

HttpDNS Android客户端接入文档（腾讯内部业务专用）

原理介绍

HttpDNS服务的详细介绍可以参见文章[全局精确流量调度新思路-HttpDNS服务详解](#)。总的来说，HttpDNS作为移动互联网时代DNS优化的一个通用解决方案，主要解决了以下几类问题：

- LocalDNS劫持/故障
- LocalDNS调度不准确

HttpDNS的Android SDK，主要提供了基于HttpDNS服务的域名解析和缓存管理能力：

- SDK在进行域名解析时，优先通过HttpDNS服务得到域名解析结果，极端情况下如果HttpDNS服务不可用，则使用LocalDNS解析结果
- HttpDNS服务返回的域名解析结果会携带相关的TTL信息，SDK会使用该信息进行HttpDNS解析结果的缓存管理

接入

权限配置

```
<uses-permission android:name="android.permission.ACCESS_NETWORK_STATE" />
<uses-permission android:name="android.permission.ACCESS_WIFI_STATE" />
<uses-permission android:name="android.permission.INTERNET" />

<!-- 用于获取手机imei码进行数据上报，非必须 -->
<uses-permission android:name="android.permission.READ_PHONE_STATE" />

<!-- 灯塔 -->
<uses-permission android:name="android.permission.WRITE_EXTERNAL_STORAGE" />
```

网络切换监听配置

HttpDNS SDK监听网络切换广播，在发生网络切换时，清理HttpDNS解析结果的缓存。

targetSdkVersion < 24(Android 7.0)

在AndroidManifest文件中注册广播接收器：

```

<receiver

    android:name="com.tencent.msdk.dns.HttpDnsCache$ConnectivityChangeReceiver"

    android:label="NetworkConnection" >
        <intent-filter>
            <action android:name="android.net.conn.CONNECTIVITY_CHANGE" />
        </intent-filter>
    </receiver>

```

targetSdkVersion >= 24(Android 7.0)

App targetSdkVersion >= 24(Android 7.0)情况下，静态注册的网络切换广播接收器不会生效，详细信息参见[Changes to system broadcasts](#)。这种情况下，业务侧需要通过代码动态注册广播接收器，在HttpDNS SDK初始化之后添加以下代码片段：

```

// import com.tencent.msdk.dns.HttpDnsCache;
context.getApplicationContext()
    .registerReceiver(new HttpDnsCache.ConnectivityChangeReceiver(),
                    new
        IntentFilter(ConnectivityManager.CONNECTIVITY_ACTION));

```

网络安全配置兼容

App targetSdkVersion >= 28(Android 9.0)情况下，系统默认不允许HTTP网络请求，详细信息参见[Opt out of cleartext traffic](#)。这种情况下，业务侧需要将HttpDNS请求使用的IP配置到域名白名单中：

- AndroidManifest文件中配置

```

<?xml version="1.0" encoding="utf-8"?>
<manifest ... >
    <application
        android:networkSecurityConfig="@xml/network_security_config"
        ... >
        ...
    </application>
</manifest>

```

- xml目录下添加network_security_config.xml配置文件

```
<?xml version="1.0" encoding="utf-8"?>
<network-security-config>
    <domain-config cleartextTrafficPermitted="true">
        <domain includeSubdomains="false">182.254.116.117</domain>
        <domain includeSubdomains="false">119.29.29.29</domain>
    </domain-config>
</network-security-config>
```

接入HttpDNS

- 将HttpDNSLibs\HttpDNS_xxxx.jar拷贝至应用libs相应位置

接入灯塔

- 将HttpDNSLibs\beacon_android_xxxx.jar拷贝至应用libs相应位置
 - 注意：已经接入了腾讯灯塔(beacon)组件的应用忽略此步

接口调用

```
// 初始化灯塔：如果已经接入MSDK或者IMSDK或者单独接入了腾讯灯塔(Beacon)则不需再初始化该接口
try {
    // 注意：这里业务需要输入自己的灯塔appkey
    UserAction.setAppKey("0I000LT6GW1YGCP7");
    UserAction.initUserAction(MainActivity.this.getApplicationContext());
} catch (Exception e) {
    Log.e(TAG, "Init beacon failed", e);
}

/**
 * 初始化HttpDNS：如果接入了MSDK，建议初始化MSDK后再初始化HttpDNS
 *
 * @param context 应用上下文，最好传入ApplicationContext
 * @param appkey 业务appkey，腾讯云官网
 * (https://console.cloud.tencent.com/HttpDNS) 申请获得，用于上报
 * @param debug 是否开启debug日志，true为打开，false为关闭，建议测试阶段打开，正式上线时关闭
 * @param timeout dns请求超时时间，单位ms，建议设置1000
 */
MSDKDnsResolver.getInstance().init(MainActivity.this, appkey, debug,
timeout);

/**
 * 设置OpenId，已接入MSDK业务直接传MSDK OpenId，其它业务传“NULL”
 *
 * @param String openId
 */
MSDKDnsResolver.getInstance().WGSetDnsOpenId("10000");
```

```

/**
 * HttpDNS同步解析接口
 * 首先查询缓存，若存在则返回结果，若不存在则进行同步域名解析请求
 * 解析完成返回最新解析结果，解析结果有多个IP则以“;”分隔
 * 解析失败返回null
 *
 * @param domain 域名(如www.qq.com)
 * @return 域名对应的解析IP结果集合
 */
String ips = MSDKDnsResolver.getInstance().getAddrByName(domain);

```

接入验证

init接口中debug参数传入true，过滤TAG为“WGGetHostByName”的日志。查看到LocalDns（日志上为ldns_ip）和HttpDNS（日志上为hdns_ip）相关日志，则可以确认接入无误

注意事项

- getAddrByName是耗时同步接口，应当在子线程调用；域名解析失败接口返回null，业务需要进行相关处理
- 如果客户端的业务是与host绑定的，比如是绑定了host的http服务或者是cdn的服务，那么在用HttpDNS返回的IP替换掉URL中的域名以后，还需要指定下Http头的Host字段
 - 以URLConnection为例：

```

URL oldUrl = new URL(url);
URLConnection connection = oldUrl.openConnection();
// 获取HttpDNS域名解析结果
String ips =
MSDKDnsResolver.getInstance().getAddrByName(oldUrl.getHost());
if (null != ips) { // 通过HttpDNS获取IP成功，进行URL替换和HOST头设置
    String ip;
    if (ips.contains(";")) {
        ip = ips.substring(0, ips.indexOf(";"));
    } else {
        ip = ips;
    }
    String newUrl = url.replaceFirst(oldUrl.getHost(), ip);
    connection = (HttpURLConnection) new
URL(newUrl).openConnection(); // 设置HTTP请求头Host域名
    connection.setRequestProperty("Host", oldUrl.getHost());
}

```

- 以curl为例，假设你要访问www.qq.com，通过HttpDNS解析出来的IP为192.168.0.111，那么可以这么访问：

```
curl -H "Host:www.qq.com" http://192.168.0.111/aaa.txt
```

- 检测本地是否使用了Http代理，如果使用了Http代理，建议不要使用HttpDNS做域名解析 示例如下：

```
String host = System.getProperty("http.proxyHost");
String port = System.getProperty("http.proxyPort");
if (null != host && null != port) {
    // 使用了本地代理模式
}
```

实践场景

OkHttp

OkHttp提供了Dns接口用于向OkHttp注入Dns实现。得益于OkHttp的良好设计，使用OkHttp进行网络访问时，实现Dns接口即可接入HttpDNS进行域名解析，在较复杂场景（Https/Https + SNI）下也不需要额外处理，侵入性极小。示例如下：

```
mOkHttpClient =
    new OkHttpClient.Builder()
        .dns(new Dns() {
            @NonNull
            @Override
            public List<InetAddress> lookup(String hostname) {
                Utils.checkNotNull(hostname, "hostname can not be null");
                String ips =
                    MSDKDnsResolver.getInstance().getAddrByName(hostname);
                if (null == ips) {
                    return Collections.emptyList();
                }
                String[] ipArr;
                if (ips.contains(";")) {
                    ipArr = ips.split(";");
                } else {
                    ipArr = new String[1];
                    ipArr[0] = ips;
                }
                if (0 == ipArr.length) {
                    return Collections.emptyList();
                }
                List<InetAddress> inetAddressList = new ArrayList<>
                    (ipArr.length);
                for (String ip : ipArr) {
                    try {
                        InetAddress inetAddress =
                            InetAddress.getByName(ip);
                        inetAddressList.add(inetAddress);
                    } catch (UnknownHostException ignored) {}
                }
            }
        })
```

```

        }
        return inetAddressList;
    }
})
.build();

```

注意：实现Dns接口意味着所有经由当前OkHttpClient实例处理的网络请求都会经过HttpDNS。如果业务只有少部分域名是需要通过HttpDNS进行解析的，建议在调用HttpDNS域名解析接口之前先进行过滤。

Retrofit + OkHttp

Retrofit实际上是一个基于OkHttp，对接口做了一层封装桥接的lib。因此只需要仿OkHttp的接入方式，定制Retrofit中的OkHttpClient，即可方便地接入HttpDNS。示例如下：

```

mRetrofit =
    new Retrofit.Builder()
        .client(mOkHttpClient)
        .baseUrl(baseUrl)
        .build();

```

WebView

Android系统提供了API以实现WebView中的网络请求拦截与自定义逻辑注入。我们可以通过该API拦截WebView的各类网络请求，截取URL请求的host，然后调用HttpDNS解析该host，通过得到的IP组成新的URL来进行网络请求。

```

mWebView.setWebViewClient(new WebViewClient() {
    // API 21及之后使用此方法
    @SuppressWarnings("NewApi")
    @Override
    public WebResourceResponse shouldInterceptRequest(WebView view,
WebResourceRequest request) {
        if (request != null && request.getUrl() != null &&
request.getMethod().equalsIgnoreCase("get")) {
            String scheme = request.getUrl().getScheme().trim();
            String url = request.getUrl().toString();
            Log.d(TAG, "url:" + url);
            // HttpDNS解析css文件的网络请求及图片请求
            if ((scheme.equalsIgnoreCase("http") ||
scheme.equalsIgnoreCase("https"))
                && (url.contains(".css") || url.endsWith(".png") ||
url.endsWith(".jpg") || url.endsWith(".gif"))) {
                try {
                    URL oldUrl = new URL(url);
                    URLConnection connection = oldUrl.openConnection();
                    // 获取HttpDNS域名解析结果

```

```

        String ips =
MSDKDnsResolver.getInstance().getAddrByName(oldUrl.getHost());
        if (null != ips) { // 通过HttpDNS获取IP成功, 进行URL替换和
HOST头设置

            String ip;
            if (ips.contains(";")) {
                ip = ips.substring(0, ips.indexOf(";"));
            } else {
                ip = ips;
            }
            String newUrl = url.replaceFirst(oldUrl.getHost(),
ip);

            connection = (HttpURLConnection) new
URL(newUrl).openConnection(); // 设置HTTP请求头Host域名
            connection.setRequestProperty("Host",
oldUrl.getHost());
        }
        Log.d(TAG, "contentType:" +
connection.getContentType());
        return new WebResourceResponse("text/css", "UTF-8",
connection.getInputStream());
    } catch (MalformedURLException e) {
        e.printStackTrace();
    } catch (IOException e) {
        e.printStackTrace();
    }
}
}
return null;
}

// API 11至API20使用此方法
public WebResourceResponse shouldInterceptRequest(WebView view, String
url) {
    if (!TextUtils.isEmpty(url) && Uri.parse(url).getScheme() != null)
    {
        String scheme = Uri.parse(url).getScheme().trim();
        Log.d(TAG, "url:" + url);
        // HttpDNS解析css文件的网络请求及图片请求
        if ((scheme.equalsIgnoreCase("http") ||
scheme.equalsIgnoreCase("https"))
            && (url.contains(".css") || url.endsWith(".png") ||
url.endsWith(".jpg") || url.endsWith(".gif"))) {
            try {
                URL oldUrl = new URL(url);
                URLConnection connection = oldUrl.openConnection();
                // 获取HttpDNS域名解析结果
                String ips =
MSDKDnsResolver.getInstance().getAddrByName(oldUrl.getHost());

```

```

        if (null != ips) { // 通过HttpDNS获取IP成功, 进行URL替换和
HOST头设置

            String ip;
            if (ips.contains(";")) {
                ip = ips.substring(0, ips.indexOf(";"));
            } else {
                ip = ips;
            }
            String newUrl = url.replaceFirst(oldUrl.getHost(),
ip);

            connection = (HttpURLConnection) new
URL(newUrl).openConnection(); // 设置HTTP请求头Host域名
            connection.setRequestProperty("Host",
oldUrl.getHost());
        }
        Log.d(TAG, "contentType:" +
connection.getContentType());
        return new WebResourceResponse("text/css", "UTF-8",
connection.getInputStream());
    } catch (MalformedURLException e) {
        e.printStackTrace();
    } catch (IOException e) {
    }
}

return null;
});
// 加载web资源
mWebView.loadUrl(targetUrl);

```

HttpURLConnection

- Https 示例如下:


```
// 以域名为www.qq.com, HttpDNS解析得到的IP为192.168.0.1为例
String url = "https://192.168.0.1/"; // 业务自己的请求连接
HttpsURLConnection connection = (HttpsURLConnection) new
URL(url).openConnection();
connection.setRequestProperty("Host", "www.qq.com");
connection.setHostnameVerifier(new HostnameVerifier() {
    @Override
    public boolean verify(String hostname, SSLSession session) {
        return
HttpsURLConnection.getDefaultHostnameVerifier().verify("www.qq.com",
session);
    }
});
connection.setConnectTimeout(mTimeOut); // 设置连接超时
connection.setReadTimeout(mTimeOut); // 设置读流超时
connection.connect();
```

- Https + SNI 示例如下:

```
// 以域名为www.qq.com, HttpDNS解析得到的IP为192.168.0.1为例
String url = "https://192.168.0.1/"; // 用HttpDNS解析得到的IP封装业务的请求
URL
HttpsURLConnection sniConn = null;
try {
    sniConn = (HttpsURLConnection) new URL(url).openConnection();
    // 设置HTTP请求头Host域
    sniConn.setRequestProperty("Host", "www.qq.com");
    sniConn.setConnectTimeout(3000);
    sniConn.setReadTimeout(3000);
    sniConn.setInstanceFollowRedirects(false);
    // 定制SSLSocketFactory来带上请求域名 ***关键步骤
    SniSSLSocketFactory sslSocketFactory = new
SniSSLSocketFactory(sniConn);
    sniConn.setSSLSocketFactory(sslSocketFactory);
    // 验证主机名和服务端验证方案是否匹配
    HostnameVerifier hostnameVerifier = new HostnameVerifier() {
        @Override
        public boolean verify(String hostname, SSLSession session) {
            return
HttpsURLConnection.getDefaultHostnameVerifier().verify("原解析的域名",
session);
        }
    };
    sniConn.setHostnameVerifier(hostnameVerifier);
    ...
} catch (Exception e) {
    Log.w(TAG, "Request failed", e);
} finally {
```

```

        if (sniConn != null) {
            sniConn.disconnect();
        }
    }

    class SniSSLSocketFactory extends SSLSocketFactory {

        private HttpURLConnection mConn;

        public SniSSLSocketFactory(HttpURLConnection conn) {
            mConn = conn;
        }

        @Override
        public Socket createSocket() throws IOException {
            return null;
        }

        @Override
        public Socket createSocket(String host, int port) throws
        IOException, UnknownHostException {
            return null;
        }

        @Override
        public Socket createSocket(String host, int port, InetAddress
        localhost, int localPort) throws IOException, UnknownHostException {
            return null;
        }

        @Override
        public Socket createSocket(InetAddress host, int port) throws
        IOException {
            return null;
        }

        @Override
        public Socket createSocket(InetAddress address, int port,
        InetAddress localAddress, int localPort) throws IOException {
            return null;
        }

        @Override
        public String[] getDefaultCipherSuites() {
            return new String[0];
        }

        @Override
        public String[] getSupportedCipherSuites() {

```

```

        return new String[0];
    }

    @Override
    public Socket createSocket(Socket socket, String host, int port,
boolean autoClose) throws IOException {
        String realHost = mConn.getRequestProperty("Host");
        if (realHost == null) {
            realHost = host;
        }
        Log.i(TAG, "customized createSocket host is: " + realHost);
        InetAddress address = socket.getInetAddress();
        if (autoClose) {
            socket.close();
        }

        SSLCertificateSocketFactory sslSocketFactory =
(SSLCertificateSocketFactory)
SSLCertificateSocketFactory.getDefault(0);
        SSLSocket ssl = (SSLSocket)
sslSocketFactory.createSocket(address, port);
        ssl.setEnabledProtocols(ssl.getSupportedProtocols());
        if (Build.VERSION.SDK_INT >=
Build.VERSION_CODES.JELLY_BEAN_MR1) {
            Log.i(TAG, "Setting SNI hostname");
            sslSocketFactory.setHostname(ssl, realHost);
        } else {
            Log.d(TAG, "No documented SNI support on Android < 4.2,
trying with reflection");
            try {
                Method setHostnameMethod =
ssl.getClass().getMethod("setHostname", String.class);
                setHostnameMethod.invoke(ssl, realHost);
            } catch (Exception e) {
                Log.w(TAG, "SNI not useable", e);
            }
        }

        // verify hostname and certificate
        SSLSession session = ssl.getSession();
        HostnameVerifier hostnameVerifier =
HttpsURLConnection.getDefaultHostnameVerifier();
        if (!hostnameVerifier.verify(realHost, session)) {
            throw new SSLPeerUnverifiedException("Cannot verify
hostname: " + realHost);
        }

        Log.i(TAG, "Established " + session.getProtocol() + "
connection with " + session.getPeerHost() + " using " +
session.getCipherSuite());
        return ssl;
    }

```

```
}
```

Unity

- 初始化HttpDNS和灯塔接口 注意：若已接入msdk或者单独接入了腾讯灯塔则不用初始化灯塔。示例如下：

```
private static AndroidJavaObject sHttpDnsObj;
public static void Init() {
    AndroidJavaClass unityPlayerClass = new
AndroidJavaClass("com.unity3d.player.UnityPlayer");
    if (unityPlayerClass == null) {
        return;
    }
    AndroidJavaObject activityObj =
unityPlayerClass.GetStatic<AndroidJavaObject>("currentActivity");
    if (activityObj == null) {
        return;
    }
    AndroidJavaObject contextObj = activityObj.Call<AndroidJavaObject>
("getApplicationContext");
    // 初始化HttpDNS
    AndroidJavaObject httpDnsClass = new
AndroidJavaObject("com.tencent.msdk.dns.MSDKDnsResolver");
    if (httpDnsClass == null) {
        return;
    }
    sHttpDnsObj = httpDnsClass.CallStatic<AndroidJavaObject>
("getInstance");
    if (sHttpDnsObj == null) {
        return;
    }
    sHttpDnsObj.Call("init", contextObj, appkey, debug, timeout);
}
```

- 调用getAddrByName接口解析域名 示例如下：

```
// 该操作建议在子线程中或使用Coroutine处理
// 注意在子线程中调用需要在调用前后做AttachCurrentThread和
DetachCurrentThread处理
public static string GetHttpDnsIP(string strUrl) {
    string strIp = string.Empty;
    AndroidJNI.AttachCurrentThread(); // 子线程中调用需要加上
    // 解析得到IP配置集合
    strIp = sHttpDnsObj.Call<string>("getAddrByName", strUrl);
    AndroidJNI.DetachCurrentThread(); // 子线程中调用需要加上
    if (null != strIp) {
        string[] strIps = strIp.Split(';');
    }
}
```

```
        strip = strips[0];  
    }  
    return strip;  
}
```