV	unmanned underwater vehicle
UWA-CH	underwater acoustic cluster head
UWA-GW	underwater acoustic gateway
UWA-SNode	underwater acoustic sensor node

5 u-MIB overview and basic concepts

5.1 u-MIB definition

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Underwater management information base (u-MIB) is a database specifically designed for managing the elements or entities in the underwater network management system (U-NMS). Figure 1 shows the elements of U-NMS where u-MIB is included. The u-MIB is included in the elements such as a manager and an agent.

– In U-NMS, the manager is the program installed in the devices to control the whole functions of underwater networks.
– The agent is the program that is bundled inside the underwater devices such as UWA-GW, UWA-CH, UUV, UWA-SNode, etc.
– Management protocol defines the format of a packet exchange between a manager and an agent in U-NMS.
– u-MIB creates the collection of managed objects (MOs) that uses the structured format for defining the name and objects which are adapted to U-NMS.

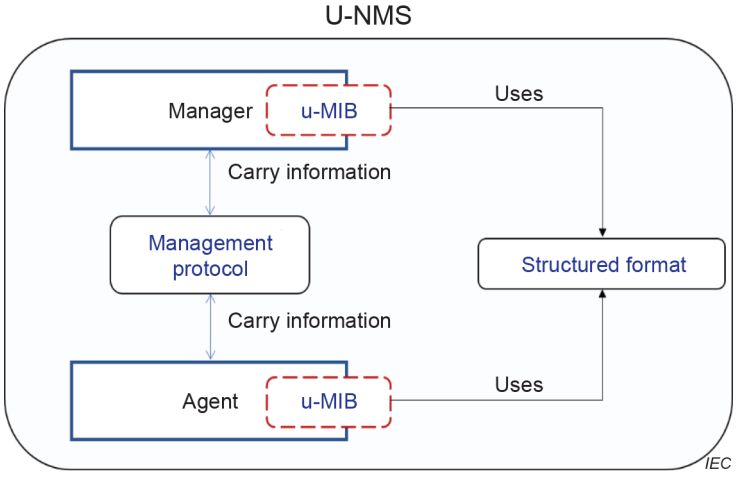

Figure 1 – Elements of u-MIB in U-NMS

5.2 Necessity of u-MIB in U-NMS

The environmental condition of underwater networks is considerably different from that of terrestrial area networks. Hence, the underwater network management system is necessary to handle the networks and devices in the underwater environment. In this case, it is difficult to adapt the legacy management information base (MIB) to the underwater environment because of the following factors.

a) The resource availability of underwater devices is extremely different from terrestrial devices.

b) MIB in terrestrial area networks holds a huge number of MOs. Hence, it is heavyweight and therefore it is difficult to adapt it to underwater devices .

Therefore, it is necessary to establish a unique underwater MIB based on the condition of the underwater environment by reducing the MOs. The reduced MOs can be termed "u-MIB", which has the key functions of U-NMS and is utilized to monitor the status of devices and networks in the underwater environment.

The specific roles of u-MIB in U-NMS are given below.

– Used as the database: u-MIB is used by the manager and agent for storing and retrieving information in U-NMS.

– Avoiding complexity: u-MIB is the lightweight version with limited MOs. Therefore, it is suitable for the U-NMS components such as manager and agent. This can avoid the complexity in U-NMS.

– Easy adaptation/management: Due to the dynamic changes in the underwater environment, the MOs need to be created based on the problems in U-NMS such as memory problems, battery problems, connection problems, etc. Therefore, the U-NMS components can be adapted or managed easily in the underwater environment.

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5.3 U-NMS system architecture for using u-MIB

Figure 2 shows the U-NMS system architecture for using u-MIB, which indicates the formation of u-MIB in U-NMS components such as the manager, and agent. The u-MIB is installed separately into the manager and agent components of U-NMS. The installed MOs are extremely different for both manager and agent u-MIB. The methods such as Get Request, Get Response, Set Request and Set Response are used by the manager to MOs from the agent. Trap is the notification message sent by the agent if some critical events occur in underwater devices such as the increase in temperature, reduced battery charge, out of memory space, etc. The exchange of messages between the manager and agents is performed using the network management protocol.

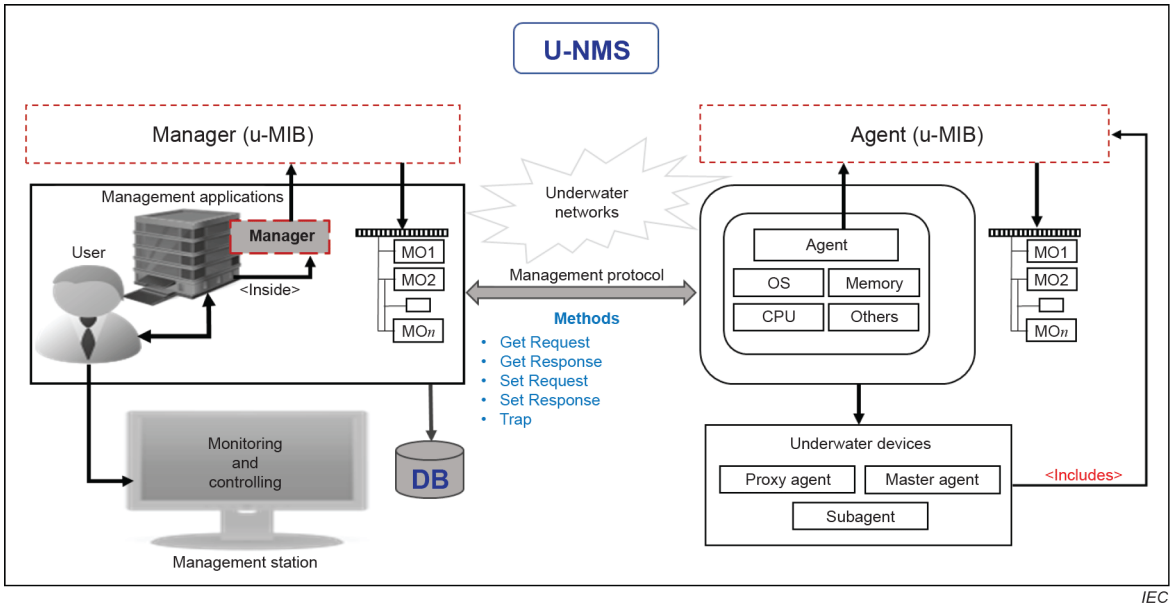

Figure 2 – U-NMS system architecture for using u-MIB

5.4 Structure of u-MIB

5.4.1 General

In general, the u-MIB is designed using the collection of MOs constructed in a hierarchical structure, as shown in Figure 3.

5.4.2 u-MIB objects

It is the collection of MOs in U-NMS. u-MIB objects comprise management information of each device in U-NMS built in a structured format.

5.4.3 u-MIB OIDs

The object identifiers (OIDs) in u-MIB allow the U-NMS to access information inside the U-NMS devices.

5.4.4 u-MIB OID hierarchy

The OIDs of u-MIB are described in a hierarchical format (*u-MIBObjects u_networks* and *u-MIBObjects u_devices*).

– *u-MIBObjects*;
– *u_networks;*
– *u_devices*.

u-MIB in U-NMS can be categorized into two sections.

a) *u_networks*: It is also known as underwater network information. In this case, OIDs are utilized to manage the network link between U-NMS devices.

   MOs of network management are built under the name *u_networks* in *u-MIBObjects*. For example, checking the connectivity between the devices.