Android Framework Traning: Binder

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Agenda

- **What is Binder**
- Binder driver
- Binder framework service
- How to use Binder?

What is Binder

- Start with OpenBinder
- Why Android choose Binder?

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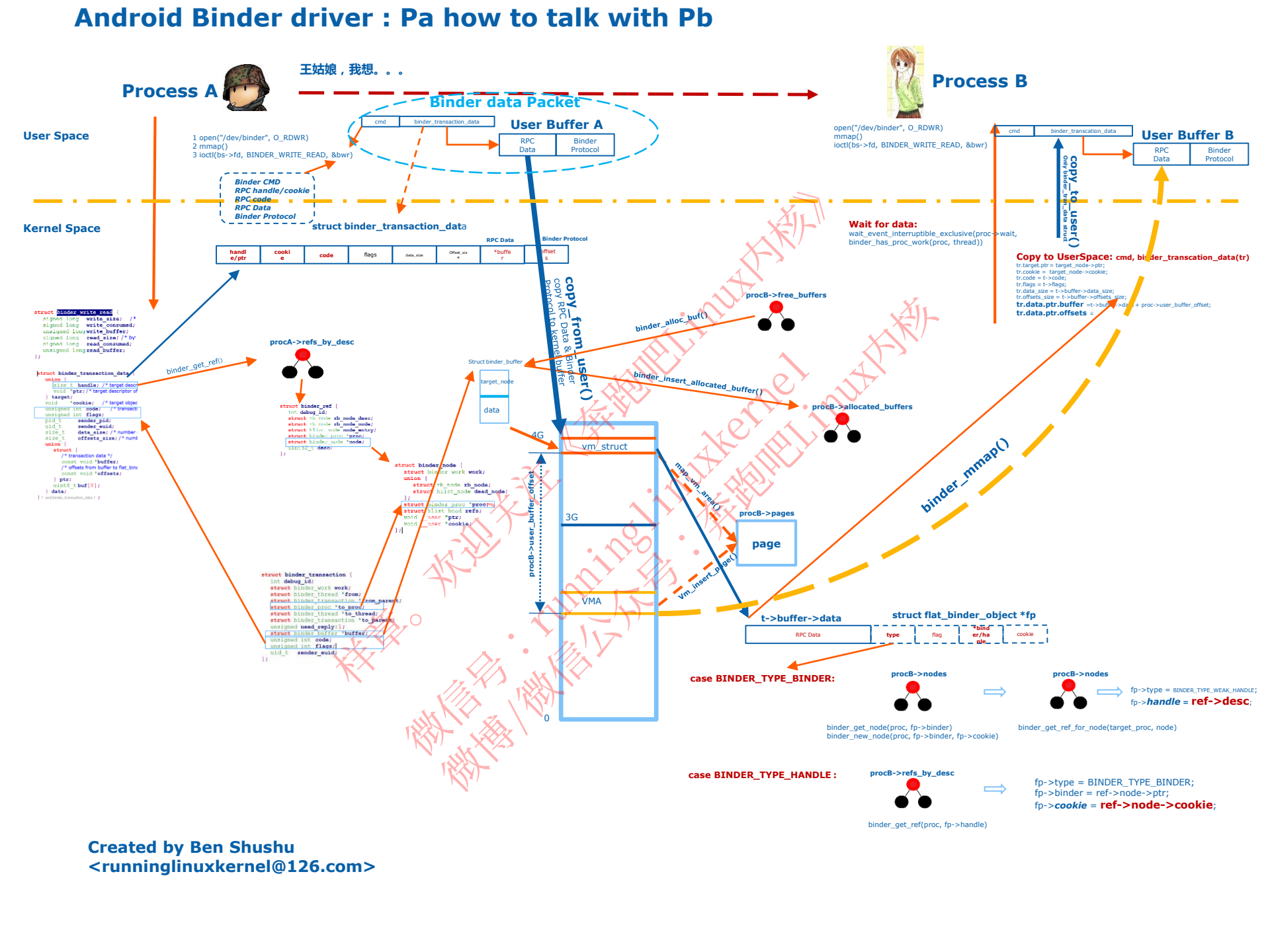
- What is Binder
- **Binder driver**
- Binder framework service
- How to use Binder?

Android Binder driver : Pa how to talk with Pb



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- What is Binder
- Binder driver
- **Binder framework service**
- How to use Binder?

Binder Framework - Step 1: Register service

AudioFlinger::instantiate()

defaultServiceManager()->addService("media.audio_flinger", **new AudioFlinger**);

interface_cast<IServiceManager>(
ProcessState::self()->getContextObject(NULL));

BpServiceManager(new BpBinder(0))

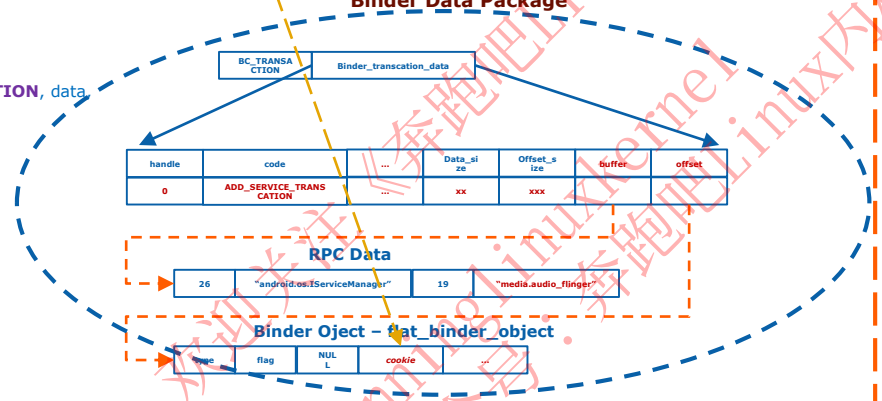
BpServiceManager->addService:
data.writeInterfaceToken();
data.**writeString16**(name);
data.**writeStrongBinder**(service);
data.writeInt32();
remote()->transact(**ADD_SERVICE_TRANSACTION**, data, &reply);

BpBinder::transact:
IPCThreadState::self()->transact(
mHandle, code, data, reply, flags);

IPCThreadState::writeTransactionData
IPCThreadState::talkWithDriver

Send service name, cookie

Binder Data Package



ServiceManager (handle = 0)

svcmgr_handler: SVC_MGR_ADD_SERVICE

svclist List

1. Get **service name from RPC data** :
2. Get binder object pointer (***handle***) from **flat_binder_object**
3. New service element, add to svclist

Send service name, handle to ServiceManager

Binder Driver

case BINDER_TYPE_BINDER:

proc->nodes

- Find binder_node by handle : binder_get_node(proc, fp->binder)
- New binder_node : binder_new_node(proc, fp->binder, fp->cookie)

node->cookie point to AudioFlinger

proc->nodes

binder_get_ref_for_node(target_proc, node)

fp->type = BINDER_TYPE_WEAK_HANDLE;
fp->***handle*** = **ref->desc**;

Binder Framework Step 2: get service

Binder Framework Step 3: RPC Call

Binder Framework – summary (For example: AudioFlinger)

Step 1: Register Service (AudioFlinger::instantiate())

- **Service_Process** send "service name" and cookie (point to **new BnAudioFlinger**) to binder driver
- Binder driver new a binder_node and binder_ref,
  binder_node->cookie
  binder_ref->desc
- Binder driver send struct flat_binder_object to user space
  fp->handle = ref->desc;
- ServiceManager add svcinfo to list
  svcinfo->name = "service name"
  svcinfo->ptr = fp->handle

Step 2: Get Service (AudioSystem::get_audio_flinger())

- Client_Process send "service name" to binder driver, binder driver bypass to ServiceManager
- ServiceManager find service element by "service name", get the **service handle**
- Client_Process use **service handle** to new a **Bpbinder**, and type conversion to **BpAudioFlinger.**

Step 3: RPC Call (AudioSystem::setMode(int mode))

- Client_process get **BpAudioFlinger**, and send binder package data to binder driver: handle, RPC func code, parameter
- Binder driver find binder_node by handle, and sent binder_node->cookie to Service Process
- Service Process get cookie and type conversion to **AudioFlinger** (BnAudioFlinger)
  BnAudioFlinger::onTranscat() => call AudioFlinger::setMode() => send reply to binder driver
  binder driver wait up client process
- Client process get result.

Binder App example: HelloWorldService

Source code : https://github.com/mcr/Android-HelloWorldService

Client

1 GetService

```
sm = android::defaultServiceManager()
sp<android::IBinder> binder;

binder = sm->getService("hellowold_name"));
```

2 Get BpHelloWorldClient

```
android::sp<IHelloWorldClient> shw;
shw = android::interface_cast<IHelloWorldClient>(binder);
```

3 RPC Call

```
shw->hellothere("fun");
```

BpHelloWorldClient talk to binder driver

```
void hellothere(const char *str)
    {
        android::Parcel data, reply;
        data.writeInterfaceToken();
        data.writeCString(str);
        remote()->transact(HW_HELLOTHERE, data,
&reply, android::IBinder::FLAG_ONEWAY);
    }
```

Service

1 Register Service and start service:

```
void HelloWorldService::instantiate() {
  android::defaultServiceManager()->addService("", new HelloWorldService());
}

android::ProcessState::self()->startThreadPool();
```

2 BnHelloWorldService

```
HelloWorldService::onTransact(code,)

switch(code) {
    case HW_HELLOTHERE: {
        CHECK_INTERFACE(IHelloWorldService, data, reply);
        const char *str;
        str = data.readCString();
        /* hellothere(str); */
        printf("hello: %s\n", str);
        return android::NO_ERROR;
    } break;
```

Thank you!

Discussion after class

1. For mmap system call, the function mmap for user space :

void* mmap(void *addr, size_t size, int prot, int flags, int fd, long offset)

but in kernel space like binder driver, the mmap function:

int binder_mmap(struct file *filp, **struct vm_area_struct *vma**)

It is too difference, so the second parameter struct vm_area_struct *vma in binder_mmap(), where is come from?

2. In binder, Process A send data to Process B, it need copy data between kernel space and user space, so how many times of copy data does it occur?

3. In binder driver, we use copy_from_user()/copy_to_user() to copy data between kernel space and user space, is it instead of using memcpy()? Why?

4. In binder_mmap() function, it reversed a vmalloc region for remap new pages by get_vm_area(), and the new page also remap to VMA region, why it remap two regions?

Thank you!