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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No. **EU 658832834 US**22151 U.S.PTO
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103003

INVENTOR(S)					
Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)			
Alexander I	Soto	San Diego, CA			
Additional inventors are being named on the _____ separately numbered sheets attached hereto					
TITLE OF THE INVENTION (500 characters max)					
System and method for novel optical module					
Direct all correspondence to: CORRESPONDENCE ADDRESS					
☐ Customer Number: _____					
OR					
☒ Firm or Individual Name: Alexander Soto					
Address: 7623 Hazard Center Dr.					
Address: _____					
City: San Diego		State: CA		Zip: 92108	
Country: USA		Telephone: 949-836-5735		Fax: _____	
ENCLOSED APPLICATION PARTS (check all that apply)					
☒ Specification Number of Pages: 7					
☐ CD(s), Number: _____					
☒ Drawing(s) Number of Sheets: 7					
☒ Other (specify) check + postcard					
☐ Application Date Sheet. See 37 CFR 1.76					
METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT					
☒ Applicant claims small entity status. See 37 CFR 1.27.					
☒ A check or money order is enclosed to cover the filing fees.					
☐ The Director is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number: _____					
☐ Payment by credit card. Form PTO-2038 is attached.					
FILING FEE Amount (\$) 80.00					
The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.					
☒ No.					
☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____					

[Page 1 of 2]

Respectfully submitted,

SIGNATURE Alexander SotoTYPED or PRINTED NAME Alexander SotoTELEPHONE 949-836-5735Date 10/30/2003

REGISTRATION NO. _____

(if appropriate)

Docket Number: _____

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

This collection of information is required by 37 CFR 1.51. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 8 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop Provisional Application, Commissioner for Patents, P. . Box 1450, Alexandria, VA 22313-1450.

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10/30/03
16152 U.S. PTO

PTO/SB/17 (05-03)

Approved for use through 04/30/2003. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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FEE TRANSMITTAL for FY 2003

Effective 01/01/2003. Patent fees are subject to annual revision.

☒ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT (\$) 80.00

Complete if Known

Application Number _____
Filing Date _____
First Named Inventor Alexander I Soto
Examiner Name _____
Art Unit _____
Attorney Docket No. _____

METHOD OF PAYMENT (check all that apply)

☒ Check ☐ Credit card ☐ Money Order ☐ Other ☐ None

☐ Deposit Account:

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The Director is authorized to: (check all that apply)

☐ Charge fee(s) indicated below ☐ Credit any overpayments

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FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code (\$)	Small Entity Fee Code (\$)	Fee Description	Fee Paid
1001 750	2001 375	Utility filing fee	
1002 330	2002 165	Design filing fee	
1003 520	2003 260	Plant filing fee	
1004 750	2004 375	Reissue filing fee	
1005 160	2005 80	Provisional filing fee	<u>80</u>

SUBTOTAL (1) (\$) 80

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

Total Claims	Extra Claims	Fee from below	Fee Paid
Independent Claims	-20** =	X	
Multiple Dependent	-3** =	X	

Large Entity Fee Code (\$)	Small Entity Fee Code (\$)	Fee Description
1202 18	2202 9	Claims in excess of 20
1201 84	2201 42	Independent claims in excess of 3
1203 280	2203 140	Multiple dependent claim, if not paid
1204 84	2204 42	** Reissue independent claims over original patent
1205 18	2205 9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) (\$) 0

**or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code (\$)	Small Entity Fee Code (\$)	Fee Description	Fee Paid
1051 130	2051 65	Surcharge - late filing fee or oath	
1052 50	2052 25	Surcharge - late provisional filing fee or cover sheet	
1053 130	1053 130	Non-English specification	
1812 2,520	1812 2,520	For filing a request for <i>ex parte</i> reexamination	
1804 920*	1804 920*	Requesting publication of SIR prior to Examiner action	
1805 1,840*	1805 1,840*	Requesting publication of SIR after Examiner action	
1251 110	2251 55	Extension for reply within first month	
1252 410	2252 205	Extension for reply within second month	
1253 930	2253 465	Extension for reply within third month	
1254 1,450	2254 725	Extension for reply within fourth month	
1255 1,970	2255 985	Extension for reply within fifth month	
1401 320	2401 160	Notice of Appeal	
1402 320	2402 160	Filing a brief in support of an appeal	
1403 280	2403 140	Request for oral hearing	
1451 1,510	1451 1,510	Petition to institute a public use proceeding	
1452 110	2452 55	Petition to revive - unavoidable	
1453 1,300	2453 650	Petition to revive - unintentional	
1501 1,300	2501 650	Utility issue fee (or reissue)	
1502 470	2502 235	Design issue fee	
1503 630	2503 315	Plant issue fee	
1460 130	1460 130	Petitions to the Commissioner	
1807 50	1807 50	Processing fee under 37 CFR 1.17(q)	
1806 180	1806 180	Submission of Information Disclosure Stmt	
8021 40	8021 40	Recording each patent assignment per property (times number of properties)	
1809 750	2809 375	Filing a submission after final rejection (37 CFR 1.129(a))	
1810 750	2810 375	For each additional invention to be examined (37 CFR 1.129(b))	
1801 750	2801 375	Request for Continued Examination (RCE)	
1802 900	1802 900	Request for expedited examination of a design application	

Other fee (specify) _____

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) (\$) 0

SUBMITTED BY

Name (Print/Type) Alexander I Soto Registration No. _____ Telephone 949-836-5735
Signature Alexander Soto (Attorney/Agent) _____ Date 10/30/2003

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Alexander and Walter Soto, Ex. 2027

Nokia of America Corporation v. Alexander and Walter Soto, IPR2023-00960

SYSTEM AND METHOD FOR NOVEL OPTICAL MODULE

FIELD OF THE INVENTION

[0001] The present invention relates to optical modules generally, and more specifically to a media access control protocol, transmission convergence and physical layer implementation within optical modules.

BACKGROUND OF THE INVENTION

[0002] Optical modules are used in applications requiring digital optical transmission such as SONET/SDH, 10 Gigabit Ethernet, Fibre Channel and DWDM running across metro access networks, wide area networks, access networks, storage area networks, and local area networks.

[0003] Optical modules integrate components used in the transmission and reception of optical signals into a single packaged subsystem. Makers of optical networking systems find optical modules attractive, because the highly integrated packaging approach can cut several months of system development and manufacturing time, consume less power and increase port densities over board-level solutions built from discrete components. But with so much functionality in one module, timely and sufficient component supply becomes even more essential for successful system delivery. Multi-source agreement (MSA) developed so systems vendors can feel more confident about getting the components they need and being able to incorporate them without costly and time-consuming system redesigns. Further with MSA, system vendors can concentrate on system architecture and not optical research and development. Optical modules can be purchased off the shelf from a choice of several suppliers.

[0004] A typical optical module 100, as shown in FIG. 1, is composed of a: laser 101; laser driver (LD) 102; photo detector (PD) 103; transimpedance amplifier (TIA) 104; limiting amplifier (LA) 105 and sometimes physical-layer devices 108 such as a mux/demux with associated clock multiplier unit (CMU) and clock data recovery (CDR) functions in a serializer 109 and deserializer 110. A typical optical module 100 has dual optical fibers for reception 106 and transmission 107 of signals and can have serial or parallel input 111 and output 112 pins. Optical modules have several levels of integration as shown in FIG. 2. Optical modules that contain only the optical-electrical

and electrical-optical (o-e/e-o) components 204, such as a laser and photo detector, are labeled discrete 202. Optical modules that contain (o-e/e-o) 204 and hi speed integrated circuits 205 such as LD, TIA and LA are called transceivers 201. Optical modules that contain (o-e/e-o) 204, hi speed integrated circuits 205 and Mux/Demux devices 206 are called transponders 200. Mux/Demux 206 devices contain CDR and CMUs. Optical modules are ultimately connected with various interfaces to Framers and Media Access Control (MAC) devices 207 as shown in FIG. 2.

[0005] In FIG. 3, the evolution of MSA 10 Gb/s optical modules is shown. Beginning with discrete components, followed by 300pin, XENPAK, X2, and XPAK transponders and finally with XFP transceivers. The evolution of optical modules has been to reduce the size, power, and number of components in optical modules for the purpose of increasing port densities. The very nature of the intent of the invention is contrary to the evolution of MSA 10 Gb/s optical modules in that an increase in power and number of components result while enabling point-to-multipoint networks.

SUMMARY OF THE INVENTION

[0006] A system and method for an unconventional optical module. The invention involves enabling Media Access Control (MAC), Transmission Convergence Layer (TC-Layer) and Physical Layer (PHY-Layer) functionality via a plurality of discrete electronic components in an optical module, which can interface to existing Physical Media Attachment (PMA) layer devices or to devices via the Media Independent Interface (MII). This enables a consolidation of a plurality of network equipment layers resulting in cost savings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 is a diagram of a typical optical module and components.

[0008] FIG. 2 is a diagram illustrating the basic components of transponder, transceiver and discrete optical modules.

[0009] FIG. 3 illustrates the evolutionary history of 10 Gb/s optical modules.

[0010] FIG. 4 is a diagram of an optical module with MAC, TC-Layer and PHY-Layer components according to an exemplary embodiment of the invention.

[0011] FIG. 5 is an illustration of the location of the invention in the Ethernet OSI model according to an exemplary embodiment of the invention.

[0012] FIG. 6 is an illustration of the location of the invention in the Fiber Channel model structure according to an exemplary embodiment of the invention.

5 [0013] FIG. 7 is a diagram of a point to multipoint network utilizing the invention.

DETAILED DESCRIPTION

10 [0014] FIG. 4 is a diagram of an optical module 400 with MAC, TC-Layer and PHY-Layer functionality components 408 according to an exemplary embodiment of the invention. The form factor of the optical module 400 can comply with any current or future optical module form factor. The preferred embodiment of the invention would have a form factor that complies with an MSA optical module such as the XENPAK, X2 and XFP MSA optical modules. The optical module 400 contains the optical-

15 electrical/electrical-optical components such as a laser 401 and a photo detector 403 as well as hi speed devices such as the laser driver 402, TIA 404 and limiting amp 405. The MAC, TC-Layer and PHY-Layer functionality component(s) 408 inside the optical module are the basis of the invention and are not to be confused with replacing the traditional MAC, TC-Layer and PHY-Layer devices that reside outside of optical

20 modules. The MAC and TC-Layer comprise of functionality needed to generate and receive transmission frames and are responsible for the entire overhead associated with the transmission frame for a point-to-multipoint network. The invention is envisioned to enable point-to-multipoint connections in previously point-to-point only connections via passive optical network (PON) implementation. This implies a headend or Optical Line

25 Terminal (OLT) MAC and TC-Layer, which must emulate the functionality of a point-to-point link and is the master of the point-to-multipoint link, with a complementary client or Optical Network Terminal (ONT) MAC and TC-Layer operating in a slave like relationship to the headend MAC & TC-Layer counter part. The MAC performs the efficient arbitrating of downstream and upstream data by determining bandwidth

30 allocation and packet destination on the point-to-multipoint network. The term TC-Layer originated with ATM protocol but has become and is used here to describe a specification

that: bundles and unbundles sent and received data into packets or frames; manages the transmission of packets or frames on a network via medium access and bandwidth allocation; provides necessary messaging and end point behavior, and checks and corrects for errors. The PHY-Layer comprises the functionality of clock data recovery, analog to digital and digital to analog conversion. The preferred optical module embodiment would also contain a performance monitor 413, clock generator 414 and a micro-controller 415. The performance monitor 403 contains a photo diode and is used to monitor and correct the extinction ratio of the laser. The clock generator 414 is a clock source for the various digital components in the preferred optical module embodiment 400. The micro-controller 415 enables the optical module 400 to communicate to an external intelligence the capabilities of the optical module 400 as well as receive configuration commands from the external intelligence. The input 411 and output 412 of the optical module 400 can be either serial or parallel pins depending on the type of network apparatus that the optical module 400 is intended to be connected to.

[0015] The optical module 400 can connect to a plurality of network apparatus according to an exemplary embodiment of this invention. Given today's network infrastructure the invention is preferred to connect to Ethernet and Fibre Channel networks. FIG. 5 is a diagram of the Ethernet OSI model. The embodiment of the invention connects to Ethernet devices at two levels in the OSI model, as Physical Coding Sublayer (PCS) layer 502 and Physical Media Dependent (PMD) layer 503 devices. The embodiment connects to Ethernet devices as the PCS layer 502 via an xMII type interface, which is a generic term for 100Mbit or higher Media Independence Interfaces. FIG. 6 is a diagram of the Fibre Channel model structure and the embodiment of the invention connects to Fibre Channel devices at two levels in this structure model, as FC-1 layer 602 and FC-0 layer 603 devices. The embodiment connects to Fibre Channel devices as the FC-1 layer 602 via the interface specified by the Fibre Channel specification, which as recently adopted an xMII interface as well.

[0016] The embodiment connects to Ethernet devices as the PMD layer 503 and Fibre Channel devices as the FC-0 layer 603 via an MSA optical module port whereby the embodiment replaces an existing MSA optical module or is an outright substitute for traditional MSA optical modules. The embodiment in this case would have either serial

or XAUI interface depending on the MSA form factor of the MSA optical module port. Furthermore, the embodiment in this case has the addition of 8/10 bit decode 700 functionality as part of the MAC, as shown in FIG. 7. Both Ethernet and Fibre channel employ 8/10 bit encoding at the PCS layer. In order for the MAC to perform its functions part of the incoming data must be decoded to determine the destination of the packet on the point-to-multipoint network. The data is preferred to be sent with the 8/10 bit encoding to reduce the burden of complete decoding and recoding at the destination. Although in particular embodiments 8/10 bit decoding 700 and encoding 701 can be desired and done.

[0017] Quality of Service (QoS) in network designs has never been as important as it is today. Manageable QoS needs to be available at all levels of a network, including LAN, WAN, campus networks, enterprise networks, and metropolitan networks. QoS management should be provided at all layers of the network protocol, or the QoS is only as good as the weakest link. QoS is usually implemented via Station Management interfaces with Management Information Base (MIB) table of registers to manipulate the network device. The embodiments of the invention enable a new level of QoS management at the PCS and PMD layers or the equivalent thereof. QoS can be enabled via a Station Management interface with the micro-controller 415 where the MIB resides.

[0018] The exemplary embodiment of the invention as discussed is a radical and contrary departure from the evolution of optical modules. The invention enables new levels of network configuration and deployment as well as cost reduction in the form of consolidation of network equipment.

[0019] Although the invention has been described in terms of exemplary embodiments, it is not limited thereto. Rather, the appended claims should be construed broadly, to include other variants and embodiments of the invention, which may be made by those skilled in the art without departing from the scope and range of equivalents of the invention.

What is claimed is:

1. A system and method for novel optical modules enabling new levels of network configuration and deployment comprising a plurality of:
 - a. A laser, photo detector, laser driver, transimpedance amplifier and limiting amplifier and,
 - b. A micro-controller, clock generator and performance monitor and,
 - c. A discrete device implementing a Media Access Control protocol and,
 - d. A discrete device implementing a Transmission Convergence Layer protocol and,
 - e. A discrete device implementing Physical Layer functionality.
2. The system of claim 1, wherein (c) & (d) enables a point-to-multipoint network.
3. The system of claim 1, wherein (c) the Media Access Control device performs the efficient management of downstream and upstream bandwidth allocation.
4. The system of claim 1, wherein (c) the Media Access Control device snoops the incoming data to determine packet destination.
5. The system of claim 1, wherein (c) the Media Access Control device performs 8/10 bit decoding on incoming data.
6. The system of claim 1, wherein (c) the Media Access Control device performs 8/10 bit encoding on outgoing data.
7. The system of claim 1, wherein (d) the Transmission Convergence Layer device bundles and unbundles sent and received data into packets or frames.
8. The system of claim 1, wherein (d) the Transmission Convergence Layer device manages the transmission of packets or frames on the optical network.
9. The system of claim 1, wherein (d) the Transmission Convergence Layer device provides necessary messaging and end point behavior configuration and management controls.

10. The system of claim 1, wherein (d) the Transmission Convergence Layer device checks and corrects for errors.

5 11. The system of claim 1, wherein (e) the Physical Layer device performs an analog-to-digital and digital-to-analog conversion.

12. The system of claim 1, wherein (e) the Physical Layer device performs clock data recovery.

10 13. The optical module of claim 1, wherein the form factor of the optical module conforms to a Multi-Source Agreement optical module form factor.

15 14. The method of claim 1, wherein the optical module attaches to Ethernet devices as the Physical Medium Dependent device.

15. The method of claim 1, wherein the optical module attaches to Fibre Channel devices as the FC-0 device.

20 16. The method of claim 1, wherein the optical module attaches to Ethernet devices as the Physical Coding Sublayer device.

17. The method of claim 1, wherein the optical module attaches to Fibre Channel devices as the FC-1 device.

25 18. The system of claim 1, wherein (c), (d), and (e) are implemented in one device.

19. The system of claim 1, wherein (b) the micro-controller is connected to a station management interface.

30 20. The system of claim 1, wherein (b) the micro-controller contains a Management Information Base table of registers for the management of quality of services.

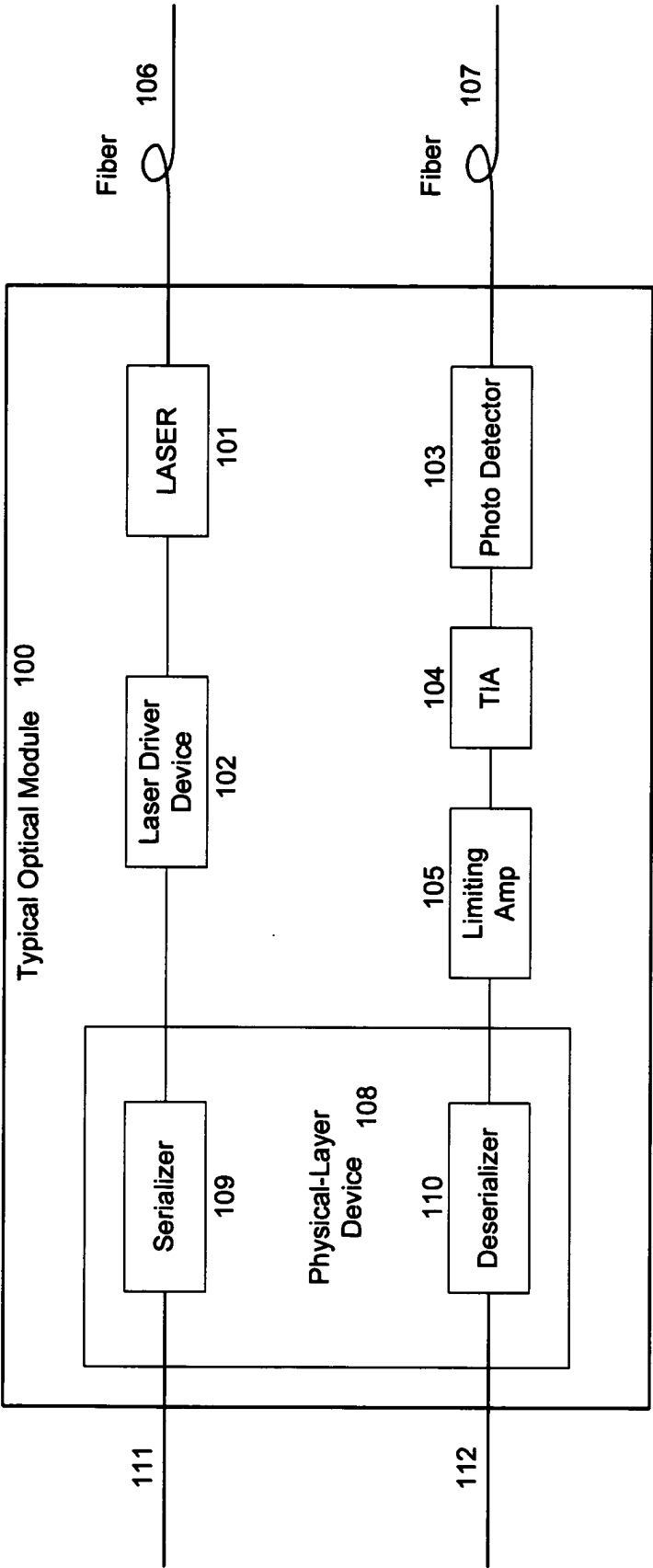


FIG. 1

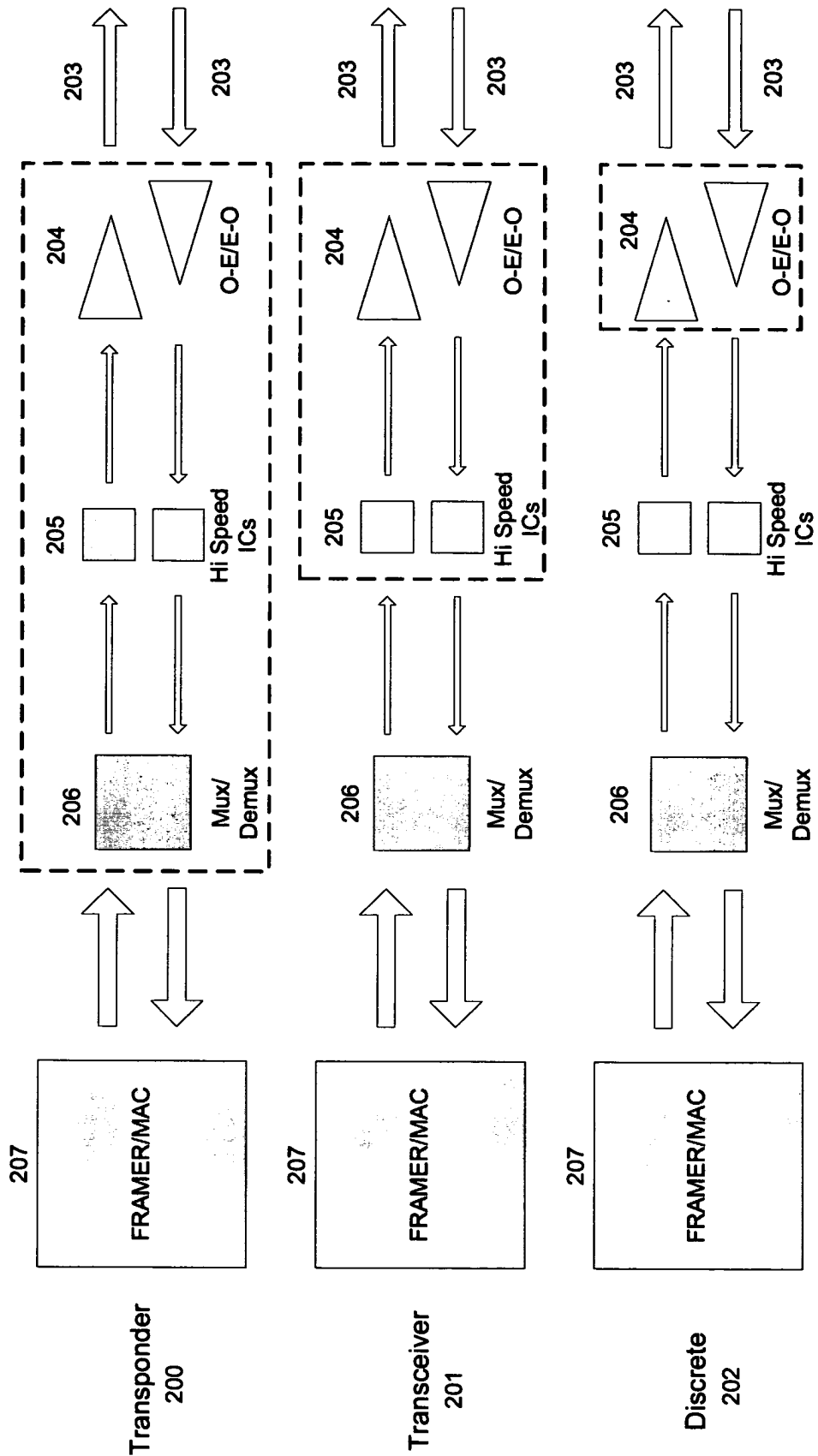


FIG. 2

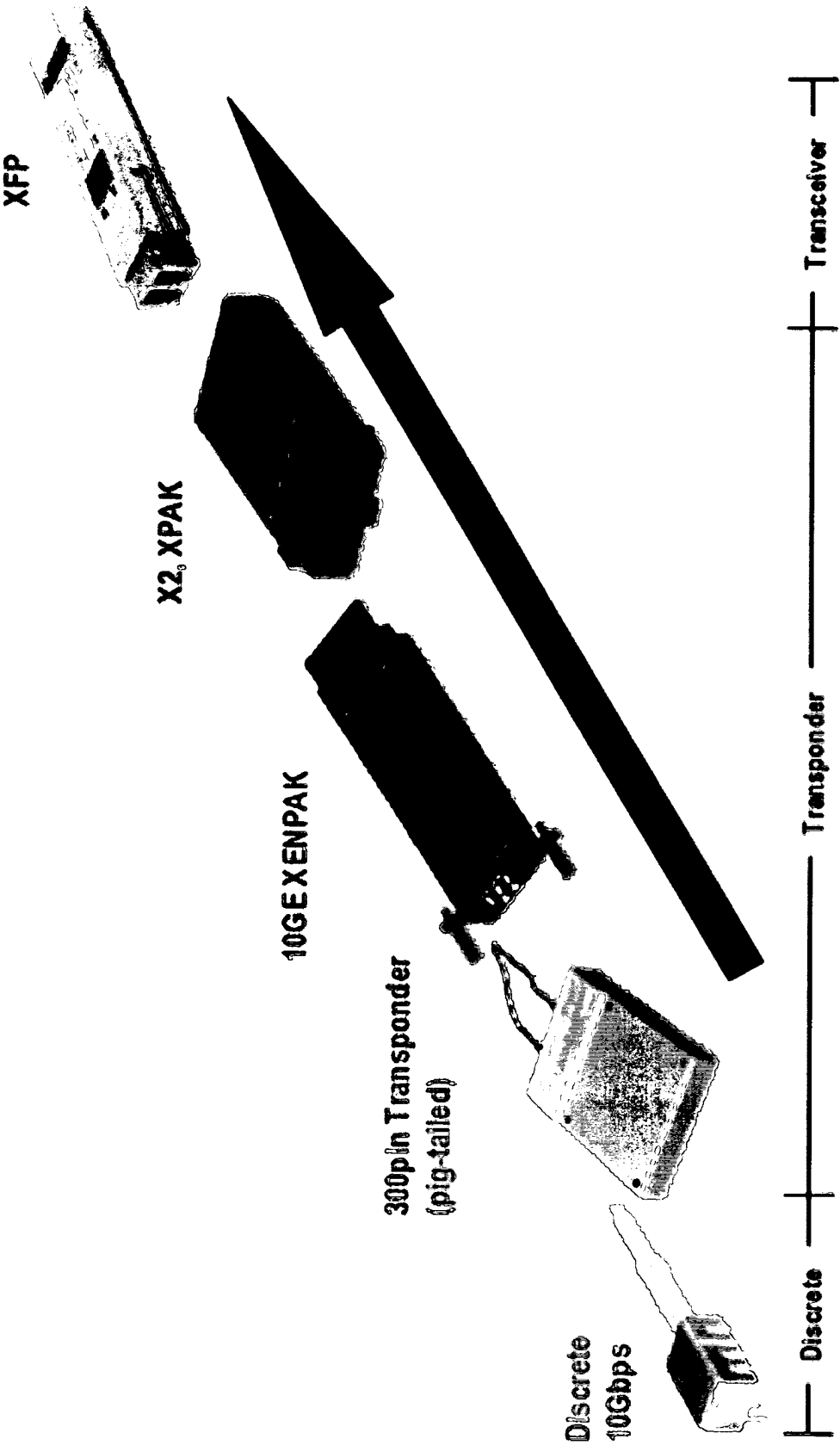


FIG. 3

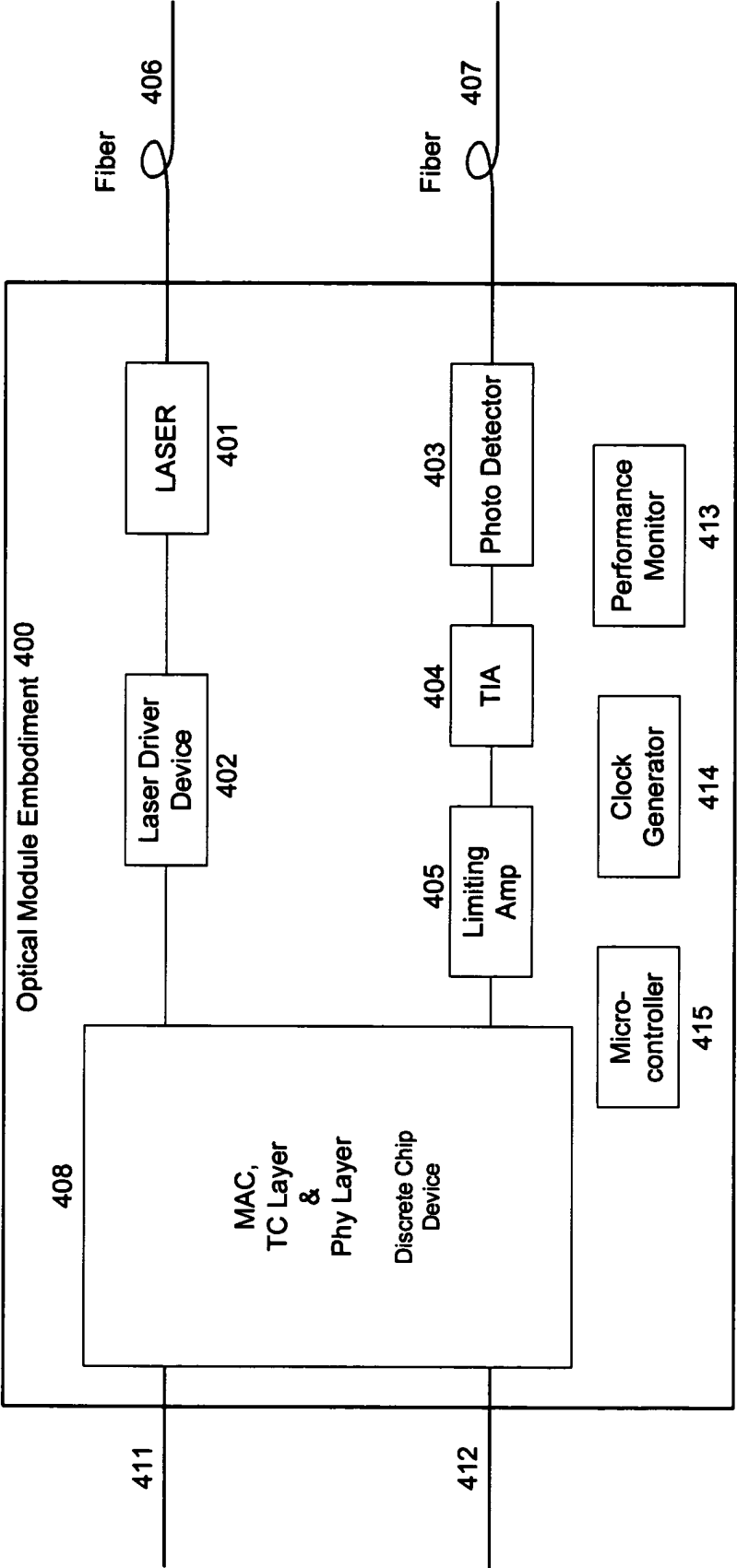


FIG. 4

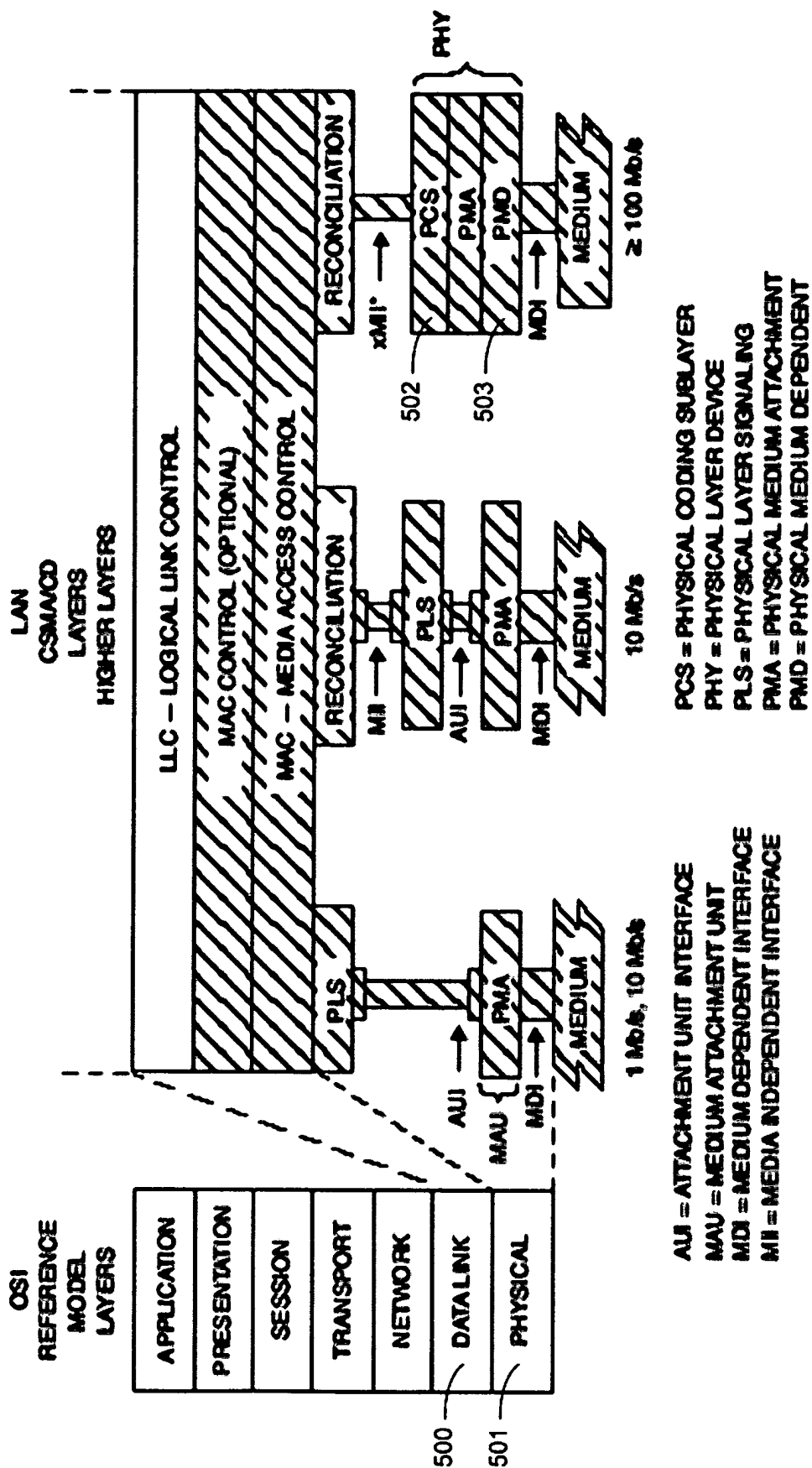


FIG. 5

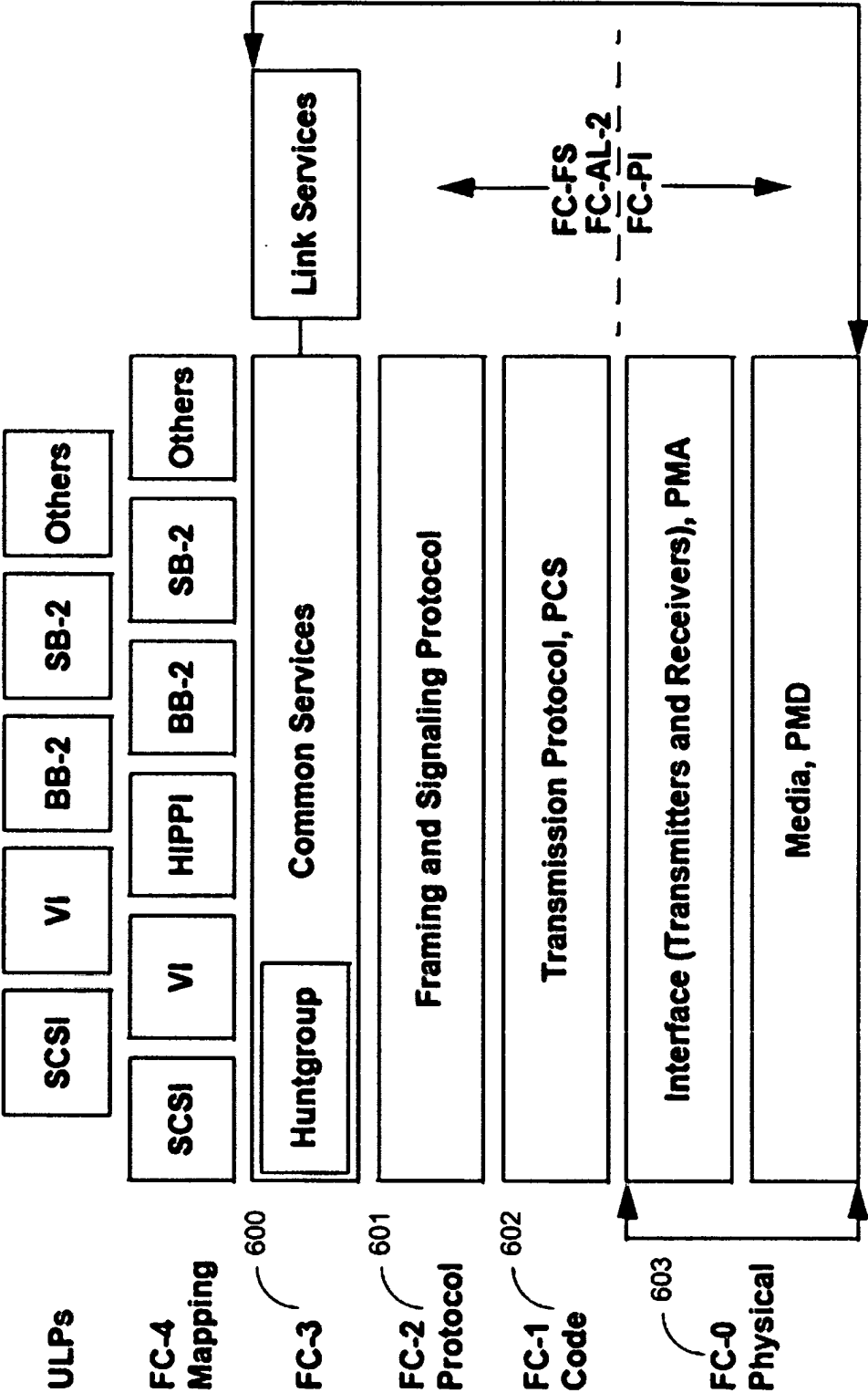


FIG. 6

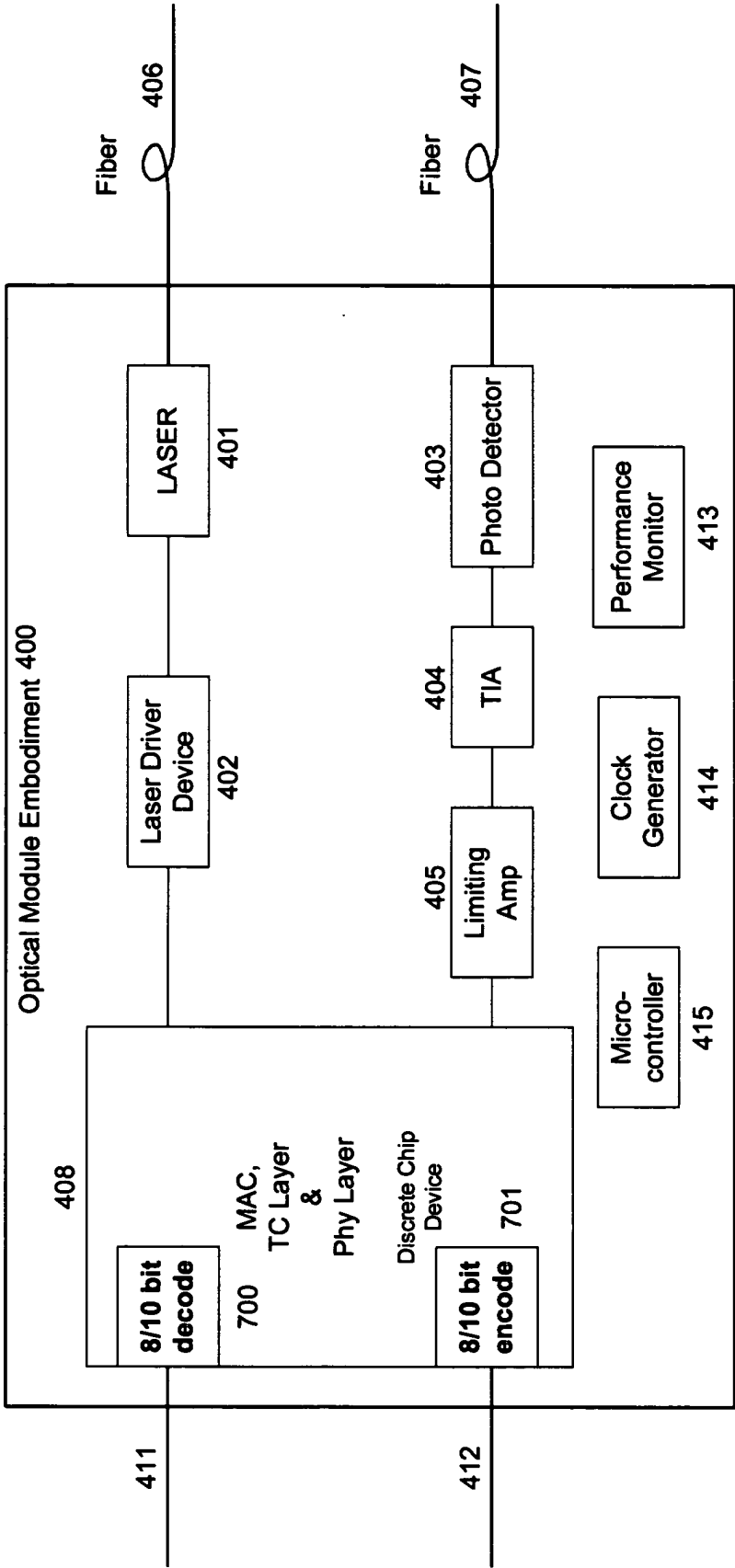


FIG. 7

PATENT APPLICATION SERIAL NO. _____

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

11/03/2003 HTECKLU1 00000078 60515836

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