Abstract: A dynamic upstream bandwidth allocation scheme is disclosed, i.e., limited sharing with traffic prediction (LSTP), to improve the bandwidth efficiency of upstream transmission over PONS. LSTP adopts the PON MAC control messages, and dynamically allocates bandwidth according to the on-line traffic load. The ONU bandwidth requirement includes the already buffered data and a prediction of the incoming data, thus reducing the frame delay and alleviating the data loss. ONUs are served by the OLT in a fixed order in LSTP to facilitate the traffic prediction. Each optical network unit (ONU) classifies its local traffic into three classes with descending priorities: expedited forwarding (EF), assured forwarding (AF), and best effort (BE). Data with higher priority replace data with lower priority when the buffer is full.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

<table>
<thead>
<tr>
<th>IPC(8)</th>
<th>HO2L 12/16 (2007.10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USPC</td>
<td>370/230</td>
</tr>
</tbody>
</table>

According to International Patent Classification (IPC) or to both national classification and IPC.

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

<table>
<thead>
<tr>
<th>IPC(8)</th>
<th>HO2L 12/16 (2007.10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USPC</td>
<td>370/230, 468</td>
</tr>
</tbody>
</table>

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Databases: PatBase, Google Scholar

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
</table>

| * Special categories of cited documents: |
| "A" document defining the general state of the art which is not considered to be of particular relevance |
| "E" earlier application or patent but published on or after the international filing date |
| "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) |
| "O" document referring to an oral disclosure, use, exhibition or other means |
| "P" document published prior to the international filing date but later than the priority date claimed |
| "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention |
| "Y" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone |
| "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art |
| "M" document member of the same patent family |

Date of the actual completion of the international search

29 October 2007

Date of mailing of the international search report

19 DEC 2007

Name and mailing address of the ISA/US

Mall Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-3201

Authorized officer:
Blaine R. Copenhaver
PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (April 2005)
This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-9 and 12-20, drawn to a method for providing network bandwidth allocation to network terminals.
Group II, claims 10, 11, 21 and 22, drawn to a method providing service differentiation among information sets of different priority.

The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention is causing the unit's requested duration to include the transmission time of stored local data awaiting transmission from the network unit to the terminal as well as a waiting time which is an estimate of the time required to transmit from the unit to the terminal that data which is expected to be received in the interval between the request and the initiation of transmission from the unit to the terminal after receiving the grant as claimed therein, is not present in the invention of Group II; the special technical feature of the Group II invention is maintaining (at a network unit) a buffer of members to be transmitted to the terminal, enqueuing members for transmission to the terminal in queues each dedicated to members of a specific priority, in the interval between a network unit request and a following transmission of data thereby, replacing data in the buffer with data being received which is of higher priority when the buffer is full as claimed therein is not present in the invention of Group I.

Since none of the special technical features of the Group I and II Inventions is found in more than one of the inventions, unity of invention is lacking.
**INTERNATIONAL SEARCH REPORT**

**International application No.**
PCT/US06/14287

**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.;  
   because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.;  
   because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.;  
   because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

See (extra Sheet (page 10))

1. ❌ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**

☐ The additional search fees were accompanied by the applicant’s protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant’s protest but the applicable protest fee was not paid within the time limit specified in the invitation.

❌ No protest accompanied the payment of additional search fees.