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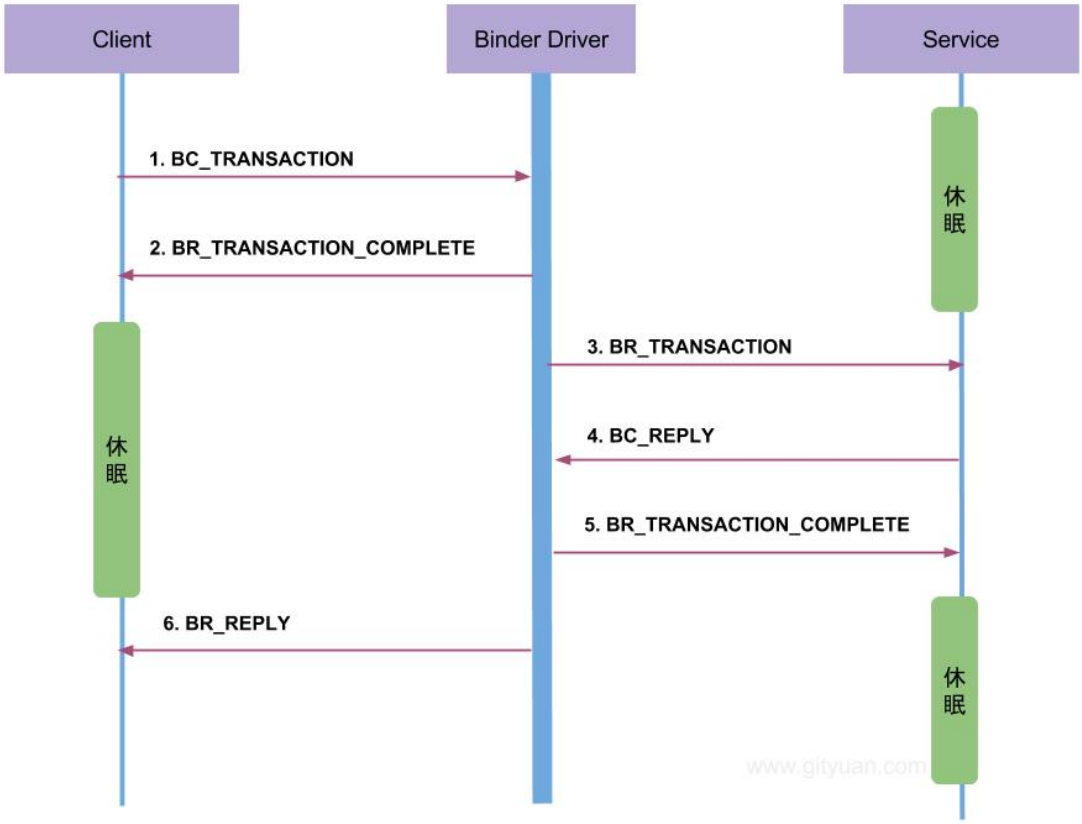
# addService流程




# 1.SytemServer

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

// 167
public static void main(String[] args) {
    new SystemServer().run();
}
```

## 1-1.run

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

// 176
private void run() {

// 263 创建 SystemServiceManager
mSystemServiceManager = new SystemServiceManager(mSystemContext);

// 268
startBootstrapServices();
```

## 1-2.startBootstrapServices

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

// 322
private void startBootstrapServices() {

// 329 获取 AMS 的对象
mActivityManagerService = mSystemServiceManager.startService(
                ActivityManagerService.Lifecycle.class).getService();

// 378
mActivityManagerService.setSystemProcess();
```

## 1-3.setSystemProcess

```
frameworks/base/services/core/java/com/android/server/am/ActivityManagerService.
java

// 2172
public void setSystemProcess() {

// 2174 添加 AMS("activity")到 service_manager中
ServiceManager.addService(Context.ACTIVITY_SERVICE, this, true);
```

## 1-4.ServiceManager.addService

```
frameworks/base/core/java/android/os/ServiceManager.java

// 87
public static void addService(String name, IBinder service, boolean
allowIsolated) {

// 89 ---见后面小节（分别分析 getIServiceManager和 addService）
getIServiceManager().addService(name, service, allowIsolated);
```

# 2.getIServiceManager

```
frameworks/base/core/java/android/os/ServiceManager.java

// 33
private static IServiceManager getIServiceManager() {
    /* 采用单例形式返回 ServiceManagerProxy对象 */
    if (sServiceManager != null) {
        return sServiceManager;
    }

    // 相当于 new ServiceManagerProxy(new BinderProxy); ---见后面小节（分别分析
asInterface和 getContextObject）
    sServiceManager =
ServiceManagerNative.asInterface(BinderInternal.getContextObject());
    return sServiceManager;
}
```

## 2-1.BinderInternal.getContextObject

```
frameworks/base/core/java/com/android/internal/os/BinderInternal.java

// 88
public static final native IBinder getContextObject();
```

### 2-1-1.android_os_BinderInternal_getContextObject

```
frameworks/base/core/jni/android_util_Binder.cpp

// 899
static jobject android_os_BinderInternal_getContextObject(JNIEnv* env, jobject
clazz)
{
    /* 打开 binder驱动（ProcessState是单例的），创建 BpBinder(handle) 对象，并返回 */
    sp<IBinder> b = ProcessState::self()->getContextObject(NULL);
    return javaObjectForIBinder(env, b);
}
```

### 2-1-2.javaObjectForIBinder

```
frameworks/base/core/jni/android_util_Binder.cpp

// 547
jobject javaObjectForIBinder(JNIEnv* env, const sp<IBinder>& val)

// 563 从 BpBinder中查找 BinderProxy对象，第一次为 null
jobject object = (jobject)val->findObject(&gBinderProxyOffsets);

// 576 创建 BinderProxy对象
object = env->NewObject(gBinderProxyOffsets.mClass,
gBinderProxyOffsets.mConstructor);

// 580 BinderProxy.mObject成员变量记录 BpBinder对象
env->SetLongField(object, gBinderProxyOffsets.mObject, (jlong)val.get());


// 587 将 BinderProxy对象信息添加到 BpBinder的成员变量 mObjects中
val->attachObject(&gBinderProxyOffsets, refObject,
                jnienv_to_javavm(env), proxy_cleanup);

// 593 BinderProxy.mOrgue成员变量记录死亡通知对象
env->SetLongField(object, gBinderProxyOffsets.mOrgue, reinterpret_cast<jlong>
(drl.get()));
```

## 2-2.ServiceManagerNative.asInterface

```
frameworks/base/core/java/android/os/ServiceManagerNative.java

// 33
static public IServiceManager asInterface(IBinder obj)

// 38 因为 obj为 BinderProxy，默认返回 null
IServiceManager in =
    (IServiceManager)obj.queryLocalInterface(descriptor);

// 44
return new ServiceManagerProxy(obj);
```

## 2-3.ServiceManagerProxy

```
frameworks/base/core/java/android/os/ServiceManagerNative.java$ServiceManagerPro
xy.java

// 109
class ServiceManagerProxy implements IServiceManager {
    // mRemote为 BinderProxy对象
    public ServiceManagerProxy(IBinder remote) {
        mRemote = remote;
    }
```

# 3.SMP.addService--1

```
frameworks/base/core/java/android/os/ServiceManagerNative.java$ServiceManagerPro
xy.java

// 142
public void addService(String name, IBinder service, boolean allowIsolated)
            throws RemoteException {
Parcel data = Parcel.obtain();
Parcel reply = Parcel.obtain();

// 148 此处 service == AMS
data.writeStrongBinder(service);
```

## 3-1.Parcel.writeStrongBinder

```
frameworks/base/core/java/android/os/Parcel.java

// 583
public final void writeStrongBinder(IBinder val) {
    nativeWriteStrongBinder(mNativePtr, val);
}
```

## 3-2.android_os_Parcel_writeStrongBinder

```
frameworks/base/core/jni/android_os_Parcel.cpp

// 298
static void android_os_Parcel_writeStrongBinder(JNIEnv* env, jclass clazz, jlong
nativePtr, jobject object)


// 300 将java层 Parcel转换为 native层 Parcel
Parcel* parcel = reinterpret_cast<Parcel*>(nativePtr);

// 302 ---见后面小节（分别分析 ibinderForJavaObject和 writeStrongBinder）
const status_t err = parcel->writeStrongBinder(ibinderForJavaObject(env,
object));
```

## 3-2-1.ibinderForJavaObject

```
frameworks/base/core/jni/android_util_Binder.cpp

// 603
sp<IBinder> ibinderForJavaObject(JNIEnv* env, jobject obj)

// 607
if (env->IsInstanceOf(obj, gBinderOffsets.mClass)) { // 是否是 Java层的 Binder对
象，此处是 AMS，if命中
    JavaBBinderHolder* jbh = (JavaBBinderHolder*)
        env->GetLongField(obj, gBinderOffsets.mObject);
    return jbh != NULL ? jbh->get(env, obj) : NULL; // 返回 JavaBBinder对象
}
```

### 3-2-1-1.JavaBBinderHolder.get

```
frameworks/base/core/jni/android_util_Binder.cpp$JavaBBinderHolder.cpp

// 317
sp<JavaBBinder> get(JNIEnv* env, jobject obj)

// 320
sp<JavaBBinder> b = mBinder.promote(); // 将弱指针升级为强指针，首次进来返回空指针
if (b == NULL) {
    b = new JavaBBinder(env, obj); // 创建一个 JavaBBinder 对象并返回
```

记住：writeStrongBinder的参数是 JavaBBinder对象。

## 3-2-2.(Parcel.cpp)parcel->writeStrongBinder

```
frameworks/native/libs/binder/Parcel.cpp

// 872
status_t Parcel::writeStrongBinder(const sp<IBinder>& val)
{
    return flatten_binder(ProcessState::self(), val, this);
}
```

### 3-2-2-1.flatten_binder

```
frameworks/native/libs/binder/Parcel.cpp

// 205
status_t flatten_binder(const sp<ProcessState>& /*proc*/,
    const sp<IBinder>& binder, Parcel* out)

// 208
flat_binder_object obj;

// 212 当前进程有 Binder，所以本地 Binder不为空
IBinder *local = binder->localBinder();

// 224  Binder对象扁平化，转换成 flat_binder_object对象
obj.type = BINDER_TYPE_BINDER;
obj.binder = reinterpret_cast<uintptr_t>(local->getWeakRefs());
obj.cookie = reinterpret_cast<uintptr_t>(local);

// 234
return finish_flatten_binder(binder, obj, out);
```

#### 3-2-2-2.finish_flatten_binder

```
frameworks/native/libs/binder/Parcel.cpp

// 199
inline static status_t finish_flatten_binder(
    const sp<IBinder>& /*binder*/, const flat_binder_object& flat, Parcel* out)
{
    // 将 flat_binder_object写入 out
    return out->writeObject(flat, false);
}
```

# 3.SMP.addService--2

```
frameworks/base/core/java/android/os/ServiceManagerNative.java$ServiceManagerPro
xy.java

// 142
public void addService(String name, IBinder service, boolean allowIsolated)
            throws RemoteException {

// 150 mRemote为 BinderProxy对象
mRemote.transact(ADD_SERVICE_TRANSACTION, data, reply, 0);
```

## 3-1.BinderProxy.transact

```
frameworks/base/core/java/android/os/Binder.java$BinderProxy.java

// 501
public boolean transact(int code, Parcel data, Parcel reply, int flags) throws
RemoteException {

// 503
return transactNative(code, data, reply, flags);
```

## 3-2.android_os_BinderProxy_transact

```
frameworks/base/core/jni/android_util_Binder.cpp

// 1083
static jboolean android_os_BinderProxy_transact(JNIEnv* env, jobject obj,
        jint code, jobject dataObj, jobject replyObj, jint flags) // throws
RemoteException

// 1091 获取 data对象
Parcel* data = parcelForJavaObject(env, dataObj);

// 1095 获取 reply对象
Parcel* reply = parcelForJavaObject(env, replyObj);

// 1100 获取 BpBinder 对象
IBinder* target = (IBinder*)
        env->GetLongField(obj, gBinderProxyOffsets.mObject);

// 1124
status_t err = target->transact(code, *data, reply, flags);
```

## 3-3.BpBinder::transact

```
frameworks/native/libs/binder/BpBinder.cpp

// 159
status_t BpBinder::transact(
    uint32_t code, const Parcel& data, Parcel* reply, uint32_t flags)

// 164
status_t status = IPCThreadState::self()->transact(
            mHandle, code, data, reply, flags);
```

## 3-4.IPCThreadState::transact

```
frameworks/native/libs/binder/IPCThreadState.cpp

// 548
status_t IPCThreadState::transact(int32_t handle,
                                  uint32_t code, const Parcel& data,
                                  Parcel* reply, uint32_t flags)

// 552 数据错误检查
status_t err = data.errorCheck();

// 554
flags |= TF_ACCEPT_FDS;
    TF_ACCEPT_FDS = 0x10：允许回复中包含文件描述符
    TF_ONE_WAY：当前业务是异步的，不需要等待
    TF_ROOT_OBJECT：所包含的内容是根对象
    TF_STATUS_CODE：所包含的内容是 32-bit 的状态值

// 566 整理数据，并把结果存入 mOut 中。（在 talkWithDriver方法中才会将命令真正发送给
Binder驱动）
```

```
err = writeTransactionData(BC_TRANSACTION, flags, handle, code, data, NULL);

// 574
if ((flags & TF_ONE_WAY) == 0) { // 不是异步，if命中
    if (reply) { // 不为空
        err = waitForResponse(reply); // 等待回应事件
    }
}
```

### 3-4-1.writeTransactionData

```
frameworks/native/libs/binder/IPCThreadState.cpp

// 904
status_t IPCThreadState::writeTransactionData(int32_t cmd, uint32_t binderFlags,
    int32_t handle, uint32_t code, const Parcel& data, status_t* statusBuffer)

// 934
mOut.writeInt32(cmd); // mOut写入命令为 BC_TRANSACTION
mOut.write(&tr, sizeof(tr)); // 写入 binder_transaction_data数据
```

## 3-5.IPCThreadState::waitForResponse--1

```
frameworks/native/libs/binder/IPCThreadState.cpp

// 712
status_t IPCThreadState::waitForResponse(Parcel *reply, status_t *acquireResult)

// 717 循环等待结果
while (1) {
    if ((err=talkWithDriver()) < NO_ERROR) break;
```

### 3-5-1.talkWithDriver

```
frameworks/native/libs/binder/IPCThreadState.cpp

// 803
status_t IPCThreadState::talkWithDriver(bool doReceive)

// 812 读的 buffer是否为空。现在读为 null
const bool needRead = mIn.dataPosition() >= mIn.dataSize();

// 817
const size_t outAvail = (!doReceive || needRead) ? mOut.dataSize() : 0; // 读的时
候不能写 mOut

bwr.write_size = outAvail;
bwr.write_buffer = (uintptr_t)mOut.data(); // 在 bwr中填写需要 write的大小和内容

if (doReceive && needRead) {
    bwr.read_size = mIn.dataCapacity();
    bwr.read_buffer = (uintptr_t)mIn.data();
} else { // needRead为 null，走 else
    bwr.read_size = 0;
    bwr.read_buffer = 0;
```

```
}

// 851
do { // while循环条件不会成立，只执行一次

    /* 856 写入命令 BC_TRANSACTION */
    if (ioctl(mProcess->mDriverFD, BINDER_WRITE_READ, &bwr) >= 0)

} while (err == -EINTR);
```

## 3-5-2.binder_ioctl_write_read--1

```
kernel/drivers/staging/android/binder.c

// 3136
static int binder_ioctl_write_read(struct file *filp,
                unsigned int cmd, unsigned long arg,
                struct binder_thread *thread)

// 3161 通过这个函数写入用户的数据
ret = binder_thread_write(proc, thread,
              bwr.write_buffer,
              bwr.write_size,
              &bwr.write_consumed);
```

### 3-5-2-1.binder_thread_write

```
kernel/drivers/staging/android/binder.c

// 2250
static int binder_thread_write(struct binder_proc *proc,
            struct binder_thread *thread,
            binder_uintptr_t binder_buffer, size_t size,
            binder_size_t *consumed)

// 2442
case BC_TRANSACTION:
    binder_transaction(proc, thread, &tr,
                cmd == BC_REPLY, 0); // 此处 cmd == BC_TRANSACTION，第四个参数为
false
```

### 3-5-2-2.binder_transaction

```
kernel/drivers/staging/android/binder.c

// 1829
static void binder_transaction(struct binder_proc *proc,
                   struct binder_thread *thread,
                   struct binder_transaction_data *tr, int reply,
                   binder_size_t extra_buffers_size)

// 1861 此处 reply为 false（cmd == BC_TRANSACTION）
if (reply) {

} else {
    if (tr->target.handle) { // 不命中 if，handle不为 0，才会命中 if
```

```
    } else { // 此处走 else
        /* 获取目标对象的 target_node，目标是 service_manager，所以可以直接使用全局变量
binder_context_mgr_node */
        target_node = context->binder_context_mgr_node;
    }
    /* 1919 target_proc为 service_manager进程 */
    target_proc = target_node->proc;
}

// 1954 找到 service_manager进程的 todo队列
target_list = &target_proc->todo;
target_wait = &target_proc->wait;

// 1960 生成一个 binder_transaction 变量（即变量 t），用于描述本次要进行的
transaction（最后将其加入 target_thread->todo）。
// 这样当目标对象被唤醒时，它就可以从这个队列中取出需要做的工作。
t = kzalloc(sizeof(*t), GFP_KERNEL);

// 1967 生成一个binder_work变量（即变量 tcomplete），用于说明当前调用者线程有一宗未完成的
transaction（它最后会被添加到本线程的 todo队列中）
tcomplete = kzalloc(sizeof(*tcomplete), GFP_KERNEL);

// 1996 给 transaction结构体赋值，即变量 t
if (!reply && !(tr->flags & TF_ONE_WAY)) // 非 oneway的通信方式，把当前 thread保存到
transaction的 from字段
    t->from = thread;
else
    t->from = NULL;
t->sender_euid = task_euid(proc->tsk);
t->to_proc = target_proc; // 此次通信目标进程为 service_manager进程
t->to_thread = target_thread;
t->code = tr->code; // 此次通信 code = ADD_SERVICE_TRANSACTION
t->flags = tr->flags; // 此次通信 flags = 0
t->priority = task_nice(current);

// 2009 从 service_manager进程中分配 buffer(为完成本条 transaction申请内存，从
binder_mmap开辟的空间中申请内存)
t->buffer = binder_alloc_buf(target_proc, tr->data_size,
    tr->offsets_size, extra_buffers_size,
    !reply && (t->flags & TF_ONE_WAY));

// 2028 分别拷贝用户空间的 binder_transaction_data中 ptr.buffer和 ptr.offsets到内核
if (copy_from_user(t->buffer->data, (const void __user *)(uintptr_t)
           tr->data.ptr.buffer, tr->data_size)) {
}
if (copy_from_user(offp, (const void __user *)(uintptr_t)
           tr->data.ptr.offsets, tr->offsets_size)) {
}

// 2059
for (; offp < off_end; offp++) {

    // 2075
    case BINDER_TYPE_BINDER:
    case BINDER_TYPE_WEAK_BINDER: {
        struct flat_binder_object *fp;
```

```
        fp = to_flat_binder_object(hdr);
        /* 创建 binder_ref，service_manager的 binder引用对象---见后面小节 */
        ret = binder_translate_binder(fp, t, thread);
        if (ret < 0) {
            return_error = BR_FAILED_REPLY;
            goto err_translate_failed;
        }
    } break;
}

// 2187
} else if (!(t->flags & TF_ONE_WAY)) {

    // 2191
    thread->transaction_stack = t; // 记录本次 transaction,以备后期查询（service_manager通过这个知道是谁调用的，从而返回数据）
}

// 2201
t->work.type = BINDER_WORK_TRANSACTION; // 设置 t的类型为 BINDER_WORK_TRANSACTION
list_add_tail(&t->work.entry, target_list); // 将 t加入目标的处理队列中
tcomplete->type = BINDER_WORK_TRANSACTION_COMPLETE; // 设置 binder_work的类型为 BINDER_WORK_TRANSACTION_COMPLETE
list_add_tail(&tcomplete->entry, &thread->todo); //  当前线程有一个未完成的操作
if (target_wait)
    wake_up_interruptible(target_wait);// 唤醒目标，即 service_manager
```

#### 3-5-2-2-1.binder_translate_binder

```
kernel/drivers/staging/android/binder.c

// 1564
static int binder_translate_binder(struct flat_binder_object *fp,
                   struct binder_transaction *t,
                   struct binder_thread *thread)

// 1592 创建一个 binder_ref
ref = binder_get_ref_for_node(target_proc, node);

// 1596 改变类型为 BINDER_TYPE_HANDLE
if (fp->hdr.type == BINDER_TYPE_BINDER)
    fp->hdr.type = BINDER_TYPE_HANDLE;
```

## 3-5-2.binder_ioctl_write_read--2--service_manager已被唤醒

```
kernel/drivers/staging/android/binder.c

// 3136
static int binder_ioctl_write_read(struct file *filp,
                unsigned int cmd, unsigned long arg,
                struct binder_thread *thread)

// 3174
ret = binder_thread_read(proc, thread, bwr.read_buffer,
             bwr.read_size,
             &bwr.read_consumed,
             filp->f_flags & O_NONBLOCK);
```

#### 3-5-2-3.binder_thread_read

```
kernel/drivers/staging/android/binder.c

// 2652
static int binder_thread_read(struct binder_proc *proc,
                  struct binder_thread *thread,
                  binder_uintptr_t binder_buffer, size_t size,
                  binder_size_t *consumed, int non_block)

// 2664 如果 consumed==0，则写入一个 BR_NOOP
if (*consumed == 0) {
    if (put_user(BR_NOOP, (uint32_t __user *)ptr))


// 2739 前面把一个 binder_work添加到 thread->todo队列中，所以 w不为空，类型为
BINDER_WORK_TRANSACTION_COMPLETE
if (!list_empty(&thread->todo)) {
    w = list_first_entry(&thread->todo, struct binder_work,
                         entry);


// 2760 写入命令 BR_TRANSACTION_COMPLETE
case BINDER_WORK_TRANSACTION_COMPLETE: {
    cmd = BR_TRANSACTION_COMPLETE;
    if (put_user(cmd, (uint32_t __user *)ptr))
```

## 3-5.IPCThreadState::waitForResponse--2

```
frameworks/native/libs/binder/IPCThreadState.cpp

// 712
status_t IPCThreadState::waitForResponse(Parcel *reply, status_t *acquireResult)

// 786 处理 BR_NOOP命令，什么也没干
default:
    err = executeCommand(cmd);

// 718 while循环，继续执行 talkWithDriver方法
if ((err=talkWithDriver()) < NO_ERROR) break;

    // 812 因为 mIn中有数据，所以 needRead为 false，导致 bwr.write_size和
bwr.read_size都为0，直接返回
```

```
    const bool needRead = mIn.dataPosition() >= mIn.dataSize();

// 731 处理 BR_TRANSACTION_COMPLETE命令
case BR_TRANSACTION_COMPLETE:
    if (!reply && !acquireResult) goto finish; // 当前为同步，不会进入 if，继续
while循环

// 718 再次执行 talkWithDriver方法，这个时候 bwr.write_size==0,bwr.read_size还是大于
0，所以直接执行驱动中 binder_thread_read
if ((err=talkWithDriver()) < NO_ERROR) break;
```

## 3-6.binder_thread_read--Client线程进入等待

```
kernel/drivers/staging/android/binder.c

// 2652
static int binder_thread_read(struct binder_proc *proc,
                  struct binder_thread *thread,
                  binder_uintptr_t binder_buffer, size_t size,
                  binder_size_t *consumed, int non_block)

// 2664 放入 BR_NOOP命令
if (*consumed == 0) {
        if (put_user(BR_NOOP, (uint32_t __user *)ptr))

// 2671 此时 wait_for_proc_work为false
wait_for_proc_work = thread->transaction_stack == NULL &&
            list_empty(&thread->todo);

// 2717
if (non_block) { // 是阻塞模式的，所以 if不会命中

} else // 进入等待，直到 service_manager 来唤醒
    ret = wait_event_freezable(thread->wait, binder_has_thread_work(thread));
```

## 3-7.binder_thread_read--service_manager开始处理消息

```
kernel/drivers/staging/android/binder.c

// 2652
static int binder_thread_read(struct binder_proc *proc,
                  struct binder_thread *thread,
                  binder_uintptr_t binder_buffer, size_t size,
                  binder_size_t *consumed, int non_block)

// 2757 主要是把用户的请求复制到 service_manager中并对各种队列进行调整
case BINDER_WORK_TRANSACTION: {
    t = container_of(w, struct binder_transaction, work);

// 2898 设置命令为 BR_TRANSACTION
cmd = BR_TRANSACTION;
```

## 3-8.binder_loop

```
frameworks/native/cmds/servicemanager/binder.c

// 372
void binder_loop(struct binder_state *bs, binder_handler func)

// 397 对 getService请求进行解析
res = binder_parse(bs, 0, (uintptr_t) readbuf, bwr.read_consumed, func);
```

## 3-9.binder_parse

```
frameworks/native/cmds/servicemanager/binder.c

// 204
int binder_parse(struct binder_state *bs, struct binder_io *bio,
                 uintptr_t ptr, size_t size, binder_handler func)

// 230
case BR_TRANSACTION: {

    // 237
    if (func) {

        // 243 为 reply初始化
        bio_init(&reply, rdata, sizeof(rdata), 4);

        // 245
        res = func(bs, txn, &msg, &reply); // 由 svcmgr_handler 处理请求
        binder_send_reply(bs, &reply, txn->data.ptr.buffer, res); // 将 reply发给
binder驱动
    }
```

### 3-9-1.service_manager

```
frameworks/native/cmds/servicemanager/service_manager.c

// 251
int svcmgr_handler(struct binder_state *bs,
                   struct binder_transaction_data *txn,
                   struct binder_io *msg,
                   struct binder_io *reply)

// 309
case SVC_MGR_ADD_SERVICE:

    // 316 注册指定服务
    if (do_add_service(bs, s, len, handle, txn->sender_euid,
        allow_isolated, txn->sender_pid))
```

#### 3-9-1-1.do_add_service

```
frameworks/native/cmds/servicemanager/service_manager.c

// 201
int do_add_service(struct binder_state *bs,
                   const uint16_t *s, size_t len,
```

```
                    uint32_t handle, uid_t uid, int allow_isolated,
                    pid_t spid)

// 214
if (!svc_can_register(s, len, spid, uid)) {

// 220
si = find_svc(s, len);
if (si) {
    if (si->handle) {
        svcinfo_death(bs, si); // 服务已注册时，释放相应的服务
    }
    si->handle = handle; // 重新放入新的
} else {
    si = malloc(sizeof(*si) + (len + 1) * sizeof(uint16_t));
    if (!si) { // 内存不足，无法分配足够内存
        return -1;
    }
    si->handle = handle;
    si->len = len;
    memcpy(si->name, s, (len + 1) * sizeof(uint16_t));// 内存拷贝服务信息
    si->name[len] = '\0';
    si->death.func = (void*) svcinfo_death;
    si->death.ptr = si;
    si->allow_isolated = allow_isolated;
    si->next = svclist; // svclist保存所有已注册的服务
    svclist = si;
}

/* 以 BC_ACQUIRE命令，handle为目标的信息，通过 ioctl发送给 binder驱动，binder_ref强引用
加 1操作 */
binder_acquire(bs, handle);
/* 以 BC_REQUEST_DEATH_NOTIFICATION命令的信息，通过 ioctl发送给 binder驱动，主要用于清
理内存等收尾工作 */
binder_link_to_death(bs, handle, &si->death);
```

## 3-9-2.binder_send_reply

```
frameworks/native/cmds/servicemanager/binder.c

// 170
void binder_send_reply(struct binder_state *bs,
                       struct binder_io *reply,
                       binder_uintptr_t buffer_to_free,
                       int status)

// 182
data.cmd_free = BC_FREE_BUFFER; // free buffer命令
data.buffer = buffer_to_free;
data.cmd_reply = BC_REPLY; // reply命令
data.txn.target.ptr = 0;
data.txn.cookie = 0;
data.txn.code = 0;
if (status) { // status == 0

} else {
    data.txn.flags = 0;
```

```
    data.txn.data_size = reply->data - reply->data0;
    data.txn.offsets_size = ((char*) reply->offs) - ((char*) reply->offs0);
    data.txn.data.ptr.buffer = (uintptr_t)reply->data0;
    data.txn.data.ptr.offsets = (uintptr_t)reply->offs0;
}
binder_write(bs, &data, sizeof(data)); // 向 Binder驱动通信
```

#### 3-9-2-1. binder_thread_write

```
kernel/drivers/staging/android/binder.c

// 2250
static int binder_thread_write(struct binder_proc *proc,
            struct binder_thread *thread,
            binder_uintptr_t binder_buffer, size_t size,
            binder_size_t *consumed)

binder_transaction(proc, thread, &tr,
                       cmd == BC_REPLY, 0);
```