

Classifications of Routing Protocols:

...Cntd

❖ *Hierarchical routing protocols:*

✓ These protocols introduce hierarchy in the network to achieve the following benefits:

- reduction in the size of routing tables;
- better scalability.

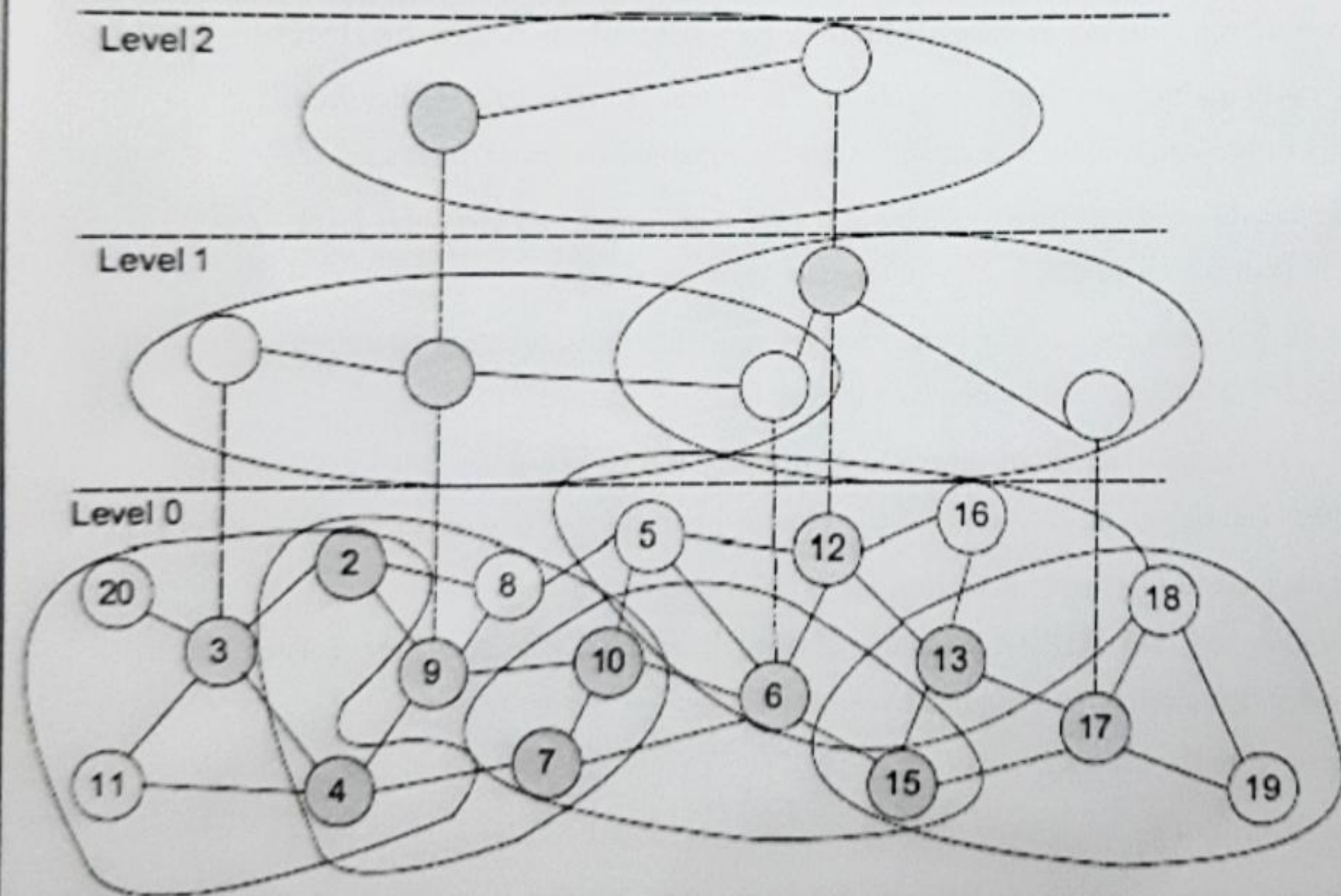
➤ **Hierarchical State Routing protocol:**

✓ *HSR is characterized by the following:*

- HSR uses multi-clustering to enhance resource allocation and management;
- HSR denotes different levels of clusters;
- at every level leader is elected;
- the first level is made of single-hop clusters (physical clustering);
- the next level is comprised of leaders of clusters.

❖ *Hierarchical routing protocols:*

➤ Hierarchical state routing protocol:



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➤ Hierarchical state routing protocol:

At the physical layer nodes are classified into:

- cluster heads; belong to a single cluster and elected as a cluster head;
- gateway nodes; belong to two or more clusters;
- normal nodes; belong to a single cluster.

Cluster heads at level 0 (physical level) could be responsible for:

- slot/frequency/code allocation to utilize spectrum more efficiently;
- call admission control from normal member nodes;
- scheduling of packets for transmission;
- exchange of routing information;
- handling route breaks.

Gateway nodes are responsible for:

- forwarding of packets between different clusters (cluster heads).

❖ *Hierarchical routing protocols:*

➤ **Hierarchical state routing protocol:**

The following routing responsibilities are assigned to nodes in HSR:

- every node maintains information about the status of links with its neighbors:
 - this information is broadcasted within the cluster at regular intervals.
- cluster heads exchange the topology and link state information at any level:
 - this is done via multiple hops using the gateway nodes.
- the path between two cluster head involves multiple links is called the virtual link:
 - this is: head - gateway - head - gateway etc.
- every node knows the exact hierarchial topology information:
 - after obtaining the information the cluster head floods it to lower level.
- to route packets hierarchial addressing is used consisting of:
 - hierarchial ID (HID): sequence of cluster headers' IDs from higher level;
 - node ID: similar to unique MAC address.

Address of node 12: (9,12,12).

- From 12 to 3: 12 - 9 - 3 over multiple links.

❖ *Hierarchical routing protocols:*

➤ **Fisheye State Routing protocol:**

Generalization of the GSR protocol where the following property is introduced:

- accurate information about nodes in local topology;
- not so accurate information about node that are far away.

Why is it needed:

- complexity proactive routing: size of the network, mobility of node;
- reactive routing: + number of connections.

What is the basis:

- a node exchanges the routing information only with neighbors at periodic intervals:
 - trade-off between link-state (topology exchanges) and distance vector (link-level info).
- the complete topology information is maintained at each nodes;
- different update frequencies for different scopes one-hop/two-hop/... scopes:
 - one-hop – highest freq., two-hop less freq. etc.: decrease of the message size.