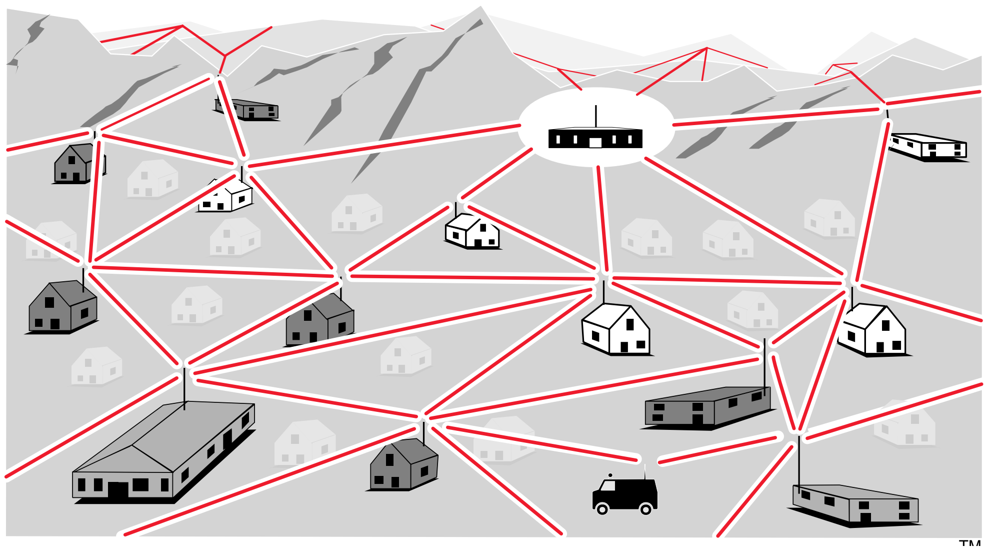
AES·IntelliNet Theory of Operation



The AES·IntelliNet is a radio alarm central monitoring system made up of two basic elements, the Central Receiver and the Subscriber Unit. The Subscriber Unit are connected to an alarm control panel at multiple remote sites. The Central Receiver is housed at a central station, monitoring for any radio alarm signals sent by the Subscriber Units.

A key feature of the AES·IntelliNet system is the ability of the Subscriber Unit to act as a store-and-forward message repeater for other Subscriber Units that are beyond direct radio reach of the Central Station. Each Subscriber Unit dynamically evaluates and stores information on all possible "routes" through which it can send messages to the Central Station.

When an alarm control panel detects an alarm condition, it activates the Subscriber Unit, which transmits the alarm signal by radio to the Central Station. The radio data message is received by the Central Station, where the operator on duty responds by dispatching the appropriate emergency team, police, fire or medical.

Radio communication of the alarm signal data is key to the AES·IntelliNet system, and is accomplished with components common to the Central Station and each remote Subscriber Unit. These include an FM radio transceiver, VHF or UHF, typically 2 watts, and a Communications Controller made up of a microprocessor and a modem.

In the Subscriber Unit, the Communications Controller is the wired interface between the local alarm control panel and the radio transceiver. In the Central Station, the Communications Controller is the wired interface between the base station radio transceiver and the computers which run the Central Station operations. All radio transceivers in the AES·IntelliNet system are identical and operate on the same fixed frequency.

Here follows a step by step explanation of:
· Enrolling A Subscriber Unit into an Existing System
· Transmission of an Alarm by a Subscriber Unit
· Retransmission of a Data Message by a Subscriber Unit

Theory of Operation

ENROLLING A SUBSCRIBER UNIT INTO AN EXISTING SYSTEM

1. Power is applied to Subscriber Unit after equipment has been mounted and antenna and coaxial cable has been installed.

2. Power-up reset is activated within the Subscriber Unit, or the installer physically presses the reset button.

3. The Subscriber Unit starts its self-test, displaying the results of the test on the installer's hand-held programmer.

4. If the self-test passes, the Subscriber Unit transmits a ready for reply signal. This signal will be heard by all other Subscriber Units in radio range.

5. Each existing Subscriber Unit within radio range reports that it can communicate with the new Subscriber Unit, and transmits it to their radio communicating proximity to the Central Station.

6. The new Subscriber Unit sets up a "routing" table. The table is prioritized so that the most direct and reliable route is used first. The less direct routes to be used as second, third, etc. Routes are added and sorted in a continuous, dynamic process.

7. Remain in standby state. In this state the Subscriber Unit is now part of the established system. It can originate alarm messages and act as a store and forward repeater for other messages within the system. It also listens to the radio channel to determine if it can further optimize its routing table by the addition of new Subscriber Units.

Theory of Operation

TRANSMISSION OF AN ALARM BY A SUBSCRIBER UNIT

1. Subscriber Unit is in standby state.

2. An alarm condition is presented to the Subscriber Unit by either a change in state of the switch inputs or via the RS 232 port.

3. The Subscriber Unit encodes the data into a “Data Message Unit” (DMU).

4. The radio channel is tested to ensure it is not busy. The Subscriber Unit uses active collision avoidance protocols to ensure the transmission is transmitted, without collision, with other Subscriber Units.

5. The DMU is addressed and sent to the Central Station if in direct communication range or, if not, to the first location on its internal routing table.

6. If routed through intermediate Subscriber Units, the message is transmitted to the next unit on the routing table.

7. Wait for an acknowledgment that the message was received and decoded correctly.

8. If no acknowledgment was received, send the DMU again and wait for the acknowledgment.

9. After “N” attempts and failure to receive an acknowledgment, use the next routing on the routing table.

10. Repeat step 4 to 8 until the message is received.

11. If no acknowledgment is received, repeat step 9.

12. When the new DMU is acknowledged, return to standby state.

Theory of Operation

RETRANSMISSION OF A DATA MESSAGE BY A SUBSCRIBER UNIT

1. Subscriber Unit is in the standby state.

2. There is a DMU addressed to this Subscriber Unit.

3. Receive the DMU, error check the DMU if necessary.

4. Acknowledge back to sending unit that the DMU has been received correctly.

5. Add the address of this Subscriber Unit onto the DMU's routing list.

6. The new DMU is addressed to the first location on this Subscriber Unit's internal routing table.

7. The radio channel is tested to ensure it is not busy. The Subscriber Unit uses active collision avoidance protocols to ensure the transmission is transmitted, without collision, with other Subscriber Units.

8. The message is transmitted to the next Subscriber Unit on the routing table.

9. Wait for an acknowledgment that the message was received and decoded correctly.

10. If no acknowledgment was received, send the DMU again and wait for the acknowledgment.

11. After "N" attempts and failure to receive an acknowledgment, use the next routing on the routing table.

12. Repeat step 7 to 10 until the message is received.

13. If no acknowledgment is received, repeat step 11.

14. When the new DMU is acknowledged, return to standby state.

NetCon / Network Connectivity: Proof of Multiple Paths for Alarm Reporting

"NetCon" is a rating of "Network Connectivity" for a subscriber unit in an AES-IntelliNet wireless data network. The rating is established by considering many factors: number of paths available; NetCon ratings of other units in each path; link layer (number of hops to the central station); signal strength; low battery conditions and other factors. NetCon indicates how good the link is between the subscriber unit and the central station, assigning a number between 0 and 7, 0 being best.

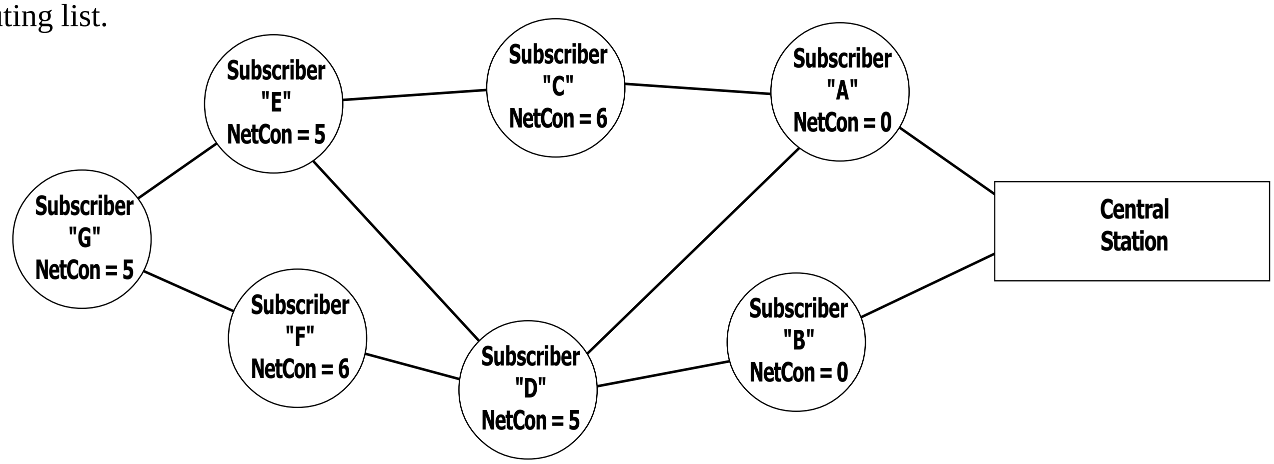
Explanation:

• If a subscriber is in direct communication with the central station (link layer = 1), with a good quality signal, then the unit's NetCon is 0 (zero).

• For subscriber units in link layers greater than 1, NetCon is calculated by adding up the number of subscribers in the routing table with a link layer lower than the calculating unit, and subtracting that number from 7.

• Note that if signal quality to all units in the routing table is poor, then a NetCon of 7 is assigned.

• Also note that a subscriber cannot have a better NetCon than that of the member on the top of its routing list.



Proving Multiple Paths: A NetCon rating of 5 or less guarantees that a subscriber unit has at least 2 valid paths available, or communicates directly with the central station.

Examples: Refer to illustration above

• Subscribers A and B communicated directly with the central station; their NetCon is 0 (zero).

• Subscriber D has subscribers A and B in its routing table, so its NetCon is [7-(1+1)] = 5.

Note that even if subscriber C is in D's routing table, it has the same link layer number as D, and thus C does not improve D's NetCon.

• Subscriber C has a NetCon of 6 since the only lower link layer unit it can communicate with is subscriber A; [7-1] = 6.

• Subscriber E has a NetCon of 5; subscriber D is at the top of its routing table, next is C; [7-(1+1)]=5.

• Subscriber F has a NetCon of 6; subscriber D is the only unit on its routing list with a link layer less than itself; [7-1]=6.

• Subscriber G has a NetCon of 5; subscriber E is at the top of its routing table, next is F; [7-(1+1)]=5.

Key Components of the System

- Central Station

7701 Central Receiver - the central hub "node" of the AES•*IntelliNet* data communications network:

- Connects to and controls 7730 data radio transceiver
- Receives and acknowledges all data messages from the radio network
- Acknowledges all data messages from the radio network
- Annunciates incoming alarms, systems faults and other warning conditions
- Outputs system activity to a printer
- Links to AES 7100 Network Controller and AES Net77 Network Management Software

7730 Transceiver - the radio section of the central receiving station