ODR protocol

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The ODR protocol

ODR (On Demand Routing) is a routing protocol used in networks having a star topology. The point-to-multipoint topology is a star topology, so ODR is widely used in wireless networks. The ODR algorithm, unlike the other dynamic routing protocols, is very simple, so its operation is not resource-intensive.

Let's look at the ODR's protocol operation based on the example in (Figure 1). The network scheme consists of a base station BS1 and three subscriber devices CPE2, CPE3 and CPE4, connected to BS1. A local network segment with its own IP addressing is present behind each wireless device. An IP subnet is also assigned to the MINT area.

- **Step 1:** pre-configuration. It is necessary to establish a radio link between the wireless devices, assign IP addresses to network interfaces and to globally disable switching. The routing tables of the devices after the pre-configuration is shown in Table 1.
- **Step 2:** role distribution. The ODR protocol uses two role types that must be configured on each device according to the case: hub - central device and spoke - end devices. Usually, the base station sector, which has a connection to the backhaul network, acts as the central device and the subscriber stations having the user devices connected, act as end devices.
- **Step 3:** default routes are added on the spoke devices. The devices having the hub role send messages to inform all the devices about their role. To send such messages, the service fields of the MINT protocol are used (see InfiLINK 2x2 and InfiMAN 2x2: Switching), so all the recipients are situated in the MINT area. When receiving such a message, the devices having the spoke role create a list of hubs. Since in a star topology a device with a hub role has a connection to the backhaul, the device with a spoke role can add a default route to its routing table by specifying the hub's address as the gateway (Table 2). One MINT area can have several devices having the hub role, therefore each spoke can have several default routes in the RIB.
- **Step 4:** default route selection. The MINT protocol is used to distribute information about the devices having the hub role. MINT uses an internal metric that reflects the radio parameters of the links and their current load, so the criteria for choosing a default route and adding it to FIB is the smallest metric value. The metric analysis is performed permanently for each device having the hub role, therefore, if the metric of the used route grows, it can be replaced by another one with a lower metric. Thus, the fault tolerance and load balancing functions are implemented.
- **Step 5:** routing information distribution. Each device with the spoke role generates service messages for each device having the hub role. These messages contain information about the directly connected and about the static routes in the device's FIB. Note that information about the networks common with the hub is not included in such messages. For example, CPE3 will report network 192.168.3.0/24 to BS1, but will not report network 172.16.0.0/29, because the BS1's radio interface is associated with this network and the BS1's FIB already has information about it (Table 1).
- **Step 6:** the connectivity between all LAN segments is established. The necessary routes have been added to the routing tables of the wireless devices (Table 2).

Title

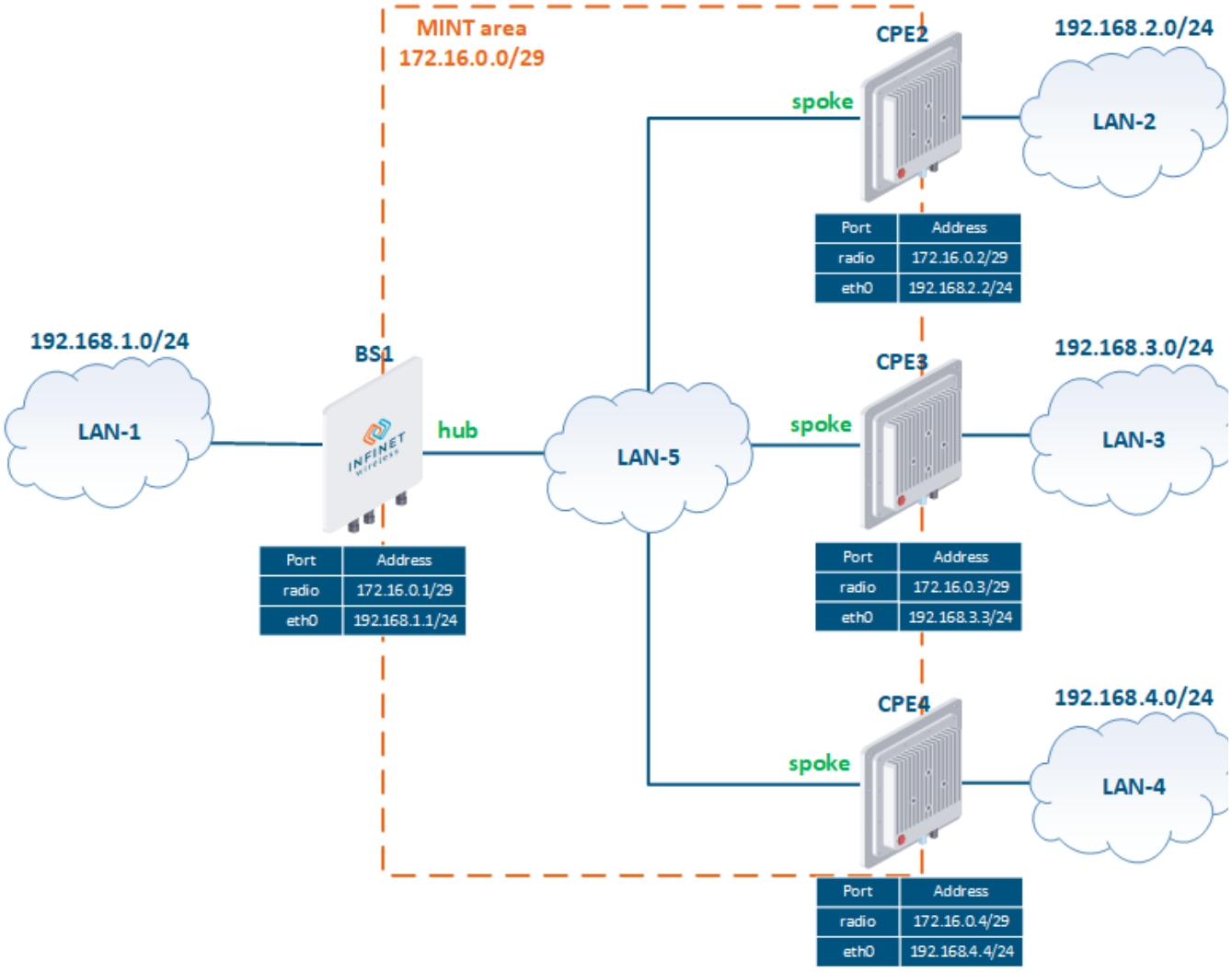

Figure 1 - The ODR protocol's operational scheme in a star topology network

BS1 router

Gateway	Output interface	Distance	Metric
-	eth0	0	24
-	radio	0	37

CPE2 router

Gateway	Output interface	Distance	Metric
-	eth0	0	24
-	radio	0	22

CPE3 router

Gateway	Output interface	Distance	Metric
-	eth0	0	24
-	radio	0	55

CPE4 router

Gateway	Output interface	Distance	Metric
-	eth0	0	24
-	radio	0	33

Table 1 - The routing tables of the wireless devices after pre-configuration

BS1 router

Gateway	Output interface	Distance	Metric
-	eth0	0	24
72.16.0.2	radio	160	47
72.16.0.3	radio	160	61
72.16.0.4	radio	160	52
-	radio	0	37

CPE2 router

Gateway	Output interface	Distance	Metric
72.16.0.1	radio	160	47
-	eth0	0	24
-	radio	0	22

CPE3 router

Gateway	Output interface	Distance	Metric
72.16.0.1	radio	160	61
-	eth0	0	24
-	radio	0	55

CPE4 router

Gateway	Output interface	Distance	Metric
72.16.0.1	radio	160	52
-	eth0	0	24
-	radio	0	33

Table 2 - The routing tables of the wireless devices after the ODR configuration

Usually, the ODR protocol is used in PTMP schemes (Figure 1), however, for a better understanding, let's complicate the scheme by implementing the load balancing and fault tolerance functions (Figure 2):

- two sectors, BS1 and BS2 and switches InfiMUX1 and InfiMUX2 are connected to Switch 1;
- two subscriber devices are connected to each sector: CPE11 and CPE12 to BS1, CPE21 and CPE22 to BS2;
- all the devices are joined into a single MINT area (see InfiLINK 2x2 and InfiMAN 2x2: Switching);
- the InfiMUX1 and InfiMUX2 devices are configured as hubs, since they are connected to the external WAN. The wireless devices are configured as spokes.

Please note that the role is not a device characteristic, but a state of an interface that supports the MINT protocol's operation. For example, a wireless device can be a hub in the MINT area to which it is connected via the rf5.0 interface, and it can be a spoke in the MINT area connected via the prf0 interface. In the example below, one common MINT area is used, therefore, for the BS1 and BS2 devices, it is enough to activate the ODR protocol support on one of the interfaces that support MINT.

After the preliminary configuration and the role distribution, CPE11, CPE12, CPE21 and CPE22 will add a default route to the routing table, specifying InfiMUX1 or InfiMUX2 as the gateway. The gateway will be selected by the lowest metric value. Each hub device will receive routing information about the end-user networks LAN-11, LAN-12, LAN-21, and LAN-22 from the devices having spoke roles. Devices BS1 and BS2 are intermediate in this scheme and do not transmit routing information to the devices with the hub role.

Fault tolerance: let's say that the whole traffic passing through BS1 also passes through InfiMUX1, and BS2's traffic - through InfiMUX2. If InfiMUX1 fails, then the BS1, CPE11 and CPE12 devices will delete the entry having the InfiMUX1 as gateway from the routing table and will add another default route via InfiMUX2. A similar situation will occur in case of failure of the InfiMUX 2.

Load balancing: the default route metric in ODR is calculated based on the radio parameters and on the channel's load level. This allows to balance the traffic for the spoke devices and evenly make use of the devices and of the communication channels in the MINT area.

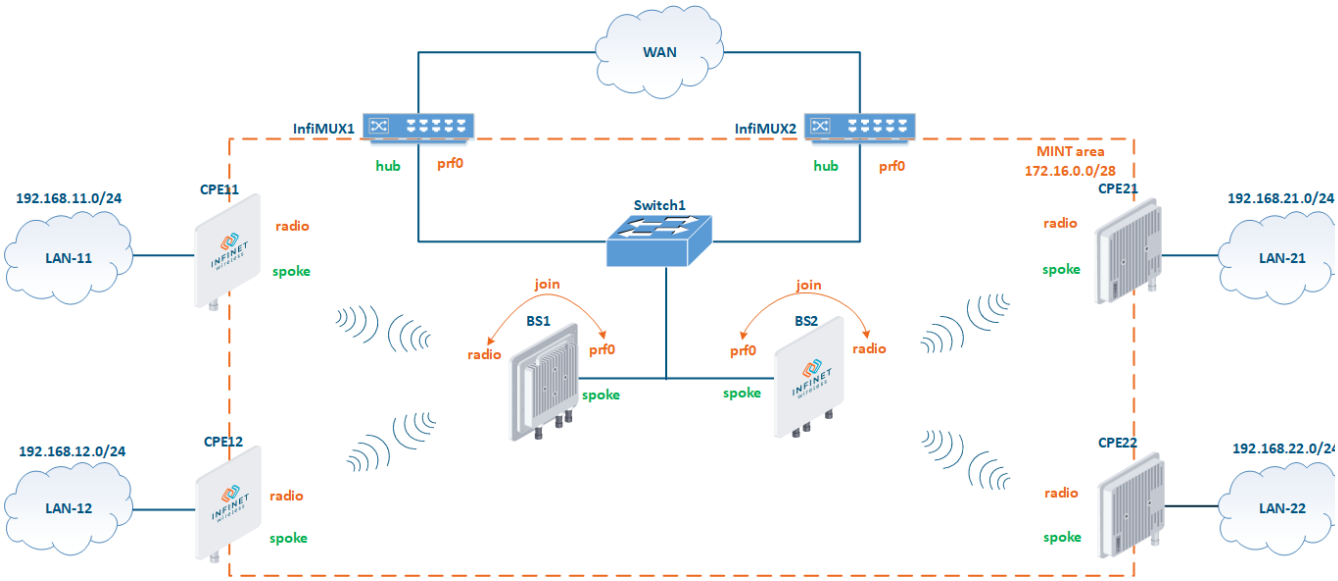

Figure 2 - Redundancy scheme using the ODR protocol

ODR protocol features

Unlike static routing, the ODR protocol has the following features:

- **easy configuration:** the basic ODR configuration consists of role distribution;
- **scalability:** an increase in the number of devices in the network does not require a larger amount of work, as it is enough to perform preliminary configuration on the devices and define a role;
- **speed:** the state of the devices and of the communication channels is constantly monitored by the ODR protocol, so changes in the network topology will instantly be reflected in the routing table;
- **fault tolerance and traffic balancing:** the implementation of the schemes for increasing reliability and optimal link utilization does not require additional manipulations as it is performed automatically;
- **topology limitation:** ODR cannot be used in arbitrary topology networks and it is intended for star type networks only;
- **proprietary implementation:** the ODR protocol is supported by other hardware manufacturers, however these implementations will not be compatible with the Infinet devices. This happens because the transport technology for ODR is not standardized and in the Infinet devices the proprietary MINT protocol is used.

ODR practice

Examples of the ODR configuration are included in the child page document: ODR protocol configuration.

Additional materials

Online courses

1. InfiLINK 2x2 / InfiMAN 2x2: Initial Link Configuration and Installation.
2. InfiLINK 2x2 and InfiMAN 2x2: Switching

Webinars

1. Typical scenario of routing setting using Infinet Wireless devices. Part I.

Other

1. Network configuration via web interface for InfiLINK 2x2, InfiMAN 2x2.
2. Network configuration via Web interface for InfiLINK Evolution, InfiMAN Evolution families devices.
3. Ifconfig command (interfaces configuration)
4. route command (static routes configuration)
5. mint command (MINT version)
6. mint command (TDMA version)