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METHOD TO OPTIMIZE QUERY PROCESSING AND UNGRACEFUL SERVICE PROVIDER HANDLING OF MDNS SERVICES IN WIRELESS DEPLOYMENTS

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ABSTRACT

The techniques presented herein propose method to distribute the mDNS query processing to the edge of the wireless network, i.e., to the Access Points (APs). This method includes, installing mDNS policy of dynamic permitted services list on the APs. This will build the intelligence on APs and optimizes the mDNS traffic to a great extent. APs will learn the service providers based on this permitted list. Clients querying for mDNS service will be forwarded to the WLC if and only if queried service is part of dynamic permitted services list. It is important to note that all the queries other than the supported and learnt list are dropped at the edge of the wireless network itself. Also, this method specifies to keeps the learnt list of 'service providers' up-to-date and relevant at the edge of the wireless network. The mDNS service providers can be present on wireless side or wired side. Service providers present on wireless side are known clients which are joined to WLC. When these clients leave WLC, it will inform APs to clear the entry from the learnt service provider list. APs monitors traffic for service providers associated to it. If the number of packet drops are above certain threshold, then it will notify WLC and take corrective action which then updates the learnt service provider list. For service providers present on wired side, WLC monitors traffic. If the number of packet drops are above certain threshold, then it will update the learnt service providers list, and then updates the learnt service provider count to the APs., so that APs will drop the queries for this service if the provider count is zero. These steps will ensure to clear the stale entries from the list to optimize the handling of mDNS traffic.

DETAILED DESCRIPTION

With the significant increase in the size of the network and number of devices connected, the need for zero-configuration mechanisms like mDNS has significantly increased. mDNS based service discovery protocol designed for typical small L2 deployments, its scope is within a VLAN.

As a result, it doesn't work across VLAN's and hence it is not enterprise friendly. In mDNS gateway solution, Wireless LAN Controllers (WLC) acts as a mDNS proxy, learns all the mDNS advertisements from Service Providers (SP) and caches them, later it responds to queries from clients with the SP list it has learnt. mDNS advertisements for printing services, streaming services, gaming services, and many more are increasing being used by applications. There is an exponential growth on the number of client devices and the applications querying for all kinds of services, most of them irrelevant to the enterprise network or outside the configured policies of WLAN network. In a typical enterprise deployment, only very few services are configured and allowed in WLC according to enterprise policies. Queries and advertisements for the rest of the services (which has 100s in nos.) traverse all the way and are dropped / denied at the mDNS gateway.

There are multiple scenarios, where huge flood of queries sent from apps present in the clients to the WLC (mDNS Gateway) which becomes the choke point. WLC is not able to handle the scale because of the overwhelming number of queries as clients continue to query for services all the time. In typical deployments, WLC will be handling the 90% to 95% of queries which are not supported and hence dropping those after pre-processing, causes wasting of resources. There is a need to relook at the way mDNS query and response is handled in a scaled deployment.

The techniques presented herein propose distributed approach to solving this problem using dynamic permitted list learnt by the mDNS Gateway. As per this technique, distribute the mDNS query processing to the edge of the wireless network, i.e., to access points in this case. And provide methods to minimize the traffic, keep the services and service providers up to date, to optimize overall handling of the mDNS traffic.

This technique includes, installing mDNS policy of dynamic permitted services list on the Access Points (APs). This will build the intelligence on AP and optimizes the mDNS traffic to a great extent. APs will learn the service providers based on this permitted list. Clients querying for mDNS service will be forwarded to the WLC if and only if queried service is part of dynamic permitted services list. It is important to note that all the queries other than the supported and learnt list are dropped at the edge of the network itself.

This technique specifies method to keeps the learnt list of 'service providers' up-to-date and relevant at the edge of the network. The mDNS service providers can be present on wireless side or wired side.

- Wireless side service providers:
    - Service providers present on wireless side are known clients which are joined to WLC. When these clients leave WLC, it will inform APs to clear the entry from the learnt service provider list.
    - APs monitors traffic for service providers associated to it. If the number of packet drops (host or port un-reachable packets) are above certain threshold, then it will notify WLC and take corrective action which then updates the learnt service provider list and updates the remaining APs at the edge of the network.
- Wired side service providers:
    - For service providers present on wired side, WLC monitors traffic. If the number of packet drops (host or port un-reachable packets) are above certain threshold, then it will update the learnt service providers list, and then updates the learnt service provider count to the APs., so that APs will drop the queries for this service if the provider count is zero.

These steps will ensure to clear the stale entries from the list to optimize the handling. In dense deployments this list can grow out-of-bounds, hence it is very important to maintain the list with valid entries.

Also, this technique specifies method to keep the mDNS policy of 'dynamic permitted list of services' up-to-date and relevant to avoid the stale entries and further optimize the handling of mDNS traffic. Graceful addition and deletion of the supported mDNS services shall be handled on WLC by modifying the mDNS policy. WLC will re-install the updated mDNS policy to the APs at edge of the wireless network.

The techniques presented herein is explained in detail as below:

A. Dynamic permitted service providers in distributed environment:

WLC will provide AP with the dynamic permitted service list. This dynamic list is generated at the WLC using the configured service list and service providers present in the

deployment which are learnt by WLC. Communication from WLC to AP's to be in the form of multicast delivery. A typical example is, if Service-1, Service-2, and Service-3 are allowed and WLC has learnt only Service-2 and Service-3 as service providers present in the network, then only these two services to be communicated to all the APs. "Add-Service" message will be sent dynamically whenever new service providers are learnt as per permitted services list. AP would allow filtering of the mDNS queries using the dynamic permitted service list received by WLC and remaining irrelevant queries are dropped at the network edge (i.e., AP) itself.

Figure-1 depicts the over-all flow of mDNS query processing at the edge.

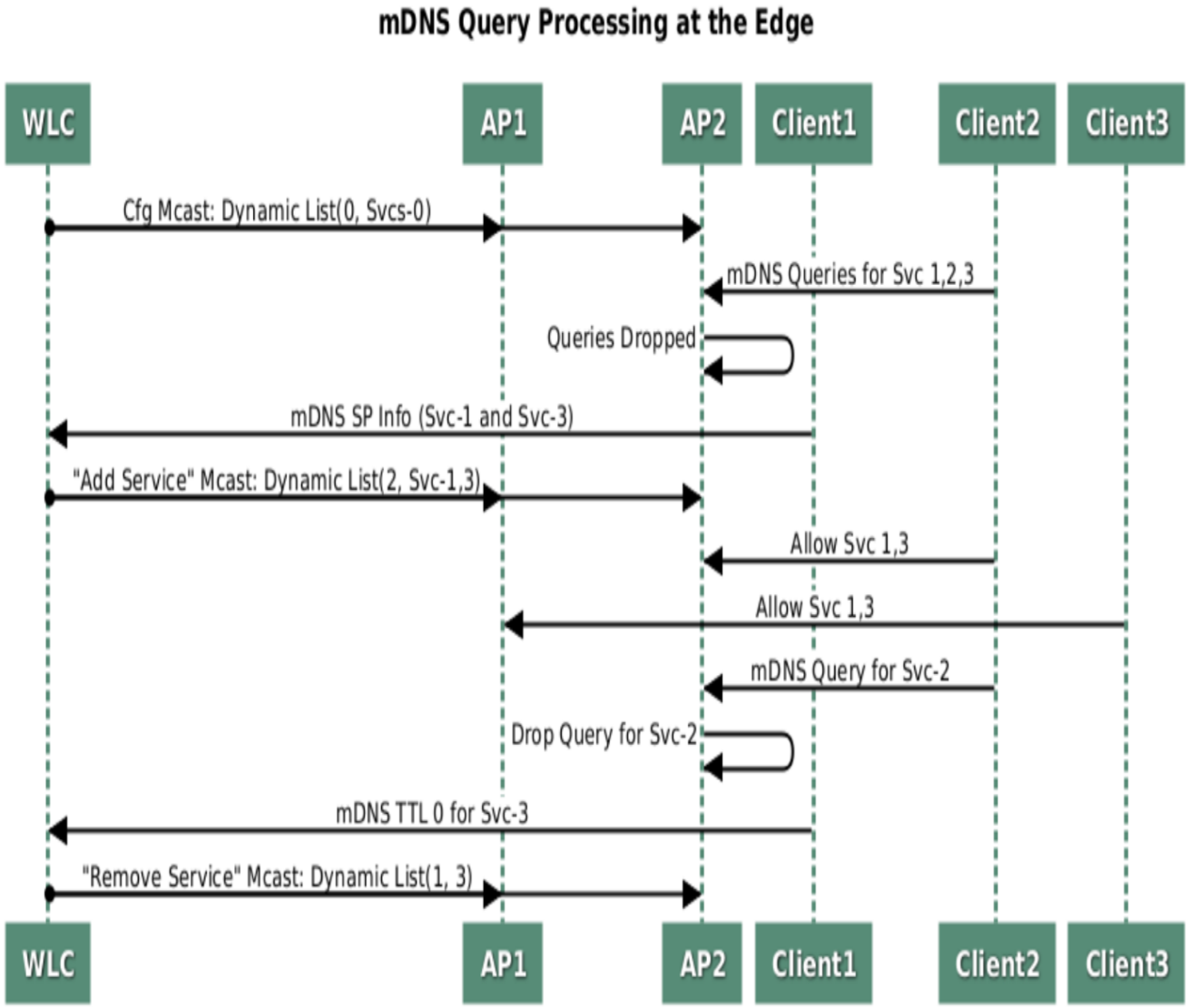

Figure-1

B. Graceful disconnection of service providers:

WLC detects graceful disconnection/tear-down of the service providers from the network and dynamically update the permitted services list at the network edge (i.e., AP). Uses the "Remove-Service" message to update the dynamic permitted services at the AP. AP to zero out the count of service providers for this service and further drop all the mDNS queries received for this service at AP itself.

C. Ungraceful disconnection of service providers:

In many scenarios, the Service Provider shuts down ungracefully without informing the network. As a result, mDNS Gateway continues to keep the stale service provider entries and continues to respond to mDNS queries by wireless client devices - resulting in flood of mDNS messages. This happens until the refresh timeout of service provider occurs. This method leverages the distributed approach and use the following techniques to avoid stale entries:

- When client (wireless side service provider) dis-associates WLC, it will inform APs when total count of providers for the given service reaches zero.
- WLC/AP monitors traffic for the packet drops of the service providers and update the learnt list to keep it up to date.

Figure-2 depicts ungraceful mDNS service provider handling at the edge.

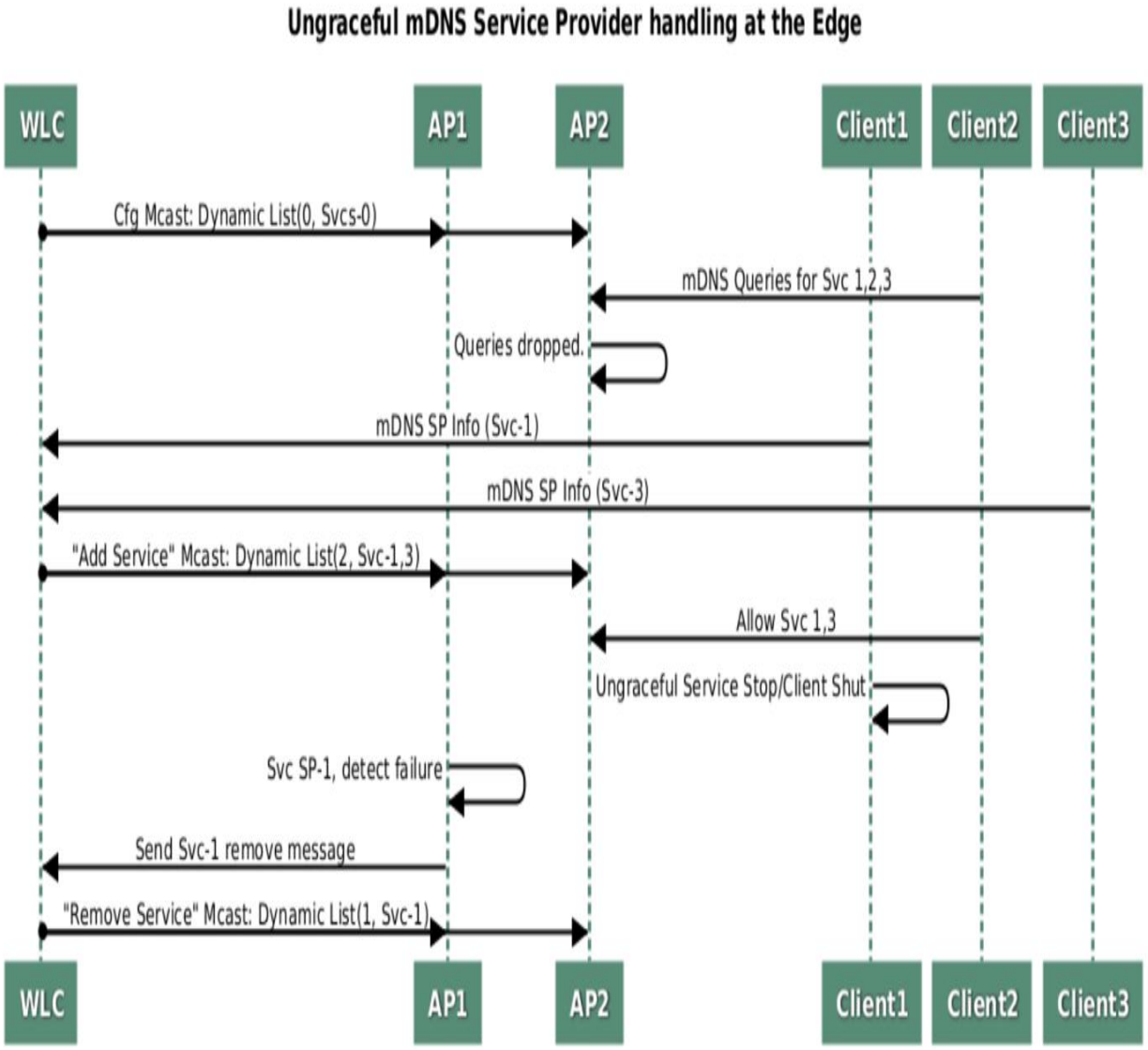

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Figure-2

In summary, the techniques presented herein propose distributed approach to handle overwhelming query processing and ungraceful service provider handling of mDNS services in wireless network. Moreover, this method is applicable even for wired deployments.