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Since the beginning of 2013, Europe has seen more than 20 M&A deals involving mobile network operators (MNO’s) having a value exceeding 1 billion USD. In addition to this, we see more and more MNO’s agreeing to share active network infrastructure. Also in markets outside Europe we see a growing number of consolidation projects. This wave of consolidation will have a significant impact on the markets affected. Following a merger or acquisition, competitive pressure is hopefully reduced stabilizing ARPU. Margin is improved by consolidating the network infrastructure, the two organizations and the retail side of the business. Network sharing on the other hand addresses the cost side of the operators’ business improving profit margin and reducing time to market for new services. In this article Huawei looks into the market situation and the business drivers behind the M&A and network sharing deals. The operators’ business objectives determine the choice of consolidation strategy and we look into the benefits of the most common business models. One critical hurdle for the operators is to get the deal approved by local authorities and, in the case of Europe, also by the EU.

Huawei has since 2009 supported MNO’s with managing the challenges of consolidating network infrastructure. The best practice developed in projects for operators in leading markets addresses three key objectives most operators set up for the consolidation: a) how to shorten the time needed to prepare and execute the consolidation, b) how to secure that the consolidated network offers a better end user experience compared to before consolidation and c) how to maximize cost synergies without jeopardizing time to market and user experience.

Consolidating two networks is a much more complex task than the typical rollout or swap project most MNO’s have experienced and many different factors determine the success. Of key importance for securing user experience and achieving cost reductions is the methodology for determining how many, and which, sites to keep in the network. The network needs to be designed and configured to support more combinations of technologies and frequency bands and carry the combined traffic of the two operators. This may require refarming of frequency
spectrum. Without strong project management and a robust step-by-step procedure for cluster upgrade and activation, the complex dependencies between involved stakeholders will cause delays and unplanned service downtime. Furthermore, the challenges with integrating two operators’ organizations into an efficient and flexible team should not be underestimated. A couple of references are provided to illustrate Huawei’s capabilities to support the operators in managing these challenges.
Drivers behind Consolidation

Operators’ profit margins have, especially in Europe, been under pressure for quite a few years. Several factors contribute to this. Market penetration has in many markets saturated limiting further subscriber growth. Intensive price competition, typically driven by the 3rd and 4th operators in a market, has increased churn and put pressure on ARPU and operators to offer more and more generous bundling packages. Furthermore, there is continued need for heavy investments in capacity expansions and new technology, mainly LTE, to satisfy the ever growing demand for higher data speed.

During the last two years we have also seen a new trend with several very large deals between mobile and cable network operators in Europe. There is an increasing interest among some of the leading operators to acquire the necessary infrastructure to become and end-to-end communications provider and offer true quad play services. A deeper analysis of this trend is not covered in this white paper. In this document focus is on consolidation between Mobile Network Operators (MNO’s).

Different Operators Choose Different Strategies

When looking at the deals and announcements made by the operators, it becomes clear that different operators choose different strategies. Some MNO’s are strengthening focus on the mobile business. Two recent examples are Telefónica’s acquisition of Eplus in Germany to become the largest MNO in Germany and Hutchinson’s bid on Telefónica O2 in the UK. This bid, if approved by the authorities, would make Hutchinson largest mobile operator in the UK. Vodafone Group has publicly stated mobile-fixed consolidation is part of corporate strategy for NGN (Next Generation Networks). The acquisitions of cable operators KDG in Germany and ONO in Spain are clear evidence of this strategy. In France we see the same type of consolidation but in this case it is the cable operator Numericable who has acquired the MNO, SFR. Operators with both mobile and fixed network infrastructure, typically the old PTT’s, focus on internal consolidation to achieve greater synergies in infrastructure, support systems and retail. One example is the new strategy adopted by Deutsche Telekom.

New RAN sharing agreements are announced more and more frequently. Telenor, currently with 4 shared networks in Europe, is one operator which has been driving the development in this area.
Defining the Business Objectives

Before deciding on what type of consolidation the operator should plan for it is of key importance to define the key business objectives. If the MNO sees a need to grow market share to combat fierce price competition and stabilize ARPU, then acquisition of, or merger with, a competitor is the natural choice.

If the operator’s focus is on increasing operational efficiency and reducing TCO for new technology and network expansion then network sharing, in particular RAN (Radio Access Network) sharing, is a strong alternative. Network sharing does not directly address the revenue part of the business, however the operators sharing the network will improve their cost efficiency relative the other operators in the market that are not part of the sharing joint venture.

A third possibility for a smaller MNO could be to sign a MVNO agreement with an established MNO, sell the network assets to this MNO and then buy back capacity. Alternatively, as a temporary measure the smaller MNO can sign a National Roaming agreement with the bigger MNO to achieve a large coverage footprint while expanding its own network infrastructure. This strategy has for example been adopted by Free in France with its roaming agreement with Orange.
Agreeing on Scope
Each consolidation case is unique. When preparing the business case, operators need to take into consideration a number of different parameters such as their positions in the market, the status and capabilities of the networks, spectrum allocations and financial status. Choices available are often limited by government restrictions on sharing frequency spectrum or the geographical extent of network sharing in the country in question.

The operators agreeing to share the RAN need to agree on the scope of sharing. Should the whole network be shared or only rural areas where the revenue per site is much less? Is the network in the biggest cities commercially too important to share? What should the balance be between on one hand maximizing the savings (share everything) and on the other hand keeping a higher degree of independence between the operators (share less)?

In some cases the operators agree to share all technologies (2G, 3G and 4G) and frequency bands for which they have licenses. Recent examples can be found in France (Bouygues Telecom & SFR) and Finland (Sonera & DNA). Note that both these shared networks will cover only the rural parts of the country. In other cases, the sharing could be limited to one technology on one particular frequency band. This is for example the case in Hungary where Tmobile and Telenor recently announced sharing LTE on the 800MHz band in all areas except the capital Budapest.

Network Sharing & Consolidation Solution
For RAN sharing the two most commonly used solutions are known as MOCN (Multi Operator Core Network) and MORAN (Multi Operator RAN). With MORAN everything in the RAN except the radio carriers is shared whereas with MOCN also the carriers are shared. With both solutions the operators can keep their existing core networks separate. A comparison between the two solutions is shown in the table below. MOCN is the most resource efficient solution.

Furthermore, it gives the operators the opportunity to pool their respective spectrum allocations, thereby improving trunking efficiency.

MORAN gives the operators the flexibility to independently implement features and upgrade configurations on cell level. Operational data can also be monitored independently on cell level. With both solutions the operators can choose between sharing the transmission pipes or having them separate (in the same physical link).

One important benefit with MOCN is the possibility to implement the feature without having to first consolidate the core networks. This makes MOCN ideal also as a temporary solution for quick coverage expansion following an acquisition or merger, for example in areas where only one operator has coverage. By simply activating MOCN the other operator’s subscribers get access to this coverage without having to integrate the core networks and completing a full HW consolidation on site level first. The alternative solution is to activate National Roaming but this requires integration of the two core networks for full services inheritance.
In Europe, the region with most shared networks this far, MORAN is used in most cases. The main reasons for this are restrictions on spectrum sharing and operators’ preference for keeping some degree of independence on RAN level. MOCN is the preferred solution in particular in the Nordic countries. One reason for this could be that the regulators in the Nordic countries have the view that as long as there is full competition between the operators in the retail side of the business, there is no need to restrict the extent of network infrastructure and spectrum sharing. Hybrid solutions where both MORAN and MOCN are used for different technologies and frequency bands but in the same shared RAN are used in a few countries such as Poland. During the last two years new RAN sharing agreements have been announced in Greece, France, Romania, Cyprus, Czech Republic, Spain, Ireland, Finland and Hungary.

For network sharing the situation is different. Two competing operators need to find a model for long term collaboration. Most operators set up a JV company to manage the relationship and take the role as the neutral part. Such JVs can be given different mandates, ranging from a pure governance and coordination role to full responsibility for network design, implementation and operations. In Sweden, one of the first markets implementing active network sharing, both models are used. Networks assets are either transferred to the JV or kept in the operators’ books.

3G Infrastructure Services (3GIS) in Sweden was set up in 2001 to build up a complete organization responsible for rolling out and operating the shared 3G RAN between Telenor and 3GIS. At the same time, TeliaSonera and Tele2 set up SUNAB for managing their shared 3G network. In this case, a different operational model was chosen. SUNAB was given the responsibility for procurement and coordination of the project. The two operator organizations however kept responsibility for executing all tasks related to rollout and operations. Sweden was split up into 4 regions and each operator took responsibility for 2 regions. The SUNAB model was later used also for Net4Mobility, the JV between Telenor and Tele2 for their shared 2G & 4G network. This “regional split” type of model is the most commonly used in Europe. The responsibility of Victus, the RAN sharing JV in Greece established 2014 by Vodafone and Wind, is however similar to 3GIS.

**Getting the Deal Approved**

One potential show stopper for the Operators is the deal approval needed from the regulator and competition authorities. In Europe the approval is often needed on EU level. In recent decisions by the EU we see a more positive attitude towards consolidation. As several recent cases show, such as Telefónica’s acquisition of Eplus, approval is however not given without concessions from the operators. In the German case, Telefónica had to commit to letting up 30% of the network capacity to MVNO’s.

GSMA concludes in a recent analysis that regulators continue to place greater emphasis on specific market segments rather than viewing the TMT market holistically. This has encouraged horizontal consolidation, such as between mobile and cable operators, as operators search for greater economies of scale.
Key Focus Areas

When the deal is approved and the operational model has been defined, it is time to start the execution of the network consolidation project. Three key areas are now in focus, how to assure user experience, how to maximize cost synergies and how to run the project on time and budget with minimum service impact.

Assuring User Experience

· Use of frequency spectrum

Before site selection and network design can commence the operators need to decide on how to use the frequency spectrum available. Often this is done early in the process as it has a significant impact on the overall business value of the consolidation.

Rearming of spectrum is often needed to achieve the desired combination of frequency allocation per band and technology. The frequency utilization plan is done in conjunction with the high level capacity plan. The objective is to decide what services to provide on the different frequency bands i.e. defining a load sharing strategy with capacity requirements per frequency band.

· Site selection and network design

When two networks are to be consolidated, the operators need to decide on how many and which sites from the two networks to keep in the consolidated networks. This is a critical activity considering the quality of the sites is what sets the limit for what can be achieved in terms of network performance. If too few sites and/or sites in non optimal locations are kept then coverage will suffer resulting in degraded end user experience. If too many sites are kept the full cost synergies of the consolidation will not be exploited. Bad site selection cannot be compensated for with network optimization.

To complete this task successfully it is of key importance to use a methodology which takes into consideration the different parameters that determine the value a certain site brings to the network. This requires merging of both coverage and traffic data from the two existing networks.

In addition, site related costs such as lease and maintenance need to be considered as well as the potential revenue that can be achieved by letting space in the mast or tower to other telecom services providers. Distance to important customers is another parameter that can be
added to the calculation. The different parameters are given different weights to model their relative importance. Using this methodology the total score for each site is calculated and then used to rank the sites according to the scores. Without an advanced network planning SW tool, such as Unet from Huawei, it would be very difficult to manage such a data intensive simulation. With its experience from consolidation projects, Huawei is well suited to support the operators with this critical activity.

- Managing network performance in a shared network

Network troubleshooting is more complex during RAN consolidation or in a shared network environment compared to when each operator runs his own network. Field & drive tests need to be carried out using SIMs from both operators. Some complex performance problems or faults require joint troubleshooting to determine the root cause, for example when subscriber tracing is needed in a shared RAN. Another example is data throughput which is impacted not only by the shared RAN but also the core network.

Mobility performance in idle and dedicated mode needs to be monitored closely to secure end users can move seamlessly between consolidated (shared) & non consolidated (shared) areas of the network, frequency bands or technologies.

Seamless handover and automatic cell reselection for the end user is something we expect to work in any mobile network. During consolidation of two networks, the border between areas that have been consolidated and areas which still have separate networks is changing more or less on a daily basis requiring updates in the live networks. Strong coordination between the involved operations teams in both operators (and JV if network sharing) together with an efficient and automated process built on robust integration between network planning and OSS tools are key success criteria. The process developed by Huawei together with customers minimizes manual interaction in order to avoid implementation failures that require rollback and cause customer dissatisfaction.
Reducing Network Cost

Network consolidation provides opportunities for reducing the cost for running the network. Typically the network will have 1.3-1.5 times as many sites after consolidation as each of the two networks had before the consolidation started. This means that 25-35% of the sites can be decommissioned at the same time as coverage is significantly improved compared to each of the standalone networks. Depending on the configuration requirements for the site consolidation, exiting base station equipment is either upgraded to support additional frequency bands and/or technologies or swapped out for a more modern version with high capacity and better scalability. The scope of work determines the complexity of the consolidation procedure. If antennas and bases stations need to be swapped service affecting work on site may be needed several times. Cost synergies are not only achieved by reducing site count. All layers and domains of the networks should be analyzed to identify both potential for savings through consolidation and need for modernization to achieve a future proof solution. The transport network is an area which in most cases needs to be modernized in order to support fast growing traffic volumes. This often requires swap out of old legacy platforms, a flatter architecture to reduce latency, move of higher bandwidth closer to the base stations and interconnect between IP nodes to balance load. Furthermore, OPEX can often be reduced by terminating duplicate leased lines. Equipment that has been swapped out can many times be reused in other sites. One common situation is when the two operators use different RAN vendors. In this case there is a need to create homogenous vendor areas under each RNC or BSC in the consolidated network. This triggers the need to move large volumes of equipment. Without a well designed logistics solution including transportation, refurbishment & equipment testing in warehouse and putting together new equipment configuration with new and refurbished HW, this can easily become a serious bottleneck delaying the overall progress. Huawei has in many projects proven its capability to quickly build up the organization and infrastructure needed to manage this challenging task.

Another important area for consolidation is IT/BSS/OSS. Most operators use many different kinds of support systems, some of which could be applications developed in house or customizations of commercially available systems. Many years have probably been spent on integrating the systems with each other creating a very operator unique and complex environment having many internal dependencies. Considerable time is therefore needed to analyze and agree on a plan identifying which platforms on both sides to keep, upgrade or replace and how to integrate them with each other.

Shortening Time to Market

Consolidation into a multi operator network is a much more complex process than traditional swap. New competencies and skills are required to manage non standard tasks. Typically the project runs over one or several years. Dependencies between activities & stakeholders increase risk for delays & increased cost as well as unplanned service downtime. The need to manage subcontractors and other stakeholders engaged in the project sets tough requirements on the capabilities of the project management function.· Functionality tests

Before MOCN, MORAN is introduced in the network, testing in a controlled environment is required to secure that interoperability between RAN & the two core networks is working as it should. This is especially important in a multi vendor environment when the two core networks are supplied by different vendors than the RAN. Handling or international roaming users with MOCN is another important function that needs to be verified. In a shared RAN there is a continuous need to coordinate and align core network and RAN SW releases and feature status between the JV and operators to secure compatibility with regards to MOCN and MORAN.
**RAN consolidation methodology**

RAN consolidation is best done on a cluster by cluster basis where a cluster typically consists of 5-20 sites. Each activity in the cluster preparation process must have a clearly defined scope and relationship with other activities. At GO/NO GO, project management should be confident that all preparations have been completed correctly. A fallback procedure is required and non keep sites are soft decommissioned before dismantling. The objective is to minimize risk for unplanned service downtime or degradation. The picture below illustrates the process.

![Cluster preparation diagram](image)

Furthermore, considering handover boundaries between the consolidated and the non consolidated networks change on a daily basis and traffic from decommissioned sites migrate to remaining sites, skills to efficiently verify network performance and quickly tune the network to remove performance degradations or unexpected capacity bottlenecks following activation are of key importance. This requires highly experienced engineers together with advanced tools and support systems for efficient troubleshooting, analysis and correction.

**Prime Integrator Model**

The traditional model for network planning and implementation used by MNO’s includes the use of a number of subcontractors, both telecom equipment vendors and local services providers, for mainly implementation related tasks. Each subcontractor is given responsibility for a well defined task and the coordination of the different subcontractors is managed by the Operators. Managing a network consolidation project is a significantly more complex and demanding task compared to the traditional swap or upgrade project. The dependencies between the three networks involved (Operator A network, Operator B network and the part of the network that has already been consolidated) set very tough requirements on the preparation and execution of the different tasks in order to minimize risk for unplanned service downtime or network quality degradations. Strong coordination of all involved parties and resources and a robust methodology are key success factors.

The Prime Integrator model offers advantages compared to the traditional model used by the Operators. By giving the Prime Integrator full responsibility for all activities impacting the live network performance during the consolidation phase, a clear line of accountability is established. The Prime Integrator coordinates the different field subcontractors’ tasks of preparing network nodes and
transmission to have everything ready in time for integration. The Prime Integrator then takes full control of all integration related activities and support systems and work in close cooperation with the Operators’ network operations departments to secure all changes to the live network are coordinated and the impact on the end user minimized. The pictures below illustrate the responsibilities of the Prime Integrator.

With the Prime Integrator model, the Operators are better equipped to meet their quality, TTM and cost objectives.
Huawei Reference Project

Two leading MNO’s in a leading European market had decided to merge their networks. The consolidation project was however not progressing according to plan resulting in delayed LTE rollout, OPEX not being reduced as planned and project costs running over budget. This was the result of poor coordination of the involved parties leading to late cluster completion and performance issues due to site by site swap (late acceptance). The project suffered from a lack of transparency, control and accountability. In addition to this, network performance was negatively impacted by the poor quality of the frequency plans.

At this point Huawei proposed to implement the Prime Integrator model. After a trial period this was accepted by the customer and applied on the whole project. Huawei was given end-to-end deployment responsibility including driving third parties to deliver against contracts and increase transparency across the program. This quickly led to a dramatic improvement in pipeline management and very clear accountability. The average lead time from site identification to cluster activation was reduced from 311 to 118 days. By securing all preparations had been completed before activation, all main KPI’s kept stable. Furthermore, frequency refarming could be implemented without performance degradations using a new more advanced frequency planning methodology. All this made it possible to catch up the lost time and achieve the OPEX reduction in the business plan. The consolidated network was later ranked as the leading LTE network in the country following benchmark tests carried out by an independent company.
Operator consolidation is here to stay and the rate of consolidation can be expected to intensify during coming years. Given the fierce competition in the market and the projects already started, more and more operators will come under pressure to seriously evaluate different options for consolidation. EU’s recent approvals of several large deals in leading European markets will further encourage this development.

In this article Huawei has shared some experiences gained when supporting operators all over the world with managing the challenges following M&A and network sharing agreements. Consolidating networks and organizations is complex and although each case is unique, the best practice and solutions developed by Huawei help operators get started on the right track, execute the project efficiently and achieve their business objectives.

Summary

Sources

GSMA Intelligence Analysis on Convergence – February 2015