

Open Source Telco for the People

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Abstract— An alternative technology for low cost Telecommunication infrastructure as used by Indonesians will be reported. It is based on open source software. The technology is fairly modular and open source, several important modules are the SIP softswitch, ENUM server and OpenBTS technology. This is a more than 15 years of struggle, the whole process is not about technology. More emphasis is on empowering the people, run workshops in many places, write articles and books to educate the Indonesian to get up and run their own telecommunication infrastructure based on open source software.

I. THE NEED

INDONESIA is a country with more than 240 million people. About 150 million Indonesians have access to phone. Unfortunately, about 100 million Indonesians have no access to phone [1]. They are mostly in rural, especially in eastern Indonesia, e.g. Papua Island, where it is sparsely populated. The use of conventional telecommunication and cellular technology is fairly expensive and is more difficult to return on investment in rural areas. Thus, the need of low cost telephone infrastructure is quite apparent especially in rural / remote area.

In this works, open source will be reported especially to used for telecommunication infrastructure developing countries, such as Indonesia. Debian [2] / Ubuntu [3] based operating system is assumed in the discussion.

II. THE ACTION

Triggered by the increase of telephone cost imposed by government, in early 2000, a small group of techies started to deploy open H.323 softswitch on Indonesian public Internet [4]. Since then, workshops & roadshows was performed in all over Indonesian cities to introduce the technology to public. It was funded by the audience, thus, self-funded by the Indonesian people and not much support from formal government.

Proxy server in many corporate networks is our major stumbling block in implementing a nationwide H.323 network. Thus, the H.323 approach is gradually abandon. However, it shows clearly the possibility to implement people's based carrier over the Internet.

In around 2006, Anton Rahaja led the implementation public SIP based softswitch on Indonesian public Internet at <http://www.voiprakyat.or.id> [5]. Anton even publishes a ready to use softswitch operating system in ISO format at <http://briker.org> that can be freely downloaded and use.

The latest technology explored by the Indonesians is the OpenBTS technology [6][7]. It is an open source software defined radio for GSM BTS Station. Funded by Ford Foundation via ICTWATCH.COM, five (5) USRP development kits are acquired. These kits are used for.

- Introducing OpenBTS Technology to the young Indonesians through workshops, demos, articles, forum discussions.
- There is 8-10 articles on OpenBTS in the national media, especially, kompas.com and detik.com. Including one feature in MetroTV the national television. [8]
- A dozen of students finishes their final project on OpenBTS using the development kits.
- Starting 30 April 2011, around 50+ demos / workshops of OpenBTS has been organized in various campuses and events. These activities expose more than 3000 students in many Indonesian universities on the OpenBTS technology. [9]
- As of December 2012, a book on OpenBTS is in printing.

In addition, a group of researchers based at UC Berkeley involving Kurtis Heimerl et.al. [10] is currently deploying a trial OpenBTS operation in remote Papua.

IP based backbone network is an important element in the network. Some of the highlights are

- Unlicensing 2.4GHz and 5.8GHz in Indonesia. After 12 years of bitter fight, on 5 January 2005, 2.4GHz is unlicensed [11][12]. This is a strategic milestone. Long haul wireless network, as described in wndw.net is currently one of the key element on Indonesian IP infrastructure.
- ISP License is fairly liberated. Currently, there are more than 200 ISPs in Indonesia. [13]
- National Internet Exchange is important for the country. Today, there are at least 5 national Internet Exchange with local peak traffic at 64Gbps. [14]

III. A GLIMPSE ON THE SCRIPTS

This section is aimed to give the reader some idea on installing the scripts to implement open source telecommunication infrastructure. The installation processes are fairly standard open source applications installation process.

A. *The Simplified Installation of Softswitch*

In this section, a simplified SIP Softswitch installation will be described. We have several options on softswitch, e.g., asterisk and yate. Asterisk installation is as follows [15]

```
apt-get install asterisk
```

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Minimally, we need to edit two (2) files, i.e., `/etc/asterisk/sip.conf` & `/etc/asterisk/extensions.conf` to make it work & running on our network.

For yate softswitch, we need to compile it from the source code follows, [16]

```
cp yate-4.2.0-2.tar.gz /usr/local/src/
cd /usr/local/src/
tar zxvf yate-4.2.0-2.tar.gz
cd /usr/local/src/yate
./configure
make
make install
```

we need to edit `/usr/local/etc/yate/ysipchan.conf`, `/usr/local/etc/yate/regexroute.conf` and `/usr/local/etc/yate/extmodule.conf`. To run yate manually, [16]

```
cd /usr/local/src/yate, ./run -t -l /var/log/yate -vvvv -c
/usr/local/etc/yate -m /usr/local/lib/yate -e
/usr/local/share/yate -d.
```

B. Simplified ENUM Server

ENUM is basically a mapping server for phone number to VoIP account. BIND (DNS Server) is normally used. [17] To install BIND is as follows [18]

```
sudo apt-get install dnstools bind9
```

we need to edit, e.g. `/etc/bind/8.8.8.6.9.e164.om.db`. For example, the entry is as follows

```
0.0.0.2 NAPTR 10 100 "u" "E2U+sip"
"!^.*$!sip:2000@sip.squ.edu.om!" .
1.0.0.2 NAPTR 10 100 "u" "E2U+sip"
"!^.*$!sip:2001@sip.squ.edu.om!" .
```

Which means, the phone number +968 88 2000 equal to ENUM 0.0.0.2.8.8.8.6.9.e164.om mapped to SIP account 2000@sip.squ.edu.om. And the number +968 88 2001 equal to ENUM 1.0.0.2.8.8.8.6.9.e164.om mapped to 2001@sip.squ.edu.om.

C. Installation of OpenBTS for GSM Coverage

OpenBTS may be one of the most subversive technology in open source for telecommunication, as it provides “software based” low cost GSM solutions. We need USRP hardware to perform the task. Assuming we have the USRP hardware. Firstly, we need to install GNURadio as follows, [19]

```
cd /usr/local/src/gnuradio-3.4.2
./configure --disable-usrp2 --enable-usrp
make clean
make all
make
make check
make install
sudo ldconfig
```

Then compile OpenBTS from source code as follows. [20]

```
cd /usr/local/src/openbts-2.8.0/openbts/trunk
autoreconf -i
./configure --with-usrp1
make clean
make
make install
```

The most interesting part of OpenBTS is it act as a real BTS in the real world. It can act as a real operator BTS by configuring the MCC & MNC of the operator, e.g. [21]

```
config GSM.Radio.Band 900
config GSM.Radio.CO 50
config GSM.Identity.MCC 422
config GSM.Identity.MNC 02
config GSM.Identity.ShortName OmanMobile
```

The above example is for Oman Mobile with MCC 422 and MNC 02. It is violating the law, if it is not done by the proper / real operator. For a test network, we have to use MCC 001 and MNC 01 as shown in the following configuration

```
config GSM.Radio.Band 900
config GSM.Radio.CO 50
config GSM.Identity.MCC 001
config GSM.Identity.MNC 01
config GSM.Identity.ShortName OpenBTS
```

Please note that the above notes are the simplified version of the installation process.

IV. A GLIMPSE OF FUTURE PATHS

From technology point of view, it is clear that open source based telecommunication is the solution in telecommunication for all. Today, in Indonesia, about 80% of the Indonesian Telco switches are using Session Initiation Protocol (SIP). Thus, in short, the people's telecommunication is basically the same as the professional / national carrier equipment.

To be able to exploit the technology for the benefit of the whole nation, sooner or later, the regulator must,

- Change the licensing scheme for GSM operator allowing people's based GSM infrastructure to operate especially in the area where commercial operator not interested to invest. [22]
- Allocate E.164 phone number for people's telecommunication infrastructure.
- Allocate GSM channel, known as ARFCN, for people's telecommunication infrastructure. For example in Indonesia, there are six (6) channels are not used by the operators, i.e. in 900MHz band ARFCN 50, while in 1800MHs band ARFCN 611, 686, 711, 786 and 836. These channels can be used by the people and community as it will not interfere with the operators. [23]

For the IP backbone, a strong need to

- Unlicense 24GHz, to be able to deploy AirFiber technology to get 1.5Gbps access.

- Especially in rural areas, wireless mesh, such as, Optimized Link State Routing (OLSR) is a good alternative. [24]

The whole process may only be possible if a massive and elaborate education process is performed at universities to empower the young students on the open source technology.

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