IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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**Application No.** 14/782,783

**Filed:** October 6, 2015

**Confirmation No.** 6435

**For:** REDUCTION OF BUFFER OVERFLOW **FILED VIA EFS**

**Examiner:** Jason A. Harley **ON** **JANUARY X, 2017**

**Art Unit:** 2468

**Attorney Reference No.** P61054US

FILED VIA EFS

COMMISSIONER FOR PATENTS

**RESPONSE**

This responds to the Non-final Office action dated December 15, 2016 (“Action”).

**Listing of the claims** begins on page 2.

**Remarks** begin on page 7.

**Listing of Claims**

1. (Original) A node operable to control discontinuous reception (DRX) configurations for a plurality of user equipments (UEs), the node having computer circuitry configured to:

receive a buffer overflow message, from a serving gateway (S-GW), indicating a potential overflow at an S-GW buffer when downlink information that is stored at the S-GW buffer exceeds a predetermined threshold;

select one or more UEs from the plurality of UEs according to predefined criteria; and

modify the DRX configurations of the one or more UEs in order to reduce the downlink information that is stored at the S-GW buffer, thereby reducing the potential for overflow at the S-GW buffer.

2. (Original) The computer circuitry of claim 1, wherein the downlink information is stored at the S-GW buffer until the UEs awake from a low power mode during a discontinuous reception (DRX) sleep cycle.

3. (Original) The computer circuitry of claim 1, further configured to receive the buffer overflow message from the S-GW via a mobility management entity (MME).

4. (Original) The computer circuitry of claim 1, further configured to modify the DRX configurations of the one or more UEs by reducing a DRX sleep cycle length of the one or more UEs.

5. (Original) The computer circuitry of claim 1, further configured to select the one or more UEs based on the predefined criteria of a highest data rate or a longest DRX sleep cycle length in comparison to the plurality of UEs.

6. (Original) The computer circuitry of claim 1, further configured to modify the DRX configurations of the one or more UEs that are in a connected mode.

7. (Original) The computer circuitry of claim 1, further configured to modify a DRX sleep cycle length of the one or more UEs when the UEs transition from the idle mode to the connected mode.

8. (Original) The computer circuitry of claim 1, further configured to prevent the one or more UEs from entering a low power mode during a DRX sleep cycle in response to receiving the buffer overflow message from the S-GW.

9. (Original) The computer circuitry of claim 1, further configured to modify DRX sleep cycle lengths of the plurality of UEs in response to receiving multiple buffer overflow messages from the S-GW.

10. (Original) The computer circuitry of claim 1, further configured to reconfigure DRX sleep cycle lengths of the one or more UEs to a previous DRX configuration in response to receiving an indication from the S-GW that the potential for overflow at the S-GW buffer has ended.

11. (Original) The computer circuitry of claim 1, wherein the node is selected from a group consisting of a base station (BS), a Node B (NB), an evolved Node B (eNB), a baseband unit (BBU), a remote radio head (RRH), a remote radio equipment (RRE), or a remote radio unit (RRU).

12. (Original) A Third Generation Partnership Project (3GPP) Serving Gateway (S-GW) operable to buffer downlink information for a plurality of user equipments (UEs), the S-GW having computer circuitry configured to:

receive the downlink information for the plurality of UEs;

store the downlink information, at an S-GW buffer, when the plurality of UEs are in a low power mode during a discontinuous reception (DRX) sleep cycle;

detect an overflow potential at the S-GW buffer when the downlink information stored at the S-GW buffer exceeds a predetermined threshold; and

communicate a buffer overflow message indicating the overflow potential at the S-GW buffer to an evolved node B (eNB), wherein the buffer overflow message instructs the eNB to modify DRX configurations associated with one or more UEs in the plurality of UEs in order to reduce overflow potential at the S-GW buffer.

13. (Original) The computer circuitry of claim 12, wherein the buffer overflow message instructs the eNB to modify a DRX sleep cycle length of the one or more UEs in order to reduce overflow potential at the S-GW buffer.

14. (Original) The computer circuitry of claim 12, wherein the one or more UEs are in a connected mode.

15. (Original) The computer circuitry of claim 12, further configured to communicate the buffer overflow message to the eNB via a mobility management entity (MME).

16. (Original) The computer circuitry of claim 12, wherein the plurality of UEs include machine type communication (MTC) devices.

17. (Original) The computer circuitry of claim 12, wherein the plurality of UEs include an antenna, a touch sensitive display screen, a speaker, a microphone, a graphics processor, an application processor, internal memory, or a non-volatile memory port.

18. (Original) A method for reducing buffer overflow at a Third Generation Partnership Project (3GPP) Serving Gateway (S-GW), the method comprising:

receiving a buffer overflow message, at an evolved node B (eNB) from the S-GW, indicating potential overflow of downlink information at a S-GW buffer, wherein the downlink information is stored at the S-GW buffer until a plurality of user equipments (UEs) awake from a low power mode during a discontinuous reception (DRX) sleep cycle;

selecting one or more UEs from the plurality of UEs according to predefined criteria, wherein the one or more UEs are in a connected mode; and

modifying the DRX configurations of the one or more UEs in order to reduce the downlink information that is stored at the S-GW buffer, thereby reducing the potential for overflow at the S-GW buffer.

19. (Original) The method of claim 18, further comprising receiving the buffer overflow message from the S-GW when the downlink information that is stored at the S-GW buffer exceeds a predetermined threshold.

20. (Original) The method of claim 18, further comprising receiving the buffer overflow message from the S-GW via a mobility management entity (MME).

21. (Original) The method of claim 18, further comprising selecting the one or more UEs based on the predefined criteria relating to a data rate or a DRX cycle length.

22. (Original) The method of claim 18, wherein modifying the DRX configurations of the one or more UEs comprises reducing a DRX sleep cycle length of the one or more UEs.

23. (Original) The method of claim 18, wherein modifying the DRX configurations of the one or more UEs comprises preventing the one or more UEs from entering a DRX sleep cycle.

**Remarks**

The Applicant respectfully requests reconsideration in view of the following remarks. Claims 1-23 are pending, of which claims 1, 12 and 18 are independent claims.

***Claim Rejections - 35 U.S.C. § 101***

The Action rejects claims 1, 12 and 18 under 35 U.S.C. § 101 as allegedly being directed to a judicial exception without significantly more. Action, Pages 2, 3. The Applicant respectfully traverses these rejections.

The independent claims, recite method and systems respectively that improve a particular technical field. The conventional Machine Type Communication (MTC) has the following drawbacks.

As explained in the Specification at ¶ 3:

Although the amount of data sent by UEs equipped for MTC is very small, a large number of these devices connected to a wireless network and concurrently being used may increase a data load and overhead expense on a network.

As explained in the Specification at ¶ 22:

When the maximum DRX sleep cycle length is 2.56 seconds, the network may be adequate to buffer the IP packets until the UEs wake up from idle mode. However, if the DRX sleep cycle length increases to several minutes or even several hours (i.e., the UE sleeps according to the extended DRX sleep cycle length); the network may be unable to buffer all of the IP packets until the UEs wake up from idle mode. As the DRX sleep cycle length increases (e.g., from 2.56 seconds to 10 seconds), the amount of information to be buffered at the network may also increase. In other words, the extended DRX sleep cycle may result in an increased number of IP packets being buffered at the network. Thus, the network may be unable to handle the increased amount of information that is to be buffered, especially when a plurality of UEs equipped for MTC (e.g., thousands of UEs) are using extended DRX sleep cycle lengths simultaneously. Even if a single IP Packet in the order of 1 kilobyte (kB) is buffered at the network for each of the plurality of UEs (e.g., several thousand UEs) while the plurality of UEs are idle, the amount of information may exceed a buffer capacity of the network.

Further, as explained in the specification at ¶ 26:

The potential for buffer overflow at the S-GW may increase when the S-GW is suddenly faced with a high volume of connected users. As a result, the S-GW 106 may drop IP packets, and hence, the IP packets may not be received at the UE 102 when the UE 102 wakes up from idle mode. The loss of IP packets at the UE may degrade a user's experience.

The features of independent claim 1 provide a technical improvement to the computer operation to overcome the data load and overhead expense on the network by receiving “a buffer overflow message, from a serving gateway (S-GW), indicating a potential overflow at an S-GW buffer when downlink information that is stored at the S-GW buffer exceeds a predetermined threshold,” and modifying “the DRX configurations of the one or more UEs in order to reduce the downlink information that is stored at the S-GW buffer.” According to the Specification at ¶ 34, “[m]odifications to the DRX configurations associated with the UEs may reduce the downlink information that is stored at the S-GW buffer,” reducing the potential for overflow at the S-GW.

In *Enfish v. Microsoft*, Fed. Cir. No. 2015-1244, May 12, 2016, the court determined that when technical “benefits flow from a design” which are not present in the conventional models (*Enfish,* page 7), and that design results in “an improvement to computer-related technology” (*Enfish,* page 11), and the “plain focus of the claims is on an improvement to computer functionality itself, not on ... other tasks for which a computer is used in its ordinary capacity” (*Enfish,* page 12), then those claims “are not directed to an abstract idea within the meaning of *Alice”* (*Enfish,*  page 12).

The Examiner states in the Action, page 2, that the claims are not directed to improvements to the functioning of a computer. To the contrary, that is exactly what the claims achieve - an improved functionality in how devices communicate over a network. As a contrasting example, the Supreme Court held in Alice that a process of mitigating settlement risk performed on a computer was directed to an abstract idea (i.e. mitigating settlement risk). The mitigation of settlement risk is a business process and does not affect the functioning of the computers, themselves. In contrast, claim 1 recites a “node operable to control discontinuous reception (DRX) configurations for a plurality of user equipments (UEs)...” The entire claim is directed to an improvement in the functioning of a computer, and not to a business process that may be performed on a computer for convenience, as in Alice.

Here, there is an indication of “a potential overflow at an S-GW buffer when downlink information that is stored at the S-GW buffer exceeds a predetermined threshold,” not present in conventional models that results in an improvement to the computer’s functioning efficiency. Further, the claims are very specifically directed to the improved functionality itself by “modify the DRX configurations of the one or more UEs in order to reduce the downlink information that is stored at the S-GW buffer, thereby reducing the potential for overflow at the S-GW buffer.” Thus, the Applicant respectfully asserts that the independent claim 1 is not “an abstract idea within the meaning of *Alice”* (*Enfish*, page 12).

Independent claims 12 and 18 are patent-eligible for at least similar reasons given for claim 1. Therefore, independent claims 12 and 18 recite patent-eligible subject matter as well.

Accordingly, Applicant respectfully requests that the rejection of claims 1, 12 and 18 under 35 U.S.C. § 101 be withdrawn. The Applicant also notes that there are other reasons why the claims satisfy 35 U.S.C. § 101 and reserve the right to make such arguments if needed.

***Claim Rejections - 35 U.S.C. § 103***

In the Action, the Examiner rejects claims 1-4 and 6-17 under 35 U.S.C. § 103 as being unpatentable over U.S. Patent Application Publication No. 2013/02233091 to Hsiao et al. (“Hsiao”) in view of U.S. Patent Application Publication No. 2009/0180414 to Maeda et al. (“Maeda”) and claims 5,18-23 Under 35 U.S.C. § 103 as being unpatentable over Hsiao in view of Maeda and further in view U.S. Patent Application Publication No. 2014/0161007 to Donthi et al. (“Donthi”). Action, Pages 3-15. The Applicant respectfully disagrees with the rejections.

Independent Claim 1

Claim 1, as amended, recites:

receive a buffer overflow message, from a serving gateway (S-GW), indicating a potential overflow at an S-GW buffer when downlink information that is stored at the S-GW buffer exceeds a predetermined threshold;

Hsiao and Maeda, taken separately or in combination, fail to teach or suggest the above-cited language of claim 1.

Hsiao describes a mobile station and a power saving method for a wireless communication system. Hsiao, Abstract. The mobile station stays in a sleep mode, and comprises a buffer, a transceiver and a processor. The buffer is configured to temporarily store an uplink data packet. Hsiao, ¶ 10. The “mobile station in a sleep mode keeps temporarily storing an uplink data packet according to the information carried in a downlink traffic indication message from a base station, and this can extend the period of time in which the mobile station stays in the sleep mode so as to achieve the purpose of power saving.” Hsiao, ¶ 9.

As described in the Specification of Hsiao at ¶ 22:

If there is an uplink data packet to be transmitted to the base station when the mobile station stays in the sleep mode, then the mobile station will temporarily store but not transmit the uplink data packet. Afterwards, if the information carried in the downlink traffic indication message is a non-having downlink data packet information, the mobile station keeps temporarily storing the uplink data packet to keep staying in the sleep mode. Conversely, if the information carried in the downlink traffic indication message is a having downlink data packet information, the mobile station leaves the sleep mode to receive the downlink data packet from the base station and transmit the uplink data packet to the base station.

Hsiao fails to teach or suggest “receive a buffer overflow message, from a serving gateway (S-GW), indicating a potential overflow at an S-GW buffer,” as recited in claim 1. At most, Hsiao describes a mobile station comprising a buffer to “temporarily store an uplink data packet.” *See* Hsiao, ¶¶ 23, 38. Storing the uplink data packet is determined based on information carried in the downlink traffic indication message. *See* Hsiao ¶ 36. This does not involve receiving “a buffer overflow message,” as recited in claim 1. Hsiao is even further from teaching “receive a buffer overflow message, from a serving gateway (S-GW), indicating a potential overflow at an S-GW buffer,” as recited in claim 1.

Further, as described in Hsiao, the mobile station temporarily stores an uplink data packet and transmits the uplink data packet based on information carried in the downlink traffic indication message so that an interval in which the uplink data packet is transmitted can overlap as much as possible with an interval in which a downlink data packet is received.” *See* Hsiao, ¶¶ 3, 23, 38. This does not involve storing “downlink information … at the S-GW buffer,” as recited in claim 1. Hence, Hsiao fails to teach or suggest receiving “a buffer overflow message, from a serving gateway (S-GW), indicating a potential overflow at an S-GW buffer when downlink information that is stored at the S-GW buffer exceeds a predetermined threshold,” as recited in claim 1.

Maeda describes a base station which controls the transmission rate, the transmission power, the transmission timing, the available frequency, the width of the available frequency, and so on of each of a plurality of mobile terminals. Maeda, ¶ 125. If the base station judges that the mobile terminal is able to make a transition to a DRX period during Active when triggered by the notification from the mobile terminal, the base station temporarily stops supply of electric power to the data transmission processing units and the data reception processing units of the mobile terminal. Maeda, Abstract.

Maeda fails to teach or suggest “receive a buffer overflow message, from a serving gateway (S-GW), indicating a potential overflow at an S-GW buffer,” as recited in claim 1. At most, Maeda describes a transmission data buffer unit, of a mobile terminal and a base station, which temporarily stores the control data outputted from the protocol processing unit. *See* Maeda, ¶¶ 178, 201. This does not involve receiving “a buffer overflow message,” as recited in claim 1. Maeda is even further from teaching “receive a buffer overflow message, from a serving gateway (S-GW), indicating a potential overflow at an S-GW buffer when downlink information that is stored at the S-GW buffer exceeds a predetermined threshold,” as recited in claim 1.

Since neither Hsiao, nor Maeda disclose the recited language, their combination would also fail to describe such an arrangement. For at least these reasons, the rejection of claim 1 under 35 U.S.C. § 103 should be withdrawn.

Dependent Claims 2-4 and 6-11

Each of claims 2-4 and 6-11 depends from claim 1 and incorporate the above-cited language of claim 1. For at least this reason, the rejections of claims 2-4 and 6-11 under 35 U.S.C. § 103 should be withdrawn.

Independent Claim 12

Claim 12, recites:

communicate a buffer overflow message indicating the overflow potential at the S-GW buffer to an evolved node B (eNB), wherein the buffer overflow message instructs the eNB to modify DRX configurations associated with one or more UEs in the plurality of UEs in order to reduce overflow potential at the S-GW buffer.

For reasons similar to those explained above with reference to the above-cited

language of claim 1, Hsiao and Maeda fail to teach “communicate a buffer overflow message indicating the overflow potential at the S-GW buffer to an evolved node B (eNB),” as recited in claim 12. Hsiao and Maeda are even further from teaching “the buffer overflow message” instructing “the eNB to modify DRX configurations associated with one or more UEs in the plurality of UEs in order to reduce overflow potential at the S-GW buffer,” as recited in claim 12.

For at least these reasons, the rejection of claim 12 under 35 U.S.C. § 103 should be withdrawn.

Dependent Claims 13-17

Each of claims 13-17 depends from claim 12 and incorporate the above-cited language of claim 12. For at least this reason, the rejections of claim 13-17 under 35 U.S.C. § 103 should be withdrawn.

Independent Claim 18

Claim 18, recites:

receiving a buffer overflow message, at an evolved node B (eNB) from the S-GW, indicating potential overflow of downlink information at a S-GW buffer, wherein the downlink information is stored at the S-GW buffer until a plurality of user equipments (UEs) awake from a low power mode during a discontinuous reception (DRX) sleep cycle;

For reasons similar to those explained above with reference to the above-cited

language of claim 1, Hsiao and Maeda fail to teach “receiving a buffer overflow message, at an evolved node B (eNB) from the S-GW, indicating potential overflow of downlink information at a S-GW buffer,” as recited in claim 18. Hsiao and Maeda are even further from teaching that “the downlink information is stored at the S-GW buffer until a plurality of user equipments (UEs) awake from a low power mode during a discontinuous reception (DRX) sleep cycle,” as recited in claim 18.

Donthi describes methods to “reduce unnecessary resource consumption and network traffic in a communications network, such as an LTE network.” Donthi, Abstract. A UE may indicate a DRX cycle length to the core network during a TAU procedure. Donthi, ¶ 25.

As explained in the Specification of Donthi at ¶ 36:

To determine whether or not a TAU will be initiated, three parameters may be considered. A first parameter may be the UE-chosen DRX cycle length that the UE wishes to indicate to the MME. A second parameter may be the DRX cycle length that is broadcast by the eNB in a cell in which the UE is operating. A third parameter may be the UE-chosen DRX cycle length that is already configured in an MME (if it exists).

Initiating a TAU procedure can be avoided if the DRX cycle length that is being broadcast by the eNB is the lowest DRX cycle length among the two or more determined DRX cycle lengths (i.e., the DRX cycle length already configured in the MME and/or the DRX cycle length being broadcast by the eNB). Donthi, ¶ 37.

Donthi fails to teach or suggest “receiving a buffer overflow message, at an evolved node B (eNB) from the S-GW, indicating potential overflow of downlink information at a S-GW buffer,” as recited in claim 18. At most, Donthi describes an SGW which may generally route and forward user data packets to/from the UE, anchoring user planes during inter-eNB handovers, triggering paging when DL data is available for the UE, managing and storing contexts of the UE, etc. *See* Donthi ¶ 19. This does not involve receiving “a buffer overflow message,” as recited in claim 18. Donthi is even further from teaching “receiving a buffer overflow message, at an evolved node B (eNB) from the S-GW, indicating potential overflow of downlink information at a S-GW buffer, wherein the downlink information is stored at the S-GW buffer until a plurality of user equipments (UEs) awake from a low power mode during a discontinuous reception (DRX) sleep cycle,” as recited in claim 18.

Since neither Hsiao, nor Maeda nor Donthi disclose the recited language, their combination would also fail to describe such an arrangement. For at least these reasons, the rejection of claim 18 under 35 U.S.C. § 103 should be withdrawn.

Dependent Claims 19-23

Each of claims 19-23 depends from claim 18 and incorporate the above-cited language of claim 18. For at least this reason, the rejections of claims 19-23 under 35 U.S.C. § 103 should be withdrawn.

Dependent Claim 5

Claim 5 depends from claim 1 and incorporates the above-cited language of claim 1. Hsiao and Maeda, taken separately or in combination, fail to teach or suggest the above-cited language of claim 1. Further, for reasons similar to those explained above with reference to the above-cited language of claim 18, Donthi fails to teach “receive a buffer overflow message, from a serving gateway (S-GW), indicating a potential overflow at an S-GW buffer,” as recited in claim 1.

Since neither Hsiao, nor Maeda nor Donthi disclose the recited language of claim 1, their combination would also fail to describe such an arrangement. For at least this reason, the rejection of claim 5 under 35 U.S.C. § 103 should be withdrawn.

***Conclusion and Request for Interview***

All pending claims should be allowable. Such action is respectfully requested. Should any issues remain, the Applicant invites the Examiner to contact the undersigned attorney to discuss such remaining issues. The Commissioner is authorized to charge any other fees that may be due and owing as a result of this response to the undersigned attorney's PTO Deposit Account #XX-XXX.

Respectfully submitted,

XYZ