1   *Abstract*

In accordance with the project name, BTS is the key element of the system, while VoIP PBX is used to combine them into network. GSM core network functions are implemented on SIP-basis. Such an approach allows to start OpenBTS operation and serve subscribers as if they were legacy SIP subscribers.

Meanwhile GSM defines algorithms where decisions are done by MSC. In the case of HANDOVER, it can be ether BSS-initiated (due to radio criteria) or network-directed (due to traffic reasons), and it is Network that undertakes a decision, defines destination channel. It also knows the corresponding parameters that are contained in HANDOVER COMMAND.

To operate a network with essential load, there must be a database that handles BTS ip addresses, global cell IDs, LACs, frequencies, power levels, handover thresholds, etc. Subset of this data is needed for handover.

There are three potential ways to move:

- to follow legacy GSM network architecture, SIGTRAN or SIP-T could be used as signaling transport for BSSAP

- to provide some (SIP-based or whatever) transport for data exchange. The amount of data should allow following legacy GSM procedures

- to keep current SIP-based infrastructure, handover procedure should be seen by PBX as a sequence of legacy SIP procedures

Presently the last choice seems to be the best. Meanwhile it has some drawbacks:

- the decision is done at BTS level

- the database which carries the whole network infrastructure is substituted with light-weight version

- only BSS-initiated handover is discussed

- there is an assumption that network is underloaded

It must be taken into account that the building blocks] can be reused for building a full-featured solution.

2   *Proposal*

2.1   Assumption

Only MS-supplied measurements are taken into consideration

Network is underloaded, any BTS is able to accept handover

No payload control, no network directed handovers

Non-synchronized cell case (GSM 04.08 3.4.4.2.2) only

2.2   Pre-requirements

Some database is required. DNS mechanism could be used to store relations between cell id and ip. Global Cell Id could be included into BTS name.

2.3 Procedure

Let us suppose MS is in a call state, "initial" BTS is involved. Every 480ms measurements are provided by MS and checked against thresholds
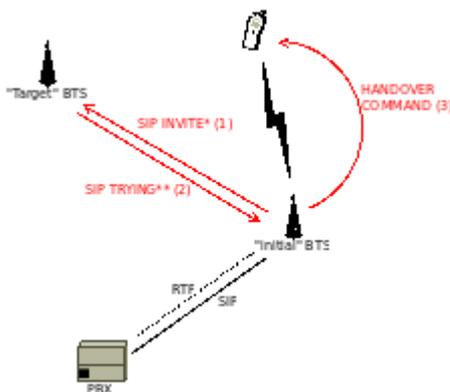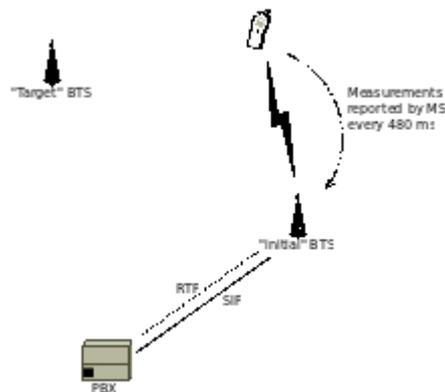
When decision is done, "initial" BTS must reserve resources. This is performed by means of issuing SIP INVITE message. Set of parameters distinguishes this message from a normal call setup.

"Target" BTS acknowledges resource allocation with SIP TRYING. Destination channel parameters are included.

After resource allocation acknowledged, HANDOVER COMMAND message is sent to MS

When MS appears at the target channel, SIP call is answered.

This triggers "initial" BTS to turn rtp session to "target" BTS endpoint by means of SIP RE-INVITE
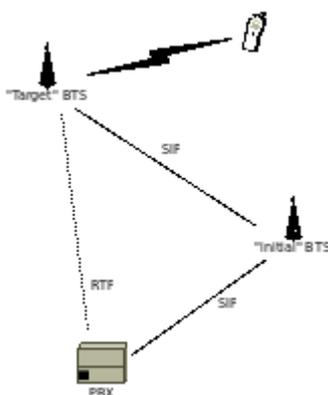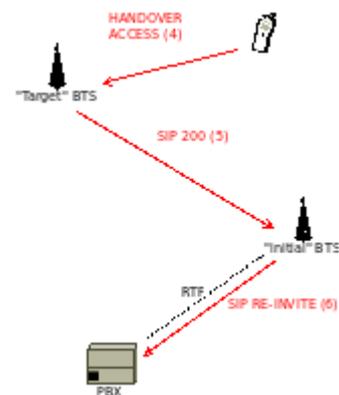
After handover is being completed, MS continues a call via the "target" BTS.
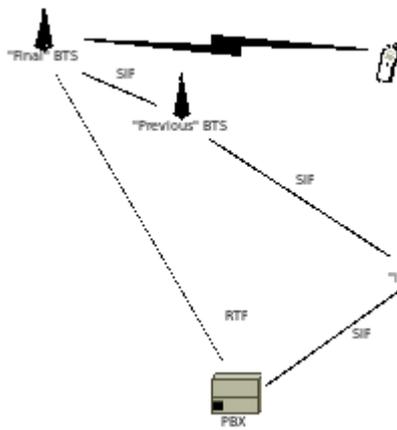
If several handover procedures sequentially take place during a single call, SIP path crosses all BTSs which were involved, while rtp session is established between the PBX and the actual BTS.
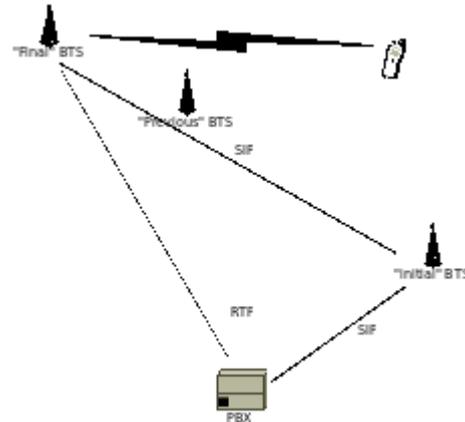
The next reasonable step is to eliminate extra SIP proxies, which are listed in VIA field. Only "initial" BTS (which behaves like an "anchor MSC") remains in front of the "final" BTS.
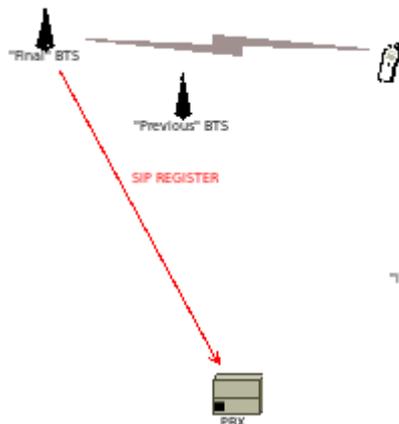
Finally, BTS sends SIP REGISTER when call is done (? or when HO finishes). Message is sent directly to the PBX.

3   Summary

This algorithm is a compromise solution.

The main advantage is handover support without any influence on the existing architecture. New network elements and protocols are not involved. Last but not least, implementation efforts are are limited, and the most of software could be reused for centralized network control.

As for the drawbacks,

- working without a centralized brain makes payload control impossible.
- BTS measurements are ignored

As for the intra-BTS SIP traffic, it is not too awful, cause the logic is transparent, and there are only few connections per a BTS. In GSM world, anchor MSC behavior is much more expensive in terms of a core network resources.