Nokia Siemens Networks Village Connection - affordable voice and internet connectivity for rural villages

Nokia Siemens Networks Village Connection brings voice and internet connectivity to rural village communities where traditional GSM network roll-out and operation would be too costly.

The solution's IP-based network architecture and the new business model of local village hosts reduce the operator's capital and operating expenditure, making a profitable business case in new growth markets.

Nokia Siemens Networks Village Connection overcomes the cost barriers that have prevented mobile operators from tapping into the enormous potential market of subscribers in new growth markets. Many rural villagers in these areas are likely to spend no more than USD 5 per month on communication services. Village Connection effectively cuts the cost of mobile voice and internet connectivity to an affordable level for the operator, thus aligning the cost of new coverage with expected revenue levels.

Village Connection relies on a network solution that significantly lowers the capital expenditure (CAPEX) and significantly reduces the operating expenditure (OPEX) associated with traditional wireless network roll-outs. As well as using innovative flat network architecture, the solution includes the business management systems and value network needed to make mobile services affordable for subscribers and profitable for operators.

Achieving connectivity village-by-village

Village Connection comprises GSM Access Points (GAP) located in the villages and regional Access Centers, routing calls between villages and providing connections to other networks. GSM Access Points that provide wide area coverage in the village are typically located on the premises of the village Access Point host (local entrepreneur) with the antenna on the roof of the building. Thus costly towers – typically used in rural coverage building – are not necessary. The main solution component is software, allowing the GSM Access Point to carry multiple functions – radio access, switching, holding updated subscriber databases. Hardware is based on Nokia Siemens Networks base station portfolio, some IT components and generally available hardware (PC).

Each Access Point handles call control and call completion for up to approximately 250 subscribers within a village. If required, the GAP capacity can be scaled up further. Village subscribers and visitors roaming to the Village Connection network use regular GSM handsets for voice and SMS services. Local calls of village subscribers are connected directly in the GSM Access Point, no backhaul resources are required. Thus the GSM Access Point can operate like a stand-alone mini-network in the village.

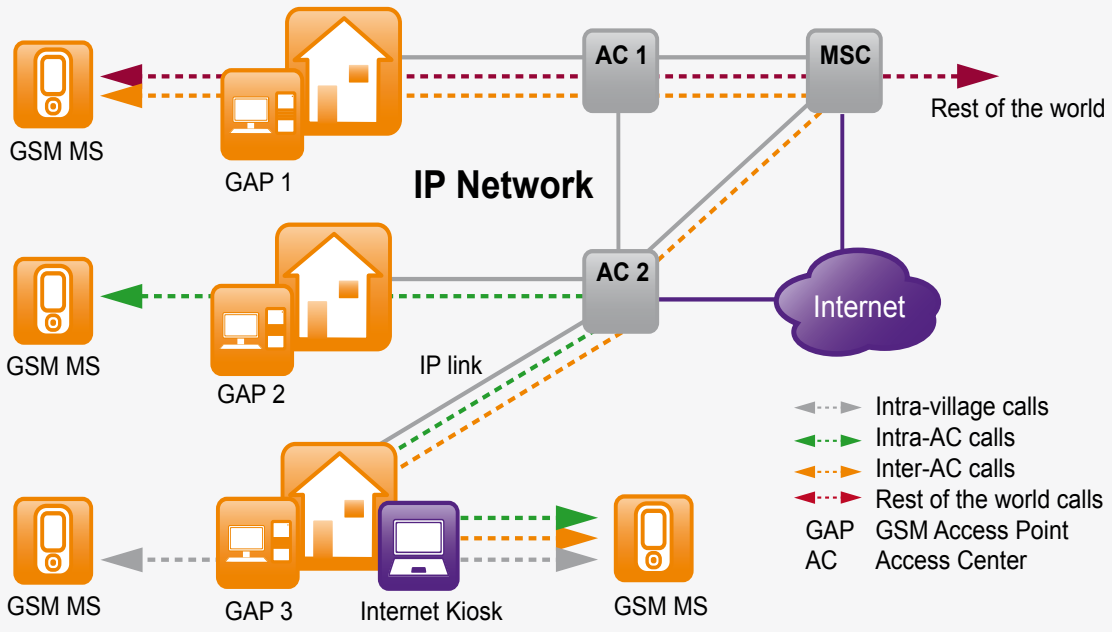
Traffic leaving the village toward the Access Center takes up only little bandwidth and uses an efficient native IP link. The IP connection can be made using various transmission media, such as point-to-multipoint radios, point-to-point radios, fiber or satellite. Spare capacity of the IP backhaul link can be used to provide shared internet access to the village users. An Internet Kiosk can be set up at the GSM Access Point, allowing villagers access to business applications, information and services such as healthcare and education.

Calls between neighboring villages are connected via the Access Center, not consuming transmission capacity toward the core network. Access Points are typically within a 20-30km range from the regional Access Center. However, in the case of satellite connections the distance is virtually unlimited.

A Village Connection network in the village integrates with other telephone networks via the Access Center that provides an interface toward the operators existing core network's Mobile Switching Center (MSC). The Access Center aggregates traffic and routes calls between up to 200 GSM Access Points in the area.

A local village host operates the GSM Access Point and Internet Kiosk typically out of his home, shop or school. Local operation in a protected environment enhances system availability and reduces cost. The village host also conducts service marketing, subscriber management and customer care, tasks done more cost efficiently locally. Furthermore the village host facilitates service usage, assisting subscribers and directing them to relevant services and content.

Nokia Siemens Networks Village Connection architecture



The autonomous GSM access points are easy to set up
A GSM Access Point bundles a radio base station, IT components, power and PC with access point software. It provides a GSM interface for subscriber terminals and switches traffic within its local cell. It also provides IP encapsulation for traffic being routed to the Access Center. The Access Point monitors local performance and incorporates the backhaul interface. Each Access Point can also operate in standalone mode should the link with the Access Center become impaired.

An Access Point is typically deployed with an omni or directional GSM antenna, along with backhaul CPE (customer premises equipment) and an antenna for providing IP connectivity to the Access Center. Very little network planning is needed. The Access Point is simple and very fast to install as no heavy civil works, such as site construction for high towers, are required. This reduces the rollout CAPEX. The ongoing maintenance of the GSM Access Point is so simple that a village host with no prior IT proficiency can be trained to carry this out.

To optimize Access Point power requirements, the cell range of 2–3 km provides coverage primarily within the populated areas of the village. Diesel generators or solar panels and battery back-up are put in place to help the Access Point overcome the uncertainties typical of rural power supply.

Access Centers cut switching and interconnection costs
The Access Center comprises routers and other standard IT hardware and software. As well as aggregating traffic from regional Access Points, an Access Center switches calls between the Access Points within its domain, connects the Village Connection network to the existing GSM network and provides remote monitoring and maintenance of Access Points. It also provides backhaul interfaces for the point-to-multipoint technology in use at the Access Points, as well as a standard A-Interface link to the MSC. Standalone operation is possible should the link to the MSC become impaired.

The Access Center can also interconnect over the A-Interface via MSC with other networks (PSTN, PLMN), thereby optimizing backhaul, switching and interconnection cost. The Access Center will typically use existing roadside sites thus lowering the site-related costs.

While the backhaul links between the Access Points and Access Center typically follow a star topology, mesh connectivity can also be supported.

Innovation delivers savings
This simple, distributed architecture is the key to delivering the cost savings operators need in order to make mobile access affordable for rural customers. For example, moving call control close to the edge of the network, i.e. into the villages, optimizes deployed switching resources and lowers backhaul costs. Similarly, moving subscriber management functions to the edge of the network makes it possible to manage customer additions, deletions and billing functions within the village. The ability to interconnect with other networks at various levels also helps operators to rationalize their interconnection and backhaul costs.

The plug-and-play Access Points, coupled with support for local subscriber management (provisioning, billing and customer support for instance), allow village personnel to handle all network operation and subscriber management functions locally. This distributed management model where all subscribers remain provisioned to the HLR by the operator but where local subscriber management can be done at the village is critical to the viability of rural roll-outs, since it significantly reduces the OPEX traditionally associated with wireless networks.

Internet Kiosk affordable and assisted internet access
The Village Connection solution supporting mobile voice and SMS services may be easily expanded at any point to include a range of value added broadband services (VAS). Village Connection Internet Kiosks provide rural consumers with shared, pay as you use, internet access models similar to those available to internet café customers in urban areas. Due to the IP connectivity of GSM Access Points, public internet access or access to specific internet-based services can be ensured. Several PCs connecting to public internet can be located at the GAP premises. The village host can operate this kiosk and provide valuable assistance to the village users. The village host will get villagers acquainted with the internet, guide them to relevant content and assist them when using internet services.

Nokia Siemens Networks Village Connection clearly demonstrates that cost-effective coverage solutions are available. Early trials also indicate that Nokia Siemens Networks Village Connection technology should provide an affordable solution for the rural villages by introducing distributed network architecture and a subscriber management solution.

Main features
- Minimal network hierarchy reduces network complexity and operating costs
- A GSM-radio front end enables Village Connection subscribers to source low-cost terminals and allows them to roam
- The use of IP allows operators to leverage a multi-service backhaul infrastructure
- Distributed network architecture enables village-level handling of crucial network operations:
  - Moving Call Control close to the edge of the network optimizes deployed switching resources and reduces backhaul costs
  - Moving Subscriber Management to the edge of the network enables a distributed management model
  - The ability to interconnect with other networks at various levels rationalizes interconnection and backhaul costs
  - Independent operation is possible at village level

GSM Access Point (GAP)
- for personal mobile voice and SMS services
- 850/900/1800/1900 MHz GSM air interface
- Light 5 m site construction
- 2–3 km coverage with omni or directional antenna
- 128 kbit Ethernet connectivity required (for 1 TRX)
- IP-based backhaul, typically 20-30 km range
- No BSC, transcoder or MSC needed to complete a local call
- 1 GHz Pentium processor with 512 Mbit RAM
- Graphical user interface to add and remove users
- Database with call records

Internet Kiosk (optional)
- for shared internet access
- PC with Monitor, Keyboard, Mouse, etc.
- Connected to public internet via IP link to AC

Access Center (AC)
– traffic aggregation, interfaces to other networks
- Up to 200 Access Points
- 1 GHz Pentium processor
- 512 Mbit RAM
- Point to Multipoint radio
- Access point monitoring

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