Network sharing: A case study

For operators who want to try their hands in the 3G or LTE markets but lack licensing, spectrum, or network resources, multi-operator core network (MOCN) technology for network sharing can help them realize the dreams.

By Gong Songqiao

Consider the following real-world scenario where two operators managed to pool their resources for the benefit of all.

Operator A’s dilemma

Operator A was the second mobile licensee in Country X, but it failed to acquire a 3G license, so it had to operate its 3G network, consisting of more than 1,000 sites in the country’s capital, under a temporary license. By pursuing a market strategy of eliminating the need to replace cards or numbers and register anew, the operator had attracted a large number of its 2G subscribers onto the 3G network. However, Operator A’s temporary 3G license was about to expire, while the limited 3G spectrum resources restricted the capacity of its radio network, making it difficult to accommodate more subscribers or add new services. Operator A sought a way to overcome these constraints and continue to develop its 3G network.

Operator B’s vision

As the incumbent fixed network operator in Country X, Operator B...
was very anxious to get a foothold in the mobile market. The operator was fortunate to have acquired a 3G license through auction, while gaining considerable spectrum resources along with it, but network rollout and O&M looked daunting. First, building a 3G network from scratch takes time, which meant that the operator might well miss the prime window of opportunity in mobile broadband. Furthermore, without 2G networks to guarantee coverage, user experiences might have been compromised. Finally, as a fixed operator, Operator A lacked experience and personnel in mobile network O&M, which meant that network quality could not be guaranteed.

Network sharing seemed a viable and mutually beneficial model. Under it, Operator A could utilize Operator B’s 3G license and spectrum resources to develop 3G services, while Operator B could expedite the introduction of its own mobile brand at reduced CAPEX and OPEX.

Huawei’s customized MOCN solution now connects Operator A’s radio network to the nodes of both operators’ core networks simultaneously, while adding some unique features to address each carrier’s distinct requirements in the shared network. As a result, Operators A and B are able to share 3G license expenses, reduce overall network construction costs, expand network coverage, and exploit the potential of the mobile broadband market, after spending just three months awaiting successful deployment.

Flexible ARFCN sharing

According to the 3GPP-defined MOCN technology standard, one absolute radio frequency channel number (ARFCN) needs to be shared by all operators. However, Operators A and B had more complex requirements. In Country X’s mobile market, value subscribers are concentrated in the capital. Through consultations, the two companies reached an agreement where in the capital, if there are three or more ARFCNs on the same site, the first two ARFCNs need to be shared by the two companies and the subsequent ARFCN(s) will

Tailored MOCN is key to network sharing
be used exclusively by Operator B. Outside the capital, only one ARFCN will be shared, while others will be used exclusively by Operator B. This forced Huawei to tailor its MOCN solution (as shown in Figure 1), allowing some ARFCNs to be shared by both operators while others are used exclusively.

**Accurate network selection**

In a traditional network, a mobile subscriber can only access the home network of a single operator. However, in a typical MOCN scenario, mobile subscribers under the same ARFCN can select from multiple operators’ networks. Whether or not a subscriber can access the correct home network depends on the network selection capability of the handset. For shared ARFCNs, the message reporting differences in both categories, forcing all handsets to select routes under the RNC’s control; none is allowed to select networks on its own; this ensures registration to the correct home network.

**Appropriate logo display**

The logo information for an operator is pre-defined in the handset or SIM/UIM card. After receiving the common PLMN broadcast from the RNC, the handset compares the received PLMN to the pre-defined information stored in the unit itself or its SIM/UIM. If the received PLMN matches the pre-defined information, the handset displays the operator logo; otherwise, it displays the PLMN. In a shared network, when broadcasting system information, the RNC can only broadcast one common PLMN in an explicit manner. If a mobile phone cannot identify an implicit message, only the operator
logo relevant to the common PLMN is displayed. In such cases, as Operator A uses the common PLMN, Operator B is the one with the logo display issues.

Huawei offered two measures to resolve the issue. First, the operator logo is pre-defined and hardwired into the SIM/UIM card. Although this method does not entail special requirements for the network or handset, it is necessary to plan and burn information into the card in advance. Second, pursuant to the 3GPP standard, the core network enables the Network Identity and Time Zone (NITZ) feature to deliver the operator logo to the mobile phone by using the mobility management information message to refresh the operator logo information (including the operator name) in the terminal, thus enabling the display of the operator logo according to NITZ mapping. After adopting the second method, Operator B finally resolved the logo display issue, enhancing its brand visibility among subscribers.

**Seamless user experience**

During initial 3G network construction, operators must switch 3G services to 2G networks where the former is not covered and then switch back whenever possible. As Operator B has no 2G network of its own, it was planned that when entering into areas not covered by 3G, its subscribers’ handsets will register on Operator A’s 2G network; when 3G signals are acquired, the handset switches back to Operator B’s 3G network as soon as possible. The tricky thing is that when a mobile phone reselects a network, by default, the same PLMN will be preferentially selected.

In Operator B’s case, before its subscribers’ handsets reselect a network, the 2G PLMN belongs to Operator A. As a result, when the handsets reselect a 3G network, they must select Operator A’s PLMN by precedence (they always attempt to register on Operator A’s 3G network first). When this fails, the search begins anew, culminating in registration on Operator B’s 3G network. During this period, the mobile phone shows no signal, and network search alerts are displayed frequently, negatively affecting the user experience.

Therefore, Huawei’s RNC initiates polling attempts on each operator’s core network, and compares messages received, to ensure users are registered correctly. In addition, through bridges and screening, it prevents messages related to network search failures from being issued to handsets, mitigating the negative impact on user perception for Operator B.

**Easy international roaming**

Due to Operator B’s limited brand influence in mobile, it will not be in a position to sign international roaming agreements with operators from other countries on a large scale any time soon. In other words, roaming is not available.

Huawei’s Multi-IMSI (International Mobile Subscriber Identity) solution resolves this problem, as Operator B can now pre-set Operator A’s IMSI to the SIM/UIM card through mapping and match it when a subscriber signs up at the operator’s outlet. Afterward, Operator B’s subscribers can use Operator A’s IMSI number segment when roaming internationally.

**MOCN-pooling compatibility**

Operator A and Operator B each have multiple sets of core network equipment for pool purposes, as this has become the most prevalent disaster recovery solution in recent years. When the said equipment works normally, the load for all subscribers is shared and registered to all network elements (NEs) in the pool. In this case, when one NE is faulty, the subscriber is automatically relocated to other functional NEs, which means that each set of radio equipment must be connected to multiple sets of core network equipment for one operator.

After the MOCN and pooling solutions are implemented in parallel, each set of radio equipment must connect to all core network equipment for both operators simultaneously, which poses a challenge to RNC routing strategy. If traversed routing to each core network is adopted, it will increase subscriber connection time.

Huawei RNC adopts a routing strategy that first identifies the operator that a mobile subscriber belongs to and then registers the handset to the NE on the core network in a single action, in light of the load on the operator’s core networks. With the introduction of pooling, Huawei RNC only adds one step, without increasing rerouting times. As a result, mobile subscribers are basically unaware of the changes in connection time, enabling the MOCN and pooling solutions to run in an efficient and compatible manner.

Editor: YaoHaifei Julia.yao@huawei.com