Cisco Umbrella Integration

The Cisco Catalyst SD-WAN Umbrella Integration feature enables cloud-based security service by inspecting the Domain Name System (DNS) query that is sent to the DNS server through the device. The security administrator configures policies on the Umbrella portal to either allow or deny traffic towards the fully qualified domain name (FQDN). The router acts as a DNS forwarder on the network edge, transparently intercepts DNS traffic, and forwards the DNS queries to the Umbrella cloud.

Table 1: Feature History

Feature Name	Release Information	Description
Cisco Umbrella Scope Credentials	Cisco IOS XE Catalyst SD-WAN Release 17.15.1a Cisco Catalyst SD-WAN Manager Release 20.15.1	This feature provides the ability to define and configure a new single Cisco Umbrella credential for both Umbrella SIG and Umbrella DNS.

- Overview of Cisco Catalyst SD-WAN Umbrella Integration, on page 1
- Restrictions for Umbrella Integration, on page 4
- Prerequisites for Umbrella Integration, on page 5
- Configure Umbrella API Token, on page 6
- Configure Cisco Umbrella Registration, on page 6
- Create Cisco Umbrella Scope Credentials, on page 7
- Define Domain Lists, on page 8
- Configure Umbrella DNS Policy Using Cisco SD-WAN Manager, on page 8
- Attach DNS Umbrella Policy to Device Template, on page 10
- Upload Umbrella Root Certificates, on page 10
- Umbrella Integration Using CLI, on page 10
- DNS Security Policy Configuration, on page 22
- Monitor Umbrella Feature, on page 24

Overview of Cisco Catalyst SD-WAN Umbrella Integration

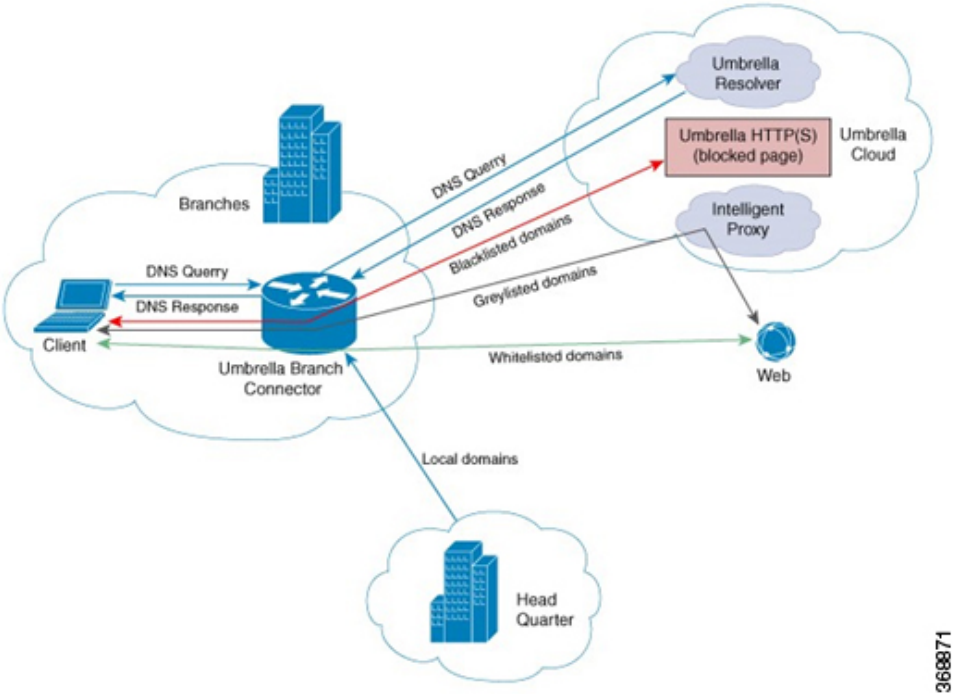
The Cisco Catalyst SD-WAN Umbrella Integration feature provides cloud-based security service by inspecting the DNS query that is sent to the DNS server through the device. When a host initiates the traffic and sends a DNS query, the Umbrella Connector in the device intercepts and inspects the DNS query. If the DNS query is for a local domain, it forwards the query without changing the DNS packet to the DNS server in the enterprise

network. If it is for an external domain, it adds an Extended DNS (EDNS) record to the query and sends it to Umbrella Resolver. An EDNS record includes the device identifier information, organization ID and client IP. Based on this information, Umbrella Cloud applies different policies to the DNS query.

The Umbrella Integration cloud, based on the policies configured on the portal and the reputation of the DNS Fully Qualified Domain Name (FQDN) may take one of the following actions:

- If FQDN is found to be malicious or blocked by the customized Enterprise Security policy, then the IP address of the Umbrella Cloud's blocked landing page is returned in the DNS response. This is called a blocked list action at Umbrella Cloud.
- If FQDN is found to be non-malicious, then the IP address of the content provider is returned in the DNS response. This is called a allowed list action at Umbrella Cloud.
- If the FQDN is suspicious, then the intelligent proxy unicast IP addresses are returned in the DNS response. This is referred to as grey list action at Umbrella Cloud.

Figure 1: Umbrella Cloud



When the DNS response is received, the device forwards the response back to the host. The host will extract the IP address from the response and send the HTTP / HTTPS requests to this IP.

Note: The intelligent proxy option has to be enabled in the Umbrella dashboard for the Umbrella Resolver to return the intelligent proxy unicast IP addresses in the DNS response when an attempt is made to access the domains in the grey list.

Handling HTTP and HTTPs Traffic

With Cisco Catalyst SD-WAN Umbrella Integration, HTTP and HTTPs client requests are handled in the following ways:

- If the Fully Qualified Domain Name (FQDN) in the DNS query is malicious (falls under blocked domains), Umbrella Cloud returns the IP address of the blocked landing page in the DNS response. When the HTTP client sends a request to this IP, Umbrella Cloud displays a page that informs the user that the requested page was blocked and the reason for blocking the page.
- If the FQDN in the DNS query is non-malicious (falls under allowedlisted domains), Umbrella Cloud returns the IP address of the content provider. The HTTP client sends the request to this IP address and gets the desired content.
- If the FQDN in the DNS query falls under grey-listed domains, Umbrella Resolver returns the unicast IP addresses of intelligent proxy in the DNS response. All HTTP traffic from the host to the grey domain gets proxied through the intelligent proxy and undergo URL filtering.

One potential limitation in using intelligent proxy unicast IP addresses is the probability of the datacenter going down when the client is trying to send the traffic to the intelligent proxy unicast IP address. This is a scenario where a client has completed DNS resolution for a domain which falls under grey-listed domain and client's HTTP/(S) traffic is being sent to one of the obtained intelligent proxy unicast IP address. If that datacenter is down, then the client has no way of knowing it.

The Umbrella Connector does not act on the HTTP and HTTPS traffic. The connector does not redirect any web traffic or alter any HTTP/(S) packets.

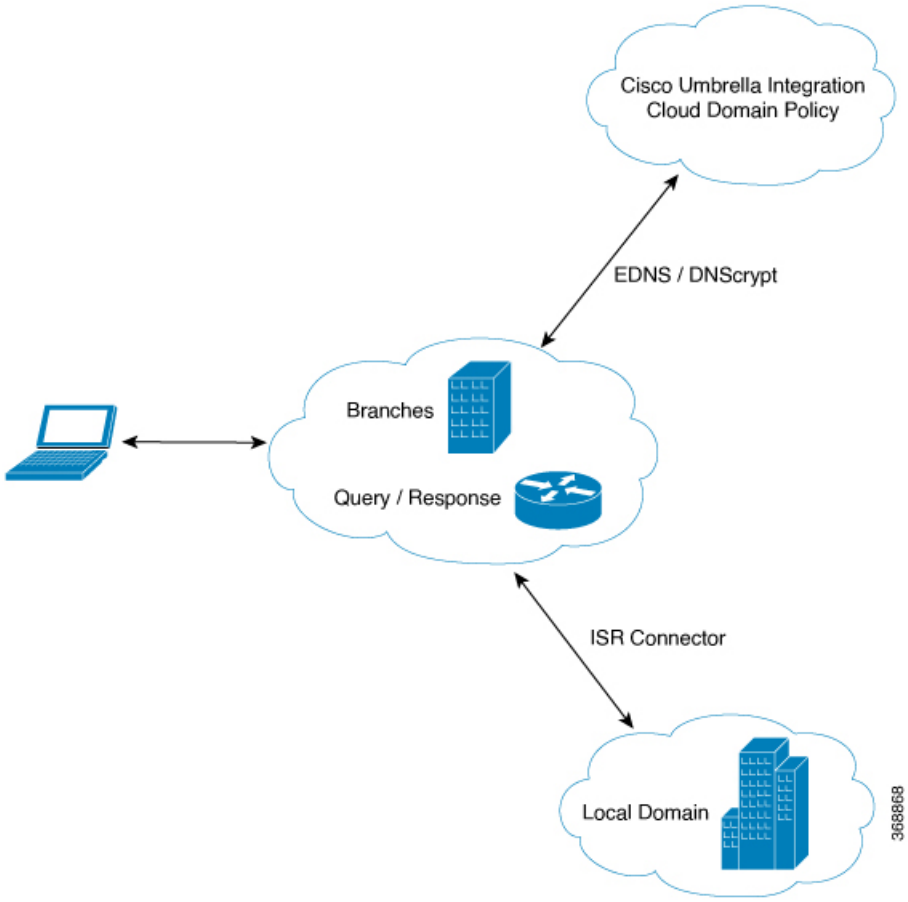
Encrypting the DNS Packet

The DNS packet sent from the device to Umbrella Integration server must be encrypted if the EDNS information in the packet contains information such as user IDs, internal network IP addresses, and so on. When the DNS response is sent back from the DNS server, device decrypts the packet and forwards it to the host. You can encrypt DNS packets only when the DNScrypt feature is enabled on the device.

The device uses the following Anycast recursive Umbrella Integration servers:

- 208.67.222.222
- 208.67.220.220
- 2620:119:53::53
- 2620:119:35::35

Figure 2: Umbrella Integration Topology



Restrictions for Umbrella Integration

- If an application or host uses IP address directly instead of DNS to query domain names, policy enforcement is not applied.
- When the client is connected to a web proxy, the DNS query does not pass through the device. In this case, the connector does not detect any DNS request and the connection to the web server bypasses any policy from the Umbrella portal.
- When the Umbrella Integration policy blocks a DNS query, the client is redirected to a Umbrella block page. HTTPS servers provide these block pages and the IP address range of these block pages is defined by the Umbrella portal.
- The type A, AAAA, and TXT queries are the only records that are redirected. Other types of query bypasses the connector. Umbrella Connector maintains a list of IP address that is known for malicious traffic. When the Umbrella roaming client detects the destination of packets to those addresses, it forwards those addresses to Umbrella cloud for further inspection.
- Only the IPv4 address of the host is conveyed in the EDNS option.

- A maximum of 64 local domains can be configured under bypass list, and the allowed domain name length is 100 characters.
- Data-policy based NAT and Umbrella DNS redirect interoperability is not supported. If NAT for internet bound traffic is configured through a data policy instead of a default NAT route in service VPN, for Umbrella DNS redirection, you must create a rule to match the DNS request and then set action as umbrella redirect. The data policy rule created for DNS redirect must be configured before the NAT rule in a sequence.
- Umbrella redirection does not work with DNS sent over TCP. Only UDP is supported.
- In IKEv2 Preshared Keys (PSK), the '\' character is not supported and should not be used.
- DNS redirect does not work if DNS traffic is received over the tunnel towards data center in case of cloud services.
- When the local internet TLOC fails, there is no capability to redirect DNS to data center.
- The Cisco Umbrella configuration may enforce IP address restrictions for the Service VPN configurations. If you do not follow the guidelines, configuration may result in traffic loss. For additional information about Cisco Umbrella configuration, see Cisco Umbrella SIG User Guide.
- The local domain list can support a maximum of 6400 characters in total. This can be one domain up to 6400 characters or multiple domains with a combined total not exceeding 6400 characters.

Prerequisites for Umbrella Integration

Before you configure the Umbrella Integration feature, ensure that the following are met:

- The device has a security K9 license to enable Umbrella Integration.
- The device runs on the SD-WAN IOS XE 16.10 software image or later.
- Cisco Catalyst SD-WAN Umbrella subscription license is available.
- The device is set as the default DNS server gateway and needs to ensure that the DNS traffic goes through the device.
- After upgrading SD-WAN Manager from version 20.9 to 20.12.x, you may experience timeouts during template operations. Starting from Cisco vManage Release 20.11.1, to resolve the timeout issue, ensure that SD-WAN Manager has outbound network connectivity to the Cisco Umbrella management API by following these steps:
  - Ensure traffic is allowed from SD-WAN Manager to the umbrella management API through port 443.
  - If an upstream firewall or network filter is present, add a rule to allow outbound traffic from SD-WAN Manager to the umbrella management API through on port 443.

Note The connectivity to umbrella management API is required even if your Umbrella account does not have any child organizations. SD-WAN Manager always attempts to contact the umbrella API endpoint during these template operations. You must ensure there are no restrictions blocking the traffic in your network security settings. This will allow API request complete successfully and template deployment proceeds without timeouts.

Configure Umbrella API Token

To configure Umbrella API token:

1. From the Cisco SD-WAN Manager menu, choose **Configuration** > **Security**.
2. Click **Custom Options** to configure the Umbrella API.
3. Choose **Umbrella API Token**.
4. Enter token number in the **Umbrella Token** field.

Note Must be exactly 40 hexadecimal.

5. Click **Save Changes** to configure the Umbrella API Token.

Configure Cisco Umbrella Registration

Table 2: Feature History

Feature Name	Release Information	Description
Auto-registration for Cisco Umbrella Cloud Services	Cisco IOS XE Catalyst SD-WAN Release 17.2.1r	This feature adds the ability to register devices to Cisco Umbrella using the Smart Account credentials to automatically retrieve Umbrella credentials (organization ID, registration key, and secret). This offers a more automatic alternative to manually copying a registration token from Umbrella.

Use this procedure to configure Cisco Umbrella registration globally for all devices. The procedure retrieves the Umbrella registration parameters automatically.

When configuring individual policies, it is also possible to configure Umbrella registration, but it can be managed more flexibly using the following procedure:

1. From the Cisco SD-WAN Manager menu, choose **Configuration** > **Security**.
2. Click **Custom Options** and choose **Umbrella Registration**.

3. In the **Manage Umbrella Registration** dialog box, use one of the following methods to register devices to Umbrella. The registration details are used globally.

   - Cisco Umbrella Registration Key and Secret

     a. Click the **Get Keys** to retrieve Umbrella registration parameters automatically: Organization ID, Registration Key, and Secret.

Note To automatically retrieve registration parameters, Cisco SD-WAN Manager uses the Smart Account credentials to connect to the Umbrella portal. The Smart Account credentials are configured in Cisco SD-WAN Manager under **Administration** > **Settings** > **Smart Account Credentials**.

     b. (Optional) If the Umbrella keys have been rotated and the details that are automatically retrieved are incorrect, enter the details manually.

     c. Click **Save Changes**.

   - Cisco Umbrella Registration Token

     (For legacy devices only) Enter a registration token (40 hexadecimal digits) provided by Umbrella.

Create Cisco Umbrella Scope Credentials

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Cloud Credentials** and select **Umbrella** as the provider.
3. Enter the following information, which is applicable to both Cisco Umbrella SIG and Cisco Umbrella DNS security:

Field	Description
Organization ID	Enter the Cisco Umbrella organization ID (Org ID) for your organization. For more information, see *Find Your Organization ID* in the *Cisco Umbrella SIG User Guide*.
Scope Credentials	
API Key	Enter the Umbrella management API key.
Secret	Enter the Umbrella management API secret.

4. Click **Save**.

Define Domain Lists

1. From the Cisco SD-WAN Manager menu, choose **Configuration** > **Security**.
2. Click **Custom Options**, and choose **Lists** from the drop-down menu.
3. Choose **Domain** in the left pane.
4. Click **New Domain List** to create a new domain list or click the domain name, and click the pencil icon on the right side for an existing list.
5. Enter the **Domain List Name**, **Add Domain**, and click **Add** to create the list.

Configure Umbrella DNS Policy Using Cisco SD-WAN Manager

1. From the Cisco SD-WAN Manager menu, choose **Configuration** > **Security**.
2. Click **Add Security Policy**.
3. In the **Add Security Policy** wizard, click **Direct Internet Access**.
4. Click **Proceed**.
5. Click **Next** until you reach the **DNS Security** page.
6. From the **Add DNS Security Policy** drop-down list, choose one of the following:
   - **Create New**: A **DNS Security - Policy Rule Configuration** wizard is displayed.
   - **Copy from Existing**: Choose a policy from the **Policy** field, enter a policy name, and click **Copy**.
7. If you are creating a new policy using the **Create New** option, the **DNS Security - Policy Rule Configuration** wizard is displayed.
8. Enter a policy name in the **Policy Name** field.
9. The **Umbrella Registration Status** displays the status of the API Token configuration.
10. Click **Manage Umbrella Registration** to add a token, if you have not added one already.
11. Click **Match All VPN** to keep the same configuration for all the available VPNs and continue with Step 13.

    Or click **Custom VPN Configuration** if you need to add target service VPNs to your policy. A Target VPNs window appears, and continue with the next step.
12. To add target service VPNs, click **Target VPNs** at the top of the window.
13. Click **Save Changes** to add the VPN.
14. From the **Local Domain Bypass List** drop-down list, choose the domain bypass.
15. Configure **DNS Server IP** from the following options:
    - **Umbrella Default**

- **Custom DNS**

16. Click **Advanced** to enable or disable the DNSCrypt. By default, the DNSCrypt is enabled.
17. Click **Save DNS Security Policy**.

    The **Configuration > Security** window is displayed, and the DNS policy list table includes the newly created DNS Security Policy.

Note Starting from Cisco IOS XE Catalyst SD-WAN Release 17.11.1a and Cisco vManage Release 20.11.1, you can select Child Org ID from the dropdown when a parent Org ID of a multi-org tenant is added to the SIG Credentials.

Table 3: DNS Security Policy

Field	Description
Add DNS Security Policy	From the **Add DNS Security Policy** drop-down list, select **Create New** to create a new DNS Security Policy policy. **Copy from Existing**: Choose a policy from the **Policy** field, enter a policy name, and click **Copy**.
Create New	Displays the DNS Security Policy wizard.
Policy Name	Enter a name for the policy.
Umbrella Registration Status	Displays the status of the API Token configuration.
Manage Umbrella Registration	Click **Manage Umbrella Registration** to add a token, if you have not added one already.
Match All VPN	Click **Match All VPN** to keep the same configuration for all the available VPNs.
Custom VPN Configuration	choose **Custom VPN Configuration** to input the specific VPNs.
Local Domain Bypass List	Choose the domain bypass.
DNS Server IP	Configure **DNS Server IP** from the following options: • **Umbrella Default** • **Custom DNS**
DNSCrypt	Enable or disable the DNSCrypt.
Next	Click **Next** to the policy summary page.

Attach DNS Umbrella Policy to Device Template

1. From the Cisco SD-WAN Manager menu, choose **Configuration** > **Templates**.
2. Click **Device Templates**, and choose **From Feature Template** from the Create Template drop-down menu.

Note In Cisco vManage Release 20.7.1 and earlier releases, **Device Templates** is called **Device**.

3. From the Device Model drop-down menu, choose a device.
4. Click **Additional Templates**. The screen scrolls to the **Additional Templates** section.
5. From the Security Policy drop-down menu, choose the name of the Umbrella DNS Security Policy you configured in the above procedure.
6. Click **Create** to apply the Umbrella policy to a device template.

Upload Umbrella Root Certificates

Minimum release: Cisco IOS XE Catalyst SD-WAN Release 17.9.1a, Cisco vManage Release 20.9.1.

If edge devices in your Cisco Catalyst SD-WAN network require new Umbrella root certificates for Umbrella DNS security, you can upload an Umbrella root certificate bundle. The bundle contains a certificate for Cisco vEdge devices and a certificate for Cisco IOS XE Catalyst SD-WAN devices, in that order. After you upload the bundle, Cisco SD-WAN Manager pushes the appropriate certificates to the appropriate devices.

1. In the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** in the **Umbrella DNS Certificate** row.
3. Perform one of the following actions to enter the Umbrella root certificate bundle in the **Umbrella Root Certificate** field:
   - Copy and paste the contents of the bundle. Ensure that the certificate for Cisco vEdge devices appears before the certificate for Cisco IOS XE Catalyst SD-WAN devices.
   - Click **Select a File** and navigate to and select the bundle that you want.
4. Click **Save**.

   Cisco SD-WAN Manager pushes the certificates to all devices that support an Umbrella root certificate.

Umbrella Integration Using CLI

Configure the Umbrella Connector

Communication for device registration to the Cisco Umbrella server is via HTTPS. This requires a DigiCert root certificate which is auto installed on the router by default.

To configure Umbrella Connector:

- Get the API token from the Umbrella portal.
- Define VRFs and each VRF can has two options: DNS resolver and enabling local domain list.
  - Umbrella registration is done per VRF only if DNS resolver is configured as Umbrella.
  - Local domain bypass list is global and each VRF can enable or disable the local domain bypass list. If enabled, the DNS packet will be matched against the local domain list.
- Umbrella is a Direct Internet Access (DIA) feature, so NAT configuration is mandatory.

Sample configuration:

```
Device# config-transaction
    Device(config)# parameter-map type umbrella global
    Device(config-profile)#?
    parameter-map commands:
          dnscrypt          Enable DNSCrypt
          exit              Exit from parameter-map
          local-domain      Local domain processing
          no                Negative or set default values of a command
          public-key        DNSCrypt provider public key
          registration-vrf  Cloud facing vrf
          resolver          Anycast address
          token             Config umbrella token
          udp-timeout       Config timeout value for UDP sessions
          vrf               Configure VRF

Per-VRF options are provided under VRF option:
Device(config)# parameter-map type umbrella global
Device(config-profile)#vrf 9
Device(config-profile-vrf)#?
vrf options:
    dns-resolver        DNS resolver address
    exit                Exit from vrf sub mode
    match-local-domain  Match local-domain list(if configured)
    no                  Negate a command or set its defaults

 parameter-map type regex dns_bypass
 pattern www.cisco.com
 pattern .*amazon.com
 pattern .*.salesforce.com
!
parameter-map type umbrella global
token 648BF6139C379DCCFFBA637FD1E22755001CE241
local-domain dns_bypass
dnscrypt udp-timeout 5
vrf 9
      dns-resolver 8.8.8.8
      match-local-domain
vrf 19
      dns-resolver 8.8.8.8
      no match-local-domain
 vrf 29
      dns-resolver umbrella
      match-local-domain
 vrf 39
      dns-resolver umbrella
```

```
      no match-local-domain
!
```

The following table captures the per VRF DNS packet behavior:

VRF	dns-resolver	Match-local-domain (dns_bypass)
9	8.8.8.8	Yes
19	8.8.8.8	No
29	umbrella	Yes
39	umbrella	No

Note The VRFs must be preconfigured. For example, the VRFs 9,19, 29, 39 are preconfigured in the above example.

Sample NAT config for DIA internet connectivity:

```
ip access-list extended dia-nat-acl
10 permit ip any any
ip nat inside source list dia-nat-acl interface <WAN-facing-Interface> overload
"ip nat outside" MUST be configured under <WAN-facing-Interface>
```

Configure the Device as a Pass-through Server

You can identify the traffic to be bypassed using domain names. In the Cisco Catalyst SD-WAN device, you can define these domains in the form of regular expressions. If the DNS query that is intercepted by the device matches one of the configured regular expressions, then the query is bypassed to the specified DNS server without redirecting to the Umbrella cloud. This sample configuration shows how to define a regex parameter-map with a desired domain name and regular expressions:

```
Device# config-transaction
Device(config)# parameter-map type regex dns_bypass
Device(config)# pattern www.cisco.com
Device(config)# pattern .*amazon.com
Device(config)# pattern .*[.]salesforce.com
```

For more information, see Regular Expression for URL Filtering and DNS Security.

DNSCrypt, Resolver, and Public-key

When you configure the device using the **parameter-map type umbrella global** command, the following values are auto-populated:

- DNSCrypt
- Public-Key

Public-key

Public-key is used to download the DNSCrypt certificate from Umbrella Integration cloud. This value is preconfigured to

B735:1140:206F:225D:3E2B:D822:D7FD:691E:A1C3:3CC8:D666:8D0C:BE04:BFAB:CA43:FB79 which is the public-key of Umbrella Integration Anycast servers. If there is a change in the public-key and if

you modify this command, then you have to remove the modified command to restore the default value. If you modify the value, the DNSCrypt certificate download may fail.

DNSCrypt

DNSCrypt is an encryption protocol to authenticate communications between the device and the Umbrella Integration. When the **parameter-map type umbrella** is configured and enabled by default on all WAN interfaces. DNSCrypt gets triggered and a certificate is downloaded, validated, and parsed. A shared secret key is then negotiated, which is used to encrypt the DNS queries. For every hour this certificate is automatically downloaded and verified for an upgrade, a new shared secret key is negotiated to encrypt the DNS queries.

To disable DNSCrypt, use the **no dnscrypt** command and to re-enable DNSCrypt, use the **dnscrypt** command.

When the DNSCrypt is used, the DNS request packets size is more than 512 bytes. Ensure that these packets are allowed through the intermediary devices; otherwise, the response may not reach the intended recipients.

Sample umbrella dnscrypt notifications:

```
Device# show sdwan umbrella dnscrypt
    DNSCrypt: Enabled
       Public-key: B735:1140:206F:225D:3E2B:D822:D7FD:691E:A1C3:3CC8:D666:8D0C:BE04:BFAB:CA43:FB79
   Certificate Update Status:
     Last Successfull Attempt: 08:46:32 IST May 21 2018
  Certificate Details:
           Certificate Magic     : DNSC
           Major Version         : 0x0001
           Minor Version         : 0x0000
           Query Magic           : 0x714E7A696D657555
           Serial Number         : 1517943461
           Start  Time           : 1517943461 (00:27:41 IST Feb 7 2018)
           End Time              : 1549479461 (00:27:41 IST Feb 7 2019)
         Server Public Key    : 240B:11B7:AD02:FAC0:6285:1E88:6EAA:44E7:AE5B:AD2F:921F:9577:514D:E226:D552:6836

         Client Secret Key Hash: 8A97:BBD0:A8BE:0263:F07B:72CB:BB21:330B:D47C:7373:B8C8:5F96:9F07:FEC6:BBFE:95D0

         Client Public key    : 0622:C8B4:4C46:2F95:D917:85D4:CB91:5BCE:78C0:F623:AFE5:38BC:EF08:8B6C:BB40:E844

         NM key Hash          : 88FC:7825:5B58:B767:32B5:B36F:A454:775C:711E:B58D:EE6C:1E5A:3BCA:F371:4285:5E3A
When disabled:
Device# show umbrella dnscrypt
       DNSCrypt: Not enabled
       Public-key: NONE

Sample configuration steps for dns-resolver and match-local-domain-to-bypass per vrf:
Router(config)# vrf definition 1
Router(config-vrf)# address-family ipv4
Router(config-ipv4)# exit-address-family
Router(config-vrf)# commitCommit complete.
Router(config-vrf)# exit
Router(config)# parameter-map type umbrella global
Router(config-profile)# ?
Possible completions:
    dnscrypt
    local-domain
    public-key
    registration-vrf
    resolver
    token
    udp-timeout
    vrf
Router(config-profile)# vrf ?
This line doesn't have a valid range expression
Possible completions:
    <name:string, min: 1 chars, max: 32 chars>  1
```

```
Router(config-profile)# vrf 1
Router(config-profile-vrf)# ?
Possible completions:
    dns-resolver
    match-local-domain-to-bypass
Router(config-profile-vrf)# dns-resolver umbrella
Router(config-profile-vrf)# match-local-domain-to-bypass
Router(config-profile-vrf)# commit
Commit complete.
Router(config-profile-vrf)# end
Router(config)# vrf definition 2
Router(config-vrf)# address-family ipv4
Router(config-ipv4)# exit-address-family
Router(config-vrf)# commitCommit complete.
Router(config-vrf)# exit
Router(config)# parameter-map type umbrella global
Router(config-profile)# vrf 2
Router(config-profile-vrf)# dns-resolver 8.8.8.8
Router(config-profile-vrf)# no match-local-domain-to-bypass
Router(config-profile-vrf)# commit
Commit complete.
Router(config-profile-vrf)# end
Router#sh umbrella config

Umbrella Configuration
=======================
Token: AAC1A2555C11B2B798FFF3AF27C2FB8F001CB7B2
OrganizationID: 1882034
Local Domain Regex parameter-map name: NONE
DNSCrypt: Enabled
Public-key: B735:1140:206F:225D:3E2B:D822:D7FD:691E:A1C3:3CC8:D666:8D0C:BE04:BFAB:CA43:FB79
UDP Timeout: 5 seconds
Resolver address:
    1. 208.67.220.220
    2. 208.67.222.222
    3. 2620:119:53::53
    4. 2620:119:35::35
Registration VRF: default
VRF List:
1. VRF 1 (ID: 1)
    DNS-Resolver: umbrella
    Match local-domain-to-bypass: Yes
2. VRF 2 (ID: 3)
    DNS-Resolver: 8.8.8.8
    Match local-domain-to-bypass: No
```

Verify the Umbrella Connector Configuration

Verify the Umbrella Connector configuration using the following commands:

```
Device# show umbrella config
Umbrella Configuration
=======================
  Token: 648BF6139C379DCCFFBA637FD1E22755001CE241
  OrganizationID: 1892929
  Local Domain Regex parameter-map name: dns_bypass
  DNSCrypt: Enabled
  Public-key: B735:1140:206F:225D:3E2B:D822:D7FD:691E:A1C3:3CC8:D666:8D0C:BE04:BFAB:CA43:FB79

  UDP Timeout: 5 seconds
  Resolver address:
      1. 208.67.220.220
      2. 208.67.222.222
      3. 2620:119:53::53
```

```
      4. 2620:119:35::35
  Registration VRF: default
  VRF List:
      1. VRF 9 (ID: 4)
          DNS-Resolver: 8.8.8.8
          Match local-domain: Yes
      2. VRF 19 (ID: 1)
          DNS-Resolver: 8.8.8.8
          Match local-domain: No
      3. VRF 29 (ID: 2)
          DNS-Resolver: umbrella
          Match local-domain: Yes
      4. VRF 39 (ID: 3)
          DNS-Resolver: umbrella
          Match local-domain: No
The output of VRF will have name and ID. The ID here is VRF ID:
Device# show vrf detail | inc VRF Id
VRF 19 (VRF Id = 1); default RD <not set>; default VPNID <not set>
VRF 29 (VRF Id = 2); default RD <not set>; default VPNID <not set>
VRF 39 (VRF Id = 3); default RD <not set>; default VPNID <not set>
VRF 9 (VRF Id = 4); default RD <not set>; default VPNID <not set>

When DNSCrypt is disabled:
Device# show umbrella config
Umbrella Configuration
=========================
    Token: 648BF6139C379DCCFFBA637FD1E22755001CE241
    OrganizationID: 1892929
    Local Domain Regex parameter-map name: dns_bypass
    DNSCrypt: Not enabled
    Public-key: NONE
    UDP Timeout: 5 seconds
    Resolver address:
        1. 208.67.220.220
        2. 208.67.222.222
        3. 2620:119:53::53
        4. 2620:119:35::35
 Registration VRF: default
 VRF List:
     1. VRF 9 (ID: 4)
         DNS-Resolver: 8.8.8.8
         Match local-domain: Yes
     2. VRF 19 (ID: 1)
         DNS-Resolver: 8.8.8.8
         Match local-domain: No
     3. VRF 29 (ID: 2)
         DNS-Resolver: umbrella
         Match local-domain: Yes
    4. VRF 39 (ID: 3)
        DNS-Resolver: umbrella
        Match local-domain: No
```

Display Umbrella Registration Details

The following example displays the device registration information:

```
Device# show sdwan umbrella device-registration
Device registration details
VRF        Tag     Status        Device-id29
vpn29      200     SUCCESS     010a9b2b0d5cb21f39
vpn39      200     SUCCESS     010a1a2e1989da19

The following example displays the device registration information in detail:
Device# show umbrella deviceid detailed
```

```
Device registration details
1.29
    Tag               : vpn29
    Device-id         : 010a9b2b0d5cb21f
    Description       : Device Id recieved successfully
    WAN interface     : None

2.39
    Tag               : vpn39
    Device-id         : 010a1a2e1989da19
    Description       : De
    vice Id recieved successfully
    WAN interface     : None
```

Configure Cisco Umbrella Using a CLI Device Template

For more information on using the CLI device template, see Device Configuration-Based CLI Templates for Cisco IOS XE Catalyst SD-WAN devices.

This section provides example CLI configurations for Cisco Umbrella.

```
secure-internet-gateway
umbrella org-id <umbrella org id>
umbrella api-key <api key>
umbrella api-secret "<secret key>"

sdwan
interface Tunnel100001
  tunnel-options tunnel-set secure-internet-gateway-umbrella tunnel-dc-preference primary-dc
 source-interface GigabitEthernet0/0/0
  exit
  interface Tunnel100002
  tunnel-options tunnel-set secure-internet-gateway-umbrella tunnel-dc-preference secondary-dc
 source-interface GigabitEthernet0/0/0
  exit

service sig vrf global
  ha-pairs
   interface-pair Tunnel100001 active-interface-weight 1 Tunnel100002 backup-interface-weight1


vrf definition <vrf#>
address-family ipv4
exit-address-family

interface Loopback<some value>
no shutdown
  vrf forwarding <vrf#>
ip address <IP Address> <mask>
exit

interface Tunnel100001
 no shutdown
  ip unnumbered GigabitEthernet0/0/0
  no ip clear-dont-fragment
  ip tcp adjust-mss 1300
  ip mtu 1400
  tunnel source GigabitEthernet<#/#/#>
  tunnel destination dynamic
  tunnel mode ipsec ipv4
  tunnel protection ipsec profile if-ipsec1-ipsec-profile
  tunnel vrf multiplexing
  tunnel route-via GigabitEthernet<###> mandatory
exit
```

```
interface Tunnel100002
  no shutdown
  ip unnumbered GigabitEthernet0/0/0
  no ip clear-dont-fragment
  ip tcp adjust-mss 1300
  ip mtu 1400
  tunnel source GigabitEthernet<#/#/#>
  tunnel destination dynamic
  tunnel mode ipsec ipv4
  tunnel protection ipsec profile if-ipsec2-ipsec-profile
  tunnel vrf multiplexing
  tunnel route-via GigabitEthernet<###> mandatory
exit

crypto ikev2 policy policy1-global
  proposal p1-global

crypto ikev2 profile if-ipsec1-ikev2-profile
  no config-exchange request
  dpd 10 3 on-demand
  dynamic
  lifetime 86400

crypto ikev2 profile if-ipsec2-ikev2-profile
  no config-exchange request
 dpd 10 3 on-demand
  dynamic
  lifetime 86400

crypto ikev2 proposal p1-global
  encryption aes-cbc-128 aes-cbc-256
  group 14 15 16
  integrity sha1 sha256 sha384 sha512

crypto ipsec transform-set if-ipsec1-ikev2-transform esp-gcm 256

crypto ipsec transform-set if-ipsec2-ikev2-transform esp-gcm 256

crypto ipsec profile if-ipsec1-ipsec-profile
  set ikev2-profile if-ipsec1-ikev2-profile
  set transform-set if-ipsec1-ikev2-transform
  set security-association lifetime kilobytes disable
  set security-association lifetime seconds 3600
  set security-association replay window-size 512

crypto ipsec profile if-ipsec2-ipsec-profile
  set ikev2-profile if-ipsec2-ikev2-profile
  set transform-set if-ipsec2-ikev2-transform
  set security-association lifetime kilobytes disable
  set security-association lifetime seconds 3600
  set security-association replay window-size 512
```

Note Cisco IOS XE does not support changing algorithms during the IKE rekey process if those algorithms were selected during the initial IKE INIT exchange.

If the IKEv2 proposal or policy is modified, on either the Cisco IOS XE Catalyst SD-WAN device or its peer, resulting in a change to the negotiated algorithms so that the original algorithms from the INIT exchange are no longer available during rekey, the rekey will fail. In this case, the IKE peers must renegotiate the session using the updated algorithms. This requirement applies to all subsequent rekey attempts as well.

Umbrella show commands at FP Layer

The **show platform software umbrella f0 config** command displays all the local domains configured for Open DNS in the FP Layer.

```
Device# show platform software umbrella f0 config
+++ Umbrella Config +++
Umbrella feature:
------------------
Init: Enabled
Dnscrypt: Enabled
Timeout:
------------------
udp timeout: 5
OrgId :
------------------
orgid : 1892929
Resolver config:
RESOLVER IP's
---------------------
208.67.220.220
208.67.222.222
2620:119:35::35
2620:119:53::53
Dnscrypt Info:
public_key:
A5:BA:18:C5:59:70:67:94:E5:37:38:33:06:F9:63:83:39:86:82:E4:00:F5:D8:BE:C1:AA:77:4A:4C:BA:64:00
magic_key: 71 4E 7A 69 6D 65 75 55
serial number: 1517943461
ProfileID    DeviceID          Mode      Resolver     Local-Domain    Tag
--------------------------------------------------------------------------------
     0                         OUT                      False
     4                         IN        8.8.8.8        True           vpn9
     1                         IN        8.8.8.8        False          vpn19
     2     010a9b2b0d5cb21f    IN     208.67.220.220    True           vpn29
     3     010a1a2e1989da19    IN     208.67.220.220    False          vpn39

The show platform software umbrella f0 local-domain displays the local domain list.
Device# show platform software umbrella f0 local-domain
01.  www.cisco.com
02.  .*amazon.com
03.  .*.salesforce.com
```

Umbrella show commands at CPP Layer

The show platform hardware qfp active feature umbrella client config command displays the configuration in CPP layer.

```
 +++ Umbrella Config +++
Umbrella feature:
----------------
Init: Enabled
Dnscrypt: Enabled
Timeout:
--------
udp timeout: 5
Orgid:
--------
orgid: 1892929
Resolver config:
------------------
RESOLVER IP's
```

```
    208.67.220.220
    208.67.222.222
    2620:119:53::53
    2620:119:35::35
Dnscrypt Info:
--------------
public_key:
D9:2D:20:93:E8:8C:B4:BD:32:E6:A3:D1:E0:5B:7E:1A:49:C5:7F:96:BD:28:79:06:A2:DD:2E:A7:A1:F9:3D:7E
magic_key: 71 4E 7A 69 6D 65 75 55
serial number: 1517943461

Umbrella Interface Config:
--------------------------
11      GigabitEthernet4 :
        Mode     : IN
        DeviceID : 010a9b2b0d5cb21f
        Tag      : vpn29
10      GigabitEthernet3 :
        Mode     : IN
        DeviceID : 0000000000000000
        Tag      : vpn9
05      Null0 :
        Mode     : OUT
06     VirtualPortGroup0 :
        Mode     : OUT
07     VirtualPortGroup1 :
        Mode     : OUT
08      GigabitEthernet1 :
        Mode     : OUT
09      GigabitEthernet2 :
        Mode     : OUT
12      GigabitEthernet5 :
        Mode     : OUT

Umbrella Profile Deviceid Config:
---------------------------------
ProfileID: 0
    Mode     : OUT
ProfileID: 1
    Mode     : IN
    Resolver : 8.8.8.8
    Local-Domain: False
    DeviceID : 0000000000000000
    Tag      : vpn19
ProfileID: 3
    Mode     : IN
    Resolver : 208.67.220.220
    Local-Domain: False
    DeviceID : 010a1a2e1989da19
    Tag      : vpn39
ProfileID: 4
    Mode     : IN
    Resolver : 8.8.8.8
    Local-Domain: True
    DeviceID : 0000000000000000
    Tag      : vpn9
ProfileID: 2
    Mode     : IN
    Resolver : 208.67.220.220
    Local-Domain: True
    DeviceID : 010a9b2b0d5cb21f
    Tag      : vpn29

Umbrella Profile ID CPP Hash:
```

```
------------------------------
VRF ID :: 1
    VRF NAME : 19
    Resolver : 8.8.8.8
    Local-Domain: False
VRF ID :: 4
    VRF NAME : 9
    Resolver : 8.8.8.8
    Local-Domain: True
VRF ID :: 2
    VRF NAME : 29
    Resolver : 208.67.220.220
    Local-Domain: True
VRF ID :: 3
    VRF NAME : 39
    Resolver : 208.67.220.220
    Local-Domain: False
```

Umbrella Data-Plane show commands

The **show platform hardware qfp active feature umbrella datapath stats** command displays the umbrella statistics in data plane.

```
Device# show platform hardware qfp active feature umbrella datapath stats
Umbrella Connector Stats:
    Parser statistics:
        parser unknown pkt: 0
        parser fmt error: 0
        parser count nonzero: 0
        parser pa error: 0
        parser non query: 0
        parser multiple name: 0
        parser dns name err: 0
        parser matched ip: 0
        parser opendns redirect: 0
        local domain bypass: 0
        parser dns others: 0
        no device id on interface: 0
        drop erc dnscrypt: 0
        regex locked: 0
        regex not matched: 0
        parser malformed pkt: 0
    Flow statistics:
        feature object allocs : 0
        feature object frees  : 0
        flow create requests  : 0
        flow create successful: 0
        flow create failed, CFT handle: 0
        flow create failed, getting FO: 0
        flow create failed, malloc FO : 0
        flow create failed, attach FO : 0
        flow create failed, match flow: 0
        flow create failed, set aging : 0
        flow lookup requests  : 0
        flow lookup successful: 0
        flow lookup failed, CFT handle: 0
        flow lookup failed, getting FO: 0
        flow lookup failed, no match  : 0
        flow detach requests  : 0
        flow detach successful: 0
        flow detach failed, CFT handle: 0
        flow detach failed, getting FO: 0
        flow detach failed freeing FO : 0
```

```
        flow detach failed, no match  : 0
        flow ageout requests          : 0
        flow ageout failed, freeing FO: 0
        flow ipv4 ageout requests     : 0
        flow ipv6 ageout requests     : 0
        flow update requests  : 0
        flow update successful: 0
        flow update failed, CFT handle: 0
        flow update failed, getting FO: 0
        flow update failed, no match  : 0
     DNSCrypt statistics:
         bypass pkt: 0
         clear sent: 0
         enc sent: 0
         clear rcvd: 0
         dec rcvd: 0
         pa err: 0
         enc lib err: 0
         padding err: 0
         nonce err: 0
         flow bypass: 0
         disabled: 0
         flow not enc: 0
    DCA statistics:
        dca match success: 0
        dca match failure: 0
```

The **show platform hardware qfp active feature umbrella datapath memory** command displays CFT information.

```
Device# show platform hardware qfp active feature umbrella datapath memory
==Umbrella Connector CFT Information==
CFT inst_id 0 feat id 0 fo id 0 chunk id 4
==Umbrella Connector Runtime Information==
umbrella init state 0x4
umbrella dsa client handler 0x2
```

The **show platform hardware qfp active feature umbrella datapath runtime** command displays internal information. For example, key index used for DNSCrypt.

```
Device# show platform hardware qfp active feature umbrella datapath runtime
udpflow_ageout: 5
ipv4_count: 2
ipv6_count: 2
ipv4_index: 0
ipv6_index: 0
Umbrella IPv4 Anycast Address
IP Anycast Address0: 208.67.220.220
IP Anycast Address1: 208.67.222.222
Umbrella IPv6 Anycast Address
IP Anycast Address0: 2620:119:53:0:0:0:0:53
IP Anycast Address1: 2620:119:35:0:0:0:0:35
=DNSCrypt=
key index: 0
-key[0]-
sn: 1517943461
ref cnt: 0
magic: 714e7a696d657555
Client Public Key:
A5BA:18C5:5970:6794:E537:3833:06F9:6383:3986:82E4:00F5:D8BE:C1AA:774A:4CBA:6400
NM Key Hash      :
16E6:DDC7:53BE:2929:1CDA:06AE:0BE2:C270:6E39:EAE7:F925:78FD:3599:2AB6:74C9:A59D
-key[1]-
sn: 0
ref cnt: 0
```

```
magic: 0000000000000000
Client Public Key:
0000:0000:0000:0000:0000:0000:0000:0000:0000:0000:0000:0000:0000:0000:0000:0000
NM Key Hash      :
0000:0000:0000:0000:0000:0000:0000:0000:0000:0000:0000:0000:0000:0000:0000:0000
Local domain 1
VPN-DEVICEID TABLE d7f37410
```

Clear Command

The **clear platform hardware qfp active feature umbrella datapath stats** command clears the Umbrella connector statistics in datapath.

```
Device# clear platform hardware qfp active feature umbrella datapath stats
Umbrella Connector Stats Cleared
```

Troubleshooting the Umbrella Integration

Troubleshoot issues that are related to enabling the Umbrella Integration feature using these commands:

- **debug umbrella device-registration**
- **debug umbrella config**
- **debug umbrella dnscrypt**

Depending on the OS, run either of these two commands from the client device:

- The **nslookup -type=txt debug.umbrella.com** command from the command prompt of the Windows machine
- The **nslookup -type=txt debug.umbrella.com** command from the terminal window or shell of the Linux machine

```
nslookup -type=txt debug.opendns.com 8.8.8.8
Server: 8.8.8.8
Address: 8.8.8.8#53
Non-authoritative answer:
debug.opendns.com text = "server r6.mum1"
debug.opendns.com text = "device 010A826AAABB6C3D"
debug.opendns.com text = "organization id 1892929"
debug.opendns.com text = "remoteip 171.168.1.7"
debug.opendns.com text = "flags 436 0 6040 39FF0000000000000000"
debug.opendns.com text = "originid 119211936"
debug.opendns.com text = "orgid 1892929"
debug.opendns.com text = "orgflags 3"
debug.opendns.com text = "actype 0"
debug.opendns.com text = "bundle 365396"
debug.opendns.com text = "source 72.163.220.18:36914"
debug.opendns.com text = "dnscrypt enabled (713156774457306E)"
```

DNS Security Policy Configuration

Domain List

CLI Command	Possible Completions	Description and possible input values

policy lists local-domain-list <name>		List of domain name regular expression patterns
		Domain name regular expression pattern string. For example, policy lists local-domain-list name as google.com.

Umbrella Registration

CLI Command	Possible Completions	Description and possible input values
security umbrella		Configure Umbrella service related security properties.
	api-key	Config umbrella api-key. The value ranges from 1 to 64 characters.
	dnscrypt	Enable DNScrypt while redirecting DNS requests to Umbrella.
	orgid	Config umbrella org id
	secret	Config umbrella secret. The value can be [0 | 6].
	token	Umbrella service registration token. The value ranges from 1 to 64 characters.

CLI Command	Possible Completions	Description and possible input values
vpn <number, range>	**dns-redirect match-local-domain-to-bypass**	List of domain name regular expression patterns
	dns-redirect umbrella	Bypass the dns redirect for entries in the local domain list Use Umbrella as DNS redirect service.

DNS-Security Policy with Domain List

```
policy
 lists
  local-domain-list domain-list
    google.com
  !
  exit
 !
!
exit
!
security
 umbrella
  dnscrypt
!
exit
!
vpn matchAllVpn
 dns-redirect umbrella match-local-domain-to-bypass
```

DNS-Redirection with NAT

This example displays the centralized policy configuration for NAT with DNS redirection.

```
policy
data-policy DP1
  vpn-list VPN1
   sequence 1
    match
     dns request
    !
    action accept
     redirect-dns umbrella
    !
   !
   sequence 2
    action accept
     nat use-vpn 0
    !
   !
   default-action drop
  !
```

Monitor Umbrella Feature

You can monitor the registered VPNs, DNSCrypt status, packet counts for required timestamps on an Umbrella configured router using the following steps.

To monitor the status of Umbrella DNS Configuration on a device:

1. From the Cisco SD-WAN Manager menu, choose **Monitor** > **Devices**.

   Cisco vManage Release 20.6.1 and earlier: From the Cisco SD-WAN Manager menu, choose the **Monitor** > **Network**.

2. Under Security Monitoring, click **Umbrella DNS Re-direct** in the left pane. **Umbrella DNS Re-direct** displays the number of packets that are redirected to configured DNS server.

3. Click **Local Domain Bypass** to view the number of packets that are bypassed from DNS server.