<table>
<thead>
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<th>Title</th>
<th>Telecommunications: bridging the urban rural divide.</th>
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<tbody>
<tr>
<td>Author(s)</td>
<td>Fatimah Ahmad.</td>
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Telecommunications: Bridging The Urban Rural Divide

By

Fatimah Ahmad
TELECOMMUNICATION:
BRIDGING THE URBAN RURAL DIVIDE

SEPTEMBER 14, 1993
Telecommunications: Bridging The Urban - Rural Divide

by: Fatimah Ahmad
Telekom Malaysia

1. INTRODUCTION

Rural telecommunication is viewed as an essential element of infrastructure for the country's economic and social progress. With the demographic and topographic conditions of the rural areas, developing countries are striving to narrow the urban-rural gap and to keep abreast with the technological development.

Even in economies which depend heavily on agricultural and industries, rural telephone service, like other infrastructural resources, has patently received low priority. Estimates by Pyramid Research of Cambridge, MA, US reveal that in Asia, Africa and Latin America, rural telephone densities are from one-fifth (1/5) to one-tenth (1/10) of urban area densities. Low telephone densities in the developing countries are a well known fact as shown in Figure 1.

Today about 50% of the world's population are living in the rural areas and the percentage is even higher in Asia. While rural and remote communities engage in a number of activities critical to the business of nation-building and require advanced telecommunication services and information, they do not have the means nor do they represent sufficient "traffic volume" to achieve them individually.

Urban and rural telecommunication systems are different in several aspects, eg. technical planning, traffic flow, financial returns and operational problems to name a few. Services to urban areas are comparatively easy to implement and most important of all they bring in good revenue. In contrast, rural services are plagued with problems such as high capital cost, high operational cost, low financial return and difficult implementation. Thus, it is not surprising that the rural population of the world especially in developing countries are lagging behind the urban community in terms of telecommunication facilities.
There is a growing concern amongst the world's telecommunications community that this imbalance should be studied and the gap narrowed.

2. RURAL DEFINITIONS

The definitions that have been adopted by CCITT are as follows:-

A rural zone generally consists of scattered settlements, villages and small towns, where the zone exhibits one or more of the following characteristics.

a) Scarcity or absence of public facilities like reliable electricity supply, water, access roads and regular transport.

b) Simplicity of life, where people are primarily concerned with survival and basic needs; locally available qualified technical personnel may be scarce.

c) Topographical conditions, e.g. lake, desert, or mountainous areas, which are obstacles to the construction of commonly used lines and transmission systems.

d) The need for telecommunication may be deemed to be socially driven, and economic only in a larger sense. The narrow economics of an individual rural installation or improvements may not be profitable though necessary for the overall economic and social well-being of the rural area in question.

e) Sparse and scattered population distribution with relatively poor and/or temporary housing.

f) Scarcity or absence of health and education facilities, currently hindered due to lack of telecommunications.

g) Economics activity limited to basic vocations like agricultural, fishing or cottage industries.
It is to be noted that (d) above defines the criterion by which a national policy may be required to provide for suitable financing of rural projects.

3. PROBLEMS AND CONSTRAINTS

Due to the nature of the service demand of the rural telecommunication services, there are numerous problems encountered. These problems are normally confined to either economics (cost) constraints or technical limitations.

Traditionally rural network poses much greater technical problems in planning, implementation and operation by the following characteristics:

* large covering areas.
* low subscriber density.
* low traffic volume.
* poor infrastructure.
* high investment cost.
* high operation & maintenance cost.
* low revenue per subscriber

For developing countries the essential problems are:

a) Technical

how to deliver basic telecommunication services into rural areas.

b) Cost

how to cost justify them against competing demands for other services.

This is due to the facts that:

a) resources for investment in telecommunication infrastructure in rural areas are limited relative to those available for urban.

b) demand for new telecommunication services is relatively low initially and is uncertain.

c) telecommunications infrastructure is expensive to install, operate and maintain.
Developing countries have to justify even a very basic telephone service against demands for other public facilities, funding problems are often severe. Developing countries generally maintain a strong government control over a monopoly supplier of telecommunication, infrastructure, and service supply.

In rural areas it is often difficult to assess how much subscriber growth should be allowed for and over what period due to the fact that the area may have no history of telephone use and that provision of a high-quality telephone service for the first time may itself prompt an unexpected growth in demand. However, the installation of a system that is almost fully loaded on the first day of service is an invitation to future problems which involves proper network planning.

Many questions face the planner of rural telecommunication system, including:

* which service should be offered
* where, in what quantity and when
* which technology should be used
* what are the operational, financial and commercial implication.
* can the project be justified to obtain funding.
* which strategy best satisfies these questions and the operator's other interest and obligations.

4. SOLUTIONS TO RURAL TELECOMMUNICATION NEEDS

A) Investment For Future

Rural telecommunication should be regarded as a strategic business opportunity and the existing services should be upgraded to modern telecommunication services. Investment on rural telecommunications should be looked at as a long term business plan which gives reasonably good
returns later. Rural Telecommunication should be viewed as an investment for the future. Although studies have shown that revenue generation is low, this does not give a complete picture.

In developing countries, the rural areas of today can well be the urban areas of a very near future. Telecommunication services will be no longer a mere facility but a necessity to the rural folks.

B) Various Technology Options

Various technologies are available to overcome terrain, scattered and low density subscribers in the rural areas. The objective of rural network design is to select the most cost-effective and technically acceptable solution based on distance, total subscribers and subscribers distribution. It is the responsibility of the network planner to choose the right technology at the right place. Among the technology options available are:

* Copper cable
* Fibre optic cable
* Multi-Access Radio System (MARS)
* VHF single channel (country set)
* Cellular System (ATUR Payphone)
* Satellite
* Digital Local Switch (DLS), Digital Remote Switch (DRS) - remote switching system
* Radio In The Local Loop (RILL) (New technology)

a) Copper Cable

The use of copper cables Figure 2 was and still is the classical approach to providing service to the rural areas.

Within the physical (terrain) and technical constraints which affects the transmission qualities this approach has been used to serve areas as far as 15 km. from the telephone exchange.
The maintenance of long land lines is usually difficult, expensive and time consuming, not to mention the poor economic returns.

b) **Fibre Optic Cable**

Fibre optic link is mostly appropriate if the rural area is more than 6km away with more than 100 subscribers and geographically an advantage (along rail, road or river).

Please refer to Figure 3 for system configuration.

c) **Multi Access Radio System (MARS)**

In remote settlements with denser population concentrations MARS is used (Figure 4). It is a microwave concentrator and consists of a central station, usually co-located with the exchange and the outstation. The area of coverage is approximately 40 km between terminal and central stations. Solar panels (in the form of array) and batteries are provided in locations with electricity supply problem.

This multi-channel system uses frequencies in the 1427 MHz to 1525 MHz band.

d) **VHF Single Channel (Country Set)**

It is normally used in small communities and is implemented in conjunction with public coin payphones.

This single-channel radio system Figure 5 uses frequencies in the low band (80 MHz) and highband (150 MHz). The subscriber side unit can be located as far as 20km - 50km from the exchange side unit. Solar panels and batteries
are provided together with the systems in areas where electricity supply is limited or unavailable.

The radio system provides service to a single customer only is best suited for big estate companies and where there is no immediate demands from others in the racinity.

e) **Cellular System (ATUR Payphone)**

The network is used basically for mobile telephones installed in vehicles or carried around. Automatic Telephone Using Radio (ATUR) Payphone is a public phones using ATUR interface. It is used particularly in areas where there is no line of sight to the exchange or there is frequency interference. In Malaysia ATUR payphone is installed in rural areas (Figure 6).

f) **Satellite**

Satellite technology has the potential to deliver advanced and modern communication services to rural areas irrespective of rough terrain and distances (Figure 7). Satellite would be the best option for remote areas of more than 200 km or 40 - 60 km separated by sea from the exchange.

g) **Remote Switching system**

New switching systems permit the installation of certain portions of their hardware in remote areas. These parts of the equipment are then linked back to the host exchange via digital transmission system. Call processing is handled by the host exchange where the software is located.
These remote portions of the equipment Figure 8 are variously called Remote Switching Unit (RSU), Remote Line Unit (RLU) and Remote Subscriber Multiplexer Unit (RSM) depending on the hardware and the extent of their capabilities.

h) Radio In The Local Loop (RILL)

The advancement and the rapid technological development has provided another dimension to provisioning of Rural Telecommunication Network. This is the concept of using fixed cellular technology.

RILL has the ability to boost the capacity and coverage capability without the need for physical wires between the local exchange and the subscriber. RILL is a new way of providing immediate telephone service with substantial cost and time savings.

The subscribers use ordinary telephone set, using PSTN numbers and enjoy the same subscriber services as their wired counterpart with respect to numbering, call awaiting, call forwarding etc. System configuration is shown in Figure 9.

C) SOCIO-ECONOMICS

Telecommunication operators have to fulfill their social obligation of developing the rural telecommunication network to a level that will enable the national economic and social goals to be achieved. Socio-economic factors must be considered in demand forecasting, identifying communities of interest is important at this stage. There must be sound economic reasons for predicting a surge in demand.
Telecommunication services are vital to rural communities in order to raise the productivity and efficiency of agriculture, industry, commerce, tourism and the social services and hence will enhance the quality of life.

D) GOVERNMENT SUPPORT

Most government and telecommunication operators would agree that provision of services to rural areas needs to be subsidised. It is the mechanism of subsidy which varies from country to country. Some countries have instituted collection of special funds to provide universal telecommunication service.

The availability of financing resources for telecommunications development is finite; for some countries available financing may even be very scarce. A suitable mechanism for financing service delivery must be developed.

Tariff structure also has to be reviewed and of course it varies from country to country where for example in Malaysia, tariff irrespective of subscriber distance from the exchange will be introduced.

5. RURAL TELECOMMUNICATION DEVELOPMENT IN MALAYSIA

Malaysia is a fast developing country with an area of 330, 434 sq. km. Rural population by definition comprises about 50% of the total population of approximately 18 million. There is a significant market potential that resides in the rural area. This population in the rural areas represents about 2 million homes and hence a sizeable market for Telekom Malaysia (TM).

TM is committed to provide adequate telephone services to the rural community in support of the Government's effort to accelerate national development. It is pertinent that a strategic plan in line with the rural communication program be focussed in order to fulfil TM's social obligation and to tap the vast market potential as economically as possible.
The rural network development in Malaysia actually started from the date of independence in 1957 with the introduction of two programs namely Rural Payphones and Rural Automatic Exchanges. The rural payphones are public payphones installed under the `Rural Public Telephone Programme' started since 1959. There were 8732 payphones installed under rural programmes since 1959 - 1990.

TM is committed in providing telecommunication services to the rural communities and in order to serve the rural demand, TM has allocated RM1.7 billion for the development over the years 1991 - 1995 (Sixth Malaysia Plan). It is TM's target to accomplish the following objectives:-

* to provide quality and cost effective telephone service to the rural community.
* to support Government's effort to accelerate national development in line with Vision 2020.
* to enhance telephone penetration from 2.6 in 1991 to 6.0 by 1995.
* to install 1/2 million rural telephones by 1995.
* to install at least 1 payphone per village by 1995.

The rural telephones growth and penetration per 100 population are as shown in Figure 10 and Figure 11 respectively.

The government in its plans has introduced a new approach to develop the rural areas ie.

i. agriculture development based on estate management system for small holding.

ii. establishment of small scale rural and village industries and other non-farm economic activities.
iii. re-clustering of traditional villages via proper planning to foster development of small centre such as rural growth centre with threshold population of 500 families.

In line with this also, there will be more industrial parks, tourist resorts, shophouses, schools, hospitals, banks etc. built up in rural areas and data (both low and high speed) and computer networking will be a common phenomena.

As statistic shows (Figure 12) the percentage growth of rural population is decreasing even though the total population is increasing. It is mainly due to the migration of rural folks to urban centres. With the introduction of new approach by the government, hopefully this will be reversed and hence maintain or increase the existing rural population. By the 21st century, rural area will be the area of growth in terms of telecommunication.

As mentioned earlier new and cost effective technologies are available to overcome terrain and low density subscribers in the rural areas. It is just a matter of choosing the right technology in order to produce a cost-effective and quality rural networks. A rough guideline on choosing the appropriate technology with respect to distance, subscriber distribution and terrain is shown in Figure 13.

In order to meet the rural demand, TM will observe the following strategies:

a) extension of network from urban to rural areas to ensure that all reasonable demands for telephones are met. Telephone service has traditionally been extended from urban centres into the surrounding rural region by metallic cables. Microwave and optical transmission systems are now available, combined with intelligent reconfigurable multiplexers, digital switching systems, radio in the local loop, they allow a diversity of technical options and upgrading paths as the system is expanded.
b) quality of services to be comparable to that in the urban areas.

c) to enable all services to be integrated into the National and International Telecommunication Network.

6. CONCLUSION

The provision of telecommunication services to the rural areas is a step towards bridging the gap between urban and rural areas. Telephone services have become a necessity for both urban and rural areas. Quality and affordable services need to be provided using modern, efficient and most cost-effective technology.

For the few years a head leading to the next century, telecommunication services to the rural will enable us to narrow the urban rural divide and will make an impact in the following ways:

a) act as an engine of growth.

b) raises the productivity and efficiency of agricultural, industrial, commercial and tourism industry.

c) enhances the quality of life.

d) enables the information society age to seep to the rural areas.

e) corrects the difference between the urban and rural area.
1. INTRODUCTION

* AN ESSENTIAL ELEMENT OF INFRASTRUCTURE FOR THE COUNTRIES ECONOMIC AND SOCIAL PROGRESS.

* RURAL TELEPHONE SERVICE HAS RECEIVED LOW PRIORITY.

* IN ASIA, AFRICA AND LATIN AMERICA, RURAL TELEPHONE DENSITIES ARE 1/5th TO 1/10th OF URBAN DENSITIES.

* HIGH CAPITAL COST, HIGH OPERATIONAL COST, LOW FINANCIAL RETURN, DIFFICULT TO IMPLEMENT.

* RURAL POPULATION ARE LAGGING BEHIND THE URBAN COMMUNITY IN TERMS OF TELECOMMUNICATION FACILITIES.
2. RURAL DEFINITIONS

* SCARCITY OR ABSENCE OF PUBLIC FACILITIES.
  - ELECTRICITY
  - WATER
  - ROADS/TRANSPORT

* SIMPLICITY OF LIFE

* TOPOGRAPHICAL CONDITIONS
  - ADVERSE TERRAIN LIKE DESERT, LAKE, MOUNTAINS

* UNNATEACTIVE ECONOMIC CONDITIONS.
  - SOCIALLY DRIVEN

* SPARSE AND SCATTERED POPULATION DISTRIBUTION.

* SCARCITY OR ABSENCE OF HEALTH AND EDUCATION FACILITIES.

* BASIC ECONOMIC ACTIVITY.
  - AGRICULTURE
  - FISHING
3. PROBLEMS AND CONSTRAINTS

* RURAL NETWORK PLANNING IMPLEMENTATION AND OPERATION PROBLEM.
  - LARGE COVERING AREAS
  - LOW SUBSCRIBER DENSITY
  - LOW TRAFFIC VOLUME
  - POOR INFRASTRUCTURE
  - HIGH INVESTMENT COST
  - HIGH OPERATION & MAINTENANCE COST
  - LOW REVENUE PER SUBSCRIBER

* HOW TO DELIVER BASIC TELECOMMUNICATION SERVICES.

* HOW TO COST JUSTIFY THEM.

* UNCERTAIN SUBSCRIBER GROWTH.
TYPICAL RURAL CHARACTERISTIC

* LARGE COVERAGE AREAS
* LOW NO. OF SUBSCRIBERS
* WIDE RANGE OF SUBSCRIBER DENSITIES
* WIDE RANGE OF SUBSCRIBER TRAFFIC
* POOR INFRASTRUCTURE
* HIGH INVESTMENT COST PER SUBSCRIBER
* HIGH O&M COST PER SUBSCRIBER
* LOW REVENUE PER SUBSCRIBER

RURAL NETWORK DIVISION
TELEKOM MALAYSIA
4. SOLUTIONS TO RURAL TELECOMMUNICATION NEEDS

* INVESTMENT FOR FUTURE.
  - LONG TERMS BUSINESS PLAN
  - NOT A MERE FACILITY BUT A NECESSITY
  - RURAL AREAS OF TODAY, CAN WELL BE URBAN AREAS OF TOMORROW

* VARIOUS TECHNOLOGY OPTIONS.

* SOCIO - ECONOMICS.
  - SOCIAL OBLIGATION
  - RAISE PRODUCTIVITY AND EFFICIENCY

* GOVERNMENT SUPPORT.
  - POLITICAL COMMITMENT
  - FINANCING
  - CROSS SUBSIDY
  - TARIFF STRUCTURE
TECHNOLOGY OPTIONS

- Physical Cable
  * Copper
  * Fibre Optics

- Country Set
  (VHF Point to Point)

- ATUR

- Multi Access Radio System (MARS)

- Satellite

- Digital Remote Switch (DRS)

- Radio In Local Loop (RILL)
<table>
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<tr>
<th>Year</th>
<th>Australia</th>
<th>Brunei</th>
<th>China</th>
<th>Hong Kong</th>
<th>Indonesia</th>
<th>Japan</th>
<th>Korea</th>
<th>Laos</th>
<th>Malaysia</th>
<th>Nepal</th>
<th>New Zealand</th>
<th>Philippines</th>
<th>Singapore</th>
<th>Taiwan</th>
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<td>47.13</td>
<td>12.73</td>
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<td>0.58</td>
<td>42.30</td>
<td>28.22</td>
<td>19.50</td>
<td>11.35</td>
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<td>50.65</td>
<td>55.65</td>
<td>23.30</td>
<td>66.19</td>
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<td>23.30</td>
<td>66.19</td>
<td>32.80</td>
<td>66.85</td>
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FIBRE SOLUTION
MULTIACCESS RADIO SUBSCRIBER SYSTEM

TERMINAL STATION

CENTRAL STATION

EXCHANGE
REMOTE SWITCHING SYSTEMS
<table>
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<tr>
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<th>% RURAL</th>
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<tr>
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<td>10,443</td>
<td>71.9</td>
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<tr>
<td>1980</td>
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<tr>
<td>1991</td>
<td>8,671</td>
<td>17,567</td>
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<tr>
<td>1993</td>
<td>8,710</td>
<td>18,434</td>
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<td>1995</td>
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<tr>
<td>To provide quality and cost-effective telephone services to the rural community</td>
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<tr>
<td>To support Government’s effort to accelerate national development in line with Vision 2020</td>
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<tr>
<td>To enhance telephone penetration from 2.6 in 1991 to 6.0 by 1995</td>
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<td></td>
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<tr>
<td>To install 520,300 rural telephones by 1995</td>
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<tr>
<td>To install at least 1 PAYPHONE per village by 1995</td>
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</table>
5. RURAL TELECOMMUNICATION DEVELOPMENT IN MALAYSIA

GOVERNMENT NEW APPROACH TO DEVELOPE RURAL AREAS.

- AGRICULTURE DEVELOPMENT BASED ON ESTATE MANAGEMENT SYSTEM FOR SMALL HOLDING.

- ESTABLISH SMALL SCALE RURAL AND VILLAGE INDUSTRIES.

- RECLUSTERING OF TRADITIONAL VILLAGE TO FORM RURAL GROWTH CENTRE.

- MORE INDUSTRIAL PARKS, TOURIST RESORTS, SCHOOL, HOSPITALS, BANKS ETC.
# PROPOSED ALTERNATIVE SOLUTIONS FOR SERVICING RURAL DEMAND

<table>
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<tr>
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<th>TERRAIN</th>
<th>DISTANCE Radius</th>
<th>SOLUTION</th>
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<td>NORMAL</td>
<td>&lt; 6km.</td>
<td>COPPER FITL / COPPER</td>
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<tr>
<td></td>
<td></td>
<td>6 - 20km.</td>
<td>MARS/RILL</td>
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<tr>
<td></td>
<td></td>
<td>&gt; 20km.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DIFFICULT</td>
<td></td>
<td>MARS/RILL</td>
</tr>
<tr>
<td>501 - 1000</td>
<td>NORMAL</td>
<td>&lt; 12 km.</td>
<td>FITL/COPPER DRS/RILL</td>
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<td>&gt; 12 km</td>
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<tr>
<td></td>
<td>DIFFICULT</td>
<td></td>
<td>DRS by Digital Radio/RILL</td>
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<tr>
<td>&gt; 1000</td>
<td>NORMAL</td>
<td>&lt; 10 km.</td>
<td>FITL/COPPER DRS by Fiber Optic</td>
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<td>&gt; 10 km.</td>
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</tr>
<tr>
<td></td>
<td>DIFFICULT</td>
<td></td>
<td>DRS by Digital Radio</td>
</tr>
<tr>
<td>&gt; 5000</td>
<td>NORMAL</td>
<td>&lt; 10 km.</td>
<td>FITL/COPPER EXCHANGE</td>
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<tr>
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<td>&gt; 10 km.</td>
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<tr>
<td></td>
<td>DIFFICULT</td>
<td></td>
<td>EXCHANGE by Digital Radio</td>
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Note:

FITL - Fibre Optic In The Local Loop
RILL - Radio In The Local Loop
MARS - Multi-Access Radio System
DRS - Digital Remote Switch

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TELEKOM MALAYSIA STRATEGIES

* EXTENSION OF NETWORK FROM URBAN TO RURAL.
  - VARIOUS TECHNOLOGY OPTIONS

* QUALITY OF SERVICE COMPARABLE TO URBAN.

* ENABLE TO BE INTEGRATED INTO NATIONAL AND INTERNATIONAL NETWORK.
6. CONCLUSION

- Act as an engine of growth.

- Raise the productivity and efficiency.

- Enhance quality of life.

- Enable information society age to seep to rural areas.

- Correct the difference between the urban and rural areas.