SWITCHING IN TELECOMMUNICATION SYSTEMS

EEEN 462 – ANALOGUE COMMUNICATION

Friday, November 14, 2025

DIRECT AND COMMON CONTROL SWITCHING SYSTEMS

1. **Direct control switching systems:** The control subsystem is an integral part of the switching network itself, e.g. the Step-by-step switching system.

2. **Common Control:** The control subsystem is outside the switching network, e.g cross-bar and all modern digital exchanges. Common Control Switching is also sometimes referred to as **indirect control or register control.**

MODEL OF A TELEPHONE SWITCH

1. The switching network is called a symmetric network when M = N.
2. The inlets/outlets may be connected to:
   a) Local subscriber lines
   b) Trunks to Other exchanges
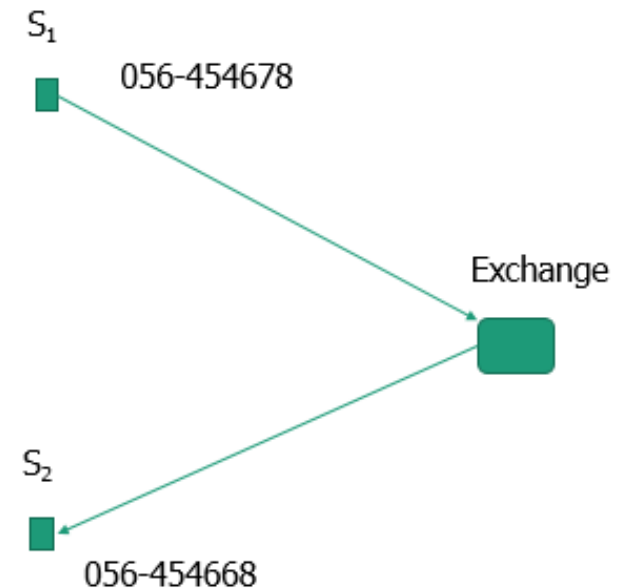   c) Trunks from other exchanges

TYPES OF CALLS IN A FIXED EXCHANGE

Four types of connections can be established in a fixed telephone network, i.e

1. **Local call** connection between two subscribers in the same exchange.

2. **Outgoing call** connection between a subscriber and an outgoing trunk, or to a subscriber on another exchange.

3. **Incoming call** connection between an incoming trunk and a local subscriber;

4. **Transit call** connection between an incoming trunk and an outgoing trunk in a transist/tandem exchange.
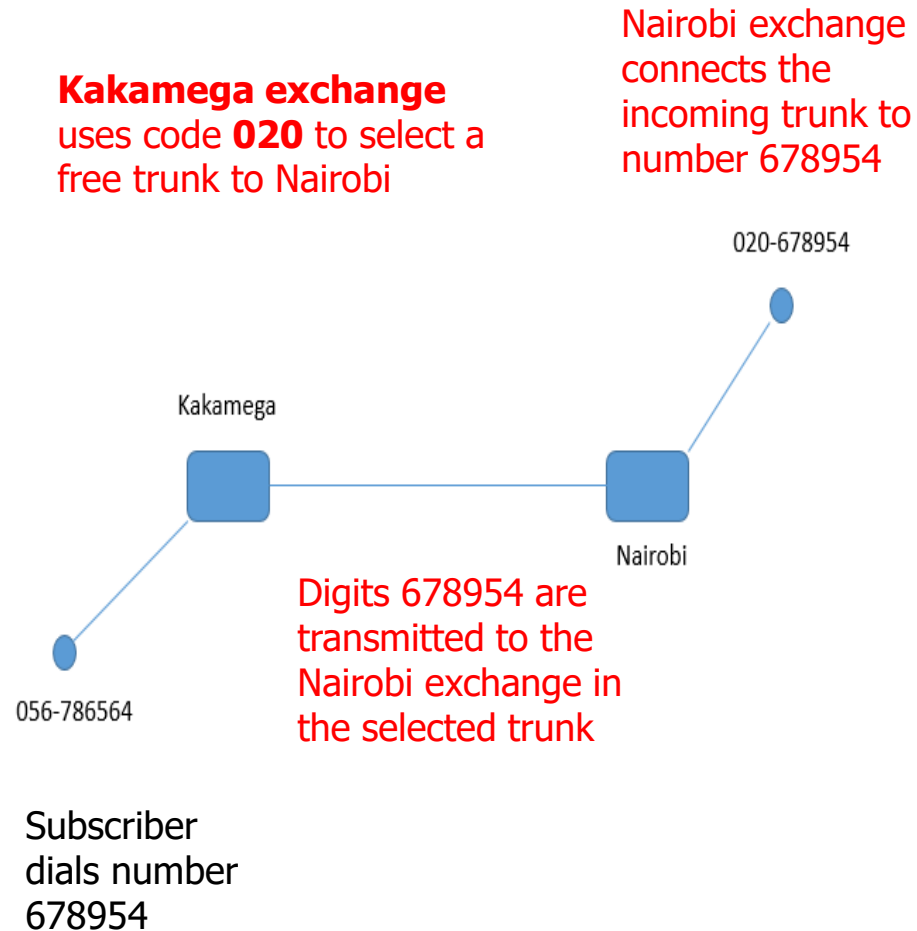
LOCAL TELEPHONE CALL IN FIXED TELEPHONE SYSTEMS

1. **A local call** is made when a local subscriber calls another local subscriber

2. The exchange uses the number minus the area code to establish the connection and from time to time, i.e 454668

3. **Local area traffic** varies from region to region. For instance:
    a) most Central Business Area (CBA) subscribers will call each other during the day.
    b) Most rural exchanges have relatively low local traffic since they mostly make calls to urban areas.
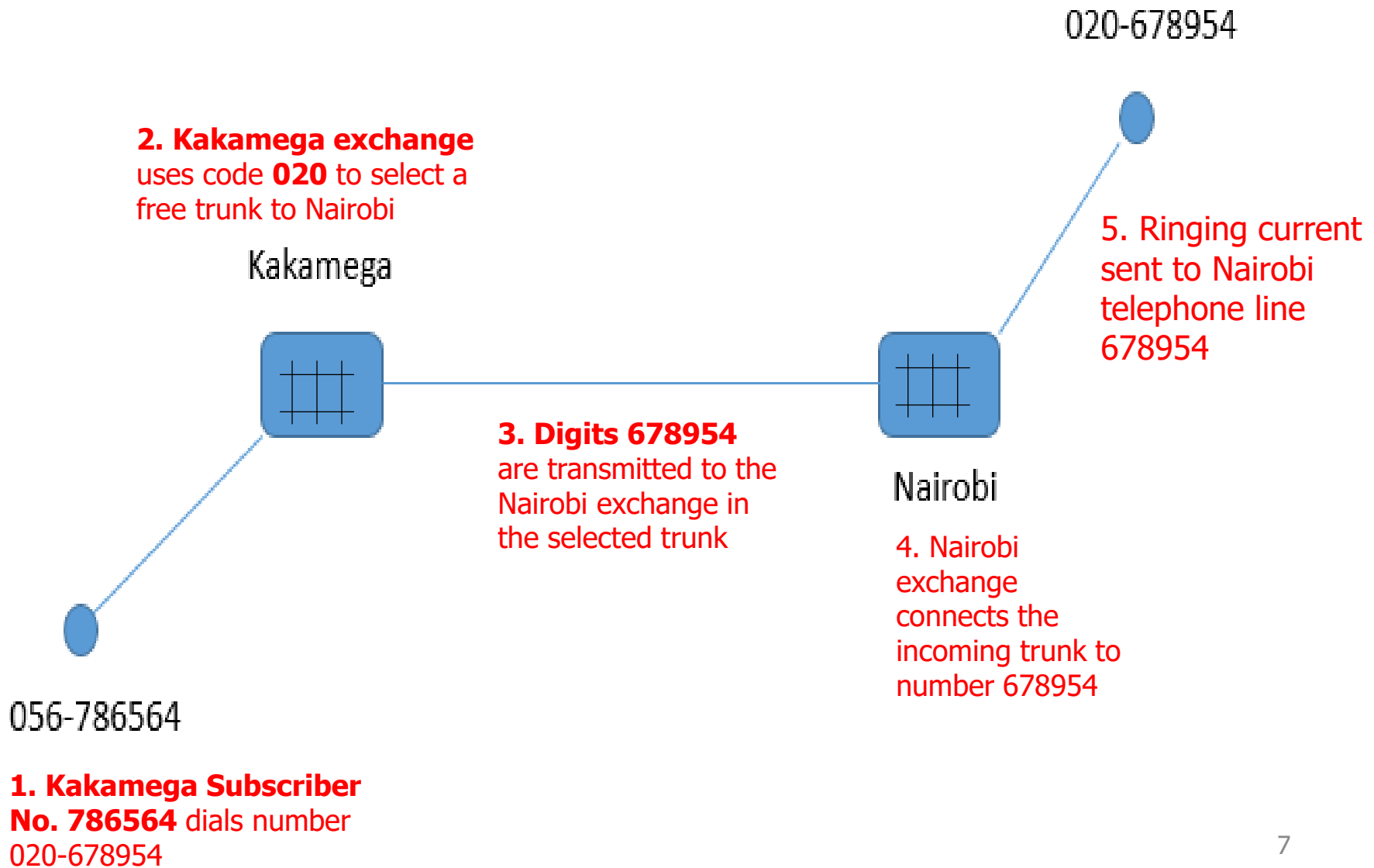   c) CBA local traffic is very low at night since most people stay in the residential areas.

S_1
056-454678

Exchange

S_2
056-454668

1. **A trunk call** connects subscribers in the same country but on different telephone exchanges as follows:

   a) **The originating telephone** exchange uses the area code to select a trunk heading to the terminating exchange. It then connects the originating number to the trunk

   b) **The terminating exchange** uses the rest of the digits to establish a connection to the called telephone line.
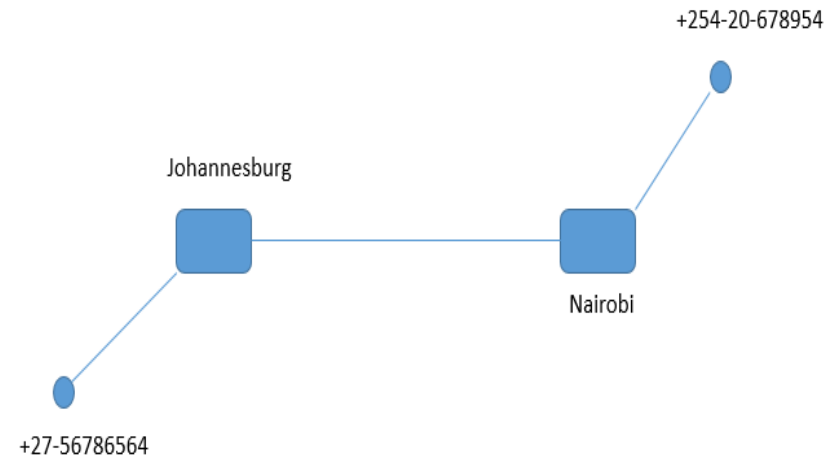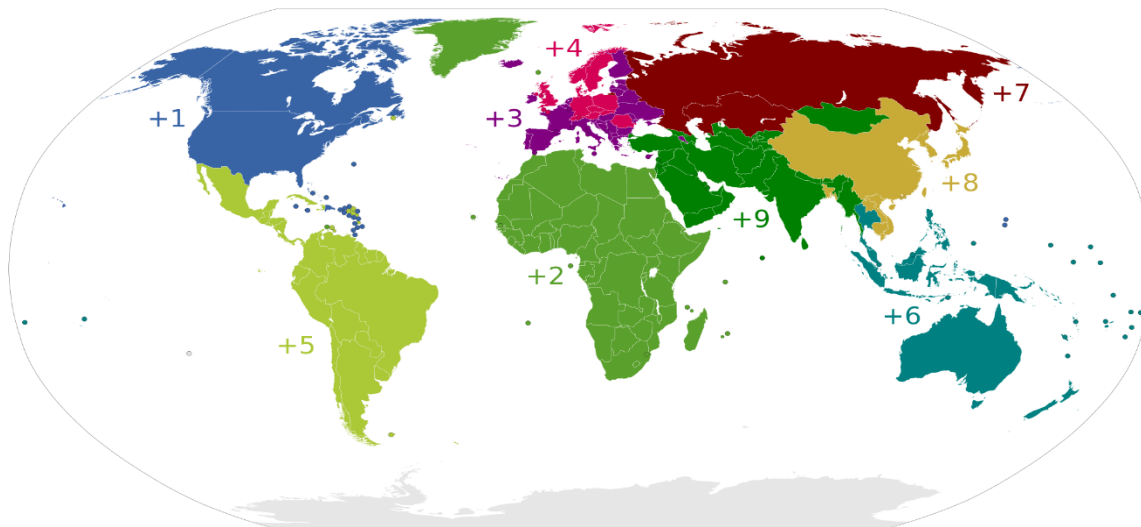
Kakamega exchange uses code **020** to select a free trunk to Nairobi

Nairobi exchange connects the incoming trunk to number 678954

020-678954

Kakamega

Nairobi

056-786564

Digits 678954 are transmitted to the Nairobi exchange in the selected trunk

Subscriber dials number 678954

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CALL SETUP PROCEDURE

020-678954

2. Kakamega exchange uses code **020** to select a free trunk to Nairobi

Kakamega

5. Ringing current sent to Nairobi telephone line 678954

3. Digits 678954 are transmitted to the Nairobi exchange in the selected trunk

Nairobi

4. Nairobi exchange connects the incoming trunk to number 678954

056-786564

1. Kakamega Subscriber No. 786564 dials number 020-678954

INTERNATIONAL CALL

1. **An international call** is made between two subscribers in different countries.

2. It is prefixed by the international code, which can be the international country code, e.g. **+254** for Kenya or **+27** for South Africa. In the fixed system, it can be prefixed by **000**.

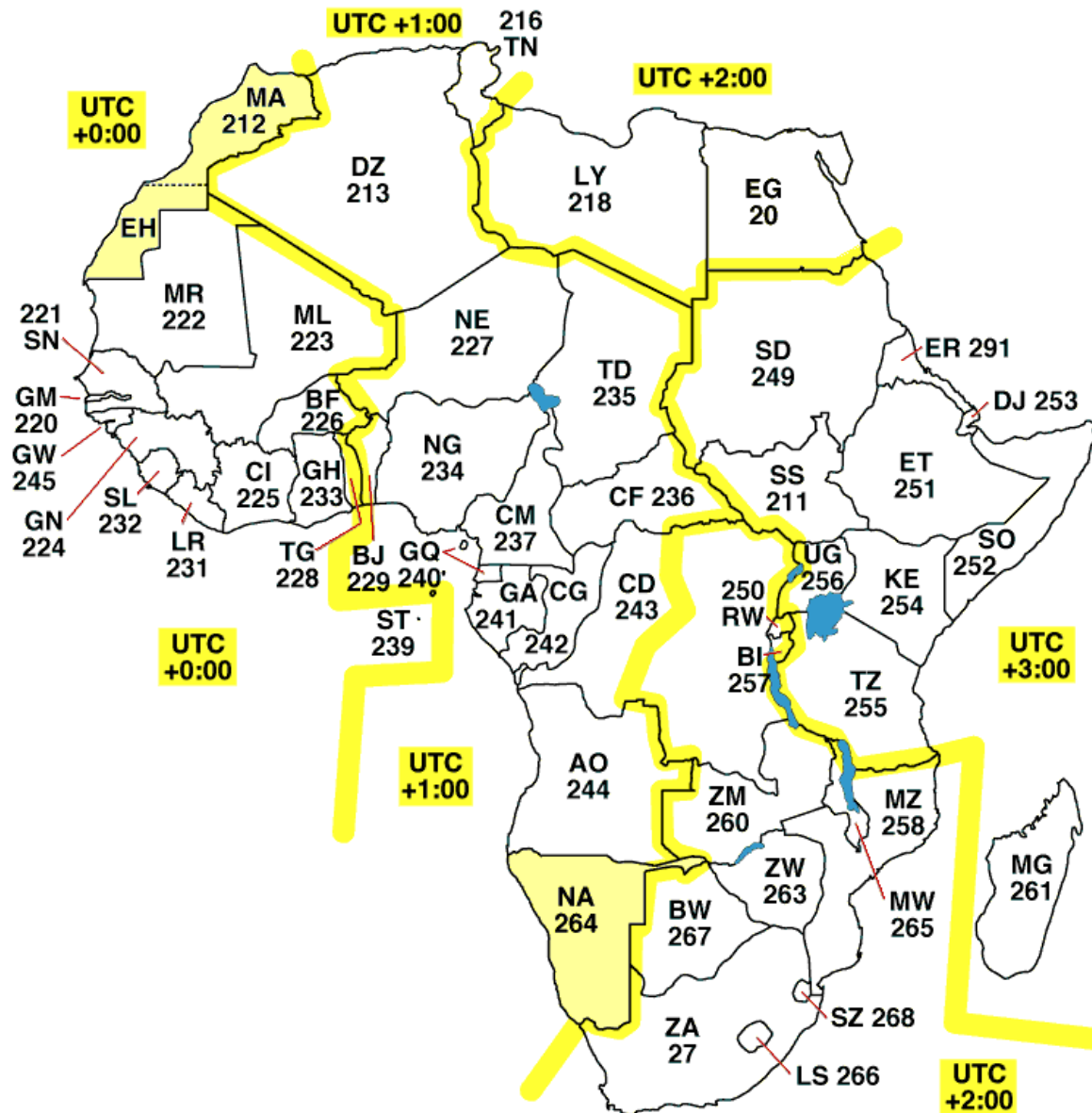3. It usually passes through an international gateway exchange.

+254-20-678954

Johannesburg

Nairobi

+27-56786564

ASSIGNMENT OF INTERNATIONAL SUBSCRIBER DIALING CODES – WORLD ZONES

1. **World Zone** is the first digit of a country code.

2. It was conceived to corresponds to a global region.

3. Over time, exceptions were made to this rule such as:

   a) **Greenland (+299)** is not in Africa, but there was not enough room in Europe's two World Zones at the time Greenland's country code was assigned).

   a) Special international services, e.g**. satellite telephone** have country code assignments under World Zones 8 and 9.
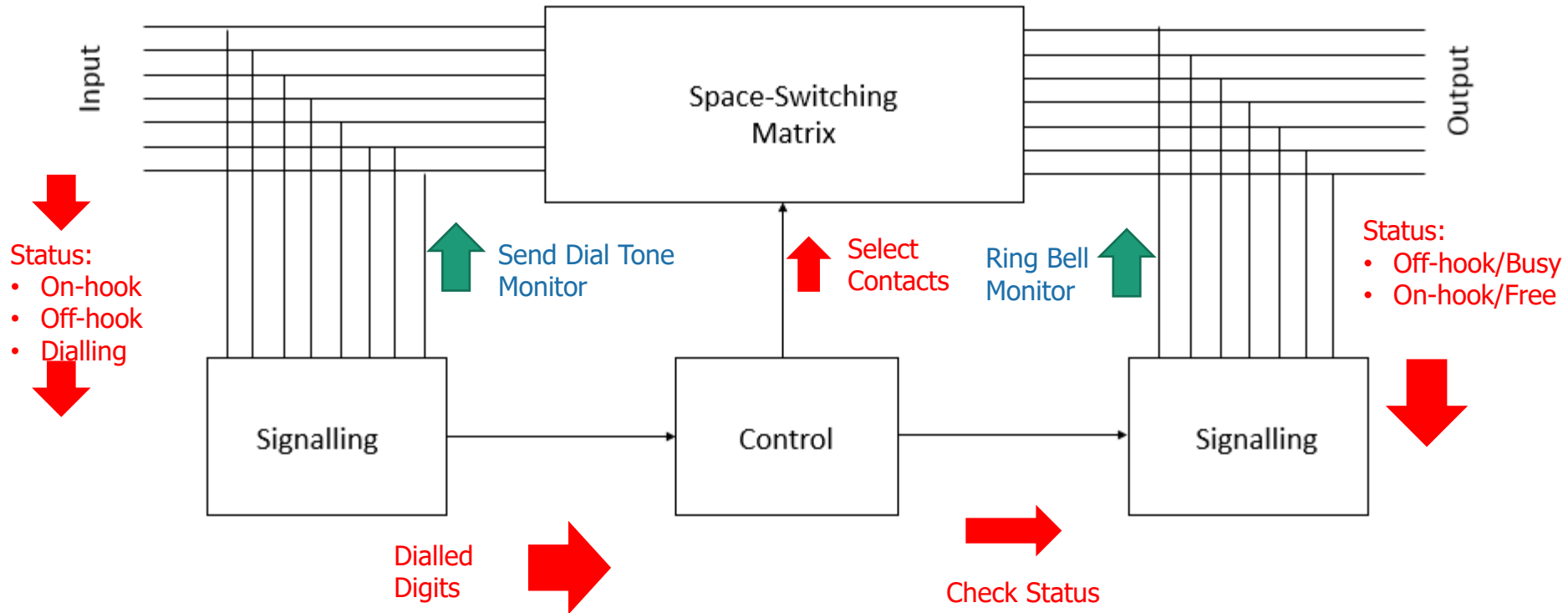
PRINCIPLES OF SPACE SWITCHING

Equipment associated with any switching system can be categorized as:

1. **Signalling** – Monitor activity of incoming/outgoing lines and forward status and control information to the control/switch.

2. **Control** – Monitor incoming signalling and set connections accordingly.

3. **Switching** – An array of selectable cross-points used to complete connections between input lines and output lines.
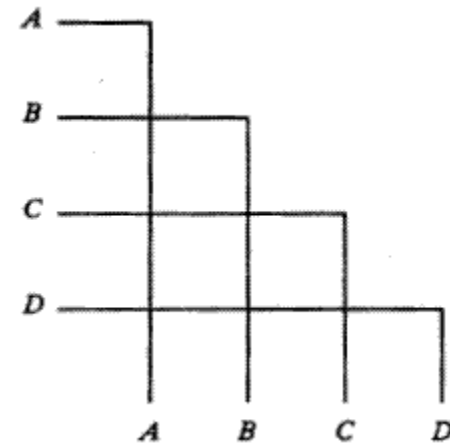
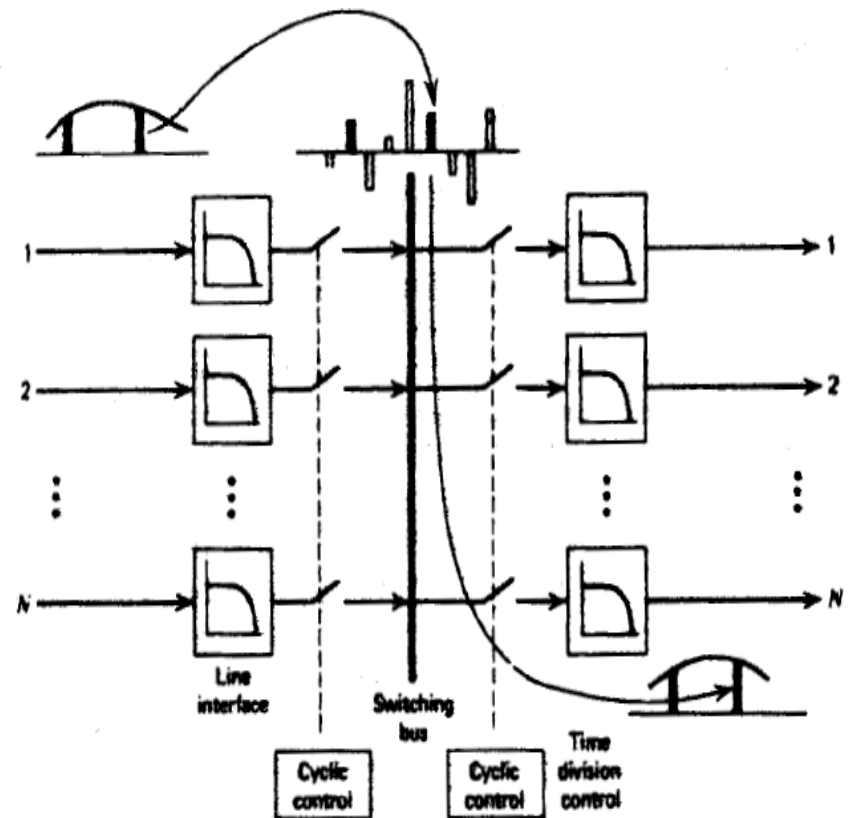# PRINCIPLES OF SPACE SWITCHING

$N\_SW = N \times N$

$N\_SW = N(N-1)/2$

PROBLEMS OF SINGLE SWITCH SYSTEMS

1. Each Individual cross-point can only connect one particular input-output pair.

2. The number of cross-points required is prohibitive.

3.   They offer a large number of capacitive loading on message paths.

4. A specific cross-point is required for a specific connection. If the cross-point fails, then the connection cannot be established.

5. Inefficient use of cross-points, e.g. only one cross-point in a row is used at a time.

TIME DIVISION SWITCHING

- Analog Time Division Multiplexing involves sharing of cross-points for shorter periods of time so that individual cross-points and associated interstage links are continuously reassigned.