Open Base Station Transport (OBAST) Requirements

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Abstract

   This document outlines the requirements for a set of open IP based
   protocols enabling seamless mobility across diverse radio access
   networks. This document begins by stating some architectural tenets
   upon which the requirements for the OBAST protocol set are based.
   Furthermore, what the authors currently believe to be the eventual
   desirable wireless Internet architecture is described. This
   architecture is shown to enable a common protocol set that we refer
   to as open base station transport (OBAST).

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1.0 Introduction

   This document lists requirements for a protocol set enabling access
   points and/or base stations, of different radio access network types,
   to communicate with each such that seamless handovers may occur
   between these radio nodes. We refer to this protocol set as: Open
   Base Station Transport (OBAST). There are fundamental architectural
   tenets that facilitate "seamless roaming". We shall review those
   first by speaking in terms of what OBAST is and isn't.

1.1 Terminology

   AP   access point
   BTS   base transceiver station
   CDG-IOS   CDMA Development Group-Inter-Operability Standard
   CDMA   Code Division Multiple Access
   GSM   Global System for Mobile communications
   OBAST   Open Base Station Transport
   IuPs
   Macro-mobility
             Inter-IP domain mobility
   MAP   Mobile Application Part
   Micro-mobility
             intra-IP domain mobility
   PSTN   Public Switched Telephone Network
   RAN   Radio Access Network
   RNC   Radio Network Controller
   SDU   Selection Distribution Unit
   SS7   Signaling System 7
   TIA   Telecommunications Industry Association
   UMTS   Universal Mobile Telephone System
   WLAN   Wireless Local Area Network
   WPAN   Wireless Personal Area Network

2 Review of Architectural Tenets

2.1 Simplicity

   There is a huge amount of commonality between the SS7 ISUP/IS-41
   [1,2] and GSM MAP [9] signaling sets used for inter-system mobility
   in classical cellular deployments. There is also a large amount of
   functional overlap at the Telecommunications Industry Association
   (TIA) reference points above A-bis (the point of base station
   attachment to the rest of the network), where IuPs [3], GSM A-bis
   [4], and CDG-IOS (IS-634) [5] all play a role on UMTS, GSM systems,
   and CDMA systems respectively. There are several micro-mobility
   proposals including Cellular IP [6], hierarchical Mobile IP [7], EMA
   [8], HAWAII, and IAPP [10] (now an IEEE standard) for 802.11 access.

The inter-network protocols between deployed cellular systems will likely remain in place for a long time. However, by pushing all radio related behavior down into the BTS or AP, OBAST hopes to simplify the "top of the access point protocol" and eventually provide seamless roaming between wireless personal area networks (WPANs), wireless LANs (WLANs), and next generation cellular networks.

2.2 OBAST is Open and Universal

The current situation in radio access networks is that they are closed and require complicated protocols to inter-network, if internetworking is possible at all. OBAST seeks to open up radio access networks to provide the same kind of internetworking that has been so successful in the wired world. The history of the Internet has proven that open protocols have a distinct technological advantage, because they are developed, reviewed, and implemented, by a broad group of network experts. A distinct economic advantage can be gained from openness, because open protocols tend to encourage competition around the quality of the implementation rather than around comparisons of feature sets that may or may not be of benefit to users. We believe these properties will hold for the wireless Internet as well.

Historically, RANs have been tightly coupled to the core cellular network so that cellular equipment could not be easily replaced without extensive modification to the core network as well. The existing 3G standards are propagating this architectural tendency forward, but in a world where wireless options are multiplying, such closed non-inter-networking solutions become less and less viable.

The OBAST architecture attempts to push "all" radio control and knowledge to the base stations so that a common and universal inter-access point or inter-BTS mobility protocol can be created. We believe that this protocol is only useful if it gains critical mass on the global Internet. We feel it can evolve with the global Internet in such a way as to someday abolish the need for core networks and radio specific standards.

2.3 OBAST is Forward Looking

The momentum behind existing 3G standards may discourage deployment of any OBAST protocols in existing cellular networks. However, we believe greenfield 3G markets and WPAN deployments and WLAN investments could potentially benefit immediately from its adoption. It is our ambition to make OBAST a protocol set supporting the most advanced, scalable, and forward looking wireless Internet architecture.

2.4 OBAST is a Protocol Set, However, It Implies Architectural Change

   For OBAST to meet its goals, it requires a change in the way wireless
   networks have been classically designed. The primary architectural
   changes are (1) the BTS or AP becomes the one and only building block
   of the radio access network, (2) All radio control terminates at the
   BTS or AP and nothing radio specific creeps out above the BTS or AP.

2.5 OBAST Promotes Seamless Mobility

   Having a common protocol for micro-mobility and macro-mobility, AAA,
   and QoS, independent of access network type is OBAST's primary end
   goal. Facilitating the fixed to wireless network transition is also
   part of the ultimate end goal, but not a primary focus. OBAST will
   focus first on a protocol set, borrowed from other standards as much
   as possible and invent only where white spaces exist.

2.6 OBAST Promotes Peer-to-Peer Protocols

   Peer-to-peer protocols imply that no master or slave is assumed.
   OBAST will support the concept of elected call anchors that follow
   the mobiles as they move through "a sea of BTSs or access points".
   The call anchor has the responsibility of terminating the radio
   portion of the call. The call anchor is also responsible for
   orchestrating handover requests for the mobile. The call anchor is
   the point of selection and distribution when macro-diversity is
   required.

2.7 OBAST Promotes IPv6 and MIPv6 Everywhere

   OBAST could be made to run over IPv4. However, being a new protocol
   we wish to architect it to run over IPv6 primarily and this is what
   we will focus on. We will also promote the use of Mobile IPv6 [12]
   clients everywhere to enable enhanced macro-mobility.

2.8 OBAST Will not Re-invent or Invent AAA or QoS Mechanisms

   Every attempt to will be made to be agnostic to these protocols where
   possible. OBAST may eventually need to endorse or provide minimal
   AAA and QoS mechanism negotiation to facilitate seamless handovers.
   Much work is being done in this area, so OBAST will defer
   incorporating AAA or QoS mechanisms into its protocol set until after
   the seamless mobility issues have been resolved.

2.9 OBAST Recognizes Other Important Standards

   The pilc [13], Mobile IP [7, 12], cnrp [14], slp [15], zeroconf [16],
   aaa [17], manet [18], diffserv [19], intserv [20], rsvp [21], pint

[22], sip [23], rohc [24], IETF working groups all contain work
useful to making OBAST happen. OBAST does/ will not replace/ dilute/
change efforts under way in 3GPP (www.3gpp.org), 3GPP2
(www.3gpp2.org), MWIF (www.mwif.org), or 3G.IP (www.3gip.org).

2.10 OBAST shall be Air Interface Agnostic

OBAST will enable seamless roaming between WLANs (eg 802.11), WPANs
(eg Bluetooth), and macro-cellular (eg EDGE [25], 3G-1X [26], etc).
As such, OBAST must not favor any particular radio type over another.
OBAST recognizes that there are going to be LOTS of competing radio
technologies making their debut over the next few years and many
portable devices will support multiple RF interfaces.

2.11 OBAST Shall Work Diligently on Micro-mobility

OBAST supports the ideas behind IAPP (but not necessarily the
implementation). OBAST is looking critically at CellularIP, HAWAII,
EMA, and the work going on in the mobileip working group that will be
speeding up mobileip hand-overs. OBAST will be flexible enough to
support multiple negotiable micro-mobility schemes but may have to
choose one as a minimum required protocol set to support
"seamlessness".

2.12 OBAST Shall Attempt To Remain Agnostic to Call Processing

Session initiation methods like SIP must be somewhat transparent to
OBAST.   It is not clear how this can be best done and this is
considered a challenge.

2.13 OBAST Shall Make the Most out of SCTP

OBAST will support the use of SCTP (sigtran) [11] for inter-radio
node signaling and possibly for transport applications (yet to be
determined).

3.0 Baseline OBAST Implied Architecture

Using OBAST implies a new (at least to cellular and WLAN standards)
view of the "Wireless Internet architecture". This architecture has
two component types: routers (that make up the global Internet), and
base stations / access points. In this view, the edge routers
themselves could possibly have radio cards and be OBAST compliant.
We feel that the scalability for routers has been proven on the
global Internet. Radios, as edge devices, must respect this
fundamental nature of the Internet architecture. The figure below
shows the relationship between these simple components.

    (Global Internet)

```
     |   . . .     |
     OBAST       OBAST
     |             |
     AP           BTS  <- OBAST enabled Radio Access Nodes
```
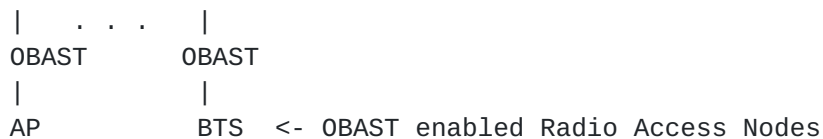
   The radio coverage, for the OBAST BTS (shown above), may engulf that
   of the AP, implying a vertical handover being required in this
   scenario. OBAST must facilitate vertical, horizontal, soft and hard
   handovers at the radio and at the servicing network layer when
   required or optimal.

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5.0 Acknowledgements

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