

MiMOMax Routing Adaptation Protocols

MRAP DESCRIPTION

A typical MiMOMax SCADA system as used by an electrical utility will generally include a mix of “point-to-point” and “point to multi-point” links, see Figure 1. In this example it can be seen that the substations can be reached via a number of different paths. MRAP (MiMOMax Router Adaption Protocols) utilised industry standard **OSPF** (Open Shortest Path First), **VRRP** (Virtual Router Redundancy Protocol) and **GRE** (Generic Route Encapsulation) to provide reliable communications under various failure conditions.

1.1 OSPF

OSPF is a popular dynamic routing protocol that determines which path to take and is used in MiMOMax wireless products to achieve this re-routing functionality. MiMOMax products can be configured to operate in either OSI layer II (Ethernet bridge) or layer III (IP router). To take advantage of MRAP, layer III must be selected.

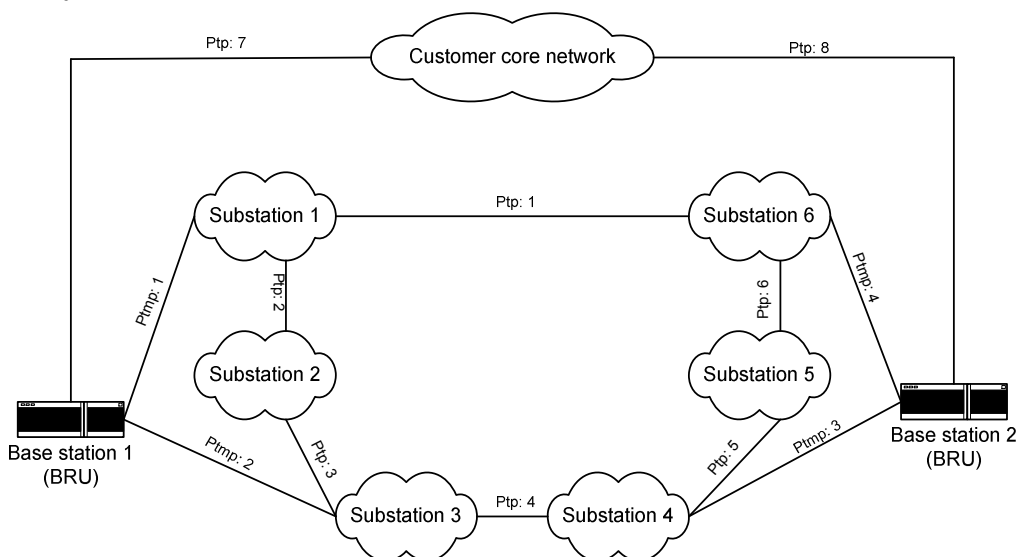


Figure 1: Typical electrical communications network

Note: PtP: Point to Point

PtMP: Point to Multi-Point

A typical electrical substation communications system can be seen in seen in Figure 2. In this case the substation is shown with an RRU linking it to the multi-point system as well as two “point-to-point” links to other substations. OSPF routing information is carried over all links in the system.

1.2 VRRP

Referring to Figure 2 again, equipment in the substation needs to have a “default gateway” set for when communications pass outside of the substation network (e.g. to the SCADA master).

In this example, there are three possible radios that could perform the function of the default gateway. A particular radio could be set as the gateway, but if this particular radio should fail, then the entire substation would lose communications, even though other radios could fulfil this role. VRRP is used to dynamically assign a virtual IP address for the default gateway to an appropriate radio. In the event of a communications failure, VRRP elects a new radio to fulfil this role. VRRP is contained within the substation and it does not communicate over the air.

In the example shown in Figure 3, the RRU has failed and can no longer communicate with the substation equipment. Using VRRP, the remaining radios recognise this and elect a new radio to hold the substation's default gateway virtual IP address. The substation equipment does not realise that it is communicating with a different radio. OSPF automatically works out that this substation is no longer reachable via the multipoint RRU and routes via the path available on the OPV links.

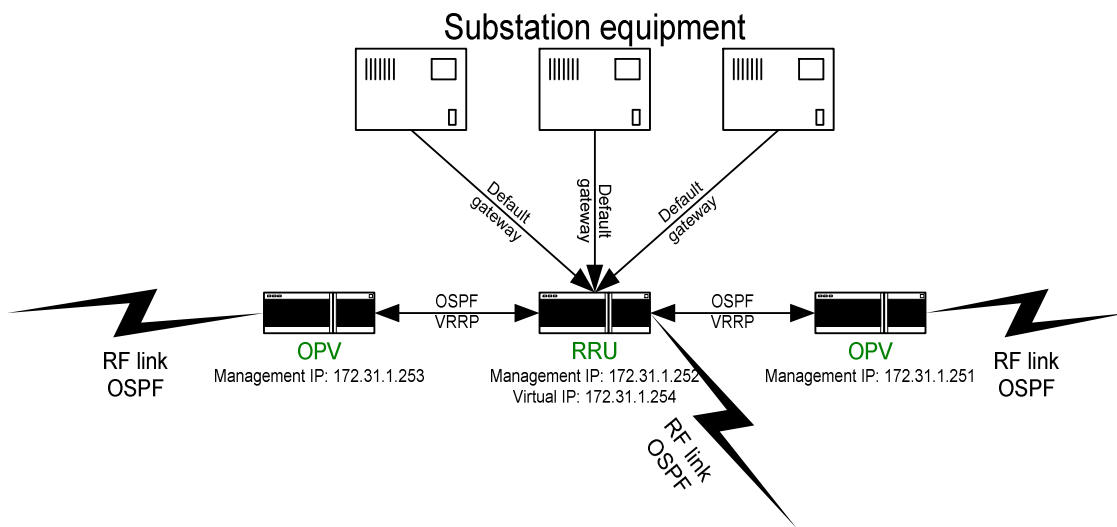


Figure 2: A typical substation

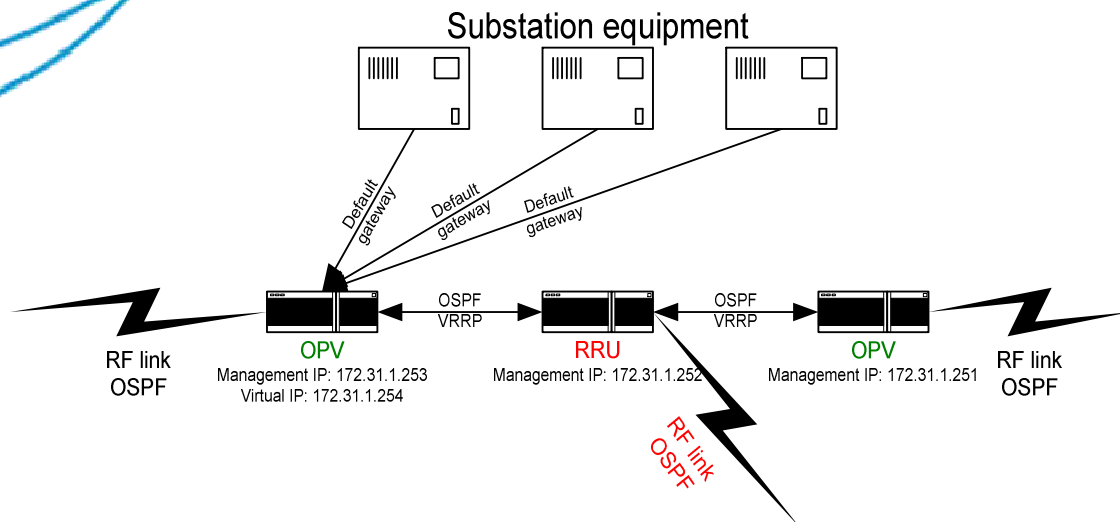


Figure 3: A typical substation with a failed radio

1.3 GRE

OSPF routers communicate their state with the other routers in that OSPF area (a group of routers working together in a particular part of the network is called an area). The detailed routing information is not available outside of the area and so is not transmitted over the air. This detailed OSPF routing information is however useful for monitoring purposes. The GRE (Generic Routing Encapsulation) protocol may be used to pipe this monitoring information from the various areas to a monitoring system in the core of the customer's network if required.

1.4 INTERACTION WITH OTHER ROUTERS

The standards based implementation in MiMOMax equipment makes it easy to integrate MiMOMax radios with other communication equipment such as fibre optic links and routers provided by other manufacturers.