

# Business Models for Open Source Air Interfaces Update - Commercial Baseband WG

Wireless Innovation Forum SDR'10

Nov 29 – Dec 2

Washington, DC

Prepared by: John Glossner & Daniele Lo Iacono



*Driving the future of radio communications and systems worldwide*

*Copyright © 2010 Software Defined Radio Forum, Inc. All Rights Reserved*



# Agenda

- **Project Scope**
- **Open Source Definition**
- **Cellular Network Architecture**
- **Some Open Source Projects**
- **Open Source Licenses and Compatibility**
- **Business Models**
- **Remaining Work Items**

# Scope of Project

## **Open source business models for air interfaces is a report including**

- L1 and required portion of stack for viable business
- What technologies and programming languages
- Licensing alternatives
- Customers and key markets
- Motivations for adoption
- Identification of current open source projects
- IP, patent, and legal issues
- Targeting both handset and infrastructure

## **Primarily for the purpose of educating member companies**

# Project Target

## Targeted to

- Baseband providers
- Computer manufacturers (MIDS)
- Automotive electronics suppliers
- Handset and Infrastructure manufacturers
- Software services companies
- Operators
- Silicon providers

## Who want to develop their own modems

# Open Source Definition

## Open Source Software (OSS) is

- computer software that is
- available in source code form
- supplied with free distribution without discrimination
- without product or technology restrictions
- without royalty or fees
- with allowance for modification (derived works)
- with redistribution under the same terms
- that does not place restrictions on other distributed software

<http://www.opensource.org>

# Types of Open Source Software

## Community Open Source

- No single corporate owner
- Relies on broad base of contributors
- Acceptance into code base by individuals (committers)

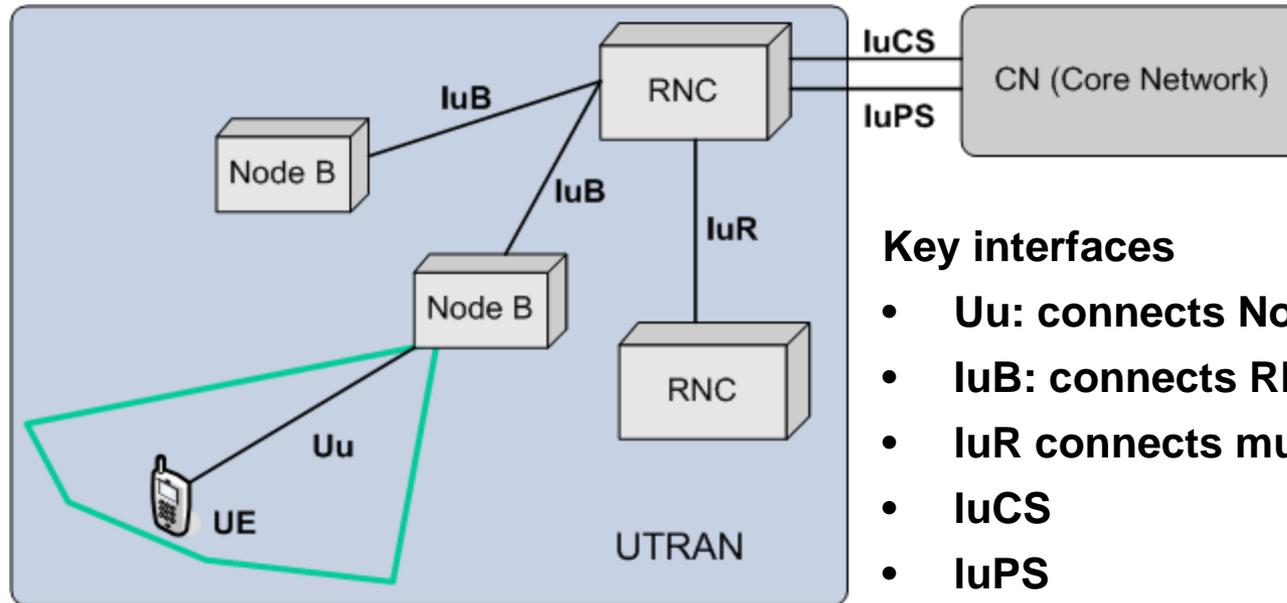
## Commercial Open Source

- A corporate entity owns and develops
- The company maintains copyrights
- The company decides what get accepted into code base

## Foundation Open Source

- One or several corporate entities fund development
- A non-profit corporation decides acceptance and copyrights

# UMTS System Architecture



## Key interfaces

- Uu: connects Node B to UE
- IuB: connects RNC to Node B
- IuR connects multiple RNCs
- IuCS
- IuPS

## UTRAN: UMTS Terrestrial Radio Access Network

- Allows connectivity between UE and Core Network
- Contains basestations (Node B) and Radio Network Controller (RNC)

LTE uses an enhanced version of this (e-UTRAN)

# Typical Basestation (NodeB)

## Uses a Base Transceiver Station (BTS)

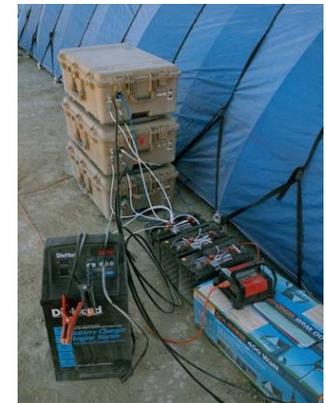
- facilitates wireless communications between UE and the network
- typically multiple transceivers per BTS
- controlled by the BSC



Typical BTS (does not include antenna)

## and Base Station Controller (BSC)

- Intelligence behind BTS
- Typically many BTS'es (10-100) per BSC
- Allocation of radio channels
- Measurements from UE
- Handover from BTS to BTS
- Concentration of many connections to the BTS



OpenBTS Transceiver

# Core Network OSS

## Asterisk PBX (GPL)

- Started 1999
- >2M users
- Analog, T1/E1, VoIP interfaces

## OpenIMS

- Call Session Control Functions
- Based upon SIP Express Router (SER) and MySQL

# Basestation OSS

## OpenBTS

- Presents a GSM air interface (“Um”) to GSM handset
- Uses Asterisk to connect calls

## OpenBSC

- Implementation of GSM A-bis protocol
- Minimal subset of BSC

# User Equipment (UE) OSS

## Osmocom GSM project

- GSM L1-L3
- <http://bb.osmocom.org>
- [www.linux-kongress.org/2010/slides/osmocombb-welte.pdf](http://www.linux-kongress.org/2010/slides/osmocombb-welte.pdf)

# Embedded Operating System OSS

**pthread**

**eCOS**

# User Interface OSS

## Symbian

- Recently pulled back into Nokia

**Meego = Moblin (Intel) + Maemo (Nokia)**

**Linux**

**OpenMoko**

**Android?**

# Open Source Hardware

**Open Cores**

**OpenMoko**

**Universal Software Radio Peripheral (USRP)**



*Driving the future of radio communications and systems worldwide*

*Copyright © 2010 Software Defined Radio Forum, Inc. All Rights Reserved*



# Open Source Licenses

## General Public License (GPL)

- Software based on or derived from GPL'ed S/W must be made available under the GPL
- Challenging when dealing with large software bases
  - Libraries based on GPL code would make whole application subject to GPL
- v3 deals with patent freedom, shutdown of systems (tivoization) and DRM

## Lesser GPL (LGPL)

- Allows redistributing S/W based on any license
- Permits linking with non-free modules
- Any modification of LGPL code must be released under LGPL
- GNU C library is LGPL

## Permissive (Apache/BSD/MIT)

- May be combined with proprietary works

# Open Hardware Licensing

## Open Hardware License (OHL)

- Focused on patents infringement issues (critical for HW)
- Cover HW but not the FW/SW loaded on programmable HW.

**OpenCore mainly uses GPL/LGPL**

# License Compatibility

## Many GPL compatible licenses

- Apache, Modified BSD, Artistic, X11, Berkeley Database License (BDL)

## 100's of INCOMPATIBLE licenses

- Older Apache, Common Public License (CPL), Eclipse, Mozilla, Nokia Open Source License, Sun
- Typically add additional restrictions
  - Mozilla does not allow linking with GPL code
  - PHP does not allow the name to be used in derived products
- Some are not approved by Open Source Initiative (OSI)
  - SystemC for example requires all recipients to enforce its trademark
  - Alladin Free Public License does not allow charging for distribution and prohibits packaging with S/W for which a charge is made

# Business Models

## Business Model – Henry Chesbrough

- a useful framework
- to link ideas and technologies
- to economic outcomes

## They perform

- value creation and value capture
- by defining a series of activities
- that will yield a new product or service
- in such a way that there is net value created
- with a portion of that value being returned to the firm.

# Business Models

## A business model should include:

1. a value proposition,
2. identify the market segment,
3. define the value chain (customers and suppliers) along with the position of the firm in the value chain,
4. specify revenue and costs,
5. formulate a competitive strategy

# Open Source Business Models

## 1. Charge for Support:

- Epitomized by Red Hat and Canonical for Ubuntu.
- Problem for startups: anyone can redistribute the code and sell support or consulting services.

## 2. Charge for Services or Consulting:

- Pay for a project to be developed using open source software

## 3. Charge for Product (or Hardware):

- You pay for the phone (Android) or the router (Linksys 54G) or the PBX Digium (Asterisk)

## 4. Charge for Proprietary Components:

- Provide some functionality for free but hold back some functionality.
- XenSource (part of Citrix), Virtuallron, MuleSource, Hyperic.

## 5. Versioning:

- Give away entry level offering but offer high functionality versions.

# Open Source Business Models

## 6. Dual licensing:

- provide some code under an open-source license (typically GPL) but also providing proprietary licenses. MySQL, Trolltech.
- Places restrictions on what other vendors can do for free.
- For startups an issue is that it is hard to leverage community development since they need to hold copyright on all code.

## 7. Charge for running programs:

- Pay for access to the cloud

## 8. Software plus services:

- Provide free desktop software and augment with a paid service.

## 9. Software as a Service (SaaS):

- Pay for the function of provided (by access, time, user, etc.). Zoho

## 10. Ad Ware: Advertisers pay.

- Google, ZD Net, Digium (Asterisk PBX)

# Open Source Business Models

## 11. A Corporation Pays:

- Google funds Firefox, IBM funds eclipse, SUN funds Open Office

## 12. Foundations: Multiple corporations pay.

- Symbian, Apache, Wikipedia

## 13. Beg:

- Requests for donations or buy logo'd products
- Sourceforge.net allows users to donate money to hosted projects

## 14. Acquisition: develop a set of expertise that larger companies may want to acquire

**We have emphasized the first 6 for baseband open source**

# Customers for open source

**Baseband providers**

**Operators**

**Handset and Infrastructure manufacturers**

**Software services companies**

**Semiconductor suppliers**

**Tools vendors**

# To Be Done

## Languages for writing air interfaces

## Open Source Frameworks

- Ossie

## Effects of patents

- Licensing
- Infringement

## Update on the SDR landscape

**You can volunteer to join this working group – even if you're not a member company!**

**THANK YOU**