

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

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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)

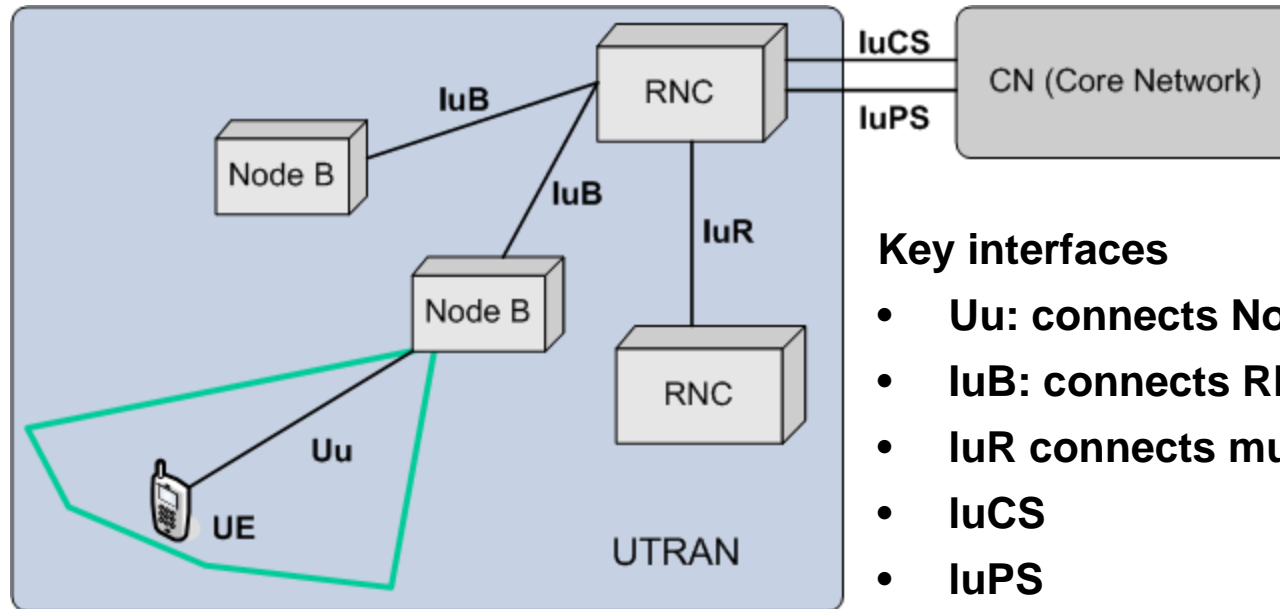
Commercial Open Source

- 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



UTRAN: UMTS Terrestrial Radio Access Network

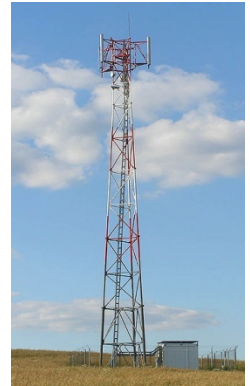
- Allows connectivity between UE and Core Network
- Contains basestations (Node B) and Radio Network Controller (RNC)

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

Embedded Operating System OSS

pthread

eCOS



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User Interface OSS

Symbian

- Recently pulled back into Nokia

Meego = Moblin (Intel) + Maemo (Nokia)

Linux

OpenMoko

Android?



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Open Source Hardware

Open Cores

OpenMoko

Universal Software Radio Peripheral (USRP)



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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



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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