White Paper

# Accelerating telecommunications growth world-wide

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# Contents

## Executive summary

Earlier, fixed lines were the way to build telecom services. Today, the mobile has become the obvious choice in increasing welfare by telecommunication services.

Voice and simple messaging services have become a key element in increasing the welfare of both society and the individual. However, these basic telecommunications services have so far been too expensive to afford, or have not been available at all for those most in need. Moreover, the current business models and cost levels of telecommunication operators are not sufficient to support extending the availability of basic communication services as widely as demanded, but this can be changed. This white paper is targeted at interest groups in the mobile industry. It outlines the potential existing in this new subscriber segment and focuses on the approach needed to achieve the foundation of a viable business model, supporting socially responsible needs.

Affordability and cost of service are clear drivers for the new mobile end-user segments. This requires new thinking in business practices and initial network planning, right through to network operations and maintenance. Many operators are already active in the new user segments. Also, other industry players are recognising the opportunity. There is no single set of applicable rules for cost reduction. The focus of this paper is on the key areas requiring operators' attention: it discusses ways to reduce operational expenditure (OPEX) and capital expenditure (CAPEX), minimise average cost per user (ACPU), and enable profitable business from segments with low average revenue per user (ARPU).

Nokia believes that lowering the total cost of ownership for consumers in the entry-level segment will create growth opportunities in low mobile penetration markets. Therefore, we are committed to increasing efficiencies and cost savings in order to provide consumers with affordable and attractive products that cater to their needs.

# Basic Telecommunications as catalyst for improving welfare

## Basic telecommunication services

Basic telecommunication services are defined primarily as voice and simple messaging to other users of telecommunication services on a national scope. They can also include basic data communication services enabling the use of e-mail and access to the Internet. The availability of these services is a significant contributor to the development of local and national economies, including the health of people, education, social contacts, and supporting the government in their effort to serve the nation in the best possible manner.

## Focus has shifted to mobile telecommunications

Until the past decade, the implementation of such services was dependent on the availability of the fixed telephony infrastructure, with limited ability to expand these services to previously unanticipated volumes of new subscribers.

Since then, the provision of basic telecommunication services through mobile telephony has changed both the affordability and expandability of the service. What used to be considered as luxury has become a justified commodity in a majority of countries.

However, as the deployment of the mobile telephony infrastructure has taken place through commercial implementation of the services, the service has initially only been made available where the local domestic economy results in individuals with sufficient wealth for these services, i.e. primarily in cities and urban areas.

## Lack of telecommunications facilities both in urban and rural areas

The resulting lack of service coverage has so far ensured basic telephony services are unavailable to a significant number of people in some of the more rural areas, where the common challenges of life would favour a wireless telecommunications solution the most.

In addition to the rural areas, basic telephony services are still considered to be inaccessible for large numbers of people living in cities, or around them, either due to a lack of fixed telephone lines, because significant expansions of the existing wireline infrastructure are laborious and time-taking, or because they are not able to afford subscribing to telephone services.

## Conditions are improving

Mobile telephony seems just about to break the barrier in making basic services also affordable to less affluent individuals and to rural areas:

- **increased competition** between the service providers - as a result of the determined efforts of national regulators - has improved the efficiency of the majority of operators, relatively lowering the operating expenses per subscriber, making it possible for them to consider widening their subscriber base and network coverage.
- **slowing growth on the traditional market of the operators** - as mobile telephony penetration among urban middle and upper class population has saturated - has increased the operators' interest to seek new growth possibilities, including value-added services and new subscriber categories.
- **favorable price development on basic functionality mobile terminals**, due to maturity and volume of open standards products - together with governments' increasing recognition that basic telephony equipment is a commodity and no longer a luxury - governments are levying customs duties and retail taxes accordingly.

# Space for growth

For the 6.4 billion people in the world, there are currently 2.2 billion telephone lines (fixed lines and mobile subscriptions altogether).

Mobile lines have been estimated to have surpassed the number of fixed lines in the year 2002, as the more flexible and economic way of building new telephony services.

It is characteristic of the telephone services that their availability is unevenly distributed globally; in some countries telephone penetration already exceeds 100%, whereas in some countries the lack of any basic communication services is severe.

In countries with lower penetration, the service may also be physically difficult to reach, e.g. require several hours of traveling to reach, or only be available at a limited number of public telephone offices, perhaps located at a long walking distance.

It is notable, that quite often the wealth of individuals currently with limited or no access to basic telephone services is very limited and daily economical life runs around cash or exchange of goods, thus setting specific requirements, e.g. for charging arrangements.

Although the benefits of availability of basic telecommunication services are clear also for current non-subscribers, the available average personal income may be low, less than USD 150 per month, and the ability to spend on communications is limited, usually 1-5% of income over a period of time.

From a service provider's view, the very high number of such potential subscribers can compensate for the limited revenue potential of these new subscribers. By improving their internal efficiency and business support processes, several operators, e.g. in India and the Philippines, are creating a profitable business case out of this new subscriber potential through solutions such as prepaid and short messaging.

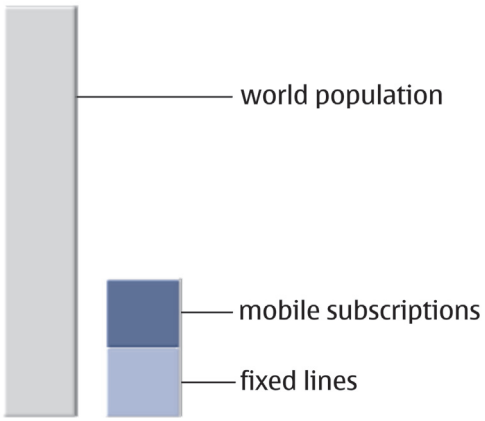


*Figure 1. World population and number of telephone lines*

| Country | Population (millions) | Fixed + cellular lines (millions) | Population minus number of telecom lines (millions) |
|---|---|---|---|
| India | 1046 | 36 | 1010 |
| China | 1284 | 327 | 957 |
| Indonesia | 231 | 15 | 216 |
| Pakistan | 148 | 4 | 143 |
| Bangladesh | 133 | 1 | 132 |
| Nigeria | 130 | 2 | 128 |
| Brazil | 176 | 48 | 128 |
| Russia | 145 | 44 | 101 |
| Vietnam | 81 | 4 | 77 |
| Philippines | 85 | 17 | 68 |
| Ethiopia | 68 | 0 | 67 |
| Mexico | 103 | 38 | 66 |
| Egypt | 71 | 8 | 63 |
| Iran | 67 | 8 | 58 |
| Congo D. R. | 55 | 0 | 55 |
| Burma | 42 | 0 | 42 |
| Thailand | 62 | 21 | 41 |
| Tanzania | 37 | 1 | 36 |
| Sudan | 37 | 1 | 36 |
| Ukraine | 48 | 13 | 36 |
| Colombia | 41 | 9 | 32 |
| Kenya | 31 | 1 | 30 |
| Algeria | 32 | 3 | 30 |
| Afghanistan | 28 | 0 | 28 |
| South Africa | 44 | 17 | 26 |
| Argentina | 38 | 14 | 24 |
| Peru | 28 | 4 | 24 |
| Turkey | 67 | 44 | 23 |
| Poland | 39 | 21 | 18 |

*Table 1. Population and telephone line statistics examples (from 1998-2002)*

At the global level, a variety of different growth scenarios for the number of mobile subscriptions have been presented, with different timetables and subscriber levels. But the sources all agree that a significant part of the growth comes from basic telecommunication services in the new growth markets, if not the majority when reaching for the next billion new subscribers.

As global penetration is expected to double during this decade, there will no longer be such strong growth in many of the countries with established telecommunications services, the subscriptions in most of the new growth market countries will increase many-fold, creating a challenge for the telecommunication operators in those countries.

While limited availability of service is a key limitation to growth, the clear driver for wide adoption of telecommunication services beyond the current subscribers is the cost level seen by the end-user, including acquisition of a suitable phone, the subscription, and the cost of actual usage. The recipe for increasing affordability of the offering is formed as a sum of multiple contributors:

- operators are contributing by extending their reach in distribution and lowering their overall cost per subscriber, thus enabling themselves to provide more affordable services to end-users on a profitable basis
- telecommunication vendors are contributing by trying to find ways to produce more cost-effective products, with minimized logistics and distribution costs
- in general, governments have contributed by enabling competition on the market (to drive the cost levels down), and re-grading telecommunication products and services into basic rather than luxury items in taxation and duties.

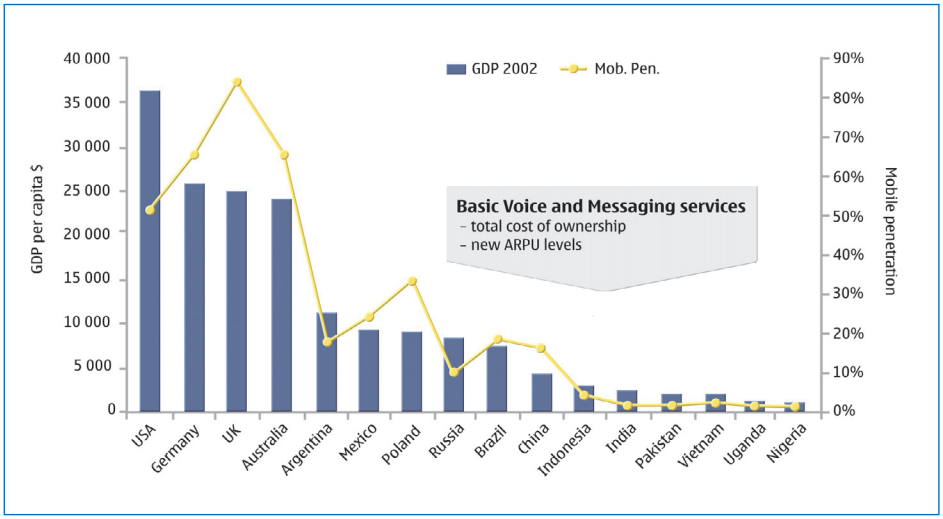


*Figure 2. Examples of GDP per capita vs. mobile phone penetration*

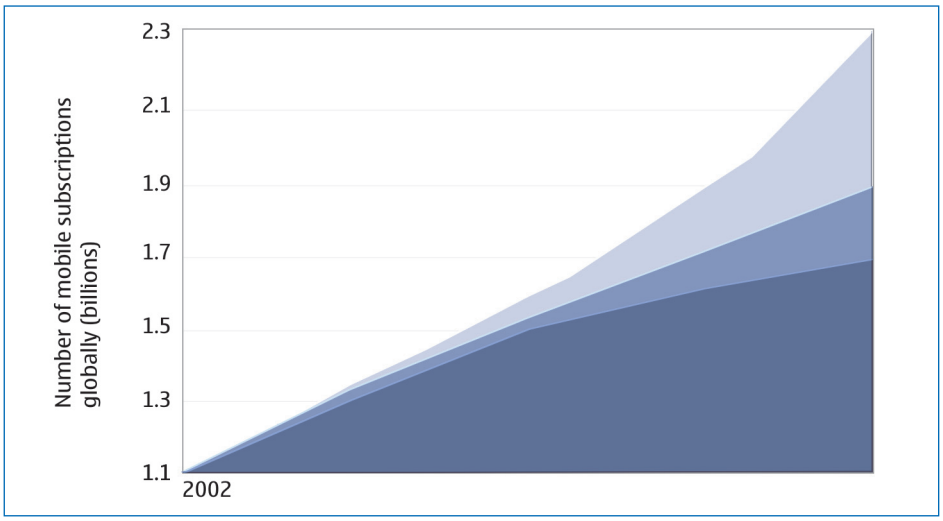


*Figure 3. Scenarios for the further growth of mobile subscriptions globally*

# Considerations of network operators

## Operator business case

### Key measures

Operators in many countries today seem to generate healthy 30-40% **EBITDA** (earnings before interest, tax and depreciations of assets) ratios on USD 10-14 per month average revenue per subscriber **(ARPU)**, indicating balanced control of average cost per user **(ACPU)** and thus that the general operational efficiency is in moderate to good shape.

However, as it is not the relative but rather the absolute profit that matters particularly in the early days of a network operator business, attention is to be paid also to the number of subscribers to the service, as absolute profit is a product of the subscriber number and average profit per user **(APPU)**.

Thus, the desire of the operators to continuously grow in a strongly competitive market place must keep driving the development on operational and investment efficiency further. Moreover, in most markets the generated revenue per basic services will decline because many of the addressed new subscribers either are not able to or do not feel it necessary to spend as much money on telecommunications as previous subscribers may have done.

### Business reporting capability

One critical requirement to measure the effectiveness of any cost reduction initiative or development plan is having the correct business reporting practices in place. Too often the overall total costs (e.g. over a financial year) and derived average cost-per-user, are not absolutely clear, and the breakdown of key contributors behind these costs are vague at best.

More often than not, there is a clear requirement to further develop internal processes and ensure reliable and timely reporting practices to guarantee the validity of the business case itself.

### Profitability and cost level targets

For the benefit of cost control activities, it is worth choosing aggressive-enough targets for future cost levels, tied to the expected total revenues, with challenging but achievable profitability targets and realistic subscriber number scenarios.

While operators must consider their targeted profit level in their own market, a generic benchmark level against an established operator is a minimum rule of thumb. Any such guideline must reflect the targets required to ensure sustainable profitability in a changing global marketplace - even if the current revenue per subscriber were to be halved.

This is an important and challenging target to set and acts as a good reference level for any new operators planning to enter the market.

In addition, the timeframe in which the new targeted cost level is to be reached should be chosen based on case-specific considerations. Naturally, the sooner the better, as every increase in operational efficiency immediately starts generating improved profit.

### Example business case calculation

A generic suggestion for a new growth market operator business case calculation targeting at 40% EBITDA on 5 USD per month ARPU is presented in the Nokia white paper *The prerequisites for profitable entry business.*

In general, a truly minimized cost level will be more difficult to reach for a greenfield operator than for an established operator, as the established operator may benefit from already established economies of scale, depreciated investments and a better learning curve.

### Co-operation with other operators to share investment

In some cases, it may be worth considering also the options of:

- site sharing between competing operators
- virtual network operators, i.e. only one physical network implementation but several operators to share the cost
- national roaming to provide increased perceived value for subscribers in a country with many regional networks run by different operators.

All these may contribute to making a more favorable entry business case - perhaps even without long-term obligations.

## Services offered to the end-users

### Basic services

The clearly dominant service appreciated by low-spending entry subscribers is voice, including traditional means to ensure a higher rate of termination of the call, such as voice mail or answering services.

A close second is the requirement for simple messaging (e.g. short message service, SMS). Here a 'simple' service means one that is cheap to produce, and can therefore be offered to the end-user at an affordable price. From the end-user perspective, the adoption of messaging services is dependent on factors such as local cultural norms, the level of literacy, and the availability of the phones to support the correct set of languages used in daily communication.

### Additional operator perspective

From the network operator's viewpoint, the technical capability of the terminals to support basic messaging may be required because it may provide the key for cost-efficient prepaid recharging and customer care.

Other services, such as fast data services, are considered of minimal importance by the low-spending entry subscribers, and are only needed later in a country's development cycle. Still, there should be at least a feasible growth path towards these services, as the same network is likely to have to serve more demanding customers such as enterprises, higher revenue customer segments or even local social services, for example, in spreading the proliferation of e-mail and Internet-based services to new geographical regions utilizing the same telecommunication network as for the basic services.

## The changing standard of quality

Quality is a subjective term, with benchmarks and the perceived level changing over time and place.

As an example; in an area where very limited or no basic telecommunication services are currently available, it is perceived as a significant improvement when basic services are first introduced, even if the service was a bit clumsy to access (e.g. need to find a location where network coverage is available), somewhat congested from time to time, or available only part of the time (e.g. due to daily outages in electricity in that region).

However, as people become accustomed to the service, or have had the chance to enjoy better service (e.g. as result of competition of the service providers), the perception and standard of quality increases, and finally reaches the level currently enjoyed in many of the highly populated cities.

Therefore, to keep the initial costs down and meet the constraints of time and competition, operators must recognize and appreciate the need for a balanced level of compromise in order to make the service available in the first place. Again, such compromises must not sacrifice the ability to further grow and develop the networks to the current market benchmark.

## Prepaid strategy in key role

Nokia expects the majority of new subscribers to have prepaid as the default payment method, particularly in the new growth market countries. As the anticipated volume of subscribers grows significantly, it is vital that processes and cost management practices for prepaid subscriber provisioning and prepaid account recharge have been tuned for maximum efficiency.

A significant factor affecting the operator's market strategy is the value of the lowest prepaid denomination. Using Asia as a yardstick here, operators who are more successful in attracting volumes on entry subscriptions are now offering prepaid subscription values starting from as little as USD 0.50, in contrast to the previous dollar plus or USD 5 minimum top-up values.

The logic behind this is as follows; while a potential subscriber saves up the 5 USD, there is a vast array of small tempting opportunities to spend that money. However, if this threshold is lowered to a 0.5 USD top-up instead, the user has a lower investment hurdle for topping-up, and, from the operator's viewpoint, this means lower risk of the money being spent elsewhere.

By encouraging continuous recharging in this manner, an operator keeps the subscribers active in the network - even during periods of lower communications activity. Thus the customer is kept in reach of in-coming calls, enabling the operator to collect revenue from other subscribers and possibly even from other operators' call-termination network fees - even when the end-user him or herself did not spend the money on communications.

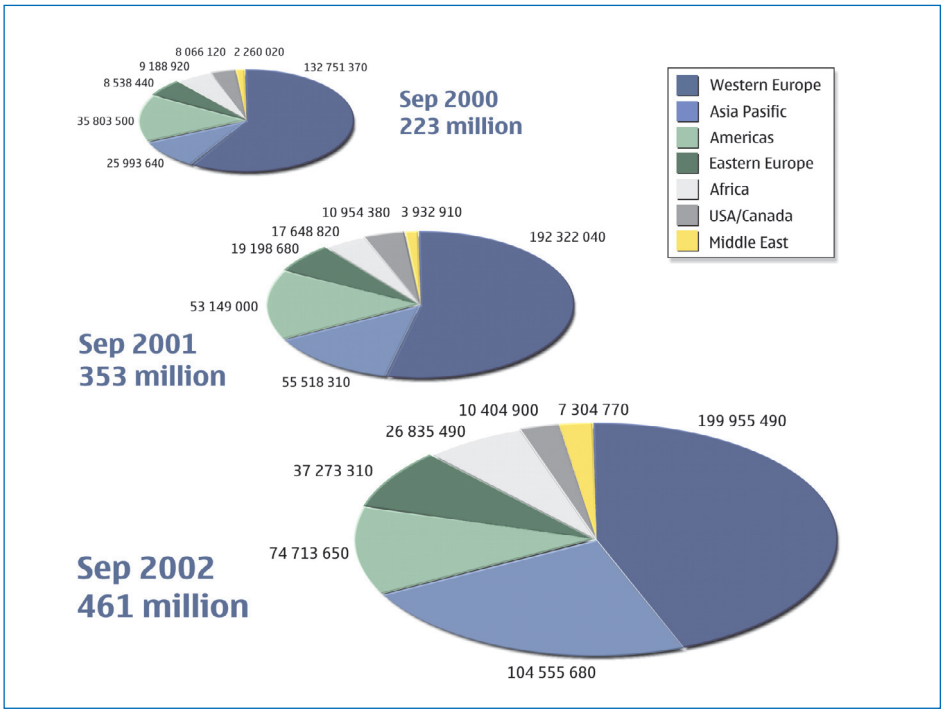


*Figure 4. Prepaid has grown rapidly as a charging mechanism (source: EMC Cellular Subscribers)*

The technical and financial challenges resulting from a higher number of low-value top-up transactions naturally include a greater number of top-up transactions to be managed by the operator. If the operator's operating expenses per transaction are high, this can soon turn into a poor business case requiring further proactive actions.

The costly process of handling paper format prepaid recharge-coupons (scratch cards), and the potential economical risks linked to their handling and distribution have led to the rapid development of electronic recharging. This has not been with the more advanced solutions, such as ATMs in countries with extensive electronic banking networks, but with the electronic reselling of airtime from small distribution points, such as village kiosk keepers or other individual entrepreneurs. In these instances, the reseller tops-up the prepaid account of a consumer by exchange of short messages with the operator's airtime accounting system. The reseller may have purchased from the operator bulk airtime at a discount price (on a prepaid or postpaid basis), reselling it further in smaller portions and making his profit out of the price difference.

This kind of approach extends the potential airtime reseller network to every place where there is network service, and has given a large boost to extending the coverage of the airtime distribution network to almost every corner and every village, in a very easy and cost-efficient way from the operators' perspective.

This approach also complements the needs of cash and exchange economies, typical in most of the rapid growth markets.

## Radio access – smart choices are required to keep network costs down

Often more than 2/3 of both the network investment and operational expenses come from the base station network, with the remaining part from the core network, including switching, network management and so on. The natural reason for this is that the radio base station sites far outnumber those needed for the more centralized parts of the network, and are located all around the network area.

To implement network services at an affordable cost per end-user, it is of the utmost importance to have the radio access components built and dimensioned correctly.

### Minimizing the number of sites, maximizing subscribers per site

A logical first step, particularly in a low traffic density region, is to minimize the number of base station sites, and to maximize the number of subscribers served by each site (thus contributing to minimized cost per subscriber).

As an example, building a low-capacity base station site (1+1+1 TRX in GSM) provides 4-5 times higher cost per subscriber than having the higher number of subscribers served by a high-capacity base station site (4+4+4 TRX) where there are more subscribers to share the site cost.

### Getting more out of the network

It is beneficial for the operators in highly populated regions to apply new spectrum efficiency increasing techniques, to stretch the network capacity even further. Typically, the approach of providing more capacity from the existing sites instead of having to build more sites clearly provides the best economy.

### Planning and implementing the network

Operators continue to report speed of rollout as one of their key differentiators in a competing market. The operator with the fastest rollout or ability to expand the capacity in the optimal manner is the more likely to attract new (and loyal) subscribers.

The quality of site implementation is a key element in limiting the number of site visits required by maintenance teams to fix or finalize their work. A vendor's experience in *getting it right the first time* reduces the need for additional site visits, hence vastly improving the time-line and cost plans of even the most experienced project manager.

The way to combine rapid deployment with good cost control is to do the planning and implementation in a systematic manner. Factors such as; choosing the target area and planning criteria, preparing for future coverage and capacity expansions, planning the needed network solution using standard site configurations, and proceeding only when the work is fully completed, are critical to a rapid implementation.

The role of standardized site solutions, i.e. keeping to a minimum number of different site configurations, is essential in overall cost management, as it gives savings throughout the process: standardized requirements for sites enable easier and faster site acquisition, a minimum number of base station configuration variants speeds up the network planning and simplifies staff training, controls the logistics cost and enables fast and correct site implementation in volume. Also network maintenance will be easier due to the usage of standard site solutions.

### Selection of the right base station site concept

Choosing the correct site concept provides significant site-level savings. A new base station site of marginal profitability could turn into a good investment, if a more economical site solution was found.

If ready premises for the equipment do not exist, the options are as follows: to apply an indoor site solution using equipment rated for use in an indoor environment, thus requiring a weatherproof housing to be built or rented; or whether to implement an outdoor site solution with all the equipment readily installed in a weatherproof cabinet suitable for environments such as a rooftop, on an existing tower structure or at ground level. The latter is usually more economical, considering the overall cost for putting up a new site, and may contain battery backup and transmission solutions built in.

### "Siteless base stations" as a new useful finding

If the need is for an outdoor base station site, it is worth considering which is better suited; a traditional solution, which is by nature heavy and large in dimensions, or a more compact and lightweight siteless base station concept (small, low-energy consumption base station located close to the antennas, not requiring availability of specific equipment room or shelter). Such a configuration offers a saving of up to half the site cost while still providing the same radio coverage and capacity expansion support, thus turning an otherwise marginally profitable base station site into a profit generator.

### Lack or quality of electricity as a challenge

A restricting factor in many cases that increases the radio access site cost is the unavailability or poor quality of electricity at base station sites. The traditional mobile network approach has been to overcome this by installing generators and battery backup systems. This is a costly approach, considering the initial investment (generator, housing for protection from weather and theft), ongoing operating expenses (regular test use, maintenance, fuel management) and social compatibility (permission to store enough fuel, working noise, management of exhaust gases and vandalism).

However, in regions with no previous telephony services, the operator's income stream may not allow for such costly implementations.
The high power drain of sites, combined with the difficulty of providing a proper supply of electricity, may contribute to the decision not to extend the service to the region at all, or to put the expansion on hold for an undetermined period of time.

While the base station equipment is the main cause for energy consumption on a base station site, the second important drain on supply is the systems to support the base station, primarily the air conditioning system. As air conditioning systems are also a major maintenance problem, and target for theft, it makes sense to try and avoid their use whenever possible.

### Working around the electricity problem

Passive or fan-only cooling is typically not an option for traditional high-power indoor base stations in hot climate countries. A potential alternative is to instead consider the use of temperature-tolerant outdoor base station types; either a high-power traditional base station or a low-power-consumption siteless base station, even allowing the use of solar energy as a source for electricity, and not requiring the use of air conditioning equipment.

The concurrent impact in site cost reduction and reduced power consumption overcomes the majority of the electricity and site maintenance concerns.

When applying a battery backup system, it is worth considering whether to dimension the backup capacity for all-time full-power use of the base station, or for the more likely typical partial load, e.g. 50-60% of the maximum site power consumption, as this makes a difference particularly from the investment point of view.

The batteries required for a solar-powered system can, in favourable cases, be buried in the ground to achieve a more optimal operating temperature, thus further decreasing the maintenance cost.

### Transmission in rural areas

It is common practice to extend the transmission system to the base station in conjunction with the rollout of electricity or roads to the site. Traditionally, optical fibers are laid at the same time as other services, to be rented or sold as an asset for providing a backbone transmission network. From centralized hub sites, the telecommunication operators would then typically extend this to their sites using microwave radio link technology.

### Reliability considerations

It makes natural sense to pay strict attention to the reliability of the base station equipment at the site, as this is often one of the largest hidden costs in the network. As the conditions at sites may be harsh over the years, the distances to sites long or access difficult during some seasons of the year, and any maintenance laboriously expensive, the failure of equipment has a greater impact on the availability of service, as well as overall operational expenses.

Remote preventive maintenance, diagnostics and manipulation practices should also be standard features for the base station sites, so that time-consuming traveling to and from sites can be taken to the absolute minimum.

## Conclusions

Mobile networks and services have become the preferable tools in increasing welfare by building telecommunications services.

Making the mobile service affordable and optimizing business practices are key roles. Addressing the new user segments needs fresh thinking and new actions from all industry players to meet the requirements – and these actions are already happening.

The growth opportunity to the next one billion mobile users is generally recognized by the industry.

**Nokia Corporation**
Nokia Networks
P.O. Box 300
FIN-00045 Nokia Group, Finland
Tel: +358 7180 08000
www.nokia.com

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