

US010142894B2

# (12) United States Patent

Himayat et al.

# (54) INTERWORKING/CO-EXISTENCE OF INTEGRATED WLAN/3GPP RAT ARCHITECTURES WITH LEGACY WLAN/3GPP INTERWORKING SOLUTIONS

(71) Applicant: **Intel Corporation**, Santa Clara, CA (US)

(72) Inventors: Nageen Himayat, Fremont, CA (US);
Alexander Sirotkin, Petach Tikva (IL);
Jing Zhu, Portland, OR (US);
Alexandre Stojanovski, Paris (FR);
Mo-han Fong, Sunnyvale, CA (US);
Vivek G. Gupta, San Jose, CA (US);
Huaning Niu, Milpitas, CA (US);
Pingping Zong, Randolph, NJ (US);
Konstantinos Dimou, Santa Clara, CA (US); Shu-Ping Yeh, New Taipei (TW);
Shilpa Talwar, Los Altos, CA (US);
Muthaiah Venkatachalam, Beaverton,
OR (US)

(73) Assignee: **Intel Corporation**, Santa Clara, CA (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 448 days.

(21) Appl. No.: 14/583,336

(22) Filed: Dec. 26, 2014

(65) **Prior Publication Data** 

US 2015/0350989 A1 Dec. 3, 2015

# Related U.S. Application Data

- (60) Provisional application No. 62/007,391, filed on Jun. 3, 2014.
- (51) **Int. Cl. H04L 12/66 H04W 36/00**(2006.01)
  (2009.01)
  (Continued)

(10) Patent No.: US 10,142,894 B2

(45) **Date of Patent:** Nov. 27, 2018

(52) U.S. Cl.

CPC ....... **H04W 36/0066** (2013.01); H04W 84/12 (2013.01); H04W 88/06 (2013.01); H04W 88/10 (2013.01)

(58) Field of Classification Search

CPC . H04W 48/18; H04W 48/16; H04W 36/0022; H04W 36/30; H04W 28/08;

(Continued)

#### (56) References Cited

## U.S. PATENT DOCUMENTS

8,130,718 B2 3/2012 Shaheen 8,446,830 B2 5/2013 Wu et al. (Continued)

#### FOREIGN PATENT DOCUMENTS

WO 2013138708 A1 9/2013 WO 2014047545 A2 3/2014 WO WO 2015/187284 12/2015

#### OTHER PUBLICATIONS

International Search Report and Written Opinion of corresponding PCT Application PCT/US15/28963 dated Aug. 27, 2015.

(Continued)

Primary Examiner — Hanh N Nguyen (74) Attorney, Agent, or Firm — Patent Capital Group

## (57) ABSTRACT

An integrated WLAN/WWAN architecture is described, in which signaling used to control the integration of the WLAN/WWAN architecture is performed over the Radio Resource Control ("RRC") plane. The integrated architecture may provide a network-controlled framework for performing traffic steering and radio resource management. Additionally, according to the disclosure provided herein, the integrated architecture may interwork with legacy systems (e.g., architectures that do not support the integrated WLAN/WWAN architecture).

#### 24 Claims, 7 Drawing Sheets

