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14/181,160 14 February 2014 (14.02.2014) US(71) Applicant (for all designated States except US): **HUAWEI TECHNOLOGIES CO., LTD.** [CN/CN]; Huawei Administration Building, Bantian, Longgang District, Shenzhen, Guangdong 518129 (CN).(71) Applicant (for US only): **FUTUREWEI TECHNOLOGIES, INC.** [US/US]; 5340 Legacy Drive, Suite 175, Plano, Texas 75024 (US).(72) Inventors: **SHARIFIAN, Alireza**; Apt. 1816, 1375 Prince of Wales, Ottawa, Ontario K2C3L5 (CA). **SCHOENEN, Rainer**; 400 Slater Street, #1403, Ottawa, Ontario K1R7S7 (CA). **YANIKOMEROGLU, Halim**; 3488 Wyman Crescent, Ottawa, Ontario K1V-0Y8 (CA). **SENARATH, Gamini**; 46, Maple Stand Way, Ottawa, Ontario K2G 6P5 (CA). **CHENG, Ho Ting**; 686 Birchland Cres., Stittsville,Ontario K2S 0S9 (CA). **DJUKIC, Petar**; 1071 Ambleside Drive Apt. 906, Ottawa, Ontario K2B 6V4 (CA).(74) Agent: **CARLSON, Brian**; Slater & Matsil, L.L.P., 17950 Preston Rd., Suite 1000, Dallas, Texas 75252 (US).

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[Continued on next page]

(54) Title: SYSTEM AND METHOD FOR NETWORK RESOURCE ALLOCATION CONSIDERING USER EXPERIENCE, SATISFACTION AND OPERATOR INTEREST

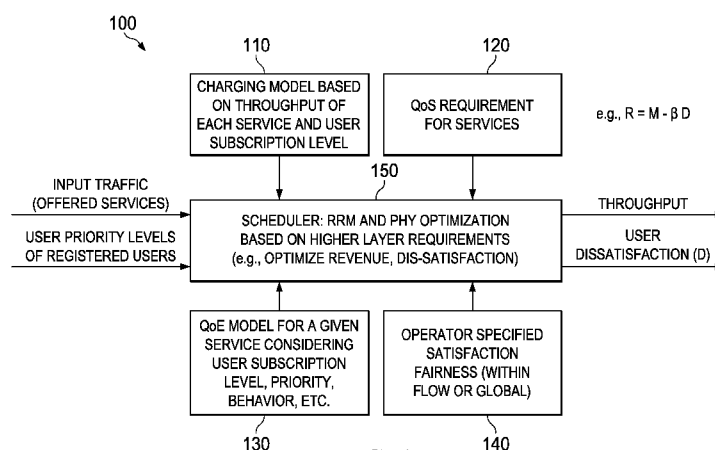


FIG. 1

(57) Abstract: Embodiments are provided for network resource allocation considering user experience, satisfaction, and operator interest. An embodiment method by a network component for allocating network resources includes evaluating, for a user, a QoE for each flow of a plurality of flows in network traffic in accordance with a QoE model, and further evaluating, for an operator, a revenue associated with the flows in accordance with a revenue model. A plurality of priorities that correspond to the flows are calculated in accordance with the QoE for the user and the revenue for the operator. The method further includes identifying a flow of the flows with a highest value of the priorities, and allocating a network resource for the flow. In an embodiment, the QoE model is a satisfaction model that provides a measure of user satisfaction for each flow in accordance with a subscription or behavior class of the user.



— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(88) Date of publication of the international search report:
9 October 2014

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US14/16575

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H04L 12/28 (2014.01)

USPC - 370/395.21

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)

IPC(8): H04L 12/26, 12/28 (2014.01)

USPC: 370/230.1, 252, 395.21

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)

MicroPatent (US-G, US-A, EP-A, EP-B, WO, JP-bib, DE-C,B, DE-A, DE-T, DE-U, GB-A, FR-A); Google/Google Scholar; IEEE; DialogPRO; satisfaction, indicator, threshold, quality, service, QoS, measure, determine, user, client network, traffic, map, experience, QoE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X — Y	US 2009/0097402 A1 (STUMPERT M et al.) April 16, 2009, paragraphs [0021], [0023], [0068] [0089], [0093], [0104]	1-11, 13 and 14 12
Y	US 7525970 B2 (MANGIN C et al.) April 28, 2009, column 2, lines 52-67	12

☐ Further documents are listed in the continuation of Box C.

* 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

"X" 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

"&" document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US14/16575

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:

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 fee must be paid.

Group I: Claims 1-14 are directed toward a method and network component for modeling user satisfaction for network services.

Group II: Claims 15-28 are directed toward a method and network component for allocating network resources.

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:

-See Supplemental Page-

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.:
1-14

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.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US14/16575

---Continued from Box III: Lack of Unity of Invention---

The special technical features of Group I include determining quality of service (QoS) requirements for a network service; measuring QoS elements in network traffic of the network service; mapping the measured QoS elements and the QoS requirements to a satisfaction indicator according to a satisfaction model; and determining user satisfaction according to the satisfaction indicator, which are not present in Group II.

The special technical features of Group II include evaluating, for a user, a quality of experience (QoE) for each flow of a plurality of flows in network traffic in accordance with a QoE model; evaluating, for an operator, a revenue associated with the flows in accordance with a revenue model; calculating priorities corresponding to the flows in accordance with the QoE for the user and the revenue for the operator; identifying a flow of the flows with a highest value of the priorities; and allocating a network resource for the flow, which are not present in Group I.

The common technical features shared by Groups I and II are a network component comprising at least one processor, and a non-transitory computer readable storage medium storing programming for execution by the at least one processor; and evaluating, for a user, a quality of experience in network traffic.

However, these common features are previously disclosed by US 2011/0007648 A1 to Liu, Y et al. (hereinafter 'Liu'). Liu discloses a network component comprising at least one processor, and a non-transitory computer readable storage medium storing programming for execution by the at least one processor (quality of experience calculations are performed by a network monitoring server (comprising processor and non-transitory computer-readable medium), paragraph [0021]); and evaluating, for a user, a quality of experience in network traffic (evaluating Quality of Experience (QoE) for services transmitted over a network, paragraph [0021]).

Since the common technical features are previously disclosed by the Liu reference, these common features are not special and so Groups I and II lack unity.