

MSC , **Young-Min Kang, An Implementation Methodology**
9725M01 of a Gateway for Inter-Domain Management between CORBA
and SNMP, CORBA/SNMP
, **1998, 55P**
Advisor : Won-Ki Hong, Text in Korean.

Abstract

Today's enterprise networks are composed of multiple types of interconnected networks. On top of these enterprise networks, there exist various systems and services supporting a wide variety of applications within an organization. In the real world, there are several technologies (e.g., IETF SNMP, OSI CMIP, ITU-T TMN and OMG CORBA) that are appropriate to solving this complex task. Each has strengths and weaknesses and will undoubtedly feature in future network management systems. To solve this problem, interoperability between these technologies is needed.

To enable interworking, it is necessary to be able to map between the relevant object models and to build on this to provide a mechanism to handle protocol conversion on the domain boundaries.

In this thesis, we describe a gateway between management application in the CORBA domain and agent in the SNMP domain and various integration methods. The main function of the gateway is to dynamically convert the method invocations on object reference in CORBA domain to SNMP messages for MIB entries at remote agents. We also present translation methods from SNMP MIB to CORBA IDL using Direct translation and Abstract translation. JIDM algorithm has no notion of containment and inheritance relationships between object classes and is difficult to understanding between management attribute and SNMP Action attribute. Abstract translation over come these problems. New superclasses define for common attributes and define explicit CORBA method for SNMP Action. It is a methodology for obtaining the CORBA-compliant management agents from already existing SNMP agents.

1.	.....	1
2.	.....	3
2.1	(NETWORK MANAGEMENT).....	3
2.1.1	.....	3
2.1.2	.....	4
2.1.2.1	Internet Network Management Framework	5
2.1.2.2	OSI Network Management Framework	5
2.1.2.3	DMI Management Framework	6
2.1.3	.....	6
2.2	CORBA	7
2.2.1	OMA	7
2.2.2	CORBA	8
2.2.3	Object Services	9
2.3	.....	10
2.3.1	JIDM	11
2.3.1.1	Specification Translation (ST).....	11
2.3.1.2	Interaction Translation (IT).....	13
2.3.2	Smile	13
2.3.3	UH Communications work	13
2.3.4	Subrata Mazumdar' s work	15
3.	.....	17
3.1	.....	17
3.2	.....	18
3.3	.....	19

4. CORBA/SNMP	.....20
4.1 CORBA/SNMP	..... 20
4.2 CORBA/SNMP	..... 21
4.2.1	..... 21
4.2.2	..... 23
4.2.3	..... 23
4.3 CORBA/SNMP	..... 24
4.3.1	..... 24
4.3.2	..... 24
4.3.3	..... 25
4.4	..... 26
4.4.1	..... 26
4.4.1.1	..... 27
4.4.1.2	..... 32
4.4.1.3	..... 34
4.4.2	..... 37
4.4.2.1 MIB Repository	..... 39
4.4.2.2 CORBA	..... 40
4.4.2.3 SNMP trap	..... 40
4.4.2.4 Naming Service	..... 40
4.4.2.5 Object Factory	..... 41
4.5	..... 41
5. CORBA/SNMP	.....43
5.1	..... 43
5.2	..... 43
5.3	..... 46
5.4	..... 48

6.	.....	50
	.....	52
APPENDIX A	.....	55

1 :	.....	4
2 : SNMP	.....	5
3 : THE OMG OBJECT MANAGEMENT ARCHITECTURE.....		7
4 : CORBA	.....	8
5 : ASN.1 IDL	.....	12
6 : SMILE	.....	13
7 : UH COMMUNICATIONS CORBA/CMIP INTERWORKING SOLUTION.....		14
8 : CORBA SNMP	.....	15
9 :	.....	26
10 : SMI IDL	.....	27
11 : SMI GROUP, TABLE TRAP	.....	28
12 :	.....	34
13 :	.....	35
14 :	.....	36
15 :	.....	37
16 :	.....	38
17 :	- MIB REPOSITORY, CORBA REQUEST	
MANAGEMENT, SNMP TRAP MANAGEMENT.....		39
18 : NAMING TREE	.....	41
19 :	.....	48

1 : SMI GROUP, TABLE TRAP IDL	28
2 : MODULE-IDENTITY, OBJECT-IDENTITY TEXTUAL-CONVENTION	29
3 : OBJECT-TYPE	30
4 : NOTIFICATION-TYPE	31
5 :	42

1.

,
가 .

가

가가 .

[1].

가 . OSI Network
Management Framework [2], Internet Management Framework [3] Common Object
Request Broker Architecture (CORBA) [4]가 가

OSI

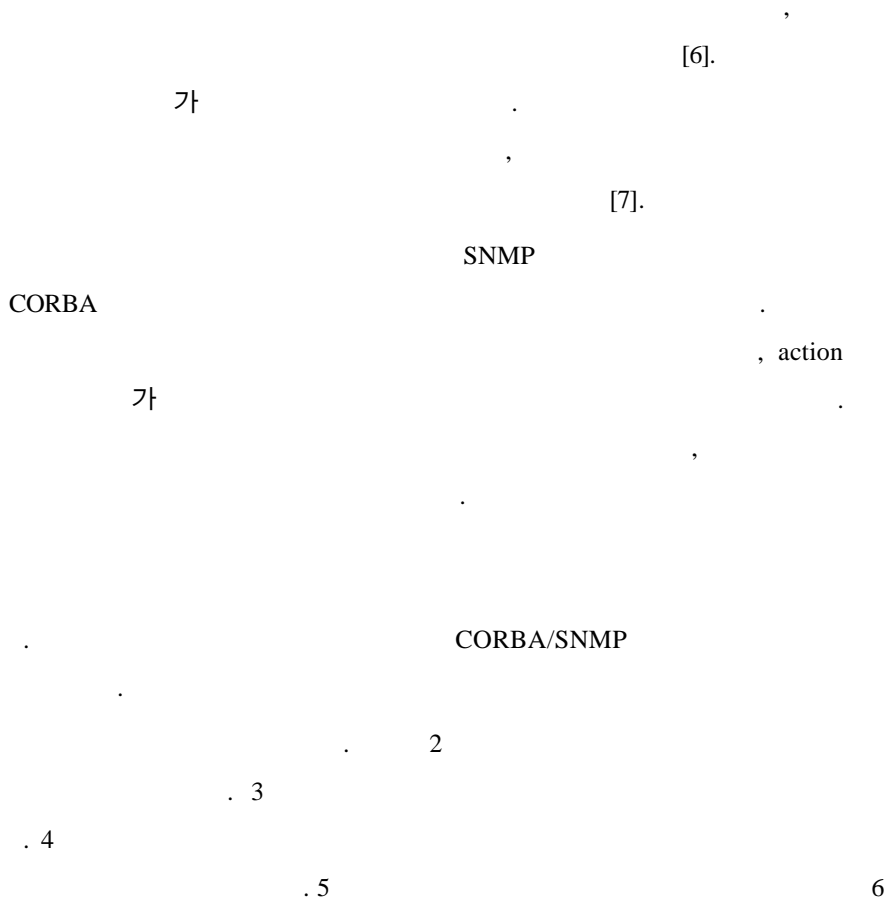
Telecommunication Management Network (TMN) [5] ,

Simple Network Management Protocol (SNMP) [3]

CORBA .

가

가



2.

CORBA

2.1 (Network Management)

[3].

~~가~~

~~가~~

가 가

~~가~~

~~가~~

가 가

2.1.1

[3]

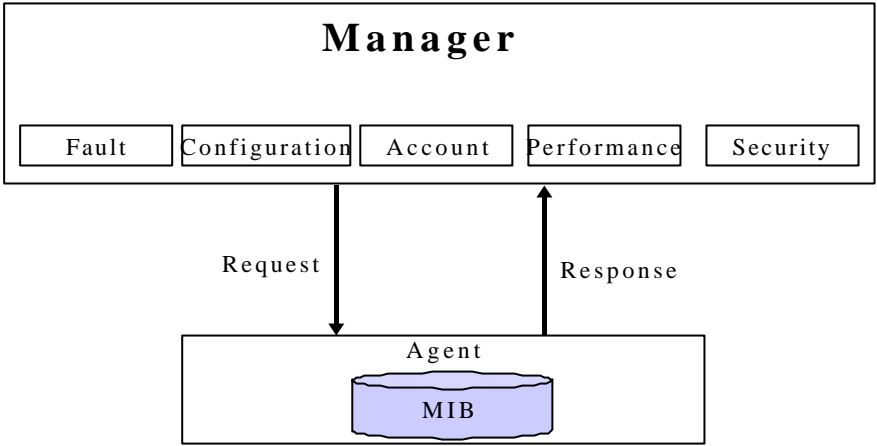
1

Management Information Base (MIB) 가

MIB

(Fault Management),

(Configuration Management), (Account Management), (Performance Management) (Security Management) (Per



1:

2.1.2

1980

가

가

가 가

[8].

가

2.1.2.1 Internet Network Management Framework

Internet Management Framework [3] Internet Engineering Task Force (IETF)

SNMP

2 SNMP

OSI Management Framework

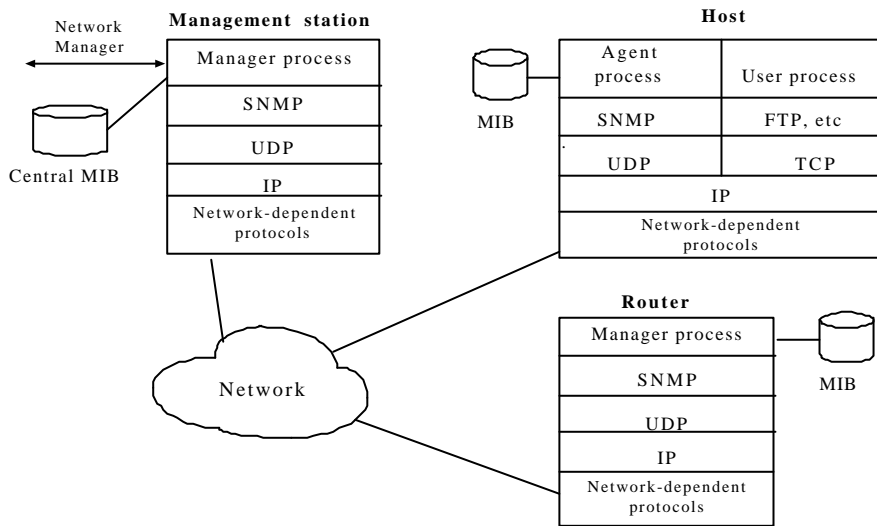
Internet Management Framework

SNMPv1 [9] 1990

SNMP

가 가

SNMPv2 [10] SNMPv3 [11]가



2 : SNMP

2.1.2.2 OSI Network Management Framework

OSI Network Management Framework Internet Management Framework

가 International Organization
for Standardization (ISO) International Telecommunications Union, Telecommuni-
cation Section (ITU-T) 가

Common Management Information
Protocol (CMIP) [12]

OSI Management Framework 가 Internet
Management Framework
가

2.1.2.3 DMI Management Framework

Desktop Management Framework (DMI) [13] Desktop Management Task Force
(DMTF) Management Application

(MA), Service Provider (SP) Component Instrumentation (CI)
MA SP

Remote Procedure Call (RPC) 가

Management Information Format (MIF)

SP MA 가

PC

2.1.3

가

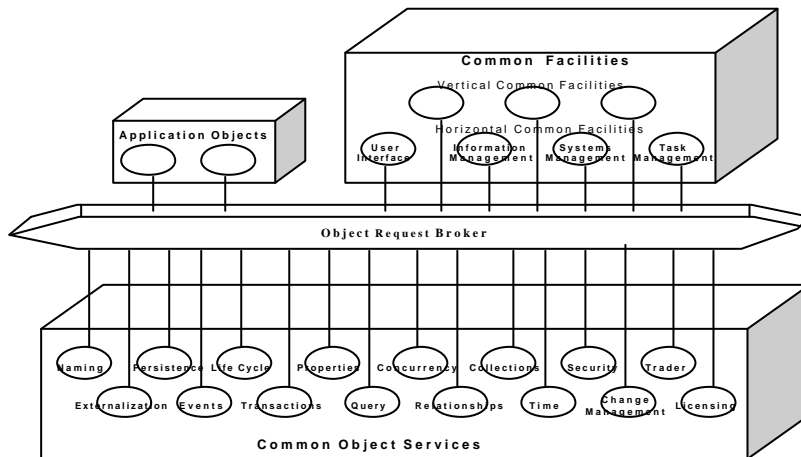
[1].

2.2 CORBA

[14] Internet Inter-ORB Protocol (IIOP) 가 , Common Object Request Broker Architecture (CORBA)

2.2.1 OMA

Object Manager Group (OMG) , , 가 Object Management Architecture (OMA) [4, 14] 3 OMA .



3 : The OMG Object Management Architecture

Object Request Broker (ORB) :
. ORB

Common Object Service :
가

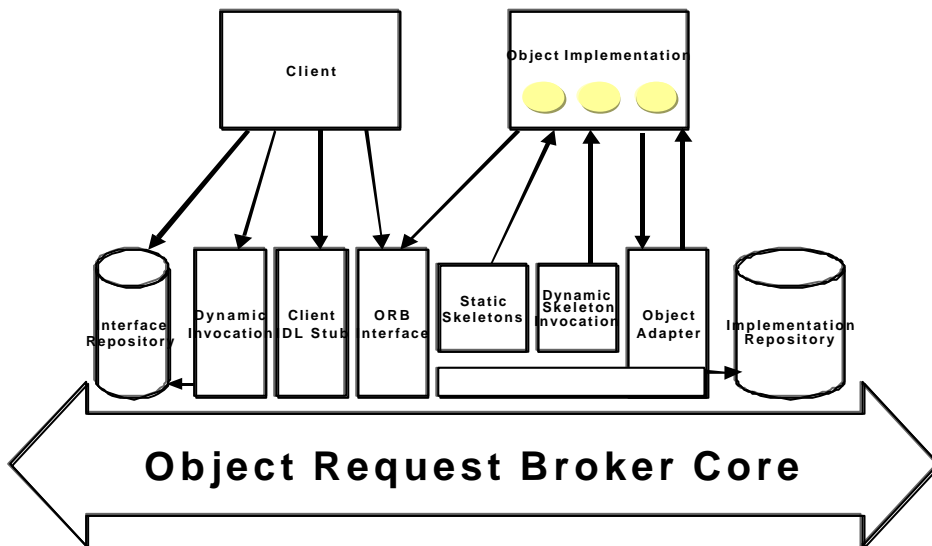
Common Facilities :

Application Objects :

2.2.2 CORBA

4 CORBA

[4]



4: CORBA

~~del~~ ORB : ORB

~~del~~ IDL stub :

~~del~~ Dynamic Invocation Interface (DII) :

~~del~~ : IDL
가

~~del~~ IDL stub :
.IDL

~~del~~ Dynamic Skeleton Interface (DSI) :

~~del~~ Object Adapter :

~~del~~ (Implementation Repository) : 가
, ID

2.2.3 Object Services

OMG

[15]

가

~~ㄹ~~ Properties Service :

가

가 가

~~ㄹ~~ Naming Service :

(Naming Context)

[17].

~~ㄹ~~ Event Service :

[16].

~~ㄹ~~ Life Cycle Service :

security, transaction, trading, time, relationship, query

[14].

2.3

CMIP

TMN

SNMP

SNMP

CORBA

2.3.1 JIDM

Joint Inter-Domain Management (JIDM) Group X/Open Network Management Forum (NMF) working group .

CORBA, CMIP SNMP , CORBA/SNMP CORBA/ CMIP [6].

JIDM

Specification Translation

ST [7, 27]. ST

가 . JIDM ASN.1[18]

GDMO [19], SMI [3] CORBA IDL [4]

Interaction Translation, IT

[6, 27].

가 JIDM ,

JIDM

JIDM

JIDM ST SMI CORBA

IDL CORBA

, SNMP action 가 . IT

CMIP, SNMP 가

, 가 COS Service

. JIDM ST IT .

2.3.1.1 Specification Translation (ST)

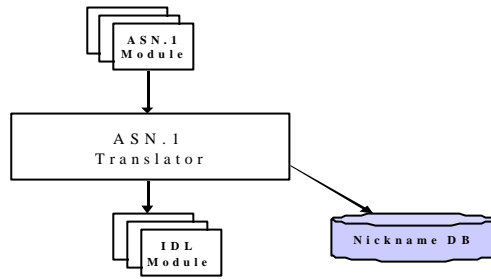
ST GDMO SMI CORBA IDL .

ST ASN.1, SNMP SMI CMIP GDMO .

2.3.1.1.1. ASN.1 IDL

ASN.1 CCITT ISO

SNMP CMIP



5 : ASN.1 IDL

5 가 ASN.1 IDL DB

2.3.1.1.2. GDMO IDL

GDMO

가 ,

, Action

Notification

. Notification

GDMO

IDL

, GDMO

가 .

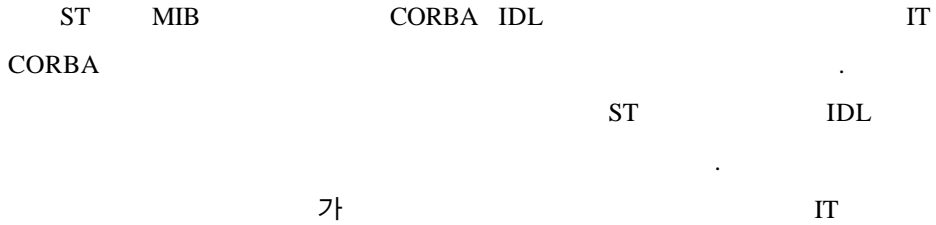
IT

가

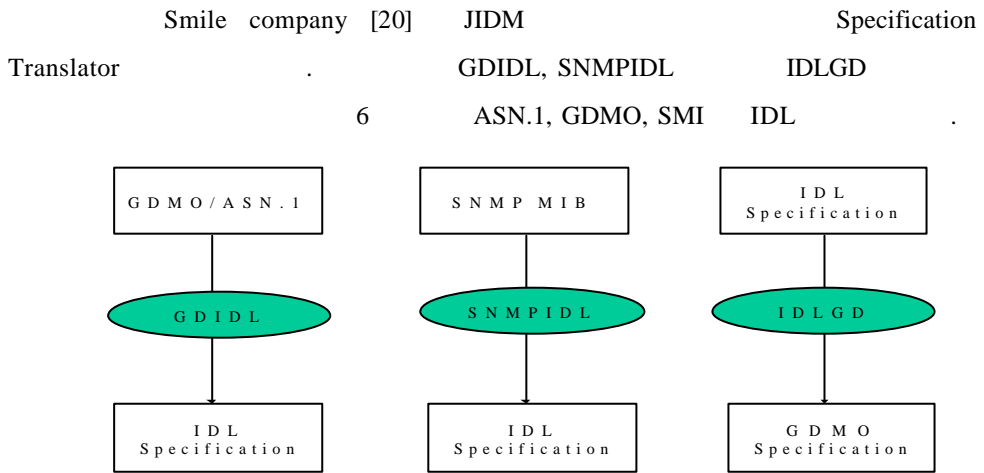
SNMP SMI

4

2.3.1.2 Interaction Translation (IT)

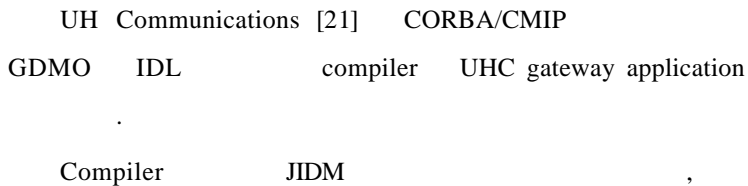


2.3.2 Smile



6 : Smile

2.3.3 UH Communications work



UHC CORBA/CMIP interworking

Adapter Object Interface :

OSI

CORBA invocation

CMIS

ManagedObjectFactory Interface : Adapter object instance

GDMO

ProxyAgent Interface :

OSI

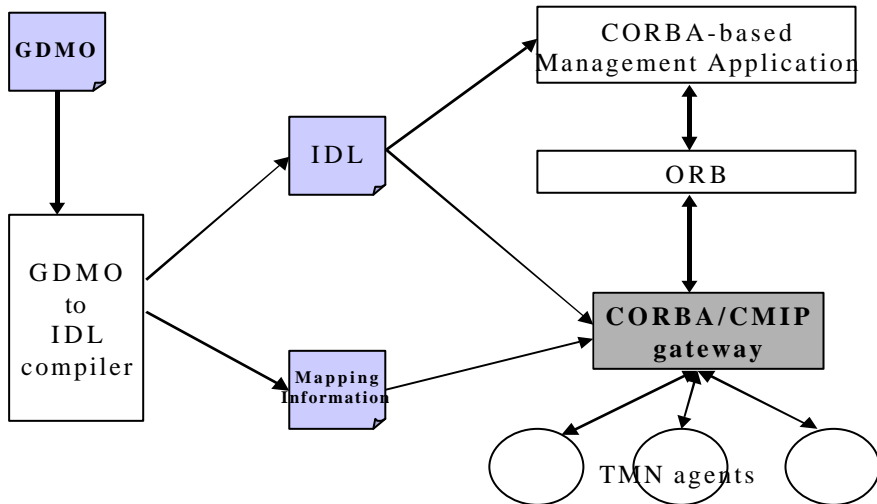
CMIS

EventPort Interface :

OSI

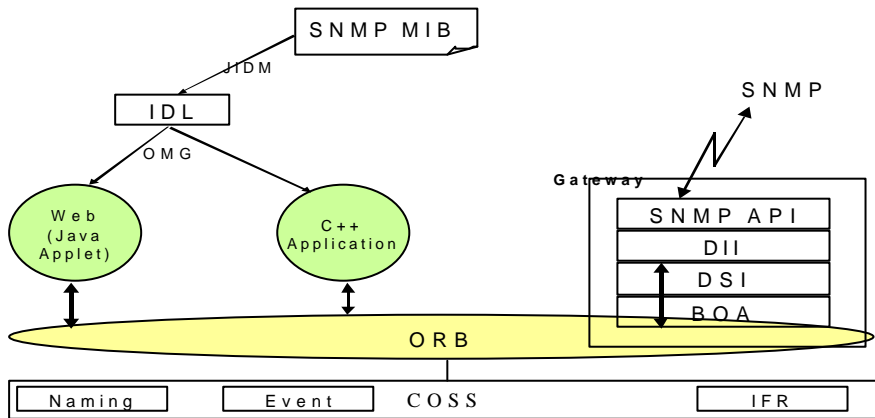
event

COSS event service



2.3.4 Subrata Mazumdar's work

Bell Lab Mazumdar Inter-Domain
 [22]. CORBA SNMP
 .
 JIDM ST SMI IDL smi2idl compiler
 . compiler JIDM .
 IT Web-based Management GUI Java
 Web Browser .
 8 Mazumdar CORBA
 SNMP .



8 : CORBA SNMP
 IDL
 CORBA 가
 SNMP
 CMU SNMP API
 MIB 가 MIB IDL
 CORBA ORB 가
 SNMP

JIDM
OMG
CORBA
가
Action
SNMP
CMP

3.

Model) (Source Information Model) (Destination Information Model)

3.1

(Information Model Translation)
(Information Model Mapping)

~~이~~

가

(Translation)

JIDM ASN.1/SMI/GDMO CORBA IDL
[6, 7].

~~이~~

(Mapping)
IBM System View Agent 가 [26]
SNMP DMI SNMP sysName DMTF
General Information systemName 가

가

3.2

가

가

가

가

~~가~~

(Direct Translation)

(Syntax Translation)

JIDM ASN.1/SMI/GDMO IDL

CORBA IDL

IDL

~~가~~

(Abstract Translation)

가

가

(Semantic)

[24].

가

가

가

3.3

가

가

~~가~~

JIDM

(proxy)

(gateway)

~~가~~

(adapter)

가

가

4. CORBA/SNMP

CORBA/SNMP

4.1 CORBA/SNMP

CORBA SNMP

CORBA ORB

가

(transparent)

가

[14, 22, 23, 24, 25].

SNMP

가 . CORBA

[22, 23].

~~ㄹ~~

CORBA

가

가

~~ㄹ~~

가 .

. CORBA 가

~~☞~~

가 ,

CORBA

가 .

~~☞~~ CORBA

(Independent).

Java , Java

C++

~~☞~~ Web

가

Java

ORB

4.2 CORBA/SNMP

CORBA

SNMP

CORBA

SNMP

4.2.1

(Information Model) ,
(Operation) [7, 22, 24]
(Organization) .

~~ㄹ~~ (Information Model)

가 가
가 .

~~ㄹ~~ (Operation)

~~ㄹ~~

가 OSI
CORBA .
가 가 SNMP SNMP
Information Module (SMI) CORBA Interface Definition Language (IDL) .

가 ,

가

4.2.2

CORBA
가 SNMP

SNMP
[29].

CORBA
, IDL

4.2.3

CORBA
SNMP

SNMP
Get/Set
가

CORBA 가

Get/Set
trap notification

SNMP
CORBA
[29].

4.3 CORBA/SNMP

3

CORBA

SNMP

4.3.1

CORBA

SNMP

CORBA

가

SNMP

CORBA

IDL

4.3.2

SNMP

CORBA

가

SNMP

SMI

CORBA

IDL

JIDM

SMI

IDL

[6, 27, 28].

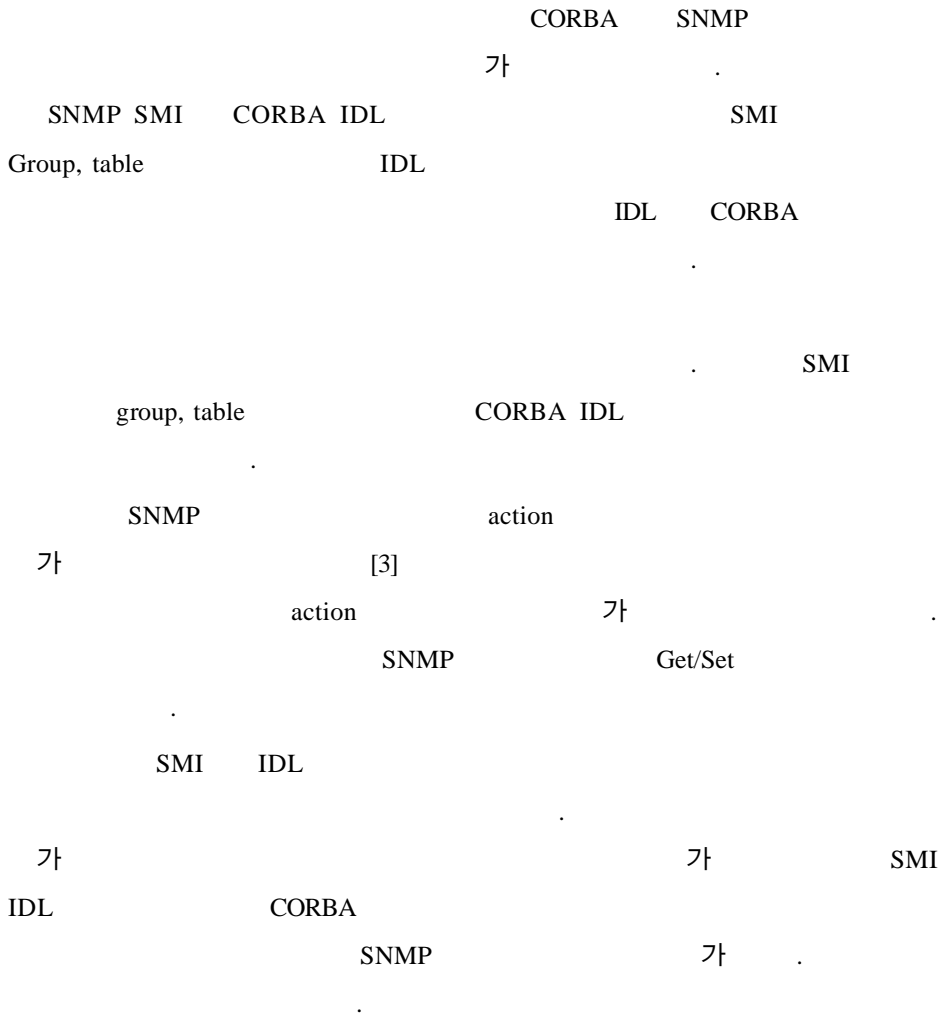
가

. 3

. CORBA

SNMP

4.3.3



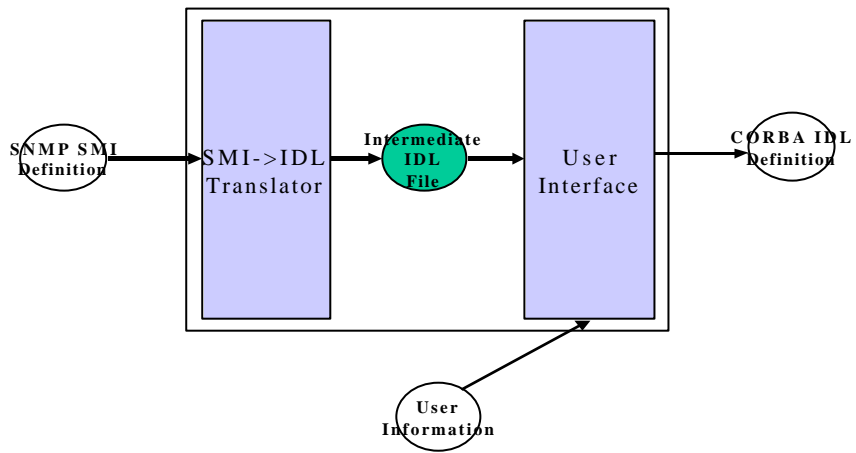
4.4

CORBA/SNMP

4.2 4.3

4.4.1

9



9:

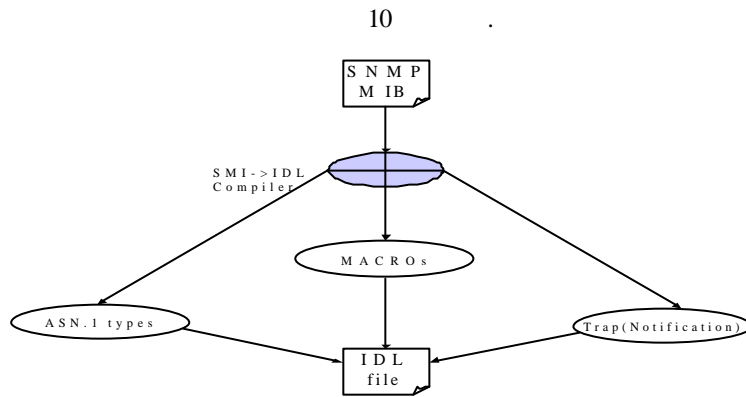
가

가

4.4.1.1

SNMP MIB CORBA
 IDL JIDM SMI IDL
 [29].

4.4.1.1.1. SNMP MIB CORBA IDL



10 : SMI IDL

SNMP , trap CORBA
 IDL 10

~~SNMP~~ SNMP group IDL 가 . group

~~SNMP~~ SNMP IDL 가 .

~~SNMP~~ SNMP trap CORBA

COSS

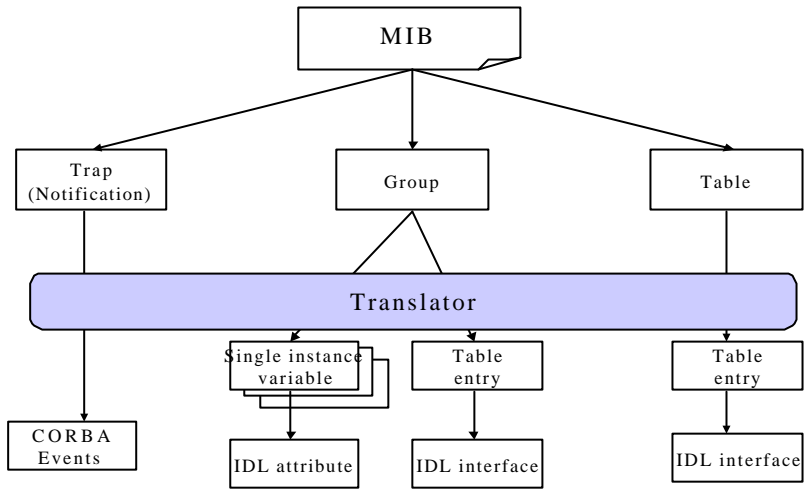
[16]
가

Naming

[17]

11

1 [27, 29].



11 : SMI Group, table Trap

SNMP MIB	CORBA IDL
MIB	Module
Group	Interface
Variable of a group	Attribute of its interface
entry of a table	Interface
Variable of a table	Attribute of its interface

1 : SMI Group, table Trap IDL

SMI IDL

4.4.1.1.2. SMI IDL

SMI IDL
 , trap . ASN.1
 [7] . SMI 가
 . MODULE-IDENTITY, OBJECT-IDENTITY TEXTUAL-CONVENTION

2

SNMPv2 Macro	IDL
Test MODULE-IDENTITY LAST-UPDATED "981125" ORGANIZATION "DPE Lab" CONTACT-INFO "ymkang" DESCRIPTION "... .." ::= { experimental 555 }	const string moduleidentity = "Test"; const string Test = "MIB::Test";
TestSets OBJECT IDENTIFIER ::= { Test 1 } Test999 OBJECT-IDENTITY STATUS current DESCRIPTION "... .." ::= { TestSet 1 }	const ASN1_ObjectIdentifier TestSet = "MIB::TestSet"; const ASN1_ObjectIdentifier Test999 = "MIB::Test999";
TimeStamp ::= TEXTUAL-CONVENTION STATUS current SYNTAX TimeTicks	typedef TimeTicksType TimeStampType;

2 : MODULE-IDENTITY, OBJECT-IDENTITY TEXTUAL-CONVENTION

SMI 가 OBJECT-TYPE
 NOTIFICATION-TYPE

OBJECT-TYPE Macro : , entry SMI
 가

1. entry interface .
2. interface

IDL OBJECT-TYPE SYNTAX

~~SE~~ mode (MAX-)ACCESS

3. DESCRIPTION

3 OBJECT-TYPE entry

SNMPv2 Macro	IDL
<pre> TestEntry OBJECT-TYPE SYNTAX TestEntry MAX-ACCESS not-accessible STATUS current DESCRIPTION "... .." ::= { TestTable 1 } TestEntry ::= SEQUENCE { TestIndex Integer32, TestStr DisplayString, TestValue Integer32, TestStatus RowStatus } </pre>	<pre> interface TestEntry { readonly attribute Integer32Type TestIndex; readonly attribute DisplayStringType TestStr; readonly attribute Integer32Type TestValue; readonly attribute RowStatusType TestStatus; } </pre>

3 : OBJECT-TYPE

~~SE~~ NOTIFICATION-TYPE Macro :

trap(notification)

1. Notifications PullNotifications interface

push/pull event communication

2. interface ip address, community name, event time

. Notification "in" mode PullNotifi cation

"out" mode

4 NOTIFICATION-TYPE

SNMP Notification Macro	Linkup NOTIFICATION-TYPE OBJECT {ifIndex} STATUS current DESCRIPTION "... .." ::= { snmpTrap 4}
IDL	Module SNMP { struct IfIndexType { ASN1_ObjectIdentifier var_name; ASN1_Integer var_value; } struct LinkUpType = { IfIndexType ifIndex; }; interface Notifications { void linkup (in ASN1_ObjectIdentifier src_party, in ASN1_ObjectIdentifier snmp_context, in SNMPv2TC::TimeStampType event_type, in LinkUpType notif_info); }; };

4 : NOTIFICATION-TYPE

4.4.1.1.3. JIDM

JIDM

가 [27]

CORBA

가

~~ES~~

CORBA

JIDM

가

group

CORBA

JIDM

~~ㄹ~~ action . SNMP action
 가 가 . SNMP set
 action **action**
invocation [3]
 CORBA 가 .
 CORBA action
 JIDM action invocation
 CORBA
 action 가 . action
 SNMP

4.4.1.2

4.4.1.1.3

가 . IDL
 IDL

~~ㄹ~~ Superclass :
 가

가가

~~SNMP~~ action
action

set

CORBA

가

action

CPUaction

CPUaction

1

2, 3, 4

set

action

()

CPUaction

action

action

가

enable(),

disable(), lock()

unlock()

CPUaction

1

setting

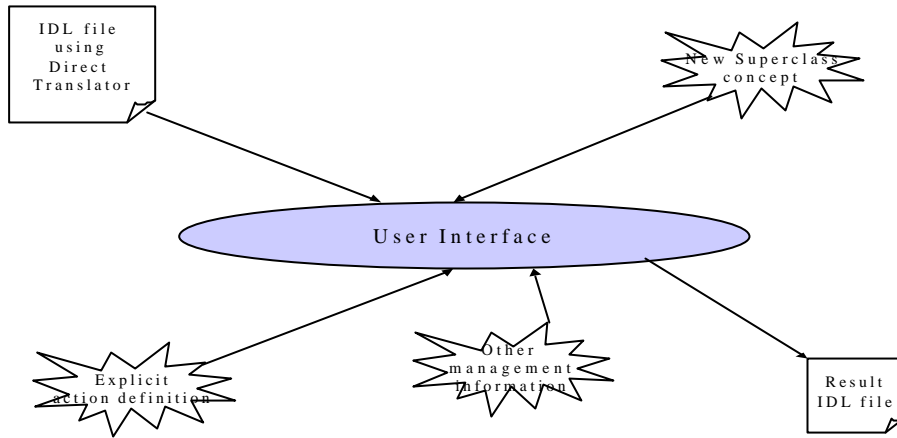
enable()

action

가, 가 가

12

IDL



12 :

4.4.1.3

4.4.1.2 CORBA IDL 가 CORBA
(Inheritance) (Aggregation)

[28].

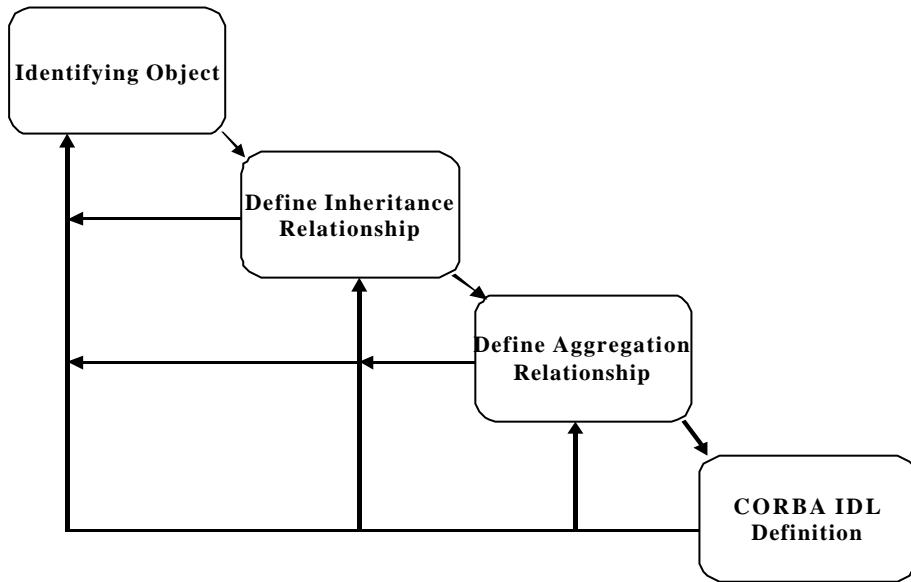
- (1) : CORBA IDL
action invocation
CORBA 가 action
- (2) (Inheritance) :
가
- (3) (Aggregation) : (2) 가
(2),(3)

가

(4) CORBA IDL :
Technique (OMT) [28]
13

Object Modeling

IDL



13 :

4.4.1.3.1.

CORBA

RFC1213

Sun Workstation MIB

Sun MIB	RFC1213	system, interface, ip, icmp, tcp, upd	snmp
group	sun system	sunSystem SunHostPerf	가

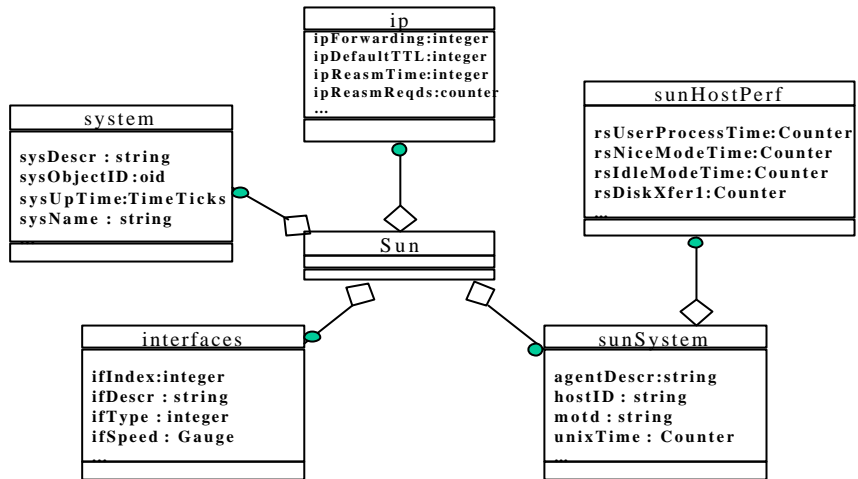
14

OMT notation

가

가

Sun MIB



14 :

IDL

Counter

In/Out

가

In/Out

read-write

action

ip ipForwarding

1, 2

setting

Forwarding

not_Forwarding

Forwarding()

not_Forwarding()

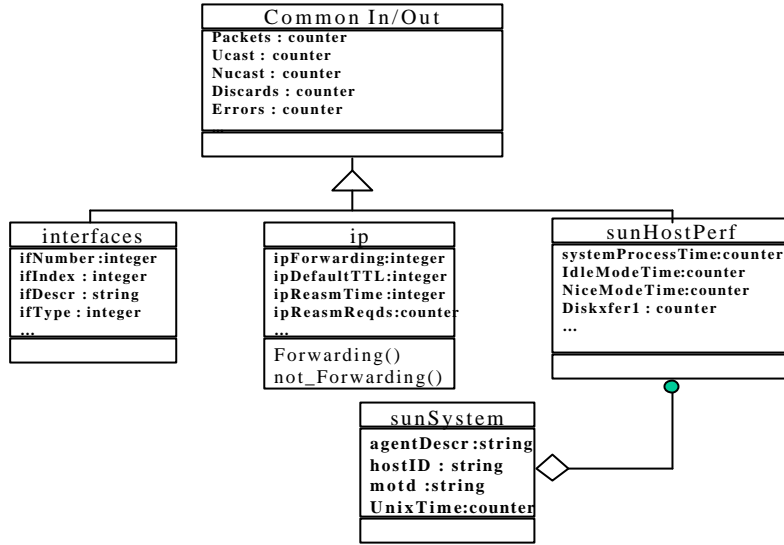
CORBA

가

15 OMT notation

Appendix A

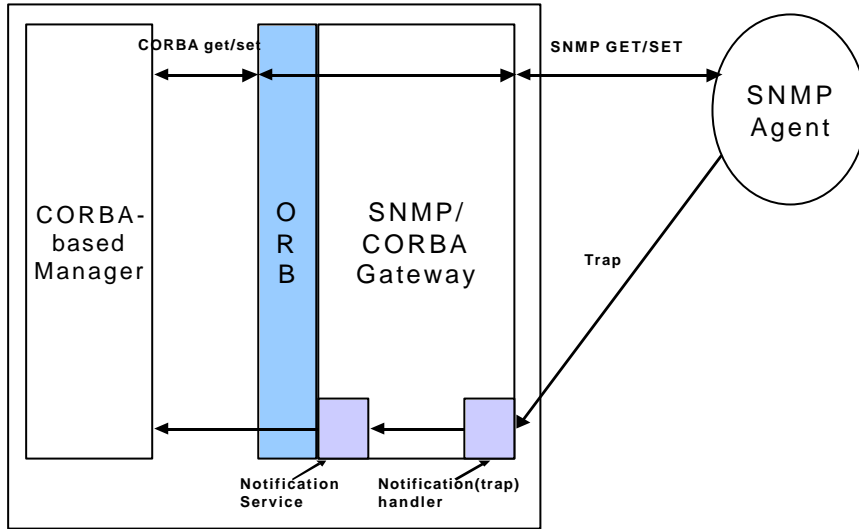
IDL



15 :

4.4.2

CORBA/SNMP
 CORBA SNMP 가 [29].
 CORBA ORB Get/Set ,
 SNMP Get/Set
 가 .
 SNMP Trap
 가 CORBA
 16 [22].



16:

3

~~SES~~

MIB Repository

~~SES~~ CORBA

SNMP

Request Management

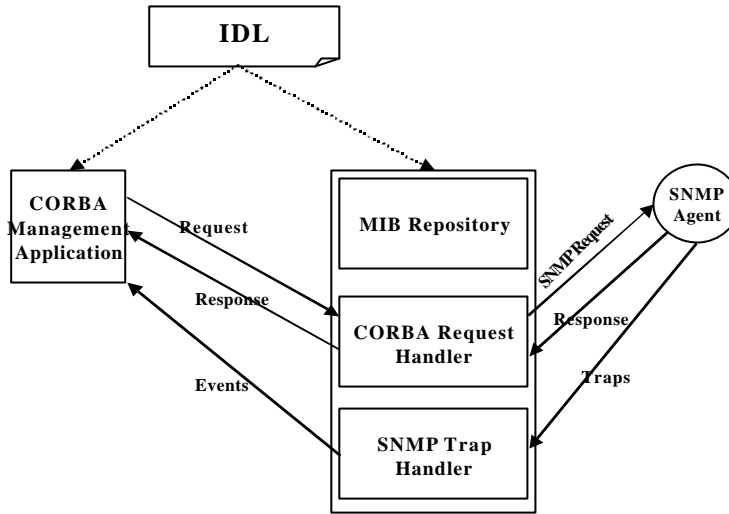
~~SES~~ SNMP

Trap

CORBA

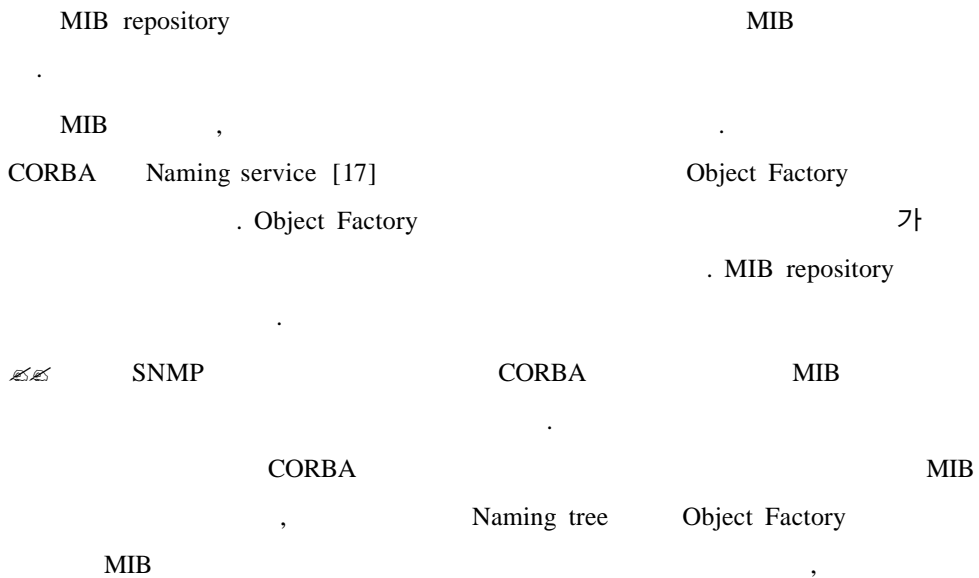
Trap Management

17



17 : - MIB Repository, CORBA Request Management, SNMP Trap Management

4.4.2.1 MIB Repository



(Request)

4.4.2.2 CORBA

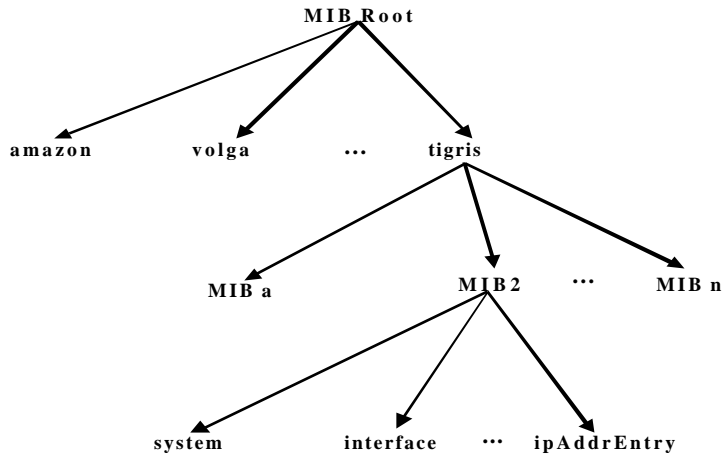
CORBA CORBA SNMP
가 naming service
get/set SNMP

4.4.2.3 SNMP trap

Trap SNMP trap CORBA
event CORBA
Event event event

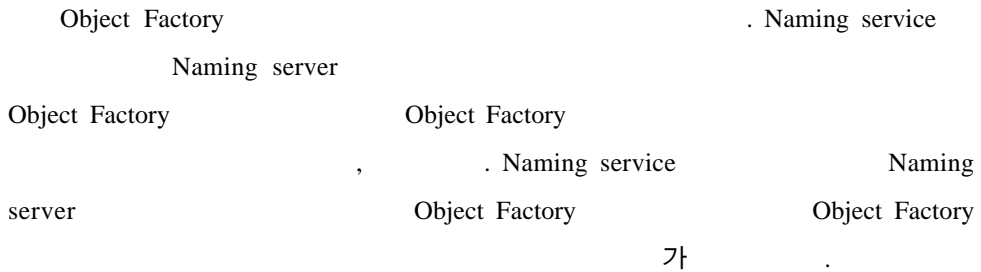
4.4.2.4 Naming Service

MIB repository SNMP MIB naming tree
naming tree 가
, 가 . Naming tree
MIB
MIB tree
가 [29, 30].
MIB MIB , , entry
. 18 naming tree

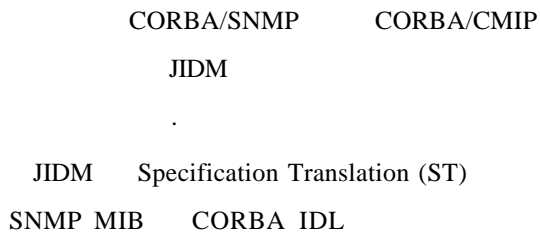


18 : Naming Tree

4.4.2.5 Object Factory



4.5



SNMP action
 action
 Super class action
 CORBA SNMP
 MIB
 MIB
 Table 가
 action CORBA
 SNMP
 action 5

		JIDM
	Super class	Table
SNMP Action	CORBA Action 가	Action

5 :

COS service
 Interaction translation 가
 Event service . Naming service
 MoFactory .

5. CORBA/SNMP

CORBA/SNMP

가

5.1

Solaris 2.5

Sun Ultra 1

flex yacc [31] SnmpIDL SMI IDL

CORBA C++

3 가

CORBA IDL

CORBA

가

IONA Orbix 2.3 [32]

5.2

SMI IDL

SMI

[33].

가

IDL

flex

```
...  
%%  
<INITIAL>"[C]" return BOXC_SYM;
```

```

<INITIAL>"[S]"      return BOXES_SYM;
<INITIAL>{WHITESPC}+ { COUNT_NEWLINES (myLineNoG, yytext);}
<INITIAL>"."        return DOT_SYM;
<INITIAL>","        return COMMA_SYM;
...
/*OBJECT-TYPE      lexical unit      */
<INITIAL>OBJECT-TYPE      return OBJECTTYPE_SYM;
<INITIAL>OBJECTS          return OBJECTS_SYM;
<INITIAL>SYNTAX           return SYNTAX_SYM;
<INITIAL>ACCESS           return ACCESS_SYM;
<INITIAL>MAX-ACCESS       return MAXACCESS_SYM;
<INITIAL>STATUS           return STATUS_SYM;
<INITIAL>DESCRIPTION      return DESCRIPTION_SYM;
...

```

SMI Macro production rule

. SMI rule .

```

<ModuleDefinition> ::= <ModuleIdentifier> DEFINITIONS
<TagDefault> ::= BEGIN
    <ModuleBody>      END
<ModuleIdentifier> ::= <modulereference><DefinitiveIdentifier>
<TagDefault> ::= EXPLICIT TAGS | IMPLICIT TAGS |
    AUTOMATIC TAGS | empty
<ModuleBody> ::=
    <Exports> <Imports> <AssignmentList> | empty
<Exports> ::= EXPORTS <SymbolsList> ; | empty
<Imports> ::= IMPORTS <SymbolsImported> ; | empty
<SymbolsImported> ::= <SymbolsFromModuleList> | empty

```

```

<SymbolsFromModuleList> ::=
    <SymbolsFromModule> | <SymbolsFromModuleList> <SymbolsFromModule>
<SymbolsFromModule> ::=
<SymbolList> FROM <GlobalModuleReference>
<GlobalModuleReference> ::= <modulereference AssignedIdentifier>
<SymbolList> ::= <Symbol> | <SymbolList> , <Symbol>
<AssignmentList> ::=
<Assignment> | <AssignmentList> <Assignment>

```

SMI

production rule

yacc

yacc

```

...
ModuleDefinition:
    ModuleIdentifier
    DEFINITIONS_SYM
    TagDefault { modulePtrG->tagDefault = $3; }
    GETS_SYM
    BEGIN_SYM
    ModuleBody
    END_SYM
    {
        modulePtrG->modId    = $1;
    }
...
SnmObjectTypeMacroType: /*OBJECT-TYPE Macro*/
    OBJECTTYPE_SYM
    SYNTAX_SYM Type
    SnmpAccess
    STATUS_SYM SnmpStatus

```

```

SnmDescrPart
SnmReferPart
SnmIndexPart
SnmDefValPart
{
    SnmpObjectTypeMacroType *s;
    SetupMacroType (&$$, MACROTYPE_SNMPOBJECTTYPE, myLineNoG);
    s = $$->basicType->a.macroType->a.snmpObjectType =
        MT (SnmpObjectTypeMacroType);
...

```

	IDL	C	
IDL	.	Appendix A	
RFC1213	IDL	.	
	가	IDL	CORBA
	4.4.1.2		가 . SMI
implicit	action	CORBA	.

5.3

4.4.2		3 가
.	IDL	IDL
C++	.	IDL
IDL	.	

```

Module SnmpFactory {
    Interface MoFactory {
        Object create (in string name);
        Void delete (in object ref);
    };
};

```

MIB Repository

MoFactory

```
Interface RequestManagement {  
    Any get_a_variable ( in ScopedName p_var_scoped_Name, in EntryIndex p_var_index )  
    Raises ( SnmpProtocol::NoSuchVariable, SnmpProtocol::NoSuchObject,  
            SnmpProtocol::ProtocolError );  
    Void set_a_variable (in ScopedName p_var_scoped_Name,in EntryIndex p_var_index,in any  
p_var_new_value )  
    Raises ( SnmpProtocol::NoSuchVariable, SnmpProtocol::NoSuchObject,  
            SnmpProtocol::ProtocolError );  
    Void list_mib_entries(in ScopedName p_entry_scoped_name, in long p_how_many,  
Out EntryIndexList p_entry_index_list,  
Out SnmpProtocol::GetNextEntryIterator p_entry_name_list_itr)  
    Raises ( SnmpProtocol::NoSuchSmiEntry, SnmpProtocol::NoSuchObject,  
            SnmpProtocol::ProtocolError );  
    Boolean is_mib_entry_exist( in ScopedName p_entry_scoped_name )  
    Raises ( SnmpProtocol::NoSuchSmiEntry, SnmpProtocol::ProtocolError );  
    Boolean is_mib_module_supported( in string p_smi_module_name )  
    Raises ( SnmpProtocol::NoSuchSmiModule, SnmpProtocol::ProtocolError );  
};
```

IDL

CORBA

가

Get/Set

SNMP Trap

IDL

```
Module SnmpNotification {  
    Interface NotificationConsumer  
    { readonly attribute long trap_port_id;  
        long connect (in Object ref);
```

```

void disconnect (in long trap_port_id);

interface NotificationSupplier
{
readonly attribute long trap_port_id;

readonly attribute string mgr_ip_address;

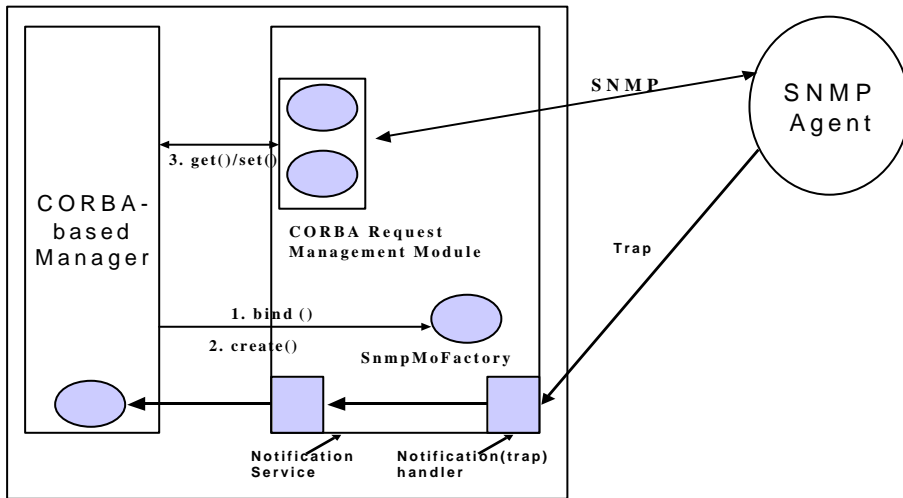
void disconnect();};

};

```

5.4

가 . 19 가



19 :

MoFactory

MIBII [34]

가

step

```

...
MoFactory_var var;
CORBA::Object* ptr;
RFC1213_MIB::system* ptr2;
Char* host_name="tigris ";
Char* community="public";
//Step 1
var = snmpMOProxyFactory::_bind();
//Step2
ptr = var->create("system");
ptr2= RFC1213_MIB::system::_narrow(ptr);
//Step3
ptr2->host(host_name); // assign host value
ptr2->community(community); // assign community value
//Step4
cout << "sysName= " << ptr2->sysName() << endl;
cout << "sysContact= " << ptr2->sysContact() << endl;
cout << "sysDescr= " << ptr2->sysDescr() << endl;
cout << "sysObjectID= " << ptr2->sysObjectID() << endl;
cout << "sysLocation= " << ptr2->sysLocation() << endl;
cout << "sysServices= " << ptr2->sysServices() << endl;
}
ptr-> delete( ptr2);
...

```

factory

community

가

6.

가

가

가

가

JIDM

CORBA

CORBA

가

“

CORBA

가

TMN

SNMP

”

CORBA

SNMP

, OSI

CMIP

proprietary

가가

가

CORBA 가 Proxy coordinator 가 .
non-CORBA prototype
가 .

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Appendix A

```
IDL      Sun-MIB      CORBA IDL      sun_snmp.idl      .
      (
      )

#ifndef _sun_snmp_IDL_
#define _sun_snmp_IDL_
#include <ASN1Types.idl>
#include <RFC1155_SMI.idl>
module sun_snmp {
    typedef RFC1155_SMI::NetworkAddressType NetworkAddressType;
    typedef RFC1155_SMI::IpAddressType IpAddressType;
    typedef RFC1155_SMI::CounterType CounterType;
    typedef RFC1155_SMI::GaugeType GaugeType;
    typedef RFC1155_SMI::TimeTicksType TimeTicksType;
    const ASN1_ObjectIdentifier mib_2= "::sun_snmp:mib_2";
    const ASN1_ObjectIdentifier transmission= "::sun_snmp:transmission";
...
interface CommonIn_Out {
    CounterType Octets(in string);
    countertype UcastPkts(in string);
    countertype NUcastPkts(in string);
    countertype Discards(in string);
    countertype Errors(in string);
    countertype UnknownProtos(in string);
}
...
interface ifEntry : CommonIn_Out{
    readonly attribute ASN1_Integer ifIndex;
    readonly attribute DisplayStringType ifDescr;
...

```

```

interface ip : CommonIn_Out{
    void ipForwarding();
    void not_ipForwarding();
    readonly attribute ASN1_Integer ipDefaultTTL;
    readonly attribute CounterType ipForwDatagrams;
    readonly attribute CounterType ipOutNoRoutes;
    readonly attribute ASN1_Integer ipReasmTimeout;
    ...
interface sunHostPerf : CommonIn_Out{
    readonly attribute CounterType rsUserProcessTime;
    readonly attribute CounterType rsNiceModeTime;
    readonly attribute CounterType rsSystemProcessTime;
    readonly attribute CounterType rsIdleModeTime;
    readonly attribute CounterType rsDiskXfer1;
    readonly attribute CounterType rsDiskXfer2;
    readonly attribute CounterType rsDiskXfer3;
    readonly attribute CounterType rsDiskXfer4;
    readonly attribute CounterType rsVPagesIn;
    readonly attribute CounterType rsVPagesOut;
    ...
};
#endif /* !_sun_snmp_IDL_ */

```