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# Underwater Management Information Base (u-MIB)



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## Background (1)

### □ Underwater network management system (U-NMS)

- **The UWASN operates in a constrained underwater environment.**
  - Connected with smart underwater devices and networks.
  - So, it is necessary to manage the underwater devices and networks.
- **But the UWASN has several network management challenges listed as follows:**
  - Connectivity problem;
  - Bandwidth problem;
  - Battery management problem;
  - Memory management problem;
  - Device management problem, etc.
- **To overcome the network management challenges in underwater, the ISO/IEC 30142 is proposed.**
- **According to ISO/IEC 30142, the key elements of U-NMS are listed below:**
  - Management station;
  - Agent;
  - Underwater Management Information Base (u-MIB);
  - Management protocol.

## Background (2)

### □ Why u-MIB is important?

- **MIB: A management information base**
  - Database used for managing the entities in communication networks.
  - Used in the terrestrial network management system.
  - Protocol stack such as SNMP, CMIP, etc. uses MIB.
- **The MIB used for SNMP and CMIP is not applicable in the underwater environment due to the various reasons as listed below:**
  - Heavy weight, So the size of MIB needs to be reduced.
  - The managed objects (MOs) are different.
  - Total number of MOs need to be reduced to avoid complexity.
- **Therefore, it is necessary to design u-MIB for underwater network management system with lightweight design.**
- **The main purpose of u-MIB in this document is:**
  - To design the lightweight MIB named as u-MIB.
  - To support the protocol stack of U-NMS.

## Background (3)

### Comparison between SNMP vs TMN vs underwater management protocol

#### SNMP vs TMN vs underwater management protocol

Areas	SNMP	TMN	Underwater management protocol
<b>Reliability</b>	SNMP is based on UDP and can't guarantee delivery of data.	Support TCP and UDP, thus message delivery is guaranteed.	Can support only UDP and can't guarantee delivery of data.
<b>MIB language</b>	SMI used in SNMP	GDMO is the management interface language used in TMN.	Object description language can be used in underwater management protocol.
<b>Complexity</b>	SNMP has simple design and architecture.	Data modelling and abstraction are complex.	Management protocol design for underwater is more complex than terrestrial.
<b>Cost</b>	Cost effectively, because architecture is simple.	Costly due to complex architecture.	Development should be very costly due to complex architecture.
<b>Protocol stack</b>	SNMP is light weight because limited operations are used here.	CMIP is the protocol stack used in TMN, it is heavy because more operations are used here.	Underwater management protocol should be very light weight. So, limited operation needs to be considered in the underwater environment.
<b>Operations</b>	M-Get, M-set, M-action, M-create, M-delete, M-event-report	Get request, Get Response, Get next Request, Get next Response, Set Request, Get Set Response, Trap	Get Request, Get Response, Set Request, Set Response, Trap
<b>Functions</b>	FCAPS	FCAPS	FCAPSC (Refer to ISO/IEC 30142)

## Background (4)

### □ Why u-MIB is important?

#### ▪ Based on the comparison of SNMP, TMN and underwater management protocol

- Underwater architecture design is complex.
- The operations need to be reduced, when compare to SNMP or TMN (Refer to ISO/IEC 30142).
- MOs should be designed by considering the constrained environment.
- Underwater protocol design should be light weight.
- So, for the lightweight protocol it is necessary to design lightweight MIB.
- So the lightweight MIB is termed as u-MIB in this document.

### □ u-MIB Introduction

- Underwater management information base (u-MIB) is distributed information store specifically designed for underwater network management system.
- u-MIB contains the collection of managed objects (MOs).
- u-MIB is used for managing the objects in underwater network management system.
- The designing format of u-MIB is in a hierarchical tree like structure.
- u-MIB information can be accessed between the manager and agent using the management protocol as defined in ISO/IEC 30142.



# UWASN NMS Standards Development Roadmap

Name of the Standards	Nov.	May	Nov.	May	Nov.	May	Nov.	May	Nov.
	2018	2018	2019	2019	2020	2020	2020	2020	2020
<b>1. ISO/IEC 30142: UWASN- Network management system overview and requirements</b>	CDV	FDIS	IS						
<b>2. UNMS-Interworking</b>		NP	PWI	CDV	FDIS	IS			
<b>3. Underwater management information base (u-MIB)</b>		NP	PWI	CDV	FDIS	IS			
<b>4. U-NMS-Management protocol</b>				NP	PWI	CDV	FDIS	IS	

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## Scope

### □ Scope of the document

- This standard document contains the Underwater Management Information Base (u-MIB) of U-NMS. It also provides:
  - Framework for designing u-MIB;
  - Guidelines for defining Managed Object in U-NMS;
  - Guidelines to use u-MIB via management protocol.

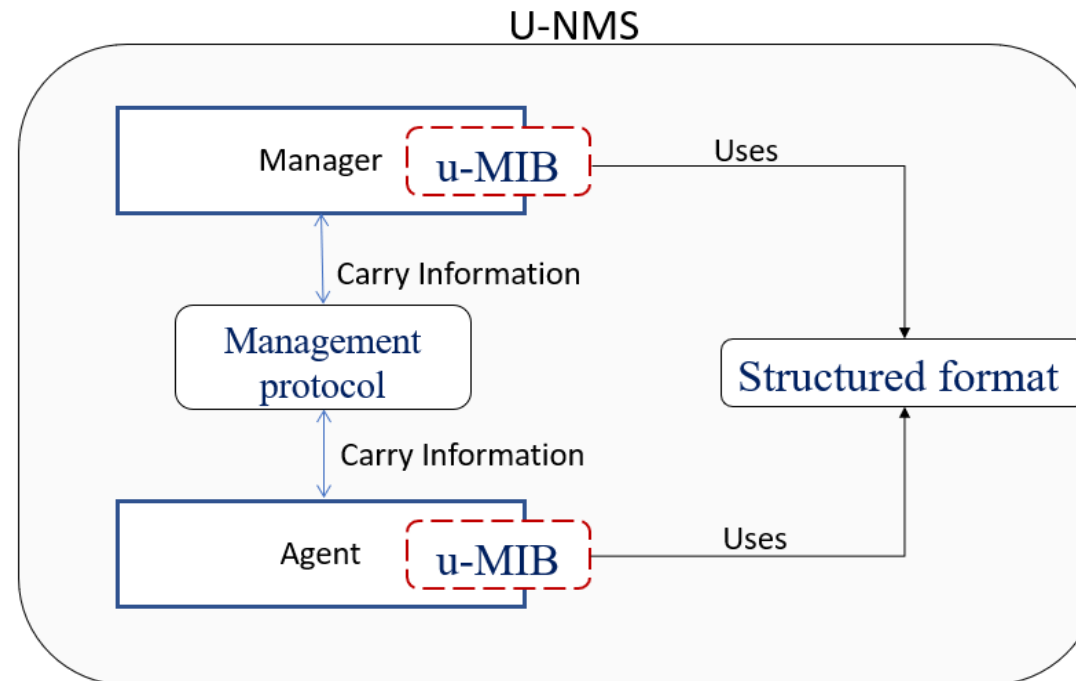
### □ Purpose of the document

- The main purpose of the document is to publish the underwater management information base (u-MIB) specifically designed for underwater network management system.

# u-MIB Overview

## □ u-MIB Definition

- **A hierarchical database that defines the information that a management system can request from an agent using management protocol**
  - In U-NMS, the element such as management protocol, structured format and u-MIB plays an important role.
  - Management protocol defines the format of packets exchanged between a manager and an agent.
  - Structured format is used for defining the name and objects in u-MIB.
  - u-MIB creates a collection of managed objects, their types and their relationships to each other in an entity to be managed.





# u-MIB in U-NMS architecture (1)

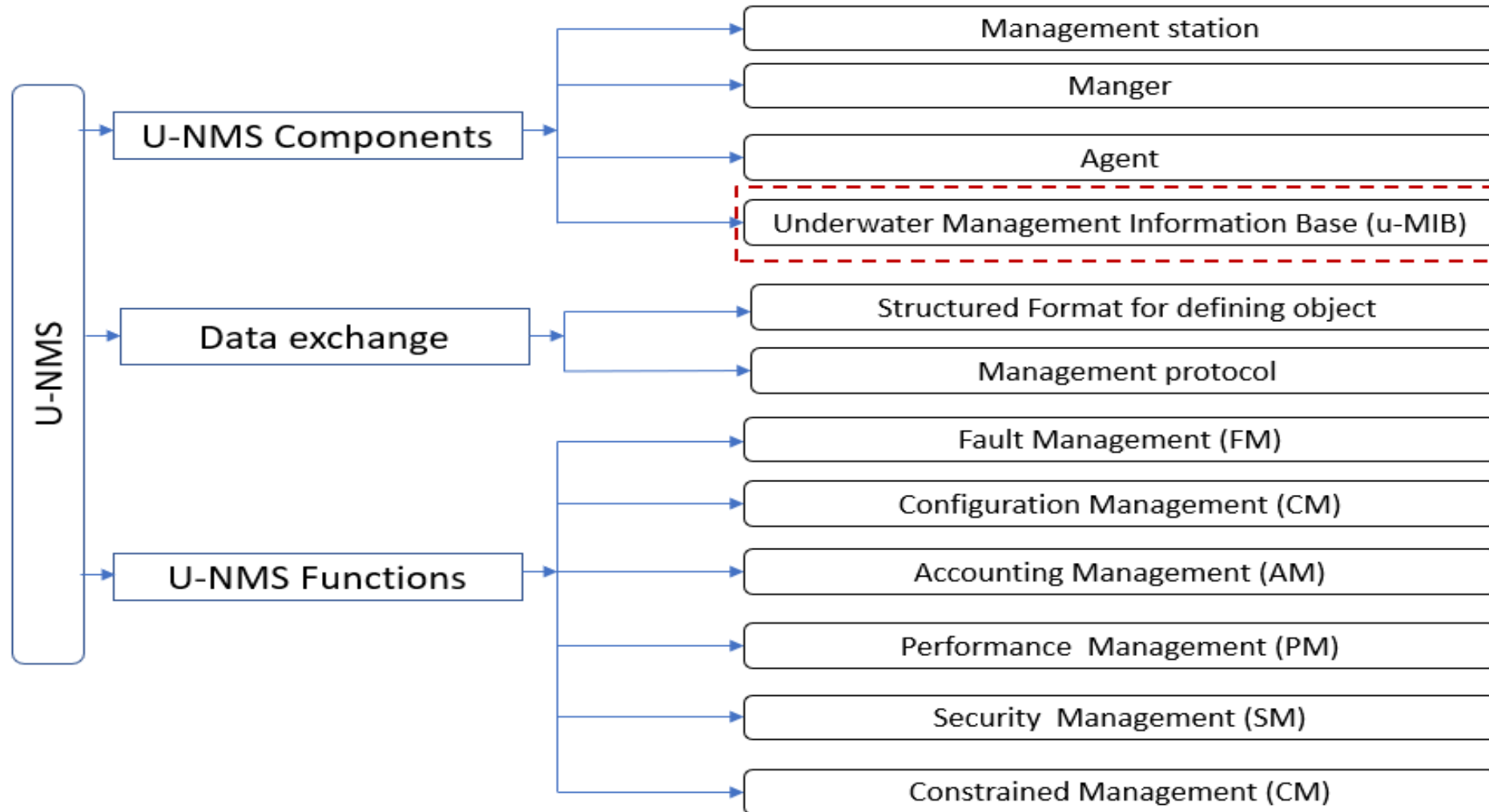


Figure 1. u-MIB in U-NMS

## u-MIB in U-NMS architecture (2)

- Figure 2 shows the U-NMS architecture designed with the u-MIB.
- u-MIBs are designed inside manager, proxy agent, master agent and subagent.

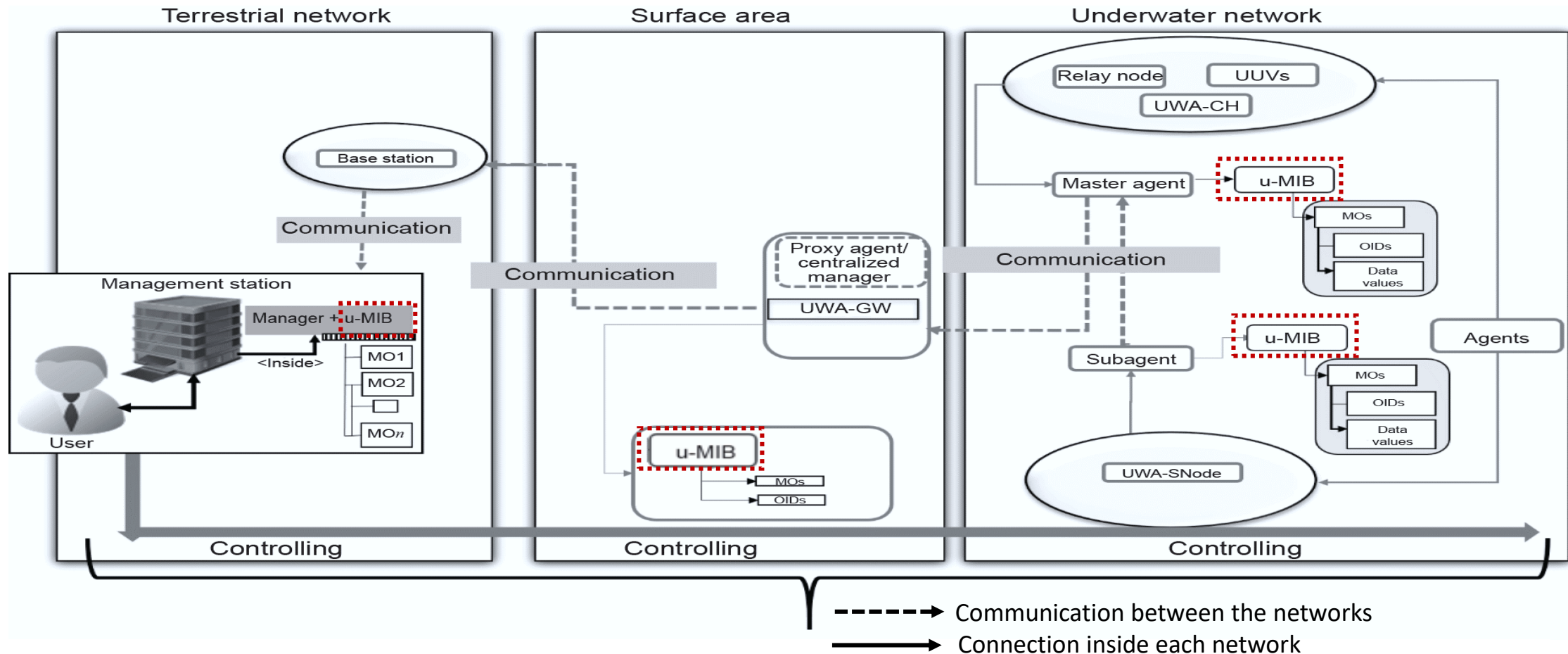


Figure 2. u-MIBs in U-NMS

# Guidelines for designing u-MIB framework

## ▪ As shown in Figure 3

- u-MIB includes collection of managed objects.
- Each **managed object (MO)** is designed using **object type, syntax, access and description**.
- **Interface description language** is used for defining MOs in u-MIB.
- **Structured format** is used for defining the name and objects in u-MIB.

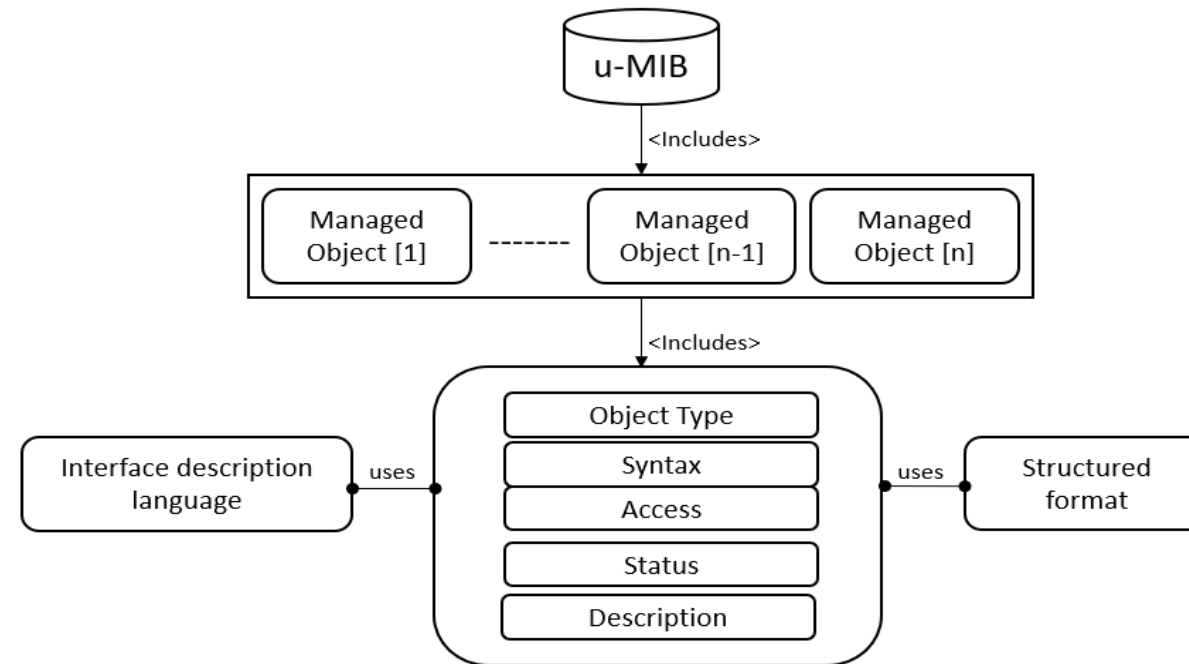


Figure 3. u-MIB framework

# Guidelines for designing u-MIB outline structure (1)

- In case of u-MIB, the outline structure should be designed with two steps:
  - **Manager u-MIB structure**
  - **Agent u-MIB structure**

## □ Manager u-MIB structure

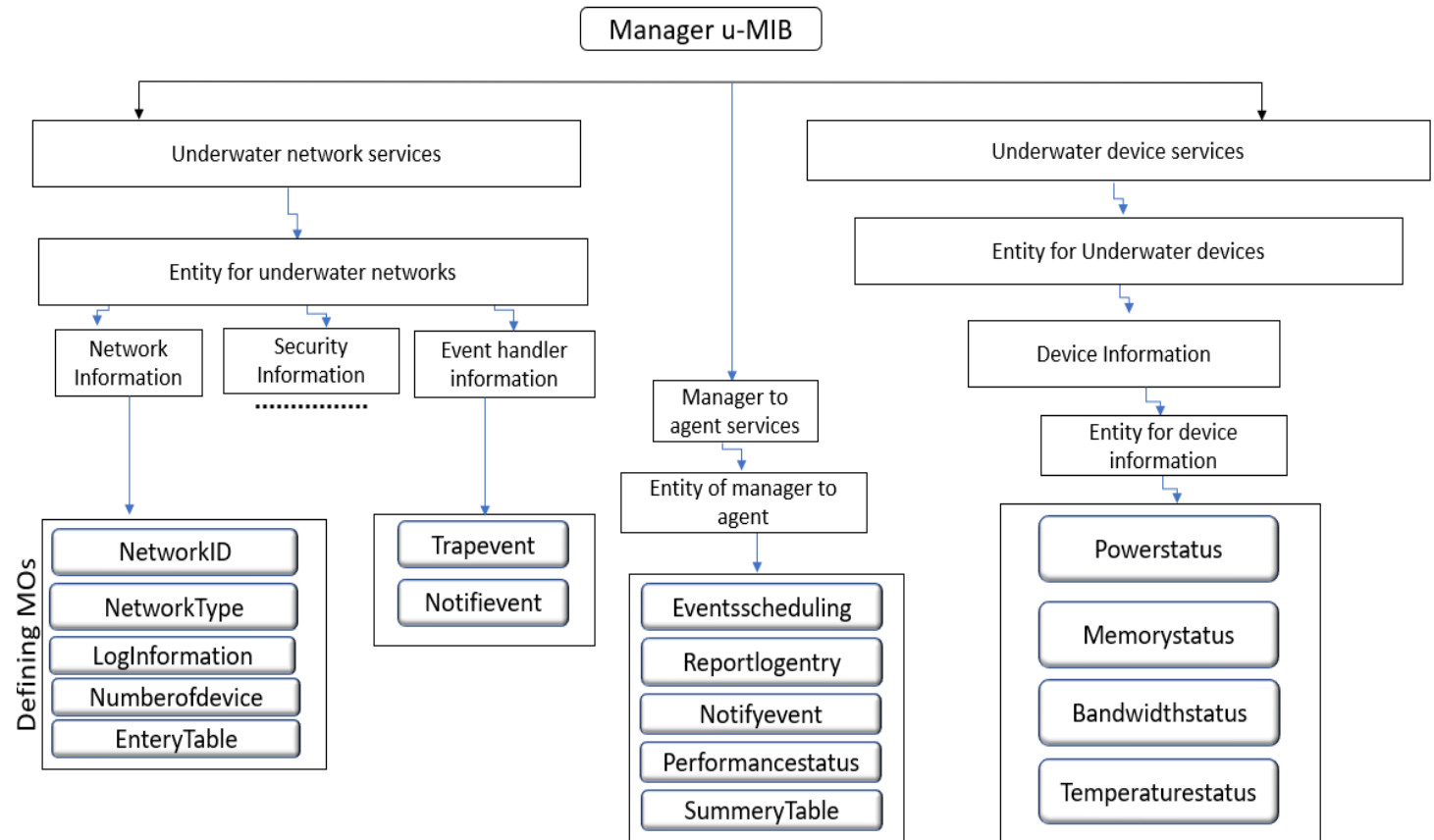


Figure 4. Outline of manager u-MIB



## Guidelines for designing u-MIB outline structure (2)

### □ Manager u-MIB structure

- Underwater network services are the connected with entities such as network information, security information and event handler information.
- Underwater device services consist of underwater device entities.

Manager u-MIB		
Entities for underwater network services		Description
<b>Network Information</b>	NetworkID	Unique number of underwater networks
	NetworkType	Specific types of connection used in the underwater networks (acoustic, RF, etc.)
	LogInformation	Maintain and update the log information of whole system such as event, notification, security, entry time, exit time, etc.
	Numberofdevices	Number of devices connected with the underwater networks
	EntryTable	Manage the summary information of U-NMS system.

## Guidelines for designing u-MIB outline structure (3)

### □ Manager u-MIB structure

Manager u-MIB		
Entities for underwater network services		Description
Event handler information	Trapevent	Information about the asynchronous event received by the manager
	Notifievent	An instance is created for every notification, based on the criteria set by the user. For example, rising threshold and falling threshold.

Manager u-MIB		
Entities for underwater network services		Description
Security Information	Accountviolation	Information about network monitoring access
	Invalidaccess	Notification for invalid user access (invalid login)

## Guidelines for designing u-MIB outline structure (4)

### □ Manager u-MIB structure

Manager u-MIB		
Entities for manager to agent services		Description
Manager to agent	Eventscheduling	Information about the event sent from manager to agent
	Reportlogentry	Report all log entry details of underwater devices
	Performancestatus	Information about the performance level of the manager
	SummaryTable	Information about manager to agent summary table

Manager u-MIB		
Entities for underwater devices		Description
Device Information	Powerstatus	Information about underwater device battery level
	Memorystatus	Information about underwater device memory level
	Bandwidthstatus	Information about current bandwidth level for connection
	Temperaturestatus	Information about temperature of underwater devices

# Guidelines for designing u-MIB outline structure (5)

## Agent u-MIB structure

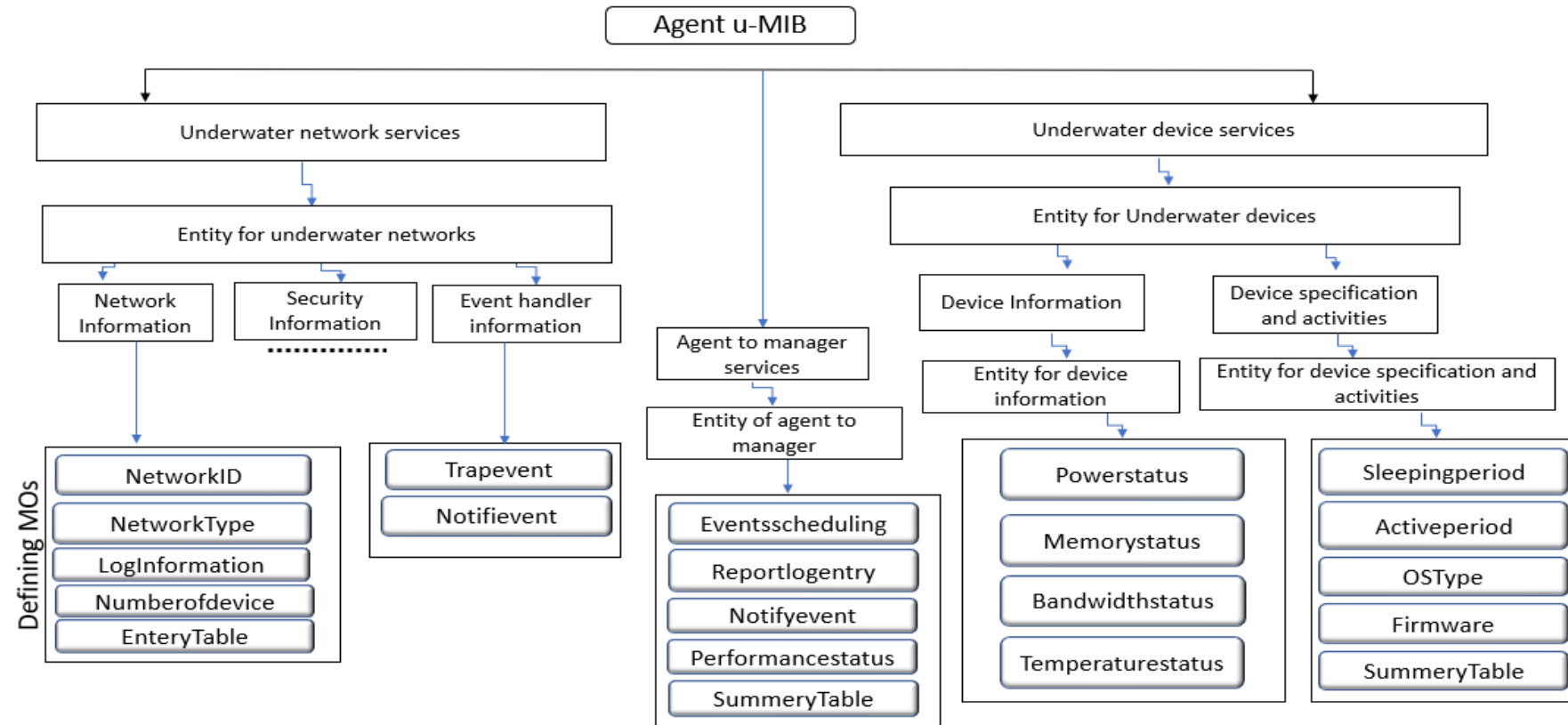


Figure 5. Outline of Agent u-MIB



# Guidelines for designing u-MIB outline structure (6)

## □ Agent u-MIB structure

Agent u-MIB		
Entities for manager to agent services		Description
Device specification and activity	Sleepingperiod	Information about the sleeping time of underwater devices
	Activeperiod	Information about the active time of underwater devices
	OSType	Information about the operating system used in underwater devices
	Firmware	Information about the firmware version supported for underwater devices

Agent u-MIB		
Entities for manager to agent services		Description
Device Information	Powerstatus	Information about the battery level of underwater devices
	Memorystatus	Information about the memory level of underwater devices
	Bandwidthstatus	Information about the current bandwidth level required for connecting underwater devices
	Temperaturestatus	Information about the temperature level of underwater devices

# Managed Objects in u-MIB (1)

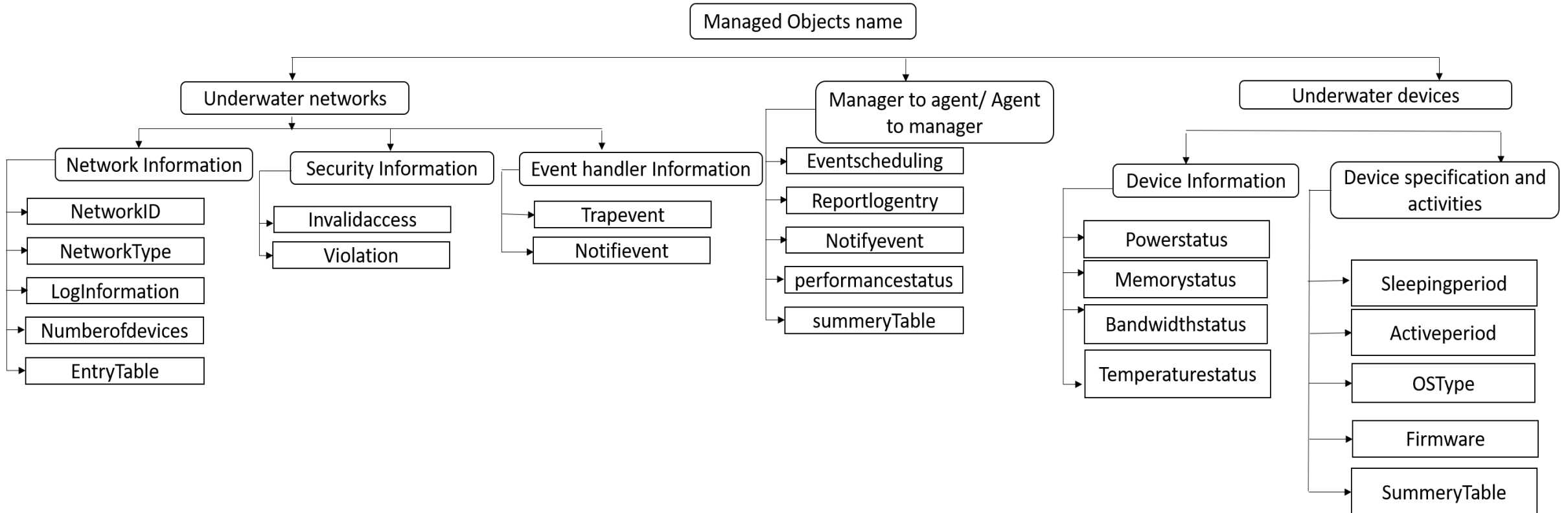


Figure 6. Managed objects in u-MIB

## Managed Objects in u-MIB (2)

### □ Managed object designing number

- Each object is identified by an OID that includes an instance.
- The value of *xx* and *yy* can be the variable numerical values.

Managed Object	OID
uNetwork	<i>xx.xx.....xx</i>
uDevices	<i>yy.yy.....yy</i>

# Annex: Syntax of Managed object

## □ Object Identifier

- Each managed object has a unique identifier.
- SMI allows OID to be either in name form, and a human can read and easily recognize possible sentences as those addresses (iso.org.dod.internet.private.enterprise.U-NMS) or number form (1.3.6.1.4.1).

## □ Type of Object

- Version: SMI.V2
- SMI defines the standard types like INTEGER & OCTET STRING.

```

 ::= {enterprises 50582}

uwash-nms OBJECT IDENTIFIER ::= { unms 1}
uDevice OBJECT IDENTIFIER ::= {uwash-nms 2}
system OBJECT IDENTIFIER ::= {uDevice 1}

-----
-- uDevice-MIB information
-----

osType OBJECT-TYPE
    SYNTAX  DisplayString (SIZE (0..65521))
    MAX-ACCESS      read-write
    STATUS          mandatory
    DESCRIPTION    "OS type in the using system ~"
 ::= { system 1 }
  
```



## Annex: u-MIB Tree Hierarchy

- The u-MIB structure is logically represented by a tree hierarchy. The structure uses branches and those that fall below each category have short text strings and integers to identify them.

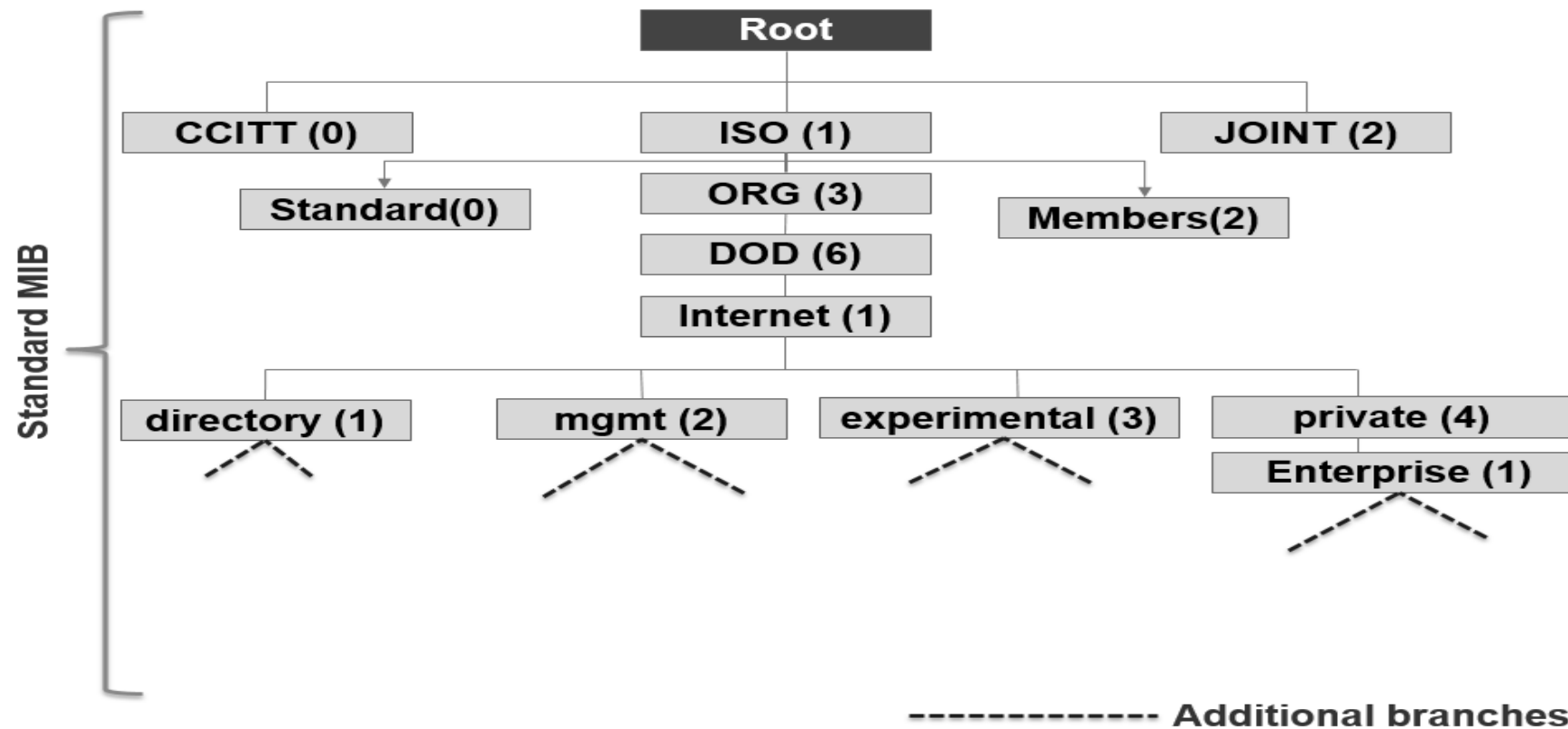


Figure A.1. u-MIB tree hierarchy structure

# Annex: u-MIB outline structure and Managed Objects in u-MIB

- u-MIB concerning unique number for U-NMS (50582) with sibling UWASN and IoUT
- The unique numbers under U-NMS are uNetwork (.50582.1) and uDevice (.50582.2).

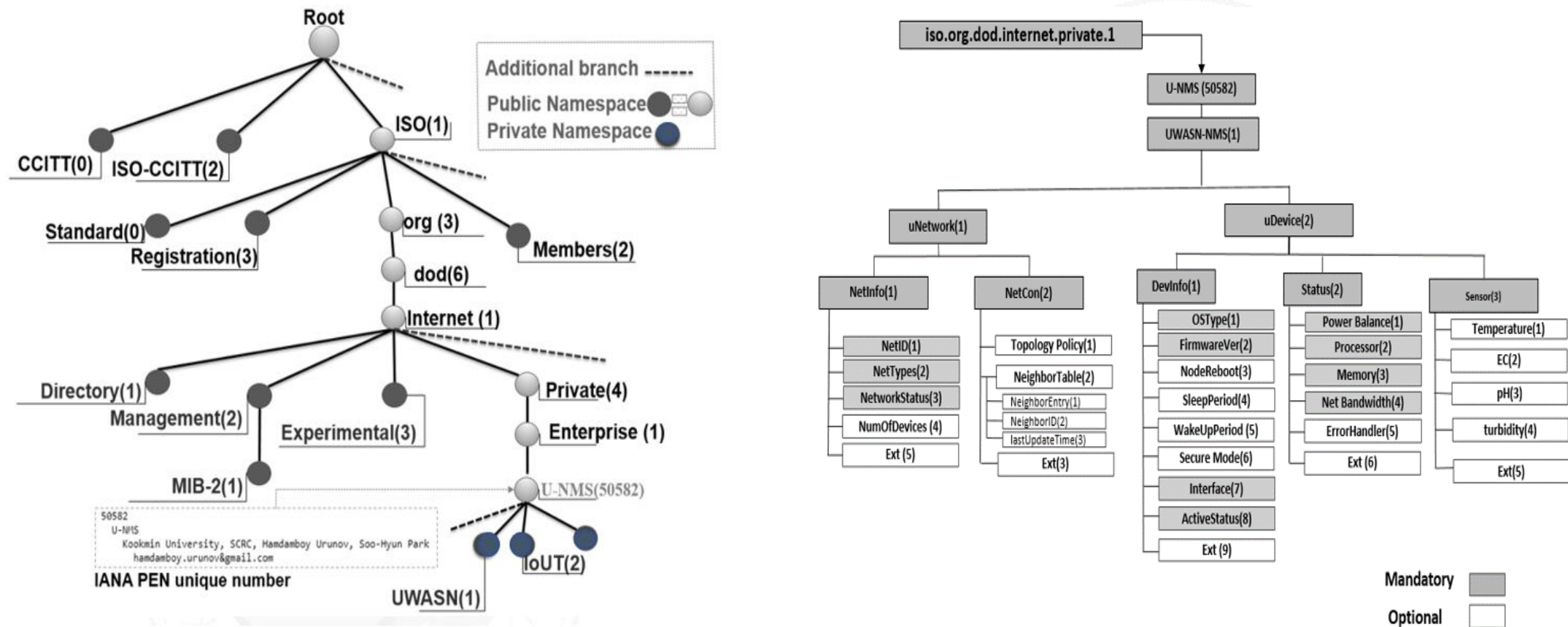


Figure A.2. u-MIB tree hierarchy structure with MOs

## Annex: Example of managed object name in table

- u-SNMP has conceptual tables, not real tables. This is because every object, whether in a table or not, is a leaf of the tree, identified by an OID that includes an instance.

Managed Object	OID
uNetwork	1.3.6.1.4.1.50582.1
uDevices	1.3.6.1.4.1.50582.2





**Thank you!!**