# Todo

发送消息弹窗，我们直接弹窗

Device/google/accessory/Arduino/AndroidAccessory

<https://www.jianshu.com/p/3dc561555f12>

<https://www.jianshu.com/p/c2a8987e1c0d>

# [WiFi debug调试环境搭建](https://confluence.djicorp.com/pages/viewpage.action?pageId=73949128)

使用场景：手机或者平板设备（下统称平板）的type c接口已经被飞机或者手持云台等设备占用，无法使用usb线连接电脑，进而无法使用有线连接进行调试。

使用前提：平板和电脑处于同一个局域网，最简单的方案就是平板或者电脑开热点，另外一个设备去连接，但是无线连接可能会存在不稳定的情况，如果手上的平板可以通过转接口连接网线（如dji Crystalsky 平板就除了提供一个type c口外，还提供了一个usb口，那么我们就可以使用网口转usb的设备，让平板进行有线网络连接），则使用有线连接会更稳定。

步骤1:先使用usb线连接平板与电脑，开启调试端口

使用usb线连接平板与电脑后，使用**adb devices** 可以查看所有连接上的android设备.

确认设备连接上以后，可以使用 **adb tcpip 端口号** 进行调试端口的打开，如adb tcpip 5555 ，如果开启成功 则会返回 restarting in TCP mode port: 5555

步骤2:查看平板ip

使用 **adb shell netcfg** 或者 **adb shell ifconfig** 进行平板的ip查看

可能列出的ip比较多，找到是跟电脑在同一局域网的那个即可。

注：不同系统可能使用的命令不一样，比如 安卓5.1 的dji Crystalsky  的是adb shell netcfg 而 安卓8 的米6是adb shell ifconfig

adb shell 后接的命令是在平板上执行的命令

步骤3: 拔掉usb线，进行无线连接

使用 **adb connect ip:端口号** 即可连接

如果连接成功 则会输出 connected to ip:端口号

如果连接失败，则会输出相应信息。如端口没打开，会 输出unable to connect to ip:端口号: Connection refused

连接上以后在android studio里面调试就可以看到对应的设备了，同时type c口也空出来可以用来连接飞机了

 ps：

如果要断开连接，可以使用adb disconnect ip:端口号

如果平板重启后，则端口需要重新打开（ip可能不变），如果没重启，则断开后可以直接连接，无需重新打开端口。

如果平板插拔了typec口，则可能会让连接断开，重新执行 adb connect ip:端口号 重新连接即可

如果电脑连接了多个设备 则在adb 后面接 -s 设备号 即可对特定设备执行 设备号可以使用 adb devices 查看

# USB

1. USB，是英文Universal Serial Bus（通用串行总线）的缩写，是一个外部总线标准，用于规范电脑与外部设备的连接和通讯。是应用在PC领域的接口技术。USB接口支持设备的即插即用和热插拔功能。USB是在1994年底由英特尔、康柏、IBM、Microsoft等多家公司联合提出的。



USB 是 Universal Serial Bus 的缩写，从字面上看，就是通用串行总线的意思。从物理上看，其实就是一对差分线，连接两台设备后，相互间进行数据传输。加上另外两路供电（ 5V 和 GND）线，一共是 4 根线。

那么，既然是只有一对差分线，那么该如何决定由谁传给谁呢（如果两边同时在线上建立电平，线路上的电平会是不确定态的，以致无法通信）？这就要说到 USB 传输的一个重要基础：“询问-应答” 机制—— Device（slave） 设备通常是处在等待状态，只有 HOST 侧设备发起询问、请求，它才会在接下来的时间片中使用数据线向 HOST 发送数据。

那么，谁是 HOST，谁是 SLAVE 又是由什么来决定的呢？答案是硬件。也就是说，你 USB 后面的那块驱动芯片如果是 HOST，那么，这个 USB 只能做 HOST 用了。反之，SLAVE 亦然。比如我们经常见到的，PC 上的 USB HOST 连接到 U盘、鼠标、键盘这些 SLAVE 设备。

后来有人觉得这样一个设备只能是 HOST 或者只能是 SLAVE 太死板了，所以又发明了 USB OTG。USB OTG（on-the-go，大意为在使用时切换身份）是在原来 4 根线的基础上，又加了一根线，ID。那块 USB 后面的驱动芯片，就可以根据这根线，来选择自己到底该扮演 HOST 还是 SLAVE 的角色。后面我们单独介绍。

另外，因为使用一对差分线进行数据传输，所以，USB 又采用了基于 HUB 的星形拓扑结构（包括根控制器，最多7 层拓扑，且7层已不具备挂载 HUB 能力，只能是功能设备）。所以，更确切来说，“HOST-SLAVE“ 是在由 HUB 支持的物理链路之上的传输机制。同时，HUB 本身也是一个 USB SLAVE 设备。



root@kp300k:/ # getprop | grep usb

[persist.sys.usb.config]: [mass\_storage,adb,acm]

[prop.usb.connected]: [1]

[prop.usb.state]: [1]

[ro.kom\_wifi.mode]: [usb]

[ro.product.usbfactory]: [rockchip\_usb]

[sys.status.hideStatusbar\_enable]: [true]

[sys.usb.config]: [mass\_storage,adb,acm]

[sys.usb.state]: [mass\_storage,adb,acm]

[sys.usb.umsavailible]: [true]

init.xxx.usb.rc这里定义了所有usb device协议的组合。当usb device的协议发生变化的时候，会设置sys.usb.config这个属性，init.xxx.usb.rc中定义的某种组合会被触发，通过sys节点来通知kernel切换USB总线协议。

USB Device的功能很丰富，其支持的协议越来越多包括：MTP、ADB、rndis、mass storage、accessory、audio\_source、CDROOM等。

## 功能概述

### [协议切换](https://www.jianshu.com/p/b267c5cedfa9)

常用到的有device协议有ADB、MTP、PTP、MassStorage这几个，这些都是可以在Setting中开关或者是切换的。

在切换协议的时候是调用UsbDeviceManager中的setCurrentFunctions(String functions, boolean makeDefault)最终设置sys.usb.config这个属性，从而触发init.xx.usb.rc去通知kernel切换usb协议。

UsbDeviceManager.java中同时也监听usb事件的uevent，并通过updateUsbState（）发出UsbManager.ACTION\_USB\_STATE这个广播来通知MtpReceiver和MountService。其中MtpReceiver负责根据所选择的usb协议，启动或者关闭MtpService。

### USB各种模式 解释

1、MTP:  
通过MTP这种技术，可以把音乐传到手机里。有了U盘功能为什么还要多此一举呢？因为版权问题，MTP可以把权限文件从电脑上导过去；如果只使用手机的U盘功能，把歌的文件拷过去之后，没有权限文件还是放不了。微软搞这个，就是想控制版权。  
    对于在中国使用，有没有MTP基本上没什么区别，因为我们没有版权环境，网上下的歌在哪都能放。

MTP是微软免费向数码相机，媒体设备等厂商公开的连接技术，这些厂商可以将其写入自己设备的“固件” 当中。MTP的基础是“照片传输协议”(PTP)。 MTP支持将通过升级或者操作系统换代整合进未来的微软操作系统当中。数码相机用户不用再额外安装驱动程序就能够将自己的数码设备连接至微软操作系统的电脑。 利用MTP，数码相机将被Windows识别为和USB闪存驱动器一样的设备

2、PTP  
PTP（Paper Tape Printer）纸带打印机  mtp  媒体传输协议，是基于PTP(Picture Transfer Protocol)协议的扩展，主要用于传输媒体文件，其中有价值的应用就是同步DRM文件的license。目前支持MTP协议的只有 WMP10(Windows Media Player 10)和WMP11(Windows Media Player 11)两个版本，WMP11加入了对Playlist和Album art的支持，在获取媒体文件信息的时候GetObjectPropList代替了WMP10的GetObjectInfo命令。  
3、RNDIS  
RNDIS是指Remote NDIS，基于USB实现RNDIS实际上就是TCP/IP over USB，就是在USB设备上跑TCP/IP，让USB设备看上去像一块网卡。  
4、DM  
手机DM就是将广告客户的打折、促销等产品信息通过短信、彩信、WAP网页以及手机电视信号的形式传送到消费者手中。  
Desktop Manager  同步软件，连接电脑用的，刷机装软件。  
增强售后服务的意思  
5、RMNET  
PPP 和 RMNET 都是上网协议  
RMNET 是老版,速度慢,兼容性高  
PPP      是新版.速度快,兼容性低  
当你在PPP下无法连接GPRS时,可选用RMNET  
信息来源：起点手机论坛   
原文链接：[http://www.qdppc.com/thread-26502-1-1.html](http://www.qdppc.com/thread-26502-1-1.html" \t "_blank)  
5、ADB  
ADB全称Android Debug Bridge, 是android sdk里的一个工具, 用这个工具可以直接操作管理android模拟器或者真实的andriod设备(如G1手机).  
它的主要功能有:  
\* 运行设备的shell(命令行)  
\* 管理模拟器或设备的端口映射  
\* 计算机和设备之间上传/下载文件  
\* 将本地apk软件安装至模拟器或android设备

### 源码目录

frameworks/base/services/java/com/android/server/usb/

usbService.java用来管理usb协议，其通过property系统与init.xxx.usb.rc通讯。其中UsbDeviceManager.java以及HostManager.java分别管理device和host的设备。

## USB Device源码分析

### [Accessory模式](https://www.jianshu.com/p/b267c5cedfa9)

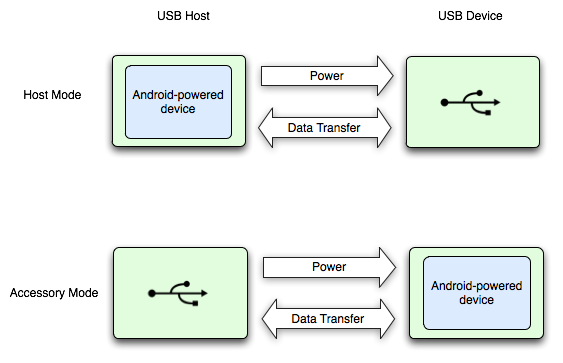
**USB accessory配件模式**

系统处于配件模式时，外部的USB设备会充当USB主机，Android设备充当从机。此时是外部设备为Android设备供电。

**USB Host 主机模式**

系统处于主机模式时，自己便充当主机，外部USB设备充当从机。此时Android设备为外部设备供电。

下图为两种模式的差异。



关于两种模式的选择，在[MFI AOA USB连接](https://confluence.djicorp.com/pages/viewpage.action?pageId=29532250)中了解到：

1.部分安卓机子不支持做USB Host,非约定的,部分厂商可以不支持.所以AOA都是rc做主,安卓做从

即：手机为accessory模式，遥控器为主机。

Android 开放配件 (AOA) 支持功能可让外部 USB 硬件（Android USB 配件）与处于配件模式下的 Android 设备进行交互。当某台 Android 设备处于配件模式时，所连接的配件会充当 USB 主机（为总线供电并列举设备），而 Android 设备则充当 USB 配件。

AOA 有两个支持不同通信类型的版本：

* **AOAv1**。支持通用配件通信和 adb 调试。适用于 Android 3.1（API 级别 12）及更高版本，在 Android 2.3.4（API 级别10）及更高版本中通过[插件库](https://developers.google.com/android/add-ons/google-apis/)获得支持。
* **AOAv2**。支持音频流式传输和人机接口设备 (HID) 功能。适用于 Android 4.1（API 级别 16）。

如果使用通用配件协议（而不是使用 adb 或音频协议）与配件通信，则必须提供可以检测 USB 配件连接并建立通信的 Android 应用。

在accessory模式下，PAD是作为Device设备的，通常需要一个支持Accessory的Host设备（ADK2012等）配合才能工作，可以参考如下谷歌文档[1](1.%09http:/developer.android.com/guide/topics/connectivity/usb/index.html),[2](1.%09http:/developer.android.com/guide/topics/connectivity/usb/accessory.html),[3](1.%09http:/developer.android.com/guide/topics/connectivity/usb/host.html)



#### Host端

Accessory模式下Host端代码可以参考cts/apps/cts-usb-accessory/cts-usb-accessory.c。这里面模拟了一个Host端的设备。其思路是main()调用system/core/libusbhost/usbhost.c中的usb\_host\_run（）函数，这个函数的主要作用就是去监控/dev/bus/usb/这个目录。

static int usb\_device\_removed(const char \*devname, void\* client\_data)

static int usb\_device\_added(const char \*devname, void\* client\_data)

usb\_host\_run(context, usb\_device\_added, usb\_device\_removed, NULL, NULL);

调用如下接口去查询/dev/bus/usb其中的设备是否支持accessory协议

usb\_device\_control\_transfer(device, USB\_DIR\_IN | USB\_TYPE\_VENDOR, ACCESSORY\_GET\_PROTOCOL, 0, 0, &protocol, sizeof(protocol), 0);

如果支持就调用如下接口尝试将其切换到accessory模式。usb\_device\_control\_transfer(device, USB\_DIR\_OUT | USB\_TYPE\_VENDOR,ACCESSORY\_START, 0, 0, 0, 0, 0);

#### Device端

/kernel/drivers/usb/gadget/f\_accessory.c中收到ACCESSORY\_START这个ioctl后（其实是由usb中断传递上来的）就会发送ACCESSORY=START的uevent。

|  |
| --- |
| static void acc\_start\_work(struct work\_struct \*data)  { |
| char \*envp[2] = { "ACCESSORY=START", NULL }; |
| kobject\_uevent\_env(&acc\_device.this\_device->kobj, KOBJ\_CHANGE, envp); |
| } |

/UsbDeviceManager.java中，接收到uevent后调用startAccessoryMode();--->setCurrentFunctions(xxx)-->设置sys.usb.config这个属性后，就触发init.xxx.usb.rc去通知kernel切换到accessory模式。

这个3399设备的节点为dev/usb\_accessory

### [Mass\_Storage模式](https://www.jianshu.com/p/b267c5cedfa9)

#### UsbDeviceManager收到插入事件

1）UsbDeviceManager监听DEVPATH=/devices/virtual/android\_usb/android0"这个路径的UEVENT，

public UsbHandler(Looper looper){

mUEventObserver.startObserving(USB\_STATE\_MATCH);}

2）在收到状态改变的时候会发出UsbManager.ACTION\_USB\_STATE这个broadcast。其中包含connect，configuration状态以及当前的usb配置的function。

|  |
| --- |
| private void updateUsbState() {  // send a sticky broadcast containing current USB state |
| Intent intent = new Intent(UsbManager.ACTION\_USB\_STATE); |
| intent.addFlags(Intent.FLAG\_RECEIVER\_REPLACE\_PENDING); |
| intent.putExtra(UsbManager.USB\_CONNECTED, mConnected); |
| intent.putExtra(UsbManager.USB\_CONFIGURED, mConfigured); |
|  |
| if (mCurrentFunctions != null) { |
| String[] functions = mCurrentFunctions.split(","); |
| for (int i = 0; i < functions.length; i++) { |
| intent.putExtra(functions[i], true); |
| } |
| } |
|  |
| mContext.sendStickyBroadcastAsUser(intent, UserHandle.ALL); |
| } |

#### MountService

frameworks/base/[services](https://android.googlesource.com/platform/frameworks/base/+/483f3b06ea84440a082e21b68ec2c2e54046f5a6/services) / [java](https://android.googlesource.com/platform/frameworks/base/+/483f3b06ea84440a082e21b68ec2c2e54046f5a6/services/java) / [com](https://android.googlesource.com/platform/frameworks/base/+/483f3b06ea84440a082e21b68ec2c2e54046f5a6/services/java/com) /[android](https://android.googlesource.com/platform/frameworks/base/+/483f3b06ea84440a082e21b68ec2c2e54046f5a6/services/java/com/android?autodive=0) / [server](https://android.googlesource.com/platform/frameworks/base/+/483f3b06ea84440a082e21b68ec2c2e54046f5a6/services/java/com/android/server) /

在MountService收到ACTION\_USB\_STATE这个广播的时候，notifyShareAvailabilityChange（）会调用所有注册的listener的bl.mListener.onUsbMassStorageConnectionChanged(avail);

同时在这里还要处理usb拔出的事件，这里必须把已经shared的盘重新Mount回系统中

#### StorageManager

StorageManager向Mountservice注册了listener

|  |
| --- |
| public StorageManager(Looper tgtLooper) throws RemoteException {  mMountService = IMountService.Stub.asInterface(ServiceManager.getService("mount")); |
| if (mMountService == null) { |
| Log.e(TAG, "Unable to connect to mount service! - is it running yet?"); |
| return; |
| } |
| mTgtLooper = tgtLooper; |
| mBinderListener = new MountServiceBinderListener(); |
| mMountService.registerListener(mBinderListener); |
| } |

#### UI监听事件

其他应用又向StorageManager注册listener，主要有如下地方：

UsbStorageActivity.java ---UMS开关界面UI切换

StorageNotification.java----实现状态栏通知（在onUsbMassStorageConnectionChange（）中实现，这个函数中可以实现自动弹出usbStorageActivity，关键字POP\_UMS\_ACTIVITY\_ON\_CONNECT）

TabletStatusBar.java---------向StorageManager注册listener，用来显示UMS状态栏通知

MtpService.java--------------Mtp状态变化

### 互斥配置

1.多用户和UMS不能共存

----谷歌默认的方式是采用fuse将/data/media模拟成用户盘，这种模式下支持多用户，但是不能支持UMS。如果要支持UMS那么就不能使用fuse，需要划出USER分区，通过Vold来管理。

目前Android4.4的SDK中通过BoradConfig.mk中的BUILD\_WITH\_UMS这个宏来在二者中切换。

BUILD\_WITH\_UMS = true即支持UMS不支持多用户

BUILD\_WITH\_UMS = false即支持多用户但是不支持UMS

2.CDROOM和UMS不能共存

----CDROOM和UMS在kernel中的实现是类似的，都往/sys/class/android\_usb/f\_mass\_storage/lun/file中写入内容来与kernel通讯。

目前Android4.4的SDK中通过BoradConfig.mk中的BUILD\_WITH\_CDROM来控制是否打开CDROOM，BUILD\_WITH\_CDROM\_PATH来设置iso的路径。注意BUILD\_WITH\_UMS和BUILD\_WITH\_CDROM两者应该是互斥的，不能同时设置成true。

## USB Host分析

当usb口作为host使用时，可以连接u盘，鼠标/键盘，usb音响等设备，针对不同的设备由不同的子系统来处理。

### 输入设备

连接鼠标/键盘/手柄等输入设备时，这些外设被当成是输入设备，归输入子系统管理。设备节点在/dev/input下，输入事件由InputReader调用EventHub来读取，具体请看EventHub的分析。

### 音频设备

外接usb音响等音频设备，这些外设被识别成音频设备，设备节点在/dev/snd/下，归音频系统管理。

### [块设备](https://www.jianshu.com/p/b267c5cedfa9)

连接usb存储设备（u盘，硬盘等）时，设备节点在/dev/bus/usb下，由UsbHostManager.java来管理.

### [rndis](https://baike.baidu.com/item/rndis)

上至下解析，android5.0以上的系统自带了ethernet service，默认开机就会启动，默认ip获取方式是动态分配

#### EthernetService启动

frameworks/base/services/Java/com/android/server/SystemServer.java

|  |
| --- |
| public final class SystemServer {  private static final String ETHERNET\_SERVICE\_CLASS =  **"com.android.server.ethernet.EthernetService**";  public static void main(String[] args) {  new SystemServer().run();  }  private void run() {  startOtherServices();  }  private void startOtherServices() {  if (mPackageManager.hasSystemFeature(PackageManager.FEATURE\_ETHERNET)) {  mSystemServiceManager.startService(ETHERNET\_SERVICE\_CLASS);  }  }  } |

#### EthernetService

[frameworks/opt/net/ethernet/java/com/android/server/ethernet/EthernetService.java](https://link.jianshu.com/?t=http://androidxref.com/5.1.1_r6/xref/frameworks/opt/net/ethernet/java/com/android/server/ethernet/EthernetService.java)

|  |
| --- |
| public final class EthernetService extends SystemService {  private static final String TAG = "EthernetService";  final EthernetServiceImpl mImpl;  public EthernetService(Context context) {  super(context);  mImpl = new EthernetServiceImpl(context);  }  @Override  public void onStart() {  Log.i(TAG, "Registering service " + Context.ETHERNET\_SERVICE);  publishBinderService(Context.ETHERNET\_SERVICE, mImpl);  }  @Override  public void onBootPhase(int phase) {  if (phase == SystemService.PHASE\_SYSTEM\_SERVICES\_READY) {  mImpl.start();  }  }  } |

#### EthernetServiceImpl

frameworks/opt/net/ethernet/java/com/android/server/ethernet/EthernetServiceImpl.java

|  |
| --- |
| public class EthernetServiceImpl extends IEthernetManager.Stub {  public EthernetServiceImpl(Context context) {  mContext = context;  Log.i(TAG, "Creating EthernetConfigStore");  mEthernetConfigStore = new EthernetConfigStore();  mIpConfiguration = mEthernetConfigStore.readIpAndProxyConfigurations();  Log.i(TAG, "Read stored IP configuration: " + mIpConfiguration);  IBinder b = ServiceManager.getService(Context.NETWORKMANAGEMENT\_SERVICE);  mNMService = INetworkManagementService.Stub.asInterface(b);  **mTracker = new EthernetNetworkFactory();**  }  public void start() {  mCM = (ConnectivityManager) mContext.getSystemService(Context.CONNECTIVITY\_SERVICE);  HandlerThread handlerThread = new HandlerThread("EthernetServiceThread");  handlerThread.start();  mHandler = new Handler(handlerThread.getLooper());  mEnabled = getPersistedState();  Log.i(TAG, "Ethernet Persisted Enabled " + mEnabled);  setState(mEnabled); //重要  }  public synchronized void setState(int state) {  enforceChangePermission();  Log.i(TAG, "setState from mState=" + mState + " to state=" + state);  if (mState != state) {  mState = state;  if (state == EthernetManager.ETHERNET\_STATE\_DISABLED) {  setPersistedState(EthernetManager.ETHERNET\_STATE\_DISABLED);  mTracker.stopInterface();  mStarted.set(false);  } else {  setPersistedState(EthernetManager.ETHERNET\_STATE\_ENABLED);  mTracker.stop();  mTracker.start(mContext, mHandler);  mStarted.set(true);  }  }  }  } |

#### EthernetNetworkFactory

frameworks/opt/net/ethernet/java/com/android/server/ethernet/EthernetNetworkFactory.java

|  |
| --- |
| class EthernetNetworkFactory {  EthernetNetworkFactory() {  mNetworkInfo = new NetworkInfo(ConnectivityManager.TYPE\_ETHERNET, 0, NETWORK\_TYPE, "");  mLinkProperties = new LinkProperties();  initNetworkCapabilities();  }  public synchronized void start(Context context, Handler target) {  IBinder b = ServiceManager.getService(Context.NETWORKMANAGEMENT\_SERVICE);  mNMService = INetworkManagementService.Stub.asInterface(b);  mEthernetManager = (EthernetManager) context.getSystemService(Context.ETHERNET\_SERVICE);  mFactory = new LocalNetworkFactory(NETWORK\_TYPE, context, target.getLooper());  mFactory.setCapabilityFilter(mNetworkCapabilities);  mFactory.setScoreFilter(-1); // this set high when we have an iface  mFactory.register();  /\*  public void register() {  if (DBG) log("Registering NetworkFactory");  if (mMessenger == null) {  mMessenger = new Messenger(this);  ConnectivityManager.from(mContext).registerNetworkFactory(mMessenger, LOG\_TAG);  }  }  frameworks/base/services/core/java/com/android/server/ConnectivityService.java  public void registerNetworkFactory(Messenger messenger, String name) {  NetworkFactoryInfo nfi = new NetworkFactoryInfo(name, messenger, new AsyncChannel());  mHandler.sendMessage(mHandler.obtainMessage(EVENT\_REGISTER\_NETWORK\_FACTORY, nfi));  }  private class InternalHandler extends Handler {  public void handleMessage(Message msg) {  case EVENT\_REGISTER\_NETWORK\_FACTORY: {  handleRegisterNetworkFactory((NetworkFactoryInfo)msg.obj);  break;  }  }  }  private void handleRegisterNetworkFactory(NetworkFactoryInfo nfi) {  if (DBG) log("Got NetworkFactory Messenger for " + nfi.name);  mNetworkFactoryInfos.put(nfi.messenger, nfi);  nfi.asyncChannel.connect(mContext, mTrackerHandler, nfi.messenger);  }  \*/  mInterfaceObserver = new InterfaceObserver();  try {  mNMService.registerObserver(mInterfaceObserver);  } catch (RemoteException e) {  Log.e(TAG, "Could not register InterfaceObserver " + e);  }  updateInterfaceState(iface, true); //注册  }  private void updateInterfaceState(String iface, boolean up) {  updateAgent();  mFactory.setScoreFilter(up ? NETWORK\_SCORE : -1); //设置scroe值；这个是网络优先级判断依据  }  public void updateAgent() {  mNetworkAgent.sendNetworkInfo(mNetworkInfo);  }  } |

#### ETHERNET监听NETD进程的socket

##### init.rc

service netd /system/bin/netd

class main

socket netd stream 0660 root system

socket dnsproxyd stream 0660 root inet

socket mdns stream 0660 root system

socket fwmarkd stream 0660 root inet

##### [NetworkManagementService.java](https://link.jianshu.com/?t=http://androidxref.com/5.1.1_r6/xref/frameworks/base/services/core/java/com/android/server/NetworkManagementService.java)

|  |
| --- |
| public static NetworkManagementService create(Context context) throws InterruptedException {  return create(context, NETD\_SOCKET\_NAME);  /\*  private static final String NETD\_SOCKET\_NAME = "netd";  \*/  }  private NetworkManagementService(Context context, String socket) {  mConnector = new NativeDaemonConnector(  new NetdCallbackReceiver(), socket, 10, NETD\_TAG, 160, wl,  FgThread.get().getLooper());  /\*  frameworks/base/services/core/java/com/android/server/NativeDaemonConnector.java  public void run() {  mCallbackHandler = new Handler(mLooper, this);  while (true) {  try {  listenToSocket();  } catch (Exception e) {  loge("Error in NativeDaemonConnector: " + e);  SystemClock.sleep(5000);  }  }  }  private void listenToSocket() throws IOException {  LocalSocketAddress address = determineSocketAddress();  mCallbackHandler.sendMessage();  }  public boolean handleMessage(Message msg) {  mCallbacks.onEvent  }  \*/  }  private class NetdCallbackReceiver implements INativeDaemonConnectorCallbacks {  public boolean onEvent(int code, String raw, String[] cooked) {  notifyInterfaceAdded(cooked[3]);  ......  notifyInterfaceRemoved(cooked[3]);  ......  notifyInterfaceStatusChanged(cooked[3], cooked[4].equals("up"));  ......  notifyInterfaceLinkStateChanged(cooked[3], cooked[4].equals("up"));  }  private void notifyInterfaceLinkStateChanged(String iface, boolean up) {  mObservers.getBroadcastItem(i).interfaceLinkStateChanged(iface, up);  }  } |

##### EthernetNetworkFactory.InterfaceObserver

frameworks/opt/net/ethernet/java/com/android/server/ethernet/EthernetNetworkFactory.java

|  |
| --- |
| private class InterfaceObserver extends BaseNetworkObserver {  public void interfaceLinkStateChanged(String iface, boolean up) {  updateInterfaceState(iface, up);  }  }  private void updateInterfaceState(String iface, boolean up) {  mFactory.setScoreFilter(up ? NETWORK\_SCORE : -1);  } |

##### NetworkFactory

frameworks/base/core/java/android/net/NetworkFactory.java

|  |
| --- |
| public void setScoreFilter(int score) {  sendMessage(obtainMessage(CMD\_SET\_SCORE, score, 0));  }  public void handleMessage(Message msg) {  case CMD\_SET\_SCORE: {  handleSetScore(msg.arg1);  break;  }  }  private void handleSetScore(int score) {  mScore = score;  evalRequests();  }  private void evalRequests() {  for (int i = 0; i < mNetworkRequests.size(); i++) {  NetworkRequestInfo n = mNetworkRequests.valueAt(i);  evalRequest(n);  }  }  private void evalRequest(NetworkRequestInfo n) {  needNetworkFor(n.request, n.score);  }  protected void needNetworkFor(NetworkRequest networkRequest, int score) {  if (++mRefCount == 1) startNetwork();  } |

##### EthernetNetworkFactory. LocalNetworkFactory()

frameworks/opt/net/ethernet/java/com/android/server/ethernet/EthernetNetworkFactory.java

|  |
| --- |
| private class LocalNetworkFactory extends NetworkFactory {  LocalNetworkFactory(String name, Context context, Looper looper) {  super(looper, context, name, new NetworkCapabilities());  }  protected void startNetwork() {  onRequestNetwork();  }  protected void stopNetwork() {  }  }  public void onRequestNetwork() {  Thread dhcpThread = new Thread(new Runnable() {  public void run() {  DhcpResults dhcpResults = new DhcpResults(); //DHCP相关  if (!NetworkUtils.runDhcp(mIface, dhcpResults)) {  /\*  frameworks/base/core/java/android/net/NetworkUtils.java  public native static boolean runDhcp(String interfaceName, DhcpResults dhcpResults);  frameworks/base/core/jni/android\_net\_NetUtils.cp  static jboolean android\_net\_utils\_runDhcp(JNIEnv\* env, jobject clazz, jstring ifname, jobject info)  {  return android\_net\_utils\_runDhcpCommon(env, clazz, ifname, info, false);  }  static jboolean android\_net\_utils\_runDhcpCommon(JNIEnv\* env, jobject clazz, jstring ifname,  jobject dhcpResults, bool renew)  {  if (renew) {  result = ::dhcp\_do\_request\_renew(nameStr, ipaddr, gateway, &prefixLength,  dns, server, &lease, vendorInfo, domains, mtu);  } else {  result = ::dhcp\_do\_request(nameStr, ipaddr, gateway, &prefixLength,  dns, server, &lease, vendorInfo, domains, mtu);  }  }  system/core/libnetutils/dhcp\_utils.c  DHCP Client和DHCP server（system/bin/dhcpd进程）通过property\_get/set 共享内存来共享信息  \*/  Log.e(TAG, "DHCP request error:" + NetworkUtils.getDhcpError());  // set our score lower than any network could go  // so we get dropped.  mFactory.setScoreFilter(-1);  return;  }  mNetworkAgent = new NetworkAgent(mFactory.getLooper(), mContext,  NETWORK\_TYPE, mNetworkInfo, mNetworkCapabilities, mLinkProperties,  NETWORK\_SCORE)  }  });  dhcpThread.start();  } |

配置完成以后ConnectivityService向EthernetManager发送CONNECTIVITY\_ACTION\_IMMEDIATE的广播；EthernetManager接收到该广播以后向应用程序发送ETHERNET\_INTERFACE\_CONF\_CHANGED广播。否则；应用程序将TIMEOUT。

|  |
| --- |
| public static final String EXTRA\_ETHERNET\_STATE = "ETHERNET\_state";  public static final String ETHERNET\_INTERFACE\_CONF\_CHANGED =  "android.net.ethernet.ETHERNET\_INTERFACE\_CONF\_CHANGED"; //add by tank  private void sendEthBroadcast(String action, boolean state) {  String bootStr = SystemProperties.get("sys.boot\_completed");  Log.d(TAG, "sendEthBroadcast -->: " + bootStr);  if(bootStr.equals("1")) { //boot complete  Intent intent = new Intent(action);  intent.putExtra(EXTRA\_ETHERNET\_STATE, state);  Log.d(TAG, "sendEthBroadcast --> action= " + action + " state=" + state);  mContext.sendBroadcast(intent);  }  }  //连接成功调用如下：  sendEthBroadcast(ETHERNET\_INTERFACE\_CONF\_CHANGED, true);  //连接失败调用如下：  sendEthBroadcast(ETHERNET\_INTERFACE\_CONF\_CHANGED, false); |

#### UI监听

网络监听一：设置 packages/apps/Settings/src/com/android/settings/ethernet/EthernetEnabler.java

设置项网络按钮类定义

网络监听二：statusbar frameworks/base/packages/SystemUI/src/com/android/systemui/statusbar/policy/NetworkController.java  
NetworkController本身是个BroadcastReceiver，其中关于网络状态变化的监听消息为EthernetManager.NETWORK\_STATE\_CHANGED\_ACTION，可以猜测这个消息是framework发出来的，往下看。

# Kernel层

<https://android.googlesource.com/kernel/tegra/+/050d171d5e47a539c616ffea9e2da82ef16bb5bc/drivers/usb/gadget/f_accessory.c>

/kernel/drivers/usb/gadget/f\_accessory.c中收到ACCESSORY\_START这个ioctl后（其实是由usb中断传递上来的）就会发送ACCESSORY=START的uevent。

## acc\_ctrlrequest

static int acc\_ctrlrequest(struct usb\_composite\_dev \*cdev,

const struct usb\_ctrlrequest \*ctrl)

{

struct acc\_dev \*dev = \_acc\_dev;

int value = -EOPNOTSUPP;

struct acc\_hid\_dev \*hid;

int offset;

u8 b\_requestType = ctrl->bRequestType;

u8 b\_request = ctrl->bRequest;

u16 w\_index = le16\_to\_cpu(ctrl->wIndex);

u16 w\_value = le16\_to\_cpu(ctrl->wValue);

u16 w\_length = le16\_to\_cpu(ctrl->wLength);

unsigned long flags;

if (b\_requestType == (USB\_DIR\_OUT | USB\_TYPE\_VENDOR)) {

if (b\_request == ACCESSORY\_START) {

dev->start\_requested = 1;

schedule\_delayed\_work(

&dev->start\_work, msecs\_to\_jiffies(10));

value = 0;

}

## acc\_start\_work

|  |
| --- |
| static void acc\_start\_work(struct work\_struct \*data)  { |
| char \*envp[2] = { "ACCESSORY=START", NULL }; |
| kobject\_uevent\_env(&acc\_device.this\_device->kobj, KOBJ\_CHANGE, envp); |
| } |

UsbDeviceManager.java中，接收到uevent后调用startAccessoryMode();--->setCurrentFunctions(xxx)-->设置sys.usb.config这个属性后，就触发init.xxx.usb.rc去通知kernel切换到accessory模式。

这个3399设备的节点为dev/usb\_accessory

# FW层

api定义：

android/hardware/usb/UsbManager.java

**public static final** String ***ACTION\_USB\_ACCESSORY\_ATTACHED*** =**"android.hardware.usb.action.USB\_ACCESSORY\_ATTACHED"**;

相关源码：

UsbSettingsManager.java

**mHandler** = **new** UsbHandler(FgThread.*get*().getLooper());

**public static final** String ***USB\_FUNCTION\_NONE*** = **"none"**;

**public static final** String ***USB\_FUNCTION\_ADB*** = **"adb"**;

**public static final** String ***USB\_FUNCTION\_RNDIS*** = **"rndis"**;

**public static final** String ***USB\_FUNCTION\_MTP*** = **"mtp"**;

**public static final** String ***USB\_FUNCTION\_PTP*** = **"ptp"**;

**public static final** String ***USB\_FUNCTION\_AUDIO\_SOURCE*** = **"audio\_source"**;

**public static final** String ***USB\_FUNCTION\_MIDI*** = **"midi"**;

**public static final** String ***USB\_FUNCTION\_ACCESSORY*** = **"accessory"**;

进入配件模式超时时间为10秒！！

**private static final int *ACCESSORY\_REQUEST\_TIMEOUT*** = 10 \* 1000;

## 注册usb事件

### UsbHandler

**private static final** String ***USB\_STATE\_MATCH*** =  
 **"DEVPATH=/devices/virtual/android\_usb/android0"**;  
**private static final** String ***ACCESSORY\_START\_MATCH*** =  
 **"DEVPATH=/devices/virtual/misc/usb\_accessory"**;

*// Watch for USB configuration changes***mUEventObserver**.startObserving(***USB\_STATE\_MATCH***);  
**mUEventObserver**.startObserving(***ACCESSORY\_START\_MATCH***);

### mUEventObserver

*/\*  
 \* Listens for uevent messages from the kernel to monitor the USB state  
 \*/***private final** UEventObserver **mUEventObserver** = **new** UEventObserver() {  
 @Override  
 **public void** onUEvent(UEventObserver.UEvent event) {  
 **if** (***DEBUG***) Slog.*v*(***TAG***, **"USB UEVENT: "** + event.toString());  
  
 String state = event.get(**"USB\_STATE"**);  
 String accessory = event.get(**"ACCESSORY"**);  
 **if** (state != **null**) {  
 **mHandler**.updateState(state);  
 } **else if** (**"START"**.equals(accessory)) {  
 **if** (***DEBUG***) Slog.*d*(***TAG***, **"got accessory start"**);  
 startAccessoryMode();  
 }  
 }  
};

*2019-04-07 12:15:43.594 3655-3964/? V/UsbDeviceManager: onUEvent(Device Cable) : {DEVNAME=usb\_accessory, SUBSYSTEM=misc, SEQNUM=55367, MAJOR=10, ACTION=change, DEVPATH=/devices/virtual/misc/usb\_accessory, MINOR=20, ACCESSORY=START}*

#### startAccessoryMode

UsbDeviceManager.java中，接收到uevent后调用startAccessoryMode();--->setCurrentFunctions(xxx)-->设置sys.usb.config这个属性后，就触发init.xxx.usb.rc去通知kernel切换到accessory模式。

这个3399设备的节点为dev/usb\_accessory

**private void** startAccessoryMode() {  
 **if** (!**mHasUsbAccessory**) **return**;  
  
 **mAccessoryStrings** = nativeGetAccessoryStrings();  
 **boolean** enableAudio = (nativeGetAudioMode() == ***AUDIO\_MODE\_SOURCE***);  
 *// don't start accessory mode if our mandatory strings have not been set* **boolean** enableAccessory = (**mAccessoryStrings** != **null** &&  
 **mAccessoryStrings**[UsbAccessory.MANUFACTURER\_STRING] != **null** &&  
 **mAccessoryStrings**[UsbAccessory.MODEL\_STRING] != **null**);  
 String functions = **null**;  
  
 **if** (enableAccessory && enableAudio) {  
 functions = UsbManager.USB\_FUNCTION\_ACCESSORY + **","** + UsbManager.USB\_FUNCTION\_AUDIO\_SOURCE;  
 } **else if** (enableAccessory) {  
  **functions = UsbManager.USB\_FUNCTION\_ACCESSORY;**  
 } **else if** (enableAudio) {  
 functions = UsbManager.USB\_FUNCTION\_AUDIO\_SOURCE;  
 }  
  
 **if** (functions != **null**) {  
 **mAccessoryModeRequestTime** = SystemClock.*elapsedRealtime*();  
 setCurrentFunctions(functions);  
 }  
}

C:\k\android-8.0.0\_r1\frameworks\base\services\core\jni\com\_android\_server\_UsbDeviceManager.cpp

nativeGetAccessoryStrings从对端获取到的数据

通过这个设备节点读取#define DRIVER\_NAME **"/dev/usb\_accessory"**

返回值String[] **mAccessoryStrings**

**static** jobjectArray android\_server\_UsbDeviceManager\_getAccessoryStrings(JNIEnv \*env,  
 jobject */\* thiz \*/*)  
{  
 **int** fd = open(DRIVER\_NAME, O\_RDWR);  
 **if** (fd < 0) {  
 ALOGE(**"could not open %s"**, DRIVER\_NAME);  
 **return** NULL;  
 }  
 jclass stringClass = env->FindClass(**"java/lang/String"**);  
 jobjectArray strArray = env->NewObjectArray(6, stringClass, NULL);  
 **if** (!strArray) **goto** out;  
 set\_accessory\_string(env, fd, ACCESSORY\_GET\_STRING\_MANUFACTURER, strArray, 0);  
 set\_accessory\_string(env, fd, ACCESSORY\_GET\_STRING\_MODEL, strArray, 1);  
 set\_accessory\_string(env, fd, ACCESSORY\_GET\_STRING\_DESCRIPTION, strArray, 2);  
 set\_accessory\_string(env, fd, ACCESSORY\_GET\_STRING\_VERSION, strArray, 3);  
 set\_accessory\_string(env, fd, ACCESSORY\_GET\_STRING\_URI, strArray, 4);  
 set\_accessory\_string(env, fd, ACCESSORY\_GET\_STRING\_SERIAL, strArray, 5);  
  
out:  
 close(fd);  
 **return** strArray;  
}

**static void** set\_accessory\_string(JNIEnv \*env, **int** fd, **int** cmd, jobjectArray strArray, **int** index)  
{  
 **char** buffer[256];  
  
 buffer[0] = 0;  
 ioctl(fd, cmd, buffer);  
 **if** (buffer[0]) {  
 jstring obj = env->NewStringUTF(buffer);  
 env->SetObjectArrayElement(strArray, index, obj);  
 env->DeleteLocalRef(obj);  
 }  
}

C:\k\android-8.0.0\_r1\bionic\libc\kernel\android\uapi\linux\usb\f\_accessory.h

#define ACCESSORY\_GET\_STRING\_MANUFACTURER \_IOW(**'M'**, 1, **char**[256])

#### setCurrentFunctions

functions= ***USB\_FUNCTION\_ACCESSORY*** = **"accessory"**

**public void** setCurrentFunctions(String functions) {  
 **if** (***DEBUG***) Slog.*d*(***TAG***, **"setCurrentFunctions("** + functions + **")"**);  
 **mHandler**.sendMessage(***MSG\_SET\_CURRENT\_FUNCTIONS***, functions);  
}

**case** MSG\_SET\_CURRENT\_FUNCTIONS:  
 String functions = (String)msg.obj;  
 setEnabledFunctions(functions, **false**);  
 **break**;

#### setEnabledFunctions

setEnabledFunctions(**"accessory"**, **false**);

**private void** setEnabledFunctions(String functions, **boolean** forceRestart) {  
 **if** (***DEBUG***) Slog.*d*(***TAG***, **"setEnabledFunctions functions="** + functions + **", "** + **"forceRestart="** + forceRestart);  
  
 *// Try to set the enabled functions.* **final** String oldFunctions = **mCurrentFunctions**;  
 **final boolean** oldFunctionsApplied = **mCurrentFunctionsApplied**;  
 **if** (trySetEnabledFunctions(functions, forceRestart)) {  
 **return**;  
 }  
  
 *// Didn't work. Try to revert changes.  
 // We always reapply the policy in case certain constraints changed such as  
 // user restrictions independently of any other new functions we were  
 // trying to activate.* **if** (oldFunctionsApplied && !oldFunctions.equals(functions)) {  
 Slog.*e*(***TAG***, **"Failsafe 1: Restoring previous USB functions."**);  
 **if** (trySetEnabledFunctions(oldFunctions, **false**)) {  
 **return**;  
 }  
 }

#### trySetEnabledFunctions

每次更新都会带上adb的原因咯，不然掉线了哈

trySetEnabledFunctions(**"accessory"**, **false**);

**private boolean** trySetEnabledFunctions(String functions, **boolean** forceRestart) {  
 **if** (functions == **null**) {  
 functions = getDefaultFunctions();  
 }  
 functions = applyAdbFunction(functions);  
 functions = applyOemOverrideFunction(functions);  
  
 **if** (!**mCurrentFunctions**.equals(functions) || !**mCurrentFunctionsApplied** || forceRestart) {  
 Slog.*i*(***TAG***, **"Setting USB config to "** + functions);  
 **mCurrentFunctions** = functions;  
 **mCurrentFunctionsApplied** = **false**;  
  
 *// Kick the USB stack to close existing connections.* setUsbConfig(UsbManager.USB\_FUNCTION\_NONE);  
  
 *// Set the new USB configuration.* **if** (!setUsbConfig(functions)) {  
 Slog.*e*(***TAG***, **"Failed to switch USB config to "** + functions);  
 **return false**;  
 }  
  
 **mCurrentFunctionsApplied** = **true**;  
 }  
 **return true**;  
}

**private** String applyAdbFunction(String functions) {  
 **if** (**mAdbEnabled**) {  
 functions = UsbManager.addFunction(functions, UsbManager.USB\_FUNCTION\_ADB);  
 } **else** {  
 functions = UsbManager.removeFunction(functions, UsbManager.USB\_FUNCTION\_ADB);  
 }  
 **return** functions;  
}

Setting USB config [mtp,adb] to [accessory,adb]

#### setUsbConfig

setUsbConfig(accessory,adb)

**private boolean** setUsbConfig(String config) {  
 **if** (***DEBUG***) Slog.*d*(***TAG***, **"setUsbConfig("** + config + **")"**);  
 *// set the new configuration  
 // we always set it due to b/23631400, where adbd was getting killed  
 // and not restarted due to property timeouts on some devices* SystemProperties.*set*(***USB\_CONFIG\_PROPERTY***, config);  
 **return** waitForState(config);  
}  
**private static final** String ***USB\_CONFIG\_PROPERTY*** = **"sys.usb.config"**;

## 内部路由事件

mHandler.updateState(state);

### updateState(String state)

**public void** updateState(String state) {  
 **int** connected, configured;  
  
 **if** (**"DISCONNECTED"**.equals(state)) {  
 connected = 0;  
 configured = 0;  
 } **else if** (**"CONNECTED"**.equals(state)) {  
 connected = 1;  
 configured = 0;  
 } **else if** (**"CONFIGURED"**.equals(state)) {  
 connected = 1;  
 configured = 1;  
 } **else** {  
 Slog.*e*(***TAG***, **"unknown state "** + state);  
 **return**;  
 }  
 removeMessages(***MSG\_UPDATE\_STATE***);  
 Message msg = Message.*obtain*(**this**, ***MSG\_UPDATE\_STATE***);  
 msg.**arg1** = connected;  
 msg.**arg2** = configured;  
 *// debounce disconnects to avoid problems bringing up USB tethering* sendMessageDelayed(msg, (connected == 0) ? ***UPDATE\_DELAY*** : 0);  
}

### handleMessage

**case** MSG\_UPDATE\_STATE:  
 mConnected = (msg.arg1 == 1);  
 mConfigured = (msg.arg2 == 1);  
 **if** (!mConnected) {  
 *// When a disconnect occurs, relock access to sensitive user data* mUsbDataUnlocked = **false**;  
 }  
 updateUsbNotification();  
 updateAdbNotification();  
 **if** (UsbManager.containsFunction(mCurrentFunctions,  
 UsbManager.USB\_FUNCTION\_ACCESSORY)) {  
 updateCurrentAccessory();  
 } **else if** (!mConnected) {  
 *// restore defaults when USB is disconnected* setEnabledFunctions(**null**, **false**);  
 }  
 **if** (mBootCompleted) {  
 updateUsbStateBroadcastIfNeeded();  
 updateUsbFunctions();  
 }

启动完成之后才会发广播，因此可能会遗漏事件

### updateCurrentAccessory

**mCurrentAccessory** = **new** UsbAccessory(**mAccessoryStrings**);

com/android/server/usb/UsbSettingsManager.java

## 查找接收者UsbSettingsManager .accessoryAttached

**public void** accessoryAttached(UsbAccessory accessory) {  
 Intent **intent** = **new** Intent(UsbManager.***ACTION\_USB\_ACCESSORY\_ATTACHED***);  
 intent.putExtra(UsbManager.***EXTRA\_ACCESSORY***, accessory);  
 intent.addFlags(Intent.***FLAG\_ACTIVITY\_NEW\_TASK***);  
  
 ArrayList<ResolveInfo> matches;  
 String defaultPackage;  
 **synchronized** (**mLock**) {  
 matches = getAccessoryMatchesLocked(accessory, intent);  
 *// Launch our default activity directly, if we have one.  
 // Otherwise we will start the UsbResolverActivity to allow the user to choose.* defaultPackage = **mAccessoryPreferenceMap**.get(**new** AccessoryFilter(accessory));  
 }  
  
 resolveActivity(**intent**, matches, defaultPackage, **null**, accessory);  
}

### getAccessoryMatchesLocked

**private final** ArrayList<ResolveInfo> getAccessoryMatchesLocked(  
 UsbAccessory accessory, Intent intent) {  
 ArrayList<ResolveInfo> matches = **new** ArrayList<ResolveInfo>();  
 List<ResolveInfo> resolveInfos = **mPackageManager**.queryIntentActivities(intent,  
 PackageManager.***GET\_META\_DATA***);  
 **int** count = resolveInfos.size();  
 **for** (**int** i = 0; i < count; i++) {  
 ResolveInfo resolveInfo = resolveInfos.get(i);  
 **if** (packageMatchesLocked(resolveInfo, intent.getAction(), **null**, accessory)) {  
 matches.add(resolveInfo);  
 }  
 }  
 **return** matches;  
}

### packageMatchesLocked

**if** (accessory != **null** && **"usb-accessory"**.equals(tagName)) {  
 AccessoryFilter filter = AccessoryFilter.*read*(parser);  
 **if** (filter.matches(accessory)) {  
 **return true**;  
 }  
}

### AccessoryFilter

**public static** AccessoryFilter read(XmlPullParser parser)  
 **throws** XmlPullParserException, IOException {  
 String manufacturer = **null**;  
 String model = **null**;  
 String version = **null**;  
  
 **int** count = parser.getAttributeCount();  
 **for** (**int** i = 0; i < count; i++) {  
 String name = parser.getAttributeName(i);  
 String value = parser.getAttributeValue(i);  
  
 **if** (**"manufacturer"**.equals(name)) {  
 manufacturer = value;  
 } **else if** (**"model"**.equals(name)) {  
 model = value;  
 } **else if** (**"version"**.equals(name)) {  
 version = value;  
 }  
 }  
 **return new** AccessoryFilter(manufacturer, model, version);  
}

**public boolean** matches(AccessoryFilter f) {  
 **if** (**mManufacturer** != **null** && !f.**mManufacturer**.equals(**mManufacturer**)) **return false**;  
 **if** (**mModel** != **null** && !f.**mModel**.equals(**mModel**)) **return false**;  
 **if** (**mVersion** != **null** && !f.**mVersion**.equals(**mVersion**)) **return false**;  
 **return true**;  
}

## 接收者转发

### FW层路由UsbSettingsManager. resolveActivity

*// don't show the resolver activity if there are no choices available***if** (count == 0) {  
 **if** (accessory != **null**) {  
 String uri = accessory.getUri();  
 **if** (uri != **null** && uri.length() > 0) {  
 *// display URI to user  
 // start UsbResolverActivity so user can choose an activity* Intent dialogIntent = **new** Intent();  
 dialogIntent.setClassName(**"com.android.systemui"**,  
 **"com.android.systemui.usb.UsbAccessoryUriActivity"**);  
 dialogIntent.addFlags(Intent.***FLAG\_ACTIVITY\_NEW\_TASK***);  
 dialogIntent.putExtra(UsbManager.***EXTRA\_ACCESSORY***, accessory);  
 dialogIntent.putExtra(**"uri"**, uri);  
 **try** {  
 **mUserContext**.startActivityAsUser(dialogIntent, **mUser**);  
 } **catch** (ActivityNotFoundException e) {  
 Slog.*e*(***TAG***, **"unable to start UsbAccessoryUriActivity"**);  
 }  
 }  
 }  
  
 *// do nothing* **return**;  
}

**if** (defaultRI != **null**) {  
 *// grant permission for default activity* **if** (device != **null**) {  
 grantDevicePermission(device, defaultRI.**activityInfo**.**applicationInfo**.**uid**);  
 } **else if** (accessory != **null**) {  
 grantAccessoryPermission(accessory, defaultRI.**activityInfo**.**applicationInfo**.**uid**);  
 }  
  
 *// start default activity directly* **try** {  
 intent.setComponent(  
 **new** ComponentName(defaultRI.**activityInfo**.**packageName**,  
 defaultRI.**activityInfo**.**name**));  
 **mUserContext**.startActivityAsUser(intent, **mUser**);  
 } **catch** (ActivityNotFoundException e) {  
 Slog.*e*(***TAG***, **"startActivity failed"**, e);  
 }  
} **else** {  
 Intent resolverIntent = **new** Intent();  
 resolverIntent.addFlags(Intent.***FLAG\_ACTIVITY\_NEW\_TASK***);  
  
  **if (count == 1) {**  
 *// start UsbConfirmActivity if there is only one choice* resolverIntent.setClassName(**"com.android.systemui"**,  
 **"com.android.systemui.usb.UsbConfirmActivity"**);  
 resolverIntent.putExtra(**"rinfo"**, matches.get(0));  
  
 **if** (device != **null**) {  
 resolverIntent.putExtra(UsbManager.***EXTRA\_DEVICE***, device);  
 } **else** {  
 resolverIntent.putExtra(UsbManager.***EXTRA\_ACCESSORY***, accessory);  
 }  
 } **else** {  
 *// start UsbResolverActivity so user can choose an activity* resolverIntent.setClassName(**"com.android.systemui"**,  
 **"com.android.systemui.usb.UsbResolverActivity"**);  
  **resolverIntent.putParcelableArrayListExtra("rlist", matches);**  
 resolverIntent.putExtra(Intent.***EXTRA\_INTENT***, intent);  
 }  
 **try** {  
 **mUserContext**.startActivityAsUser(resolverIntent, **mUser**);  
 } **catch** (ActivityNotFoundException e) {  
 Slog.*e*(***TAG***, **"unable to start activity "** + resolverIntent);  
 }  
}

### 系统APP层

Systemui.UsbResolverActivity

### 第三方app层

## 架构图

时序图

# 实战问题

多次插拔USB线，系统异常，并且造成系统奔溃

## TODO

**public class** UsbConfirmActivity **extends** AlertActivity

# 三.相关API

## 1.两个相关的类

| **Class** | **Description** |
| --- | --- |
| [UsbManager](https://developer.android.com/reference/android/hardware/usb/UsbManager.html) | 允许枚举已连接的USB设备并与其通信 |
| [UsbAccessory](https://developer.android.com/reference/android/hardware/usb/UsbAccessory.html) | 是代表USB配件的类，该类提供了方法访问配件的信息 |

通过

UsbManager manager = UsbManager.getInstance(this);或

UsbManager manager = (UsbManager) getSystemService(Context.USB\_SERVICE);

UsbAccessory accessory = UsbManager.getAccessory(intent);或

UsbAccessory accessory = (UsbAccessory) intent.getParcelableExtra(UsbManager.EXTRA\_ACCESSORY);

来获取这两个类的实例

## 2.Android manifest

* 声明<uses-feature android:name="android.hardware.usb.accessory" />
* 为主活动中的 android.hardware.usb.action.USB\_ACCESSORY\_ATTACHED 意图指定<intent-filter>和<meta-data>元素对。<meta-data>元素指向外部XML资源文件，该文件声明有关要检测的附件的标识信息。
* 在XML资源文件中，声明要过滤的附件的<usb-accessory>元素。每个<usb-accessory>都可以具有以下属性：manufacturer，model，version，将资源文件保存在res / xml /目录中。资源文件名（不带.xml扩展名）必须与在<meta-data>元素中指定的名称相同。

示例：

**AndroidManifest.xml**

|  |
| --- |
| <manifest ...>      <uses-feature android:name="android.hardware.usb.accessory" />        <uses-sdk android:minSdkVersion="<version>" />      ...      <application>        <uses-library android:name="com.android.future.usb.accessory" />          <activity ...>              ...              <intent-filter>                  <action android:name="android.hardware.usb.action.USB\_ACCESSORY\_ATTACHED" />              </intent-filter>                <meta-data android:name="android.hardware.usb.action.USB\_ACCESSORY\_ATTACHED"                  android:resource="@xml/accessory\_filter" />          </activity>      </application>  </manifest> |

**res/xml/accessory\_filter.xml：**

|  |
| --- |
| <?xml version="1.0" encoding="utf-8"?>  <resources>      <usb-accessory model="DemoKit" manufacturer="Google" version="1.0"/>  </resources> |

# 四.通信过程

## 1.监听usb设备attach

先注册监听usb设备attach的广播，然后通过

|  |
| --- |
| list = usbManager.getAccessoryList();  accessory = list[0]; |

拿到辅助设备UsbAccessory的对象

## 2.授权

注册监听授权的广播，可以和监听usb设备attach的receiver合并

|  |  |
| --- | --- |
| 1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20  21  22 | private static final String ACTION\_USB\_PERMISSION =      "com.android.example.USB\_PERMISSION";  private final BroadcastReceiver mUsbReceiver = new BroadcastReceiver() {        public void onReceive(Context context, Intent intent) {          String action = intent.getAction();          if (ACTION\_USB\_PERMISSION.equals(action)) {              synchronized (this) {                  UsbAccessory accessory = (UsbAccessory) intent.getParcelableExtra(UsbManager.EXTRA\_ACCESSORY);                    if (intent.getBooleanExtra(UsbManager.EXTRA\_PERMISSION\_GRANTED, false)) {                      if(accessory != null){                          //call method to set up accessory communication                      }                  }                  else {                      Log.d(TAG, "permission denied for accessory " + accessory);                  }              }          }      }  }; |

在Activity onCreat()注册此receiver

|  |
| --- |
| UsbManager mUsbManager = (UsbManager) getSystemService(Context.USB\_SERVICE);  private static final String ACTION\_USB\_PERMISSION =      "com.android.example.USB\_PERMISSION";  ...  mPermissionIntent = PendingIntent.getBroadcast(this, 0, new Intent(ACTION\_USB\_PERMISSION), 0);  IntentFilter filter = new IntentFilter(ACTION\_USB\_PERMISSION);  registerReceiver(mUsbReceiver, filter); |

在检测到usb设备attach后请求权限

|  |
| --- |
| UsbAccessory accessory;  ...  mUsbManager.requestPermission(accessory, mPermissionIntent); |

## 3.通信

授权成功后可以通过文件描述符进行通信

|  |
| --- |
| UsbAccessory mAccessory;  ParcelFileDescriptor mFileDescriptor;  FileInputStream mInputStream;  FileOutputStream mOutputStream;    ...    private void openAccessory() {      Log.d(TAG, "openAccessory: " + accessory);      mFileDescriptor = mUsbManager.openAccessory(mAccessory);      if (mFileDescriptor != null) {          FileDescriptor fd = mFileDescriptor.getFileDescriptor();          mInputStream = new FileInputStream(fd);          mOutputStream = new FileOutputStream(fd);          Thread thread = new Thread(null, this, "AccessoryThread");          thread.start();      }  } |

## 4.设备退出后关闭fd，清理

|  |
| --- |
| BroadcastReceiver mUsbReceiver = new BroadcastReceiver() {      public void onReceive(Context context, Intent intent) {          String action = intent.getAction();            if (UsbManager.ACTION\_USB\_ACCESSORY\_DETACHED.equals(action)) {              UsbAccessory accessory = (UsbAccessory)intent.getParcelableExtra(UsbManager.EXTRA\_ACCESSORY);              if (accessory != null) {                  // call your method that cleans up and closes communication with the accessory                  mFileDescriptor.close()                  ...              }          }      }  }; |

# Host-bulk

连接usb存储设备（u盘，硬盘等）时，设备节点在/dev/bus/usb下，由UsbHostManager.java来管理

Android设备最早都是以PC的USB外设形式而存在,主要功能就是[Android fastboot](https://link.jianshu.com/?t=http://en.wikipedia.org/wiki/Android_software_development" \l "Fastboot" \t "_blank) 或[Android Debug Bridge (adb)](https://link.jianshu.com/?t=http://developer.android.com/tools/help/adb.html" \t "_blank),都是基于bulk传输模式的.

## 启动原理

### UsbService.java中的systemReady

1. fw/services/\*\*\*/usb/UsbService.java中的systemReady()调用mHostManager.systemReady()。

UsbService监听启动完成的科学方法

**public class** UsbService **extends** IUsbManager.Stub {  
  
 **public static class** Lifecycle **extends** SystemService {  
 **private** UsbService **mUsbService**;  
  
 **public** Lifecycle(Context context) {  
 **super**(context);  
 }  
  
 @Override  
 **public void** onStart() {  
 **mUsbService** = **new** UsbService(getContext());  
 publishBinderService(Context.***USB\_SERVICE***, **mUsbService**);  
 }  
  
 @Override  
 **public void** onBootPhase(**int** phase) {  
 **if** (phase == SystemService.***PHASE\_ACTIVITY\_MANAGER\_READY***) {  
 **mUsbService**.systemReady();  
 } **else if** (phase == SystemService.***PHASE\_BOOT\_COMPLETED***) {  
 **mUsbService**.bootCompleted();  
 }  
 }  
 }

**public void** systemReady() {  
 **if** (**this**.mDeviceManager != **null**) {  
 **this**.mDeviceManager.systemReady();  
 }  
  
 **if** (**this**.mHostManager != **null**) {  
 **this**.mHostManager.systemReady();  
 }  
  
}

### UsbHostManager. monitorUsbHostBus

UsbHostManager.java的systemReady中启动一个线程来运行monitorUsbHostBus();

**public void** systemReady() {  
 **synchronized** (**mLock**) {  
 *// Create a thread to call into native code to wait for USB host events.  
 // This thread will call us back on usbDeviceAdded and usbDeviceRemoved.* Runnable runnable = **new** Runnable() {  
 **public void** run() {  
 monitorUsbHostBus();  
 }  
 };  
 **new** Thread(**null**, runnable, **"UsbService host thread"**).start();  
 }  
}

**private native void** monitorUsbHostBus();

### jni.monitorUsbHostBus

frameworks/base/services/core/jni/com\_android\_server\_UsbHostManager.cpp

android\_server\_UsbHostManager\_monitorUsbHostBus函数，在这个函数调用了usb\_host\_init函数，创建了一个INotify的fd，以及创建了一个usb\_host\_context对象。usb\_host\_run函数就是循环读取INotify的fd的事件，我们把usb\_device\_added, usb\_device\_removed两个回调函数也传入了usb\_host\_run函数了。

---------------------

|  |
| --- |
| static void android\_server\_UsbHostManager\_monitorUsbHostBus(JNIEnv \*env, jobject thiz)  { |
| struct usb\_host\_context\* context = **usb\_host\_ini**t(); |
| if (!context) { |
| ALOGE("usb\_host\_init failed"); |
| return; |
| } |
| // this will never return so it is safe to pass thiz directly |
| **usb\_host\_run**(context, usb\_device\_added, usb\_device\_removed, NULL, (void \*)thiz); |
| } |

其中分别调用到了system/core/libusbhost/usbhost.c中的usb\_host\_init(...)和usb\_host\_run(...)

#### libusbhost .usb\_host\_init

在usb\_host\_init()中，最主要的是初始化context->fd = inotify\_init();，这个会在后面用来监听**/dev/bus/usb**目录的创建和删除

usb\_host\_init是在system\core\libusbhost\usbhost.c文件中，这个函数中新建一个usb\_host\_context对象，还有新建了一个INotify，并且usb\_host\_context的fd就是INotify的fd。

#### libusbhost .usb\_host\_run

在usb\_host\_run中，主要是添加监控的目录ret = inotify\_add\_watch(context->fd, path, IN\_CREATE | IN\_DELETE);如果发现目录有create或者是delete操作，通知回调函数usb\_device\_added和usb\_device\_removed

我们再来看看usb\_host\_run函数。先调用了usb\_host\_load函数，这个函数主要把add和remove的回调，放到context相应的成员变量中，然后增加了dev目录放入INotify的观察。下面循环调用usb\_host\_read\_event函数去读取INotify fd的事件。

void usb\_host\_run(struct usb\_host\_context \*context,

usb\_device\_added\_cb added\_cb,

usb\_device\_removed\_cb removed\_cb,

usb\_discovery\_done\_cb discovery\_done\_cb,

void \*client\_data)

{

int done;

done = usb\_host\_load(context, added\_cb, removed\_cb, discovery\_done\_cb, client\_data);

while (!done) {

done = usb\_host\_read\_event(context);

}

}

usb\_host\_load函数先把add和remove的两个回调设置到usb\_host\_context 中，然后将dev目录放入INotify观察。然后调用watch\_existing\_subdirs将/dev/bus/usb下的目录都添加到INotify中观察，最后再调用find\_existing\_devices函数，把找到的设备调用added\_cb（增加的回调函数）

int usb\_host\_load(struct usb\_host\_context \*context,

usb\_device\_added\_cb added\_cb,

usb\_device\_removed\_cb removed\_cb,

usb\_discovery\_done\_cb discovery\_done\_cb,

void \*client\_data)

{

int done = 0;

int i;

context->cb\_added = added\_cb;//回调赋值

context->cb\_removed = removed\_cb;

context->data = client\_data;

D("Created device discovery thread\n");

/\* watch for files added and deleted within USB\_FS\_DIR \*/

context->wddbus = -1;

for (i = 0; i < MAX\_USBFS\_WD\_COUNT; i++)

context->wds[i] = -1;

/\* watch the root for new subdirectories \*/

context->wdd = inotify\_add\_watch(context->fd, DEV\_DIR, IN\_CREATE | IN\_DELETE);//将dev目录放入INotify观察

if (context->wdd < 0) {

fprintf(stderr, "inotify\_add\_watch failed\n");

if (discovery\_done\_cb)

discovery\_done\_cb(client\_data);

return done;

}

watch\_existing\_subdirs(context, context->wds, MAX\_USBFS\_WD\_COUNT);

/\* check for existing devices first, after we have inotify set up \*/

done = find\_existing\_devices(added\_cb, client\_data);

if (discovery\_done\_cb)

done |= discovery\_done\_cb(client\_data);

return done;

}

watch\_existing\_subdirs，就是将/dev/bus/usb下的设备目录（001开始到MAX\_USBFS\_WD\_COUNT值都inotify\_add\_watch）都添加到INotify中去。

static void watch\_existing\_subdirs(struct usb\_host\_context \*context,

int \*wds, int wd\_count)

{

char path[100];

int i, ret;

wds[0] = inotify\_add\_watch(context->fd, USB\_FS\_DIR, IN\_CREATE | IN\_DELETE);

if (wds[0] < 0)

return;

/\* watch existing subdirectories of USB\_FS\_DIR \*/

for (i = 1; i < wd\_count; i++) {

snprintf(path, sizeof(path), USB\_FS\_DIR "/%03d", i);

ret = inotify\_add\_watch(context->fd, path, IN\_CREATE | IN\_DELETE);

if (ret >= 0)

wds[i] = ret;

}

}

然后我们再来看find\_existing\_devices函数，就是遍历dev/bus/usb的目录然后再调用find\_existing\_devices\_bus函数

static int find\_existing\_devices(usb\_device\_added\_cb added\_cb,

void \*client\_data)

{

char busname[32];

DIR \*busdir;

struct dirent \*de;

int done = 0;

busdir = opendir(USB\_FS\_DIR);

if(busdir == 0) return 0;

while ((de = readdir(busdir)) != 0 && !done) {

if(badname(de->d\_name)) continue;

snprintf(busname, sizeof(busname), USB\_FS\_DIR "/%s", de->d\_name);

done = find\_existing\_devices\_bus(busname, added\_cb,

client\_data);

} //end of busdir while

closedir(busdir);

return done;

}

find\_existing\_devices\_bus函数，就是将dev/bus/usb下的目录比如001，然后001目录里面的文件，作为一个设备（组成一个devname），再调用added\_cb（增加设备的回调函数）

static int find\_existing\_devices\_bus(char \*busname,

usb\_device\_added\_cb added\_cb,

void \*client\_data)

{

char devname[32];

DIR \*devdir;

struct dirent \*de;

int done = 0;

devdir = opendir(busname);

if(devdir == 0) return 0;

while ((de = readdir(devdir)) && !done) {

if(badname(de->d\_name)) continue;

snprintf(devname, sizeof(devname), "%s/%s", busname, de->d\_name);

done = added\_cb(devname, client\_data);

} // end of devdir while

closedir(devdir);

return done;

}

因此总结下usb\_host\_load函数就是把增加、去除设备的回调赋值到usb\_host\_context 的相关变量中，然后增加相关目录的观察，最后查找已经存在的设备调用added\_cb（增加设备的回调函数）。

然后我们再来看看usb\_host\_read\_event函数，这个函数就是去INotify中的fd读取相关的事件。具体分析我们就看注释，有一点我们要注意了，除了增加bus目录失败返回的done是1，其他的返回的done都是0.也就是我们的usb\_host\_run函数会在while循环中一直循环。

int usb\_host\_read\_event(struct usb\_host\_context \*context)

{

struct inotify\_event\* event;

char event\_buf[512];

char path[100];

int i, ret, done = 0;

int offset = 0;

int wd;

ret = read(context->fd, event\_buf, sizeof(event\_buf));

if (ret >= (int)sizeof(struct inotify\_event)) {

while (offset < ret && !done) {

event = (struct inotify\_event\*)&event\_buf[offset];

done = 0;

wd = event->wd;

if (wd == context->wdd) {

if ((event->mask & IN\_CREATE) && !strcmp(event->name, "bus")) {//增加bus目录，并且将bus目录也增加到watch中

context->wddbus = inotify\_add\_watch(context->fd, DEV\_BUS\_DIR, IN\_CREATE | IN\_DELETE);

if (context->wddbus < 0) {

done = 1;//增加bus目录失败

} else {

watch\_existing\_subdirs(context, context->wds, MAX\_USBFS\_WD\_COUNT);

done = find\_existing\_devices(context->cb\_added, context->data);

}

}

} else if (wd == context->wddbus) {

if ((event->mask & IN\_CREATE) && !strcmp(event->name, "usb")) {//如果是dev/bus目录的事件

watch\_existing\_subdirs(context, context->wds, MAX\_USBFS\_WD\_COUNT);//将dev/bus/usb目录再增加到watch

done = find\_existing\_devices(context->cb\_added, context->data);//然后再看看usb下面时候有设备，有就调用添加函数

} else if ((event->mask & IN\_DELETE) && !strcmp(event->name, "usb")) {

for (i = 0; i < MAX\_USBFS\_WD\_COUNT; i++) {

if (context->wds[i] >= 0) {

inotify\_rm\_watch(context->fd, context->wds[i]);//是删除事件，就把这个watch删除了

context->wds[i] = -1;

}

}

}

} else if (wd == context->wds[0]) {//是第一个wds，也就是dev/bus/usb目录的事件

i = atoi(event->name);

snprintf(path, sizeof(path), USB\_FS\_DIR "/%s", event->name);

D("%s subdirectory %s: index: %d\n", (event->mask & IN\_CREATE) ?

"new" : "gone", path, i);

if (i > 0 && i < MAX\_USBFS\_WD\_COUNT) {

int local\_ret = 0;

if (event->mask & IN\_CREATE) {

local\_ret = inotify\_add\_watch(context->fd, path,//我们需要把usb下新增的目录也增加到watch中

IN\_CREATE | IN\_DELETE);

if (local\_ret >= 0)

context->wds[i] = local\_ret;

done = find\_existing\_devices\_bus(path, context->cb\_added,//然后再看看是否有已经存在的设备

context->data);

} else if (event->mask & IN\_DELETE) {

inotify\_rm\_watch(context->fd, context->wds[i]);

context->wds[i] = -1;

}

}

} else {

for (i = 1; (i < MAX\_USBFS\_WD\_COUNT) && !done; i++) {//最后剩下的肯定是dev/bus/usb下目录的事件

if (wd == context->wds[i]) {

snprintf(path, sizeof(path), USB\_FS\_DIR "/%03d/%s", i, event->name);

if (event->mask == IN\_CREATE) {//这里就直接调用增加设备或者删除设备的回调函数。

D("new device %s\n", path);

done = context->cb\_added(path, context->data);

} else if (event->mask == IN\_DELETE) {

D("gone device %s\n", path);

done = context->cb\_removed(path, context->data);

}

}

}

}

offset += sizeof(struct inotify\_event) + event->len;//读取的字节数增加

}

}

return done;

}

usb\_device\_added函数会调用UsbHostManager的beginUsbDeviceAdded和endUsbDeviceAdded函数，在UsbHostManager中会新建一个UsbDevice，然后放入mDevices中。

static int usb\_device\_added(const char \*devname, void\* client\_data) {

struct usb\_descriptor\_header\* desc;

struct usb\_descriptor\_iter iter;

struct usb\_device \*device = usb\_device\_open(devname);

if (!device) {

ALOGE("usb\_device\_open failed\n");

return 0;

}

JNIEnv\* env = AndroidRuntime::getJNIEnv();

jobject thiz = (jobject)client\_data;

const usb\_device\_descriptor\* deviceDesc = usb\_device\_get\_device\_descriptor(device);

char \*manufacturer = usb\_device\_get\_manufacturer\_name(device);

char \*product = usb\_device\_get\_product\_name(device);

int version = usb\_device\_get\_version(device);

char \*serial = usb\_device\_get\_serial(device);

jstring deviceName = env->NewStringUTF(devname);

jstring manufacturerName = AndroidRuntime::NewStringLatin1(env, manufacturer);

jstring productName = AndroidRuntime::NewStringLatin1(env, product);

jstring serialNumber = AndroidRuntime::NewStringLatin1(env, serial);

jboolean result = env->CallBooleanMethod(thiz, method\_beginUsbDeviceAdded,

deviceName, usb\_device\_get\_vendor\_id(device), usb\_device\_get\_product\_id(device),

deviceDesc->bDeviceClass, deviceDesc->bDeviceSubClass, deviceDesc->bDeviceProtocol,

manufacturerName, productName, version, serialNumber);

env->DeleteLocalRef(serialNumber);

env->DeleteLocalRef(productName);

env->DeleteLocalRef(manufacturerName);

env->DeleteLocalRef(deviceName);

free(manufacturer);

free(product);

free(serial);

if (!result) goto fail;

usb\_descriptor\_iter\_init(device, &iter);

while ((desc = usb\_descriptor\_iter\_next(&iter)) != NULL) {

if (desc->bDescriptorType == USB\_DT\_CONFIG) {

struct usb\_config\_descriptor \*config = (struct usb\_config\_descriptor \*)desc;

char \*name = usb\_device\_get\_string(device, config->iConfiguration);

jstring configName = AndroidRuntime::NewStringLatin1(env, name);

env->CallVoidMethod(thiz, method\_addUsbConfiguration,

config->bConfigurationValue, configName, config->bmAttributes,

config->bMaxPower);

env->DeleteLocalRef(configName);

free(name);

} else if (desc->bDescriptorType == USB\_DT\_INTERFACE) {

struct usb\_interface\_descriptor \*interface = (struct usb\_interface\_descriptor \*)desc;

char \*name = usb\_device\_get\_string(device, interface->iInterface);

jstring interfaceName = AndroidRuntime::NewStringLatin1(env, name);

env->CallVoidMethod(thiz, method\_addUsbInterface,

interface->bInterfaceNumber, interfaceName, interface->bAlternateSetting,

interface->bInterfaceClass, interface->bInterfaceSubClass,

interface->bInterfaceProtocol);

env->DeleteLocalRef(interfaceName);

free(name);

} else if (desc->bDescriptorType == USB\_DT\_ENDPOINT) {

struct usb\_endpoint\_descriptor \*endpoint = (struct usb\_endpoint\_descriptor \*)desc;

env->CallVoidMethod(thiz, method\_addUsbEndpoint,

endpoint->bEndpointAddress, endpoint->bmAttributes,

\_\_le16\_to\_cpu(endpoint->wMaxPacketSize), endpoint->bInterval);

}

}

env->CallVoidMethod(thiz, method\_endUsbDeviceAdded);

fail:

usb\_device\_close(device);

checkAndClearExceptionFromCallback(env, \_\_FUNCTION\_\_);

return 0;

}

去除函数，也会调用UsbHostManager的usbDeviceRemoved函数，注意这个函数返回就是0

static int usb\_device\_removed(const char \*devname, void\* client\_data) {

JNIEnv\* env = AndroidRuntime::getJNIEnv();

jobject thiz = (jobject)client\_data;

jstring deviceName = env->NewStringUTF(devname);

env->CallVoidMethod(thiz, method\_usbDeviceRemoved, deviceName);

env->DeleteLocalRef(deviceName);

checkAndClearExceptionFromCallback(env, \_\_FUNCTION\_\_);

return 0;

}

UsbHostManager的usbDeviceRemoved函数，会把mDevices相关的设备去除。

private void usbDeviceRemoved(String deviceName) {

synchronized (mLock) {

UsbDevice device = mDevices.remove(deviceName);

if (device != null) {

mUsbAlsaManager.usbDeviceRemoved(device);

getCurrentSettings().deviceDetached(device);

}

}

---------------------

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## jni设计

java主要通过monitorUsbHostBus来初始化cpp

cpp回调了java大部分的函数，因此你会发现UsbHostManager.java都没有地方调用，原因是通过jni方式调用的

### java调用cpp

**static const** JNINativeMethod method\_table[] = {  
 { **"monitorUsbHostBus"**, **"()V"**, (**void**\*)android\_server\_UsbHostManager\_monitorUsbHostBus },  
 { **"nativeOpenDevice"**, **"(Ljava/lang/String;)Landroid/os/ParcelFileDescriptor;"**,  
 (**void**\*)android\_server\_UsbHostManager\_openDevice },  
};

### cpp调用java

**int** register\_android\_server\_UsbHostManager(JNIEnv \*env)  
{  
 jclass clazz = env->FindClass(**"com/android/server/usb/UsbHostManager"**);  
 **if** (clazz == NULL) {  
 ALOGE(**"Can't find com/android/server/usb/UsbHostManager"**);  
 **return** -1;  
 }  
 method\_beginUsbDeviceAdded = env->GetMethodID(clazz, **"beginUsbDeviceAdded"**,  
 **"(Ljava/lang/String;IIIIILjava/lang/String;Ljava/lang/String;ILjava/lang/String;)Z"**);  
 **if** (method\_beginUsbDeviceAdded == NULL) {  
 ALOGE(**"Can't find beginUsbDeviceAdded"**);  
 **return** -1;  
 }  
 method\_addUsbConfiguration = env->GetMethodID(clazz, **"addUsbConfiguration"**,  
 **"(ILjava/lang/String;II)V"**);  
 **if** (method\_addUsbConfiguration == NULL) {  
 ALOGE(**"Can't find addUsbConfiguration"**);  
 **return** -1;  
 }  
 method\_addUsbInterface = env->GetMethodID(clazz, **"addUsbInterface"**,  
 **"(ILjava/lang/String;IIII)V"**);  
 **if** (method\_addUsbInterface == NULL) {  
 ALOGE(**"Can't find addUsbInterface"**);  
 **return** -1;  
 }  
 method\_addUsbEndpoint = env->GetMethodID(clazz, **"addUsbEndpoint"**, **"(IIII)V"**);  
 **if** (method\_addUsbEndpoint == NULL) {  
 ALOGE(**"Can't find addUsbEndpoint"**);  
 **return** -1;  
 }  
 method\_endUsbDeviceAdded = env->GetMethodID(clazz, **"endUsbDeviceAdded"**, **"()V"**);  
 **if** (method\_endUsbDeviceAdded == NULL) {  
 ALOGE(**"Can't find endUsbDeviceAdded"**);  
 **return** -1;  
 }  
 method\_usbDeviceRemoved = env->GetMethodID(clazz, **"usbDeviceRemoved"**,  
 **"(Ljava/lang/String;)V"**);  
 **if** (method\_usbDeviceRemoved == NULL) {  
 ALOGE(**"Can't find usbDeviceRemoved"**);  
 **return** -1;  
 }  
  
 clazz = env->FindClass(**"android/os/ParcelFileDescriptor"**);  
 LOG\_FATAL\_IF(clazz == NULL, **"Unable to find class android.os.ParcelFileDescriptor"**);  
 gParcelFileDescriptorOffsets.mClass = (jclass) env->NewGlobalRef(clazz);  
 gParcelFileDescriptorOffsets.mConstructor = env->GetMethodID(clazz, **"<init>"**,  
 **"(Ljava/io/FileDescriptor;)V"**);  
 LOG\_FATAL\_IF(gParcelFileDescriptorOffsets.mConstructor == NULL,  
 **"Unable to find constructor for android.os.ParcelFileDescriptor"**);  
  
 **return** jniRegisterNativeMethods(env, **"com/android/server/usb/UsbHostManager"**,  
 method\_table, NELEM(method\_table));  
}

## 插入bulk设备

当新连接一个设备之后，UsbHostManager.java中会依次从jni回调beginUsbDeviceAdded—>addUsbConfiguration—>addUsbInterface—>addUsbEndpoint—>endUsbDeviceAdded 这几个方法，分别创建UsbDevice，UsbConfigration,UsbInterface,UsbEndpoint Parcebale 对象

首先可以通过dump查一下字符串

[mName=/dev/bus/usb/003/003,mVendorId=11427,mProductId=31,**mClass**=239,**mSubclass**=2,**mProtocol**=1,mManufacturerName=KJI,mProductName=KJI,mVersion=2.0,mSerialNumber=XX,mConfigurations=[  
UsbConfiguration[mId=1,mName=**null**,mAttributes=192,mMaxPower=0,mInterfaces=[  
 **UsbInterface[mId=3,mAlternateSetting=0,mName=libusb-win32,mClass=255,mSubclass=67,mProtocol=1,mEndpoints=[  
 UsbEndpoint[mAddress=129,mAttributes=2,mMaxPacketSize=512,mInterval=0]  
 UsbEndpoint[mAddress=1,mAttributes=2,mMaxPacketSize=512,mInterval=0]]** UsbInterface[mId=4,mAlternateSetting=0,mName=CDC Communications Control,**mClass**=2,**mSubclass**=2,**mProtocol**=1,**mEndpoints**=[  
 UsbEndpoint[mAddress=131,mAttributes=3,mMaxPacketSize=16,mInterval=32]]  
 UsbInterface[mId=5,mAlternateSetting=0,mName=serial **Data**,**mClass**=10,**mSubclass**=0,**mProtocol**=0,**mEndpoints**=[  
 UsbEndpoint[mAddress=130,mAttributes=2,mMaxPacketSize=512,mInterval=0]  
 UsbEndpoint[mAddress=2,mAttributes=2,mMaxPacketSize=512,mInterval=0]]]

所以从逻辑上来说，一个device->Configuration->Interface->Endpoint都是一对多的关系！

添加设备的过程，核心的功能就是这个解析字符串

### 协议

由上面的日志可以看出，

UsbEndpoint epOut = **null**;  
UsbEndpoint epIn = **null**;  
*// look for our bulk endpoints***for** (**int** i = 0; i < intf.getEndpointCount(); i++) {  
 UsbEndpoint ep = intf.getEndpoint(i);  
 **if** (ep.getType() == UsbConstants.***USB\_ENDPOINT\_XFER\_BULK***) {  
 **if** (ep.getDirection() == UsbConstants.***USB\_DIR\_OUT***) {//<128  
 epOut = ep;  
 } **else** {  
 epIn = ep;  
 }  
 }  
}

端点协议：mAddress&***USB\_ENDPOINT\_DIR\_MASK*** = 0x80;为0就是输出，因此地址上来看，小于128的是输出，一般而言，第二端点就是写入，输出端点

1. //USBEndpoint为读写数据所需的节点
2. UsbEndpoint inEndpoint = usbInterface.getEndpoint(0);  //读数据节点
3. UsbEndpoint outEndpoint = usbInterface.getEndpoint(1); //写数据节点

### jni.usb\_device\_added

frameworks/base/services/core/jni/com\_android\_server\_UsbHostManager.cpp

**static int** usb\_device\_added(**const char** \*devname, **void**\* client\_data) {  
 **struct** usb\_descriptor\_header\* desc;  
 **struct** usb\_descriptor\_iter iter;  
  
 **struct** usb\_device \*device = usb\_device\_open(devname);//1  
 **if** (!device) {  
 ALOGE(**"usb\_device\_open failed\n"**);  
 **return** 0;  
 }  
  
 JNIEnv\* env = AndroidRuntime::getJNIEnv();  
 jobject thiz = (jobject)client\_data;  
 **const** usb\_device\_descriptor\* deviceDesc = usb\_device\_get\_device\_descriptor(device);  
  
 **char** \*manufacturer = usb\_device\_get\_manufacturer\_name(device,  
 USB\_CONTROL\_TRANSFER\_TIMEOUT\_MS);  
 **char** \*product = usb\_device\_get\_product\_name(device,  
 USB\_CONTROL\_TRANSFER\_TIMEOUT\_MS);  
 **int** version = usb\_device\_get\_version(device);  
 **char** \*serial = usb\_device\_get\_serial(device,  
 USB\_CONTROL\_TRANSFER\_TIMEOUT\_MS);  
  
 jstring deviceName = env->NewStringUTF(devname);  
 jstring manufacturerName = AndroidRuntime::NewStringLatin1(env, manufacturer);  
 jstring productName = AndroidRuntime::NewStringLatin1(env, product);  
 jstring serialNumber = AndroidRuntime::NewStringLatin1(env, serial);  
  
 jboolean result = env->CallBooleanMethod(thiz, **method\_beginUsbDeviceAdded**,//2  
 deviceName, usb\_device\_get\_vendor\_id(device), usb\_device\_get\_product\_id(device),  
 deviceDesc->bDeviceClass, deviceDesc->bDeviceSubClass, deviceDesc->bDeviceProtocol,  
 manufacturerName, productName, version, serialNumber);  
  
 env->DeleteLocalRef(serialNumber);  
 env->DeleteLocalRef(productName);  
 env->DeleteLocalRef(manufacturerName);  
 env->DeleteLocalRef(deviceName);  
 free(manufacturer);  
 free(product);  
 free(serial);  
  
 **if** (!result) **goto** fail;  
  
 usb\_descriptor\_iter\_init(device, &iter);  
  
 **while** ((desc = usb\_descriptor\_iter\_next(&iter)) != NULL) {  
 **if** (desc->bDescriptorType == USB\_DT\_CONFIG) {  
 **struct** usb\_config\_descriptor \*config = (**struct** usb\_config\_descriptor \*)desc;  
 **char** \*name = usb\_device\_get\_string(device, config->iConfiguration,  
 USB\_CONTROL\_TRANSFER\_TIMEOUT\_MS);  
 jstring configName = AndroidRuntime::NewStringLatin1(env, name);  
  
 env->CallVoidMethod(thiz, method\_addUsbConfiguration,//3.  
 config->bConfigurationValue, configName, config->bmAttributes,  
 config->bMaxPower);  
  
 env->DeleteLocalRef(configName);  
 free(name);  
 } **else if** (desc->bDescriptorType == USB\_DT\_INTERFACE) {  
 **struct** usb\_interface\_descriptor \***interface** = (**struct** usb\_interface\_descriptor \*)desc;  
 **char** \*name = usb\_device\_get\_string(device, **interface**->iInterface,  
 USB\_CONTROL\_TRANSFER\_TIMEOUT\_MS);  
 jstring interfaceName = AndroidRuntime::NewStringLatin1(env, name);  
  
 env->CallVoidMethod(thiz, method\_addUsbInterface,//4  
 **interface**->bInterfaceNumber, interfaceName, **interface**->bAlternateSetting,  
 **interface**->bInterfaceClass, **interface**->bInterfaceSubClass,  
 **interface**->bInterfaceProtocol);  
  
 env->DeleteLocalRef(interfaceName);  
 free(name);  
 } **else if** (desc->bDescriptorType == USB\_DT\_ENDPOINT) {  
 **struct** usb\_endpoint\_descriptor \*endpoint = (**struct** usb\_endpoint\_descriptor \*)desc;  
  
 env->CallVoidMethod(thiz, method\_addUsbEndpoint,//5  
 endpoint->bEndpointAddress, endpoint->bmAttributes,  
 \_\_le16\_to\_cpu(endpoint->wMaxPacketSize), endpoint->bInterval);  
 }  
 }  
  
 env->CallVoidMethod(thiz, method\_endUsbDeviceAdded);//6  
  
fail:  
 usb\_device\_close(device);  
 checkAndClearExceptionFromCallback(env, \_\_FUNCTION\_\_);  
  
 **return** 0;  
}

### UsbHostManager.beginUsbDeviceAdded

设置了一些过滤条件，

1. 同一个设备不会被add两次，虽然内核支持，但是fw层会过滤掉
2. **mNewDevice is not null in endUsbDeviceAdded**

**private boolean** beginUsbDeviceAdded(String deviceName, **int** vendorID, **int** productID,  
 **int** deviceClass, **int** deviceSubclass, **int** deviceProtocol,  
 String manufacturerName, String productName, **int** version, String serialNumber) {

**if** (isBlackListed(deviceName) ||  
 isBlackListed(deviceClass, deviceSubclass, deviceProtocol)) {  
 **return false**;  
}  
  
**synchronized** (**mLock**) {  
 **if** (**mDevices**.get(deviceName) != **null**) {  
 Slog.*w*(***TAG***, **"device already on mDevices list: "** + deviceName);  
 **return false**;  
 }  
  
 **if** (**mNewDevice** != **null**) {  
 Slog.*e*(***TAG***, **"mNewDevice is not null in endUsbDeviceAdded"**);  
 **return false**;  
 }  
  
 *// Create version string in "%.%" format* String versionString = Integer.*toString*(version >> 8) + **"."** + (version & 0xFF);  
  
 **mNewDevice** = **new** UsbDevice(deviceName, vendorID, productID,  
 deviceClass, deviceSubclass, deviceProtocol,  
 manufacturerName, productName, versionString, serialNumber);  
  
 **mNewConfigurations** = **new** ArrayList<UsbConfiguration>();  
 **mNewInterfaces** = **new** ArrayList<UsbInterface>();  
 **mNewEndpoints** = **new** ArrayList<UsbEndpoint>();  
}  
  
**return true**;

}

### UsbHostManager .addUsbConfiguration

**private void** addUsbConfiguration(**int** id, String name, **int** attributes, **int** maxPower) {  
 **if** (**mNewConfiguration** != **null**) {  
 **mNewConfiguration**.setInterfaces(  
 **mNewInterfaces**.toArray(**new** UsbInterface[**mNewInterfaces**.size()]));  
 **mNewInterfaces**.clear();  
 }  
  
 **mNewConfiguration** = **new** UsbConfiguration(id, name, attributes, maxPower);  
 **mNewConfigurations**.add(**mNewConfiguration**);  
}

### UsbHostManager .addUsbInterface

**private void** addUsbInterface(**int** id, String name, **int** altSetting,  
 **int** Class, **int** subClass, **int** protocol) {  
 **if** (**mNewInterface** != **null**) {  
 **mNewInterface**.setEndpoints(  
 **mNewEndpoints**.toArray(**new** UsbEndpoint[**mNewEndpoints**.size()]));  
 **mNewEndpoints**.clear();  
 }  
  
 **mNewInterface** = **new** UsbInterface(id, altSetting, name, Class, subClass, protocol);  
 **mNewInterfaces**.add(**mNewInterface**);  
}

### addUsbEndpoint

*/\* Called from JNI in monitorUsbHostBus() to report new USB endpoint for the device  
 currently being added. Returns true if successful, false in case of error.  
 \*/***private void** addUsbEndpoint(**int** address, **int** attributes, **int** maxPacketSize, **int** interval) {  
 **mNewEndpoints**.add(**new** UsbEndpoint(address, attributes, maxPacketSize, interval));  
}

### endUsbDeviceAdded

*/\* Called from JNI in monitorUsbHostBus() to finish adding a new device \*/***private void** endUsbDeviceAdded() {  
 **if** (**mNewInterface** != **null**) {  
 **mNewInterface**.setEndpoints(  
 **mNewEndpoints**.toArray(**new** UsbEndpoint[**mNewEndpoints**.size()]));  
 }  
 **if** (**mNewConfiguration** != **null**) {  
 **mNewConfiguration**.setInterfaces(  
 **mNewInterfaces**.toArray(**new** UsbInterface[**mNewInterfaces**.size()]));  
 }  
  
  
 **synchronized** (**mLock**) {  
 **if** (**mNewDevice** != **null**) {  
 **mNewDevice**.setConfigurations(  
 **mNewConfigurations**.toArray(  
 **new** UsbConfiguration[**mNewConfigurations**.size()]));  
 **mDevices**.put(**mNewDevice**.getDeviceName(), **mNewDevice**);  
   
 *// It is fine to call this only for the current user as all broadcasts are sent to  
 // all profiles of the user and the dialogs should only show once.* ComponentName usbDeviceConnectionHandler = getUsbDeviceConnectionHandler();  
 **if** (usbDeviceConnectionHandler == **null**) {  
  **getCurrentUserSettings().deviceAttac**hed(**mNewDevice**);  
 } **else** {  
 getCurrentUserSettings().deviceAttachedForFixedHandler(**mNewDevice**,  
 usbDeviceConnectionHandler);  
 }  
 **mUsbAlsaManager**.usbDeviceAdded(**mNewDevice**);  
 } **else** {  
 Slog.*e*(***TAG***, **"mNewDevice is null in endUsbDeviceAdded"**);  
 }  
 **mNewDevice** = **null**;  
 **mNewConfigurations** = **null**;  
 **mNewInterfaces** = **null**;  
 **mNewEndpoints** = **null**;  
 **mNewConfiguration** = **null**;  
 **mNewInterface** = **null**;  
 }  
}

主要是获取usb设备的属性,然后调用UsbHostManager.java中的usbDeviceAdded（），并将这些usb属性传递上去

### UsbSettingsManager.deviceAttached

deviceAttached（）函数，主要是检查系统中是否有安装能处理UsbManager.ACTION\_USB\_DEVICE\_ATTACHED这个广播的activity，并转到该activity.

|  |
| --- |
| public void deviceAttached(UsbDevice device) {  Intent intent = new Intent(UsbManager.ACTION\_USB\_DEVICE\_ATTACHED); |
| intent.putExtra(UsbManager.EXTRA\_DEVICE, device); |
| intent.addFlags(Intent.FLAG\_ACTIVITY\_NEW\_TASK); |
|  |
| ArrayList<ResolveInfo> matches; |
| String defaultPackage; |
| synchronized (mLock) { |
| matches = getDeviceMatchesLocked(device, intent); |
| // Launch our default activity directly, if we have one. |
| // Otherwise we will start the UsbResolverActivity to allow the user to choose. |
| defaultPackage = mDevicePreferenceMap.get(new DeviceFilter(device)); |
| } |
|  |
| // Send broadcast to running activity with registered intent |
| mUserContext.sendBroadcast(intent); |
|  |
| // Start activity with registered intent |
| resolveActivity(intent, matches, defaultPackage, device, null); |
| } |

## openDevice

而当用户进程通过UsbManger获取到设备名后，可以通过openDevice来获取连接，从而收发数据

内部实现：先通过设备名字打开得到一个文件描述符，然后利用new一个连接来关联这个描述符，最终把连接返回给用户

*/\*\*  
 \* Opens the device so it can be used to send and receive  
 \* data using {****@link*** *android.hardware.usb.UsbRequest}.  
 \*  
 \** ***@param device*** *the device to open  
 \** ***@return*** *a {****@link*** *UsbDeviceConnection}, or {****@code*** *null} if open failed  
 \*/***public** UsbDeviceConnection openDevice(UsbDevice device) {  
 **try** {  
 String deviceName = device.getDeviceName();  
 ParcelFileDescriptor pfd = **mService**.openDevice(deviceName);  
 **if** (pfd != **null**) {  
 UsbDeviceConnection connection = **new** UsbDeviceConnection(device);  
 **boolean** result = connection.open(deviceName, pfd, **mContext**);  
 pfd.close();  
 **if** (result) {  
 **return** connection;  
 }  
 }  
 } **catch** (Exception e) {  
 Log.*e*(***TAG***, **"exception in UsbManager.openDevice"**, e);  
 }  
 **return null**;  
}

### openDevice(String deviceName)

ParcelFileDescriptor 作为参数调用这个UsbDeviceConnection的open函数

*/\* Opens the specified USB device \*/***public** ParcelFileDescriptor openDevice(String deviceName) {  
 **synchronized** (**mLock**) {  
 **if** (isBlackListed(deviceName)) {  
 **throw new** SecurityException(**"USB device is on a restricted bus"**);  
 }  
 UsbDevice device = **mDevices**.get(deviceName);  
 **if** (device == **null**) {  
 *// if it is not in mDevices, it either does not exist or is blacklisted* **throw new** IllegalArgumentException(  
 **"device "** + deviceName + **" does not exist or is restricted"**);  
 }  
 getCurrentSettings().checkPermission(device);  
 **return** nativeOpenDevice(deviceName);  
 }  
}

最后也是调用了JNI函数nativeOpenDevice

### Jni. openDevice

android\_server\_UsbHostManager\_openDevice就是对应的JNI函数，这里主要调用了usb\_device\_open函数，并且返回一个usb\_device，最后我们通过usb\_device来获取其fd，并且把它封装在Java层ParcelFileDescriptor类中

**static** jobject android\_server\_UsbHostManager\_openDevice(JNIEnv \*env, jobject */\* thiz \*/*,  
 jstring deviceName)  
{  
 **const char** \*deviceNameStr = env->GetStringUTFChars(deviceName, NULL);  
 **struct** usb\_device\* device = usb\_device\_open(deviceNameStr);  
 env->ReleaseStringUTFChars(deviceName, deviceNameStr);  
  
 **if** (!device)  
 **return** NULL;  
  
 **int** fd = **usb\_device\_get\_fd(device);**  
 **if** (fd < 0) {  
 usb\_device\_close(device);  
 **return** NULL;  
 }  
 **int** newFD = dup(fd);  
 usb\_device\_close(device);  
  
 jobject fileDescriptor = jniCreateFileDescriptor(env, newFD);  
 **if** (fileDescriptor == NULL) {  
 **return** NULL;  
 }  
 **return** env->NewObject(gParcelFileDescriptorOffsets.mClass,  
 gParcelFileDescriptorOffsets.mConstructor, fileDescriptor);  
}

#### Libusb.usb\_device\_get\_fd

**int** usb\_device\_get\_fd(**struct** usb\_device \*device)  
{  
 **if** (!usb\_device\_reopen\_writeable(device))  
 **return** -1;  
 **return** device->fd;  
}

#### usb\_device\_reopen\_writeable

**static int** usb\_device\_reopen\_writeable(**struct** usb\_device \*device)  
{  
 **if** (device->writeable)  
 **return** 1;  
  
 **int** fd = open(device->dev\_name, O\_RDWR);  
 **if** (fd >= 0) {  
 close(device->fd);  
 device->fd = fd;  
 device->writeable = 1;  
 **return** 1;  
 }  
 D(**"usb\_device\_reopen\_writeable failed errno %d\n"**, errno);  
 **return** 0;  
}

### connection.open

**boolean** open(String name, ParcelFileDescriptor pfd, @NonNull Context context) {  
 **mContext** = context.getApplicationContext();  
  
 **return** native\_open(name, pfd.getFileDescriptor());  
}

#### native\_open

frameworks/base/core/jni/android\_hardware\_UsbDeviceConnection.cpp

**static** jboolean  
android\_hardware\_UsbDeviceConnection\_open(JNIEnv \*env, jobject thiz, jstring deviceName,  
 jobject fileDescriptor)  
{  
 **int** fd = jniGetFDFromFileDescriptor(env, fileDescriptor);  
 *// duplicate the file descriptor, since ParcelFileDescriptor will eventually close its copy* fd = dup(fd);  
 **if** (fd < 0)  
 **return** JNI\_FALSE;  
  
 **const char** \*deviceNameStr = env->GetStringUTFChars(deviceName, NULL);  
 **struct** usb\_device\* device = **usb\_device\_new**(deviceNameStr, fd);  
 **if** (device) {  
 env->SetLongField(thiz, field\_context, (jlong)device);  
 } **else** {  
 ALOGE(**"usb\_device\_open failed for %s"**, deviceNameStr);  
 close(fd);  
 }  
  
 env->ReleaseStringUTFChars(deviceName, deviceNameStr);  
 **return** (device != NULL) ? JNI\_TRUE : JNI\_FALSE;  
}

#### libusb.usb\_device\_new

**struct** usb\_device \*usb\_device\_new(**const char** \*dev\_name, **int** fd)  
{  
 **struct** usb\_device \*device = calloc(1, **sizeof**(**struct** usb\_device));  
 **int** length;  
  
 D(**"usb\_device\_new %s fd: %d\n"**, dev\_name, fd);  
  
 **if** (lseek(fd, 0, SEEK\_SET) != 0)  
 **goto** failed;  
 length = read(fd, device->desc, **sizeof**(device->desc));  
 D(**"usb\_device\_new read returned %d errno %d\n"**, length, errno);  
 **if** (length < 0)  
 **goto** failed;  
  
 strncpy(device->dev\_name, dev\_name, **sizeof**(device->dev\_name) - 1);  
 device->fd = fd;  
 device->desc\_length = length;  
 *// assume we are writeable, since usb\_device\_get\_fd will only return writeable fds* device->writeable = 1;  
 **return** device;  
  
failed:  
 close(fd);  
 free(device);  
 **return** NULL;  
}

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## 其他方法

我们来看USBManager中关于获取Usb设备，以及使用它们的函数

### getDeviceList

通过Bundle对象来传输的

**public void** getDeviceList(Bundle devices) {  
 **synchronized** (**mLock**) {  
 **for** (String name : **mDevices**.keySet()) {  
 devices.putParcelable(name, **mDevices**.get(name));  
 }  
 }  
}

getDeviceList可以得到一个设备名，以及对应的UsbDevice。

## API

类 介绍

UsbManager 获取连接的USB设备并与之通信

UsbDevice 代表一个连接的USB 设备，包含一系列方法获取自身信息，包括interfaces，endpoints

UsbInterface 代表USB 设备上定义的一系列功能接口，一个usb设备可以有一个或多个接口

UsbEndpoint 代表一个interface通信频道，一个interface可以有一个或多个endpoints，一般含有输入输出两个端点来支持双工通信

UsbDeviceConnection 代表设备连接的一个链路，将数据传输到端点上，这个类允许你同步或异步的来回发送数据

UsbRequest 代表一个异步请求，通过UsbDeviceConnection来跟设备通信

UsbConstants 定义了linux内核文件linux/usb/ch9.h中的常量

## 关API

在绝大部分情况下，当你需要跟USB通信时，你需要用到这些类（UsbRequest类仅在异步通信时用到）。一般的，获取UsbManager找到目标UsbDevice，接着找到恰当的UsbInterface和这个interface的UsbEndpoint，得到了正确的UsbEndpoint后，打开设备获得UsbDeviceConnection来跟USB 设备通信。

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## AdbTest

demo：\development\samples\USB\AdbTest

### 配置

<**activity android:name="AdbTestActivity" android:label="ADB Test"**>  
 <**intent-filter**>  
 <**action android:name="android.intent.action.MAIN"** />  
 <**category android:name="android.intent.category.DEFAULT"** />  
 <**category android:name="android.intent.category.LAUNCHER"** />  
 </**intent-filter**>  
  
 <**intent-filter**>  
 <**action android:name="android.hardware.usb.action.USB\_DEVICE\_ATTACHED"** />  
 </**intent-filter**>  
  
 <**meta-data android:name="android.hardware.usb.action.USB\_DEVICE\_ATTACHED"  
 android:resource="@xml/device\_filter"** />  
</**activity**>

<**resources**>  
 <**usb-device class="255" subclass="66" protocol="1"** />  
</**resources**>

### mUsbReceiver

*// listen for new devices*IntentFilter filter = **new** IntentFilter();  
filter.addAction(UsbManager.***ACTION\_USB\_DEVICE\_ATTACHED***);  
filter.addAction(UsbManager.***ACTION\_USB\_DEVICE\_DETACHED***);  
registerReceiver(**mUsbReceiver**, filter);

BroadcastReceiver **mUsbReceiver** = **new** BroadcastReceiver() {  
 **public void** onReceive(Context context, Intent intent) {  
 String action = intent.getAction();  
  
 **if** (UsbManager.***ACTION\_USB\_DEVICE\_ATTACHED***.equals(action)) {  
 UsbDevice device = (UsbDevice)intent.getParcelableExtra(UsbManager.***EXTRA\_DEVICE***);  
 UsbInterface intf = *findAdbInterface*(device);  
 **if** (intf != **null**) {  
 log(**"Found adb interface "** + intf);  
 setAdbInterface(device, intf);  
 }  
 } **else if** (UsbManager.***ACTION\_USB\_DEVICE\_DETACHED***.equals(action)) {  
 UsbDevice device = intent.getParcelableExtra(UsbManager.***EXTRA\_DEVICE***);  
 String deviceName = device.getDeviceName();  
 **if** (**mDevice** != **null** && **mDevice**.equals(deviceName)) {  
 log(**"adb interface removed"**);  
 setAdbInterface(**null**, **null**);  
 }  
 }  
 }  
};

### 交互

#### findAdbInterface

*// searches for an adb interface on the given USB device***static private** UsbInterface findAdbInterface(UsbDevice device) {  
 Log.*d*(***TAG***, **"findAdbInterface "** + device);  
 **int** count = device.getInterfaceCount();  
 **for** (**int** i = 0; i < count; i++) {  
 UsbInterface intf = device.getInterface(i);  
 **if** (i**ntf.getInterfaceClass() == 255 && intf.getInterfaceSubclass() == 66 &&  
 intf.getInterfaceProtocol() == 1**) {  
 **return** intf;  
 }  
 }  
 **return null**;  
}

哈哈，原来adb能用，是因为约定了过滤配置器啊255

#### setAdbInterface

**private boolean** setAdbInterface(UsbDevice device, UsbInterface intf) {  
 **if** (**mDeviceConnection** != **null**) {  
 **if** (**mInterface** != **null**) {  
 **mDeviceConnection**.releaseInterface(**mInterface**);  
 **mInterface** = **null**;  
 }  
 **mDeviceConnection**.close();  
 **mDevice** = **null**;  
 **mDeviceConnection** = **null**;  
 }  
  
 **if** (device != **null** && intf != **null**) {  
 UsbDeviceConnection connection = **mManager**.openDevice(device);  
 **if** (connection != **null**) {  
 log(**"open succeeded"**);  
 **if** (connection.claimInterface(intf, **false**)) {  
 log(**"claim interface succeeded"**);  
 **mDevice** = device;  
 **mDeviceConnection** = connection;  
 **mInterface** = intf;  
 **mAdbDevice** = **new** AdbDevice(**this**, **mDeviceConnection**, intf);  
 log(**"call start"**);  
 **mAdbDevice**.start();  
 **return true**;  
 } **else** {  
 log(**"claim interface failed"**);  
 connection.close();  
 }  
 } **else** {  
 log(**"open failed"**);  
 }  
 }  
  
 **if** (**mDeviceConnection** == **null** && **mAdbDevice** != **null**) {  
 **mAdbDevice**.stop();  
 **mAdbDevice** = **null**;  
 }  
 **return false**;  
}

### AdbDevice

#### 配置输入输出点

**public** AdbDevice(AdbTestActivity activity, UsbDeviceConnection connection,  
 UsbInterface intf) {  
 **mDeviceConnection** = connection;  
 **mSerial** = connection.getSerial();  
  
 UsbEndpoint epOut = **null**;  
 UsbEndpoint epIn = **null**;  
 *// look for our bulk endpoints* **for** (**int** i = 0; i < intf.getEndpointCount(); i++) {  
 UsbEndpoint ep = intf.getEndpoint(i);  
 **if** (ep.getType() == UsbConstants.***USB\_ENDPOINT\_XFER\_BULK***) {  
 **if** (ep.getDirection() == UsbConstants.***USB\_DIR\_OUT***) {  
 epOut = ep;  
 } **else** {  
 epIn = ep;  
 }  
 }  
 }  
   
 **mEndpointOut** = epOut;  
 **mEndpointIn** = epIn;  
}

start()

**public void** start() {  
 **mWaiterThread**.start();  
 connect();  
}

*// send a connect command***private void** connect() {  
 AdbMessage message = **new** AdbMessage();  
 message.set(AdbMessage.***A\_CNXN***, AdbMessage.***A\_VERSION***, AdbMessage.***MAX\_PAYLOAD***, **"host::\0"**);  
 message.write(**this**);  
}

#### WaiterThread

@Override  
**public void** run() {  
 *// start out with a command read* BulkMessage currentCommand = **new** BulkMessage();  
 BulkMessage currentData = **null**;  
 *//* ***FIXME error checking***

*//封装了usbRequest.setClientData和queue，请求读adb协议的command header数据段*currentCommand.readCommand(getInRequest());  
  
 **while** (**true**) {  
 log(**"runing"**);  
 **synchronized** (**this**) {  
 **if** (**mStop**) {  
 **return**;  
 }  
 }

*//阻塞等待request被响应，*  
 UsbRequest request = **mDeviceConnection**.requestWait();  
 **if** (request == **null**) {  
 **break**;  
 }  
  
 BulkMessage message = (BulkMessage) request.getClientData();  
 request.setClientData(**null**);  
 BulkMessage messageToDispatch = **null**;  
  
 **if** (message == currentCommand) {  
 **int** dataLength = message.getDataLength();  
 *// read data if length > 0* **if** (dataLength > 0) {

**//请求读adb协议的command data数据段**  
 message.readData(getInRequest(), dataLength);  
 currentData = message;  
 } **else** {  
 messageToDispatch = message;  
 }  
 currentCommand = **null**;

*//只需关注自己提交的、而不是其他endpoint的 command data request*  
 } **else if** (message == currentData) {  
 messageToDispatch = message;  
 currentData = **null**;  
 }  
*//command data字段 准备解析并处理*  
 **if** (messageToDispatch != **null**) {  
 *// queue another read first*

*//先提交一次read command header, 为下一次接收做准备* currentCommand = **new** BulkMessage();  
 currentCommand.readCommand(getInRequest());  
  
 *// then dispatch the current message* dispatchMessage(messageToDispatch);  
 }  
  
 *// put request back into the appropriate pool*

*//in or out request用完了 重新放回List中；* **if** (request.getEndpoint() == **mEndpointOut**) {  
 releaseOutRequest(request);  
 } **else** {  
 **synchronized** (**mInRequestPool**) {  
 **mInRequestPool**.add(request);  
 }  
 }  
 }  
}

### dispatchMessage

*// dispatch a message from the device***void** dispatchMessage(BulkMessage message) {  
 **int** command = message.getCommand();  
 **switch** (command) {  
 **case** BulkMessage.A\_SYNC:  
 log(**"got A\_SYNC"**); *//收到同步command*  
 **break**;  
 **case** BulkMessage.A\_CNXN: *//收到connect response，处理下*  
 handleConnect(message);  
 **break**;  
 **case** BulkMessage.A\_OPEN:  
 **case** BulkMessage.A\_OKAY:  
 **case** BulkMessage.A\_CLSE:  
 **case** BulkMessage.A\_WRTE:  
 AdbSocket socket = getSocket(message.getArg1());*//收到ok response*  
 **if** (socket == **null**) {  
 log(**"ERROR socket not found"**);  
 } **else** {

*//device往host write,即 host接收数据,这里的数据就是logcat的消息；*   
 socket.handleMessage(message);  
 }  
 **break**;  
 }  
}

### 协议

## Dump

**public void** dump(IndentingPrintWriter pw) {  
 **synchronized** (**mLock**) {  
 pw.println(**"USB Host State:"**);  
 **for** (String name : **mDevices**.keySet()) {  
 pw.println(**" "** + name + **": "** + **mDevices**.get(name));  
 }  
 }  
}

---------------------

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## [libusbhost](https://www.jianshu.com/p/b267c5cedfa9)

libusbhost主要提供与usb设备通信的接口

struct usb\_device \*usb\_device\_open(const char \*dev\_name)

---打开一个usb设备，在/dev/bus/usb/下

void usb\_device\_close(struct usb\_device \*device)

void usb\_descriptor\_iter\_init(struct usb\_device \*device, struct usb\_descriptor\_iter \*iter)

struct usb\_descriptor\_header \*usb\_descriptor\_iter\_next(struct usb\_descriptor\_iter \*iter)

--获取descriptor

int usb\_device\_claim\_interface(struct usb\_device \*device, unsigned int interface)

----claim一个interface用于通讯

int usb\_device\_release\_interface(struct usb\_device \*device, unsigned int interface)

int usb\_device\_bulk\_transfer(struct usb\_device \*device, --------传输数据

int endpoint,

void\* buffer,

int length,

unsigned int timeout)

int usb\_device\_control\_transfer(struct usb\_device \*device, ----------控制指令

int requestType,

int request,

int value,

int index,

void\* buffer,

int length,

unsigned int timeout)

在java代码中可以通过一下文件中提供的接口来访问usb设备。

frameworks/base/core/java/android/hardware/usb/UsbDeviceConnection.java

## 定制方案

**mHostBlacklist**

**mHostBlacklist** = context.getResources().getStringArray(  
 com.android.internal.R.array.config\_usbHostBlacklist);

## 参考

android usb host 读写USB设备

<https://blog.csdn.net/u013815973/article/details/24501583>

Android Usb在framework的相关源码分析

<https://www.jianshu.com/p/51809085e9cc>

android USB通信

<https://www.jianshu.com/p/e2e57cddac6a>

adbdevice介绍

<https://blog.csdn.net/anribras/article/details/50833269>

adb 通信协议

<https://blog.csdn.net/evilcode/article/details/6904200>

# Host-Serial

java->jni->Serial驱动，虽然也可以正常读写，这样做缺点是

1、如果突然串口不能正常通信可能会导致app崩溃，

2、这个串口只能被当前的app使用，其他app 不能使用。

3、违背正常Android设计初衷，Android标准流程是

java->service->jni->hal->serial驱动。

所以我在项目中使用了Android源码中的demo

会获取目前存在可以使用串口列表。这个根据自己需要添加。

我的就使用一个串口3

<string-array translatable="false" name="config\_serialPorts">

<item>"/dev/ttyS3"</item>

</string-array>

## SerialChat

frameworks\base\tests\SerialChat\AndroidManifest.xml

<**uses-permission android:name="android.permission.SERIAL\_PORT"**/>

**mSerialManager** = (SerialManager)getSystemService(Context.***SERIAL\_SERVICE***);

### 打开和关闭

@Override  
**public void** onResume() {  
 **super**.onResume();  
  
 String[] ports = **mSerialManager**.getSerialPorts();  
 **if** (ports != **null** && ports.**length** > 0) {  
 **try** {  
 **mSerialPort** = **mSerialManager**.openSerialPort(ports[0], 115200);  
 **if** (**mSerialPort** != **null**) {  
 **new** Thread(**this**).start();  
 }  
 } **catch** (IOException e) {  
 }  
 }  
  
}

@Override  
**public void** onDestroy() {  
 **if** (**mSerialPort** != **null**) {  
 **try** {  
 **mSerialPort**.close();  
 } **catch** (IOException e) {  
 }  
 **mSerialPort** = **null**;  
 }  
 **super**.onDestroy();  
}

### 发送和接收

**mOutputBuffer**.put(bytes);  
**mSerialPort**.write(**mOutputBuffer**, bytes.**length**);

**public void** run() {  
 Log.*d*(***TAG***, **"run"**);  
 **int** ret = 0;  
 **byte**[] buffer = **new byte**[1024];  
 **while** (ret >= 0) {  
 **try** {  
 Log.*d*(***TAG***, **"calling read"**);  
 **mInputBuffer**.clear();  
 ret = **mSerialPort**.read(**mInputBuffer**);  
 Log.*d*(***TAG***, **"read returned "** + ret);  
 **mInputBuffer**.get(buffer, 0, ret);  
 } **catch** (IOException e) {  
 Log.*e*(***TAG***, **"read failed"**, e);  
 **break**;  
 }  
  
 **if** (ret > 0) {   
 String text = **new** String(buffer, 0, ret);  
 Log.*d*(***TAG***, **"chat: "** + text);  
   
 }  
 }  
 Log.*d*(***TAG***, **"thread out"**);  
}

## 参考

<https://blog.csdn.net/lb5761311/article/details/80618834>

Android串口Serial服务解析

Android USB转串口通信

<https://www.jianshu.com/p/524d1009c069>

<https://github.com/HelloHuDi/usb-with-serial-port>

<https://www.wanandroid.com/blog/show/2239>

<https://blog.csdn.net/lnc2003/article/details/80606524>

<http://www.zhimengzhe.com/Androidkaifa/378520.html>

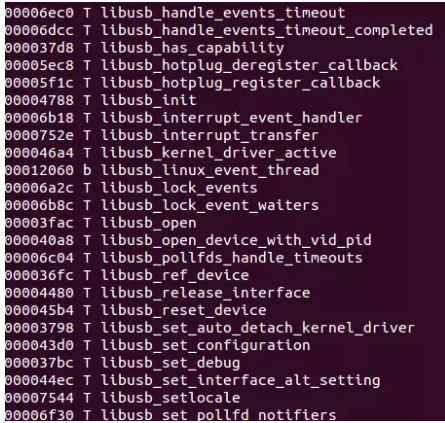
https://www.cnblogs.com/hackfun/p/7683512.html

**libusb**

android系统已经一致了

external.libusb

ibusb1.0.x主要语法



## 编译

<https://github.com/libusb/libusb>

# 六.参考

<http://scottmaxiao.github.io/AOA.html>

<https://source.android.com/devices/accessories/protocol>

<https://developer.android.com/guide/topics/connectivity/usb/accessory>

<https://source.android.com/devices/accessories/custom>

<https://blog.csdn.net/gaojinshan/article/details/12012363>

<https://blog.csdn.net/yingzhao80/article/details/45511351>

# app demo

原生demo

相关实例：

frameworks/base/libs/usb/tests/AccessoryChat/AndroidManifest.xml

\frameworks\base\tests\AccessoryDisplay\source\src\com\android\accessorydisplay\source\SourceActivity.java

cts\apps\CtsVerifier\src\com\android\cts\verifier\usb\UsbAccessoryTestActivity.java

<**activity android:name=".usb.UsbAccessoryTestActivity"  
 android:label="@string/usb\_accessory\_test"  
 android:configChanges="keyboardHidden|orientation|screenSize"  
 android:launchMode="singleTop"**>

<**activity  
 android:name=".main.activity.DJIAoaActivity"  
 android:configChanges="orientation|screenSize|keyboardHidden|keyboard"** >  
 <**intent-filter**>  
 <**action android:name="android.hardware.usb.action.USB\_ACCESSORY\_ATTACHED"** />  
 </**intent-filter**>  
  
 <**meta-data  
 android:name="android.hardware.usb.action.USB\_ACCESSORY\_ATTACHED"  
 android:resource="@xml/accessory\_filter"** />  
</**activity**>

<**resources**>  
 <**usb-accessory manufacturer="Google, Inc." model="AccessoryChat" type="Sample Program" version="1.0"** />  
</**resources**>

*<?***xml version="1.0" encoding="utf-8"***?>*<**resources**>  
 <**usb-accessory model="T600" manufacturer="DJI"**/>  
</**resources**>

# dumpsys usb

dumpsys usb

# 实战问题

对端传入null，导致系统异常

# AOA透传方案

**setprop sys.usb.config** accessory**,adb**

# Usb Debug启动流程

代码在/framework/base/service/com/android/server/usb/UsbService.java里去初始化一个叫UsbDeviceManager的类，相关文件也在同一个目录。

在UsbService.java中

public UsbService(Context context) {

mContext = context;

final PackageManager pm = mContext.getPackageManger();

....

if (new File("/sys/class/android\_usb").exists())

{

mDeviceManager = new UsbDeviceManager();

}

...

}

中的new UsbDeviceManager()就是关键代码。我的项目中由于/sys/class目录下没有android\_usb所以UsbDeviceManager初始化函数没有执行，所以会无法启动ADB。刚才/sys/class/android\_usb应该是一个和驱动有关的目录，这里不做详细介绍。　为什么UsbDeviceManager能够启动ADB呢？额。。。那是因为他监听了settings的数据库，然后做了响应动作。我们来看下UsbDeviceManager.java中做了神马事情。

private class AdbSettingsObserver extends ContentObserver {

...

@Override

boolean enable = (Settings.Global.getInt(mContextResolver, Settings.Global.ADB\_ENABLED, 0) > 0)

mHandler.sendMessage(MSG\_ENABLE\_ADB, enable);

}

而后续代码中注册了数据库的监听mContentResolver.registerContentResolver(Settings.Global.getUriFor(Settings.Global.ADB\_ENABLED), false, new AdbSettingsObserver);

来监听最上面提到的Settings.Global\_ADB\_ENABLED这个数据库字段的改变来产生相应动作。

具体动作就是对android properties属性进行设置，关键字段是persist.sys.usb.config，如果启动ADB，则通过SystemProperties.get("persisit.sys.usb.config", "adb");来启动ADB。

你可以手动通过setprop在终端中设置相应的值先试试看看。前提是你必须有root权限。

## Ref

[USB各种模式 解释](http://www.cnblogs.com/zxc2man/p/5610812.html)

[Android的USB系统简单分析之一](https://www.jianshu.com/p/b267c5cedfa9)

[Linux下使用USB模拟ACM串口设备](http://blog.csdn.net/mapeng892020/article/details/54095037)

[Android Ethernet从上至下解析一](http://www.bkjia.com/Androidjc/1045168.html)

[android 5.1 Ethernet开发相关](https://www.jianshu.com/p/b52cda6c0b58)

[android5.1 增加ethernet设置(DHCP与Static ip)-UI修改](http://blog.csdn.net/hclydao/article/details/50972932)