WDM

,   ,   ,   ,   ,   *

OAM   ,   *
{eycho, csh, prov, kimhj, hjsuk, seo}@etri.re.kr

WDM(Wavelength Division Multiplexing)

.   160Gbps WDM

WDM

.

1. WDM

160Gbps   WDM
Wave-length Division Multiplexing

. 160Gbps WDM

16   10Gbps   2.5Gbps
SDH(Synchronous Digital Hierarchy)

,
/   ,   /
,   , WDM
,

.
160Gbps
(STM: Synchronous
Transfer Mode)   STM-64(10Gbps)
STM-16(2.5Gbps)   16
(WDM)

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-
-
-
-
-

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-
-
-
-
-
- TMN
- 160Gbps TMN Manager

WDM

(TMN: Telecommunications
Management Network)
Agent

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WDM

,   ,

.
2   WDM

,

,

.   3

TMN Agent

embedded Agent
.
4   TMN Manager   WDM

OSI   DCC
.   .

2. WDM

2.1

WDM   ITU-T
SG15   G.875[3]

.

,   ,
.
(OCH: Optical CHannel section)

ochTTP
wavelength
.   /
(OMS: Optical Multiplex Section)
omsTTP,
(OTS: Optical
Transmission   Section)
otsTTP
LD(Laser   Diode)
WDM
.

그림 2. WDM

WDM

.
1.
WDM   MIT
(Management   Information   Tree)
.   WDM
M.3100[1]   G.774[2]
.

DN(Distinguished   Name)

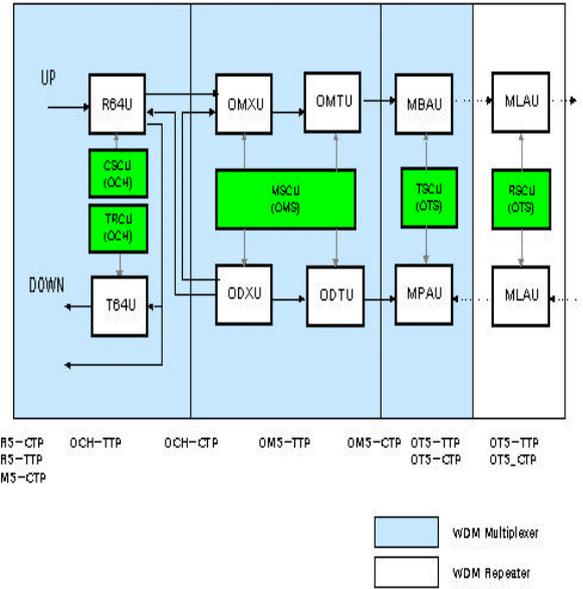rack,   shelf,   board
equipmentHolder   circuitPack

.
2.   160GbpsWDM

. OTS, OMS, OCH

TTP(Trail Termination Point)
CTP (Connection TP)
,   ,

2.2

WDM   ADM(Add   Drop
Multiplexer) ring   ,   linear ADM   ,
TM(Terminal MUX)

.   Agent

.

MIT   top
wdmNE
. networkType,   nodeType
managedElementId

160GADM1,   160GTM2,   160GR3
.   SDH
TMN   Manager
MOST   .

Agent
, Manager, GUI
.   ,

, Manager
Association   ,   GUI

160Gbps WDM ADM
Ring 3
6
TMN Manager

4
800
WDM TMN
action OMS OCH

OCH

OTS
MIT
CMIP(Common Management
Information Protocol) Agent

NUT(Non-
preemptible Unprotected Traffic)
protectionGroupR1
OCH OMS

Wdm-ProtectionUnit

OCH

protectionGroupR1
A, B
OMS

OCH

OCH (A,
B)
protecting . Protecting
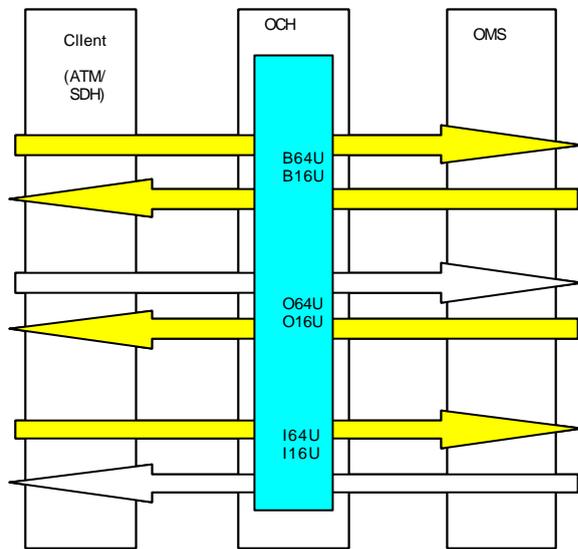
select Signal
. ProtectionUnitId

A 1 , B
2 . UnprotectedCTP
wdmProtectionUnit
OCH
UnprotectedCTPId
ochId

. ProtectedTTP

A, B
OCH
STM-16
STM-64
Transponder Unit
3.

Client (ATM/ SDH)	OCH	OMS
	B64U B16U	
	O64U O16U	
	I64U I16U	

3. OCH

2.3

TMN manager

. 160Gbps WDM
EFD(Event Forwarding Discriminator)
destination
manager NSAP filter

manager
GUI
GUI
. WDM

(equipmentAlarm)
　　　　　　　1.　　　　　.
communicationsAlarm,　　　environmental-
Alarm　　　　　　　　　　.
　　log
　　　　alarmRecord　　　　　,

.
embedded Agent

manager

.　　C++ platform　　　　log

.

EquipmentAlarm	
LowInputPowerAmp	CircuitPack (MP, MB, ML) Component (MB, ML SVLD)
HighInputPowerAmp	
LowOutputPowerAmp	
HighOutputPowerAmp	
LowPowerSVLD	
Low Output Power #1~#8	CircuitPack (ODXU, OMXU, OMTU, ODTU)
Low Input Power #1~#8	
HighOutput Power #1~#2	
HighInput Power #1~#2	
Upstream High Output Power	CircuitPack (I64U/I16U)
Upstream Low Output Power	
LD High Temp	OCH Component
LD Low Temp	
LD High Current	

1. WDM

　　　　　WDM

　　TM
　　　　　　　fiber
　　　　　　　　OTS-
LOS(LossOfSignal)
　　　　　OTS Downstream FDI(Forward
Defect Indication)　　　　　.

　　　　　　　　　OMS,
OCH　　　OTS-DWAIS
.
manager　　　WDM

Agent　　　association
EFD

　　　　　　　.　　　　GUI

　　　　　　　　　LED
GUI

.

2.4

ITU-T　G.825

.
(Optical SNR: Signal to Noise
Ratio)
　　　　　.　　　160Gbps
WDM

　　　　　　　.　,　OTS,
OMS,　OCH　　　　15　　　1

.　TMN Agent

15　　　1

.　15
16

1　　　　　　　1
.
OCH
Upstream Power, Downstream
Power, LD Temperature, LD Current
　　OMS　　　　OMXU,
ODXU, OMTU, ODTU
Input Power　Output Power　　.
OTS

.
GUI
16
.
MIT

15

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LAPD(Link Level Access
Procedure on D Channel)

3. TMN Agent

provisioning

WDM

embedded Agent

3.2

TMN Agent

，　　　，

3.1

160Gbps OTS, OMS, . TMN manager GUI
OCH WDM GUI

Agent ，　　，

. TMN Agent

，　　，

. 160Gbps agent
MIB

，　　　　　，
. Agent MIB

Agent

，

MIT .

TMN Manager System
GUI

. Agent

. ／

. protectionUnit

MAC(Media Access Control)
2 ，
TM
.

protectionGroup, .
protectionUnit, protectedTTPBidirectional,
unprotectedCTP-Bidirectional

.

.

manager action .

, C

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ITU-T G.774
Subordination rule Constraint Rule

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.

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MIB

. .

operationalState
currentProblemList . DN MIT

MIT

.

. circuitPack
terminationPoint .
subordinates

.

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. Agent MIB

manager administrative-
State

. .

, DN(Distinguished
Name) , ,

.

. WDM
15 1

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.

mapper
. MIB

DN

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3.3 Embedded Agent

MIT

TMN Agent   embedded type
.   160Gbps   WDM   MIT
         300MHz   ppc603 CPU   .
VRTX OS   .

                              64M   .   Agent
128M
      WDM
            C++ platform   64
                                    .
Embedded   .

4. OSI   DCC

OSI Stack   20
Task   Agent   LAN   DCC(Data
                              .   Communication Channel)   TMN
      LAN   LAPD   ,   manager   CMIP
                                                                   .
                                   DCC   LAPD
                                                                   LAN
                                         CMIP
                                    .   .
    Embedded Agent   WDM
                                   2Mbps
                              .   .   TMN
                                   160Gbps

                                                        DCC
                              .   . ADM Ring
                                             6.   .
                                        Agent   IS(Intermediate
                                   System)
                                                            .
                                                                              .
                                   LAPD   OSI
         .   IPC   TP
                              .

                              .   10Gbps SDH

                              . 160Gbps WDM
MIT   DCC
      ,   TM
                                    .

                                                            OTS
                                   SV(Supervisory)

160Gbps WDM

DCC TMN Manager
Agent DCC

LAN

LAPD LAN

GUI

TMN Manager GUI TMN

GUI

. Embedded Agent

GUI

. 4. ,

D

DCC

LAPD

User

role ,
Network role
. DCC [ ]

HAN/B-ISDN

OTS ,

2Mbps TMN DCC
. IT ,

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5. , ,

. ETRI

160Gbps WDM

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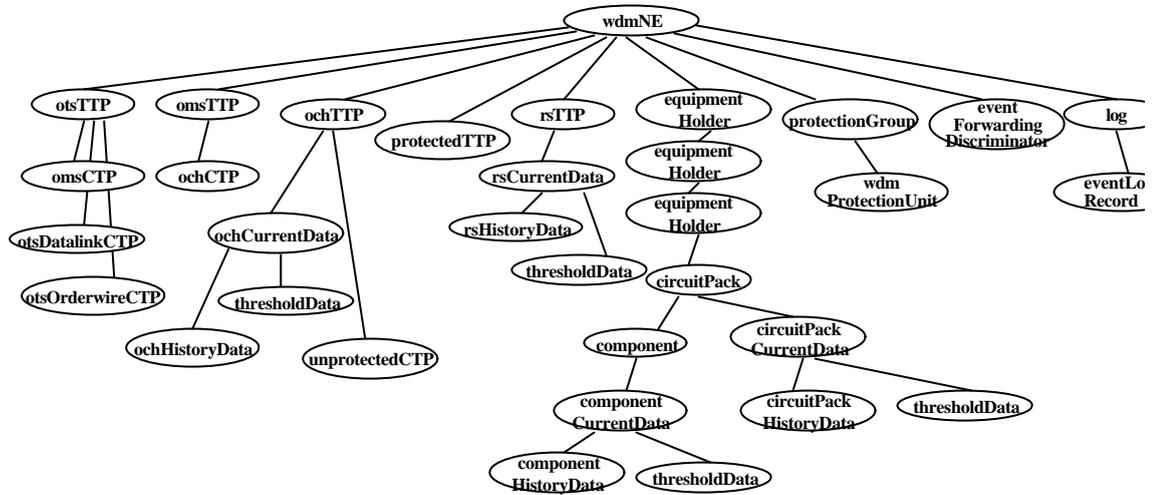
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WDM

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TMN

[1] ITU-T Recommendation M.3100, "Generic Network Information Model", 1992
[2] ITU-T Recommendation G.774, "Synchronous Digital Hierarchy(SDH) Management Information Model for the Network Element View", 1992
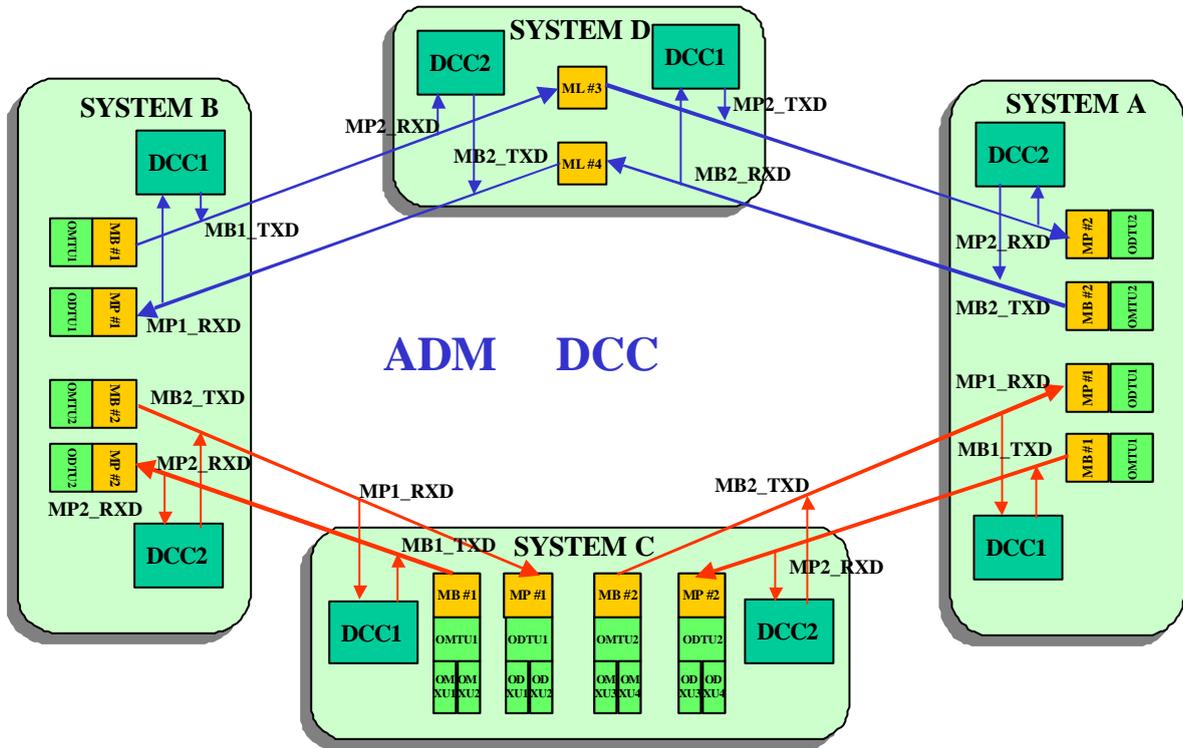[3] ITU-T Recommendation G.875, " OPTICAL TRANSPORT NETWORK (OTN) MANAGEMENT

INFORMATION MODEL FOR THE NETWORK ELEMENT VIEW ", 1999

[4] Eun-Young Cho, Yong-Sub Yoon, Kyung-Wan Kang, Yong-Kuk Park, "Embedded Agent for Optical and Regenerative Repeator on the SDH Network", ICACT2000

1. WDM Agent   MIT

4.   ADM   DCC

1986
(   )
1995 KAIST   (   )
1986 –

(   )
<   > SDH/WDM/ATM

1997
(   )
1999   (
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2000. 3
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<   >

1991
(   )
1991
1999
(   )

<   >   ,
SDH/SONET

1982   (
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1992
(   )
1988 -
(   )
<   > SDH/WDM

89~93

93~94 Brown University

95~

<   >

1980
(   )
1982
(   )
1994. 8 Texas A&M University EE
(   )
1982. 1. - 1983. 3.
1983   -
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