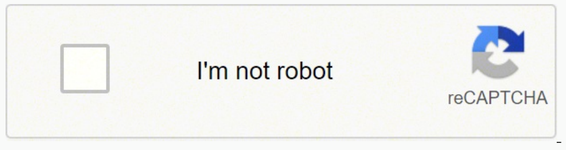

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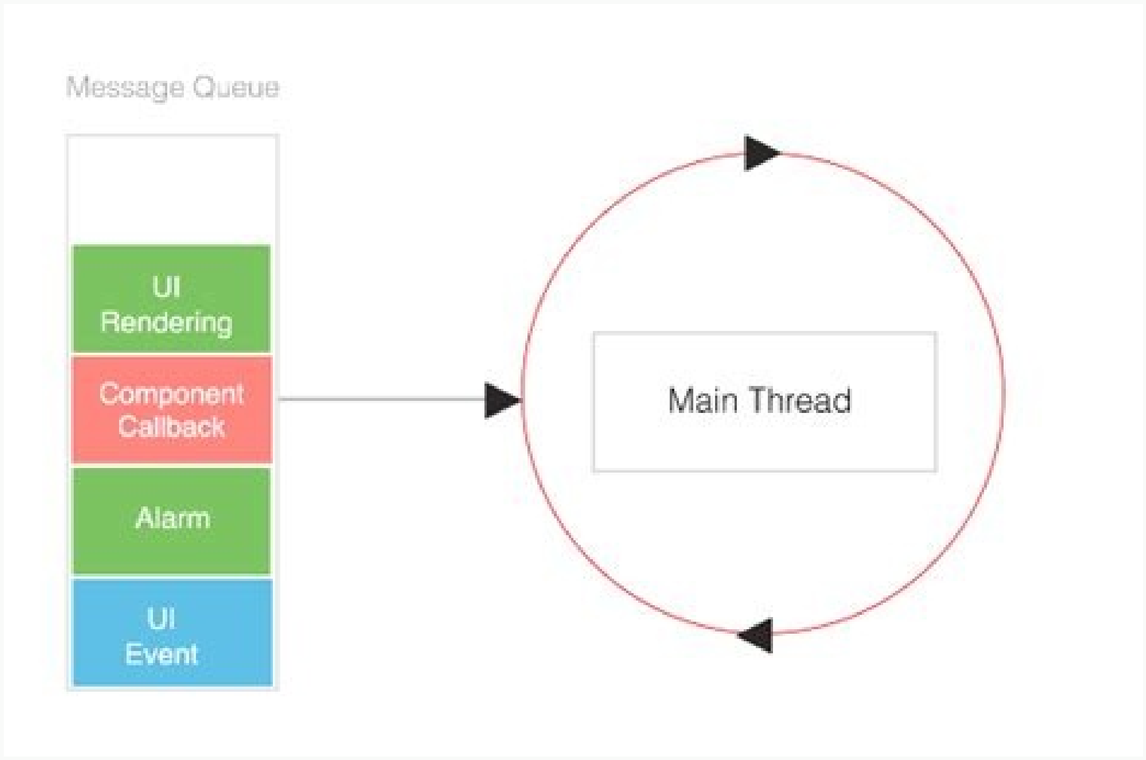
Binder tutorial android

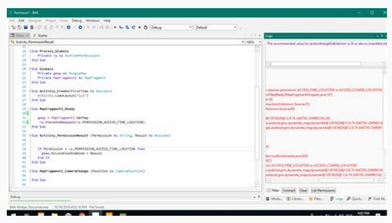



```
public final class ActivityMainBinding implements ViewBinding {
  @NonNull
  private final CoordinatorLayout rootView;

  @NonNull
  public final FloatingActionButton fab;

  @NonNull
  public final RecyclerView recyclerView;

  @NonNull
  public final TextView textViewMissingProfile;
```



Android service binder tutorial.

// This thread may have been spawned by a thread that was in the background 40. abort(); 54. if (IN < sizeof(int32_t)) return result; 12. int sum = 0; 17. Parcel data, reply; 13. The requirement for hardware is very low, which is in line with the actual situation of android. // Read the data returned by Server. 39. break; 60. I##INTERFACE::I##INTERFACE() { } \ 33. 16. cmd = mIn.readInt32(); 13. As the mechanism implementation of IPC, most components in the system are connected in series, and the coupling between components is minimized. int sum = reply.readInt32(); 24. // The data to be sent to Server is then written to Binder. The system services provided in Android are registered by Service Manager and added to the service management list to provide services to clients. Composition of Binder Mechanism Binder Driver: Binder is a character driver in the kernel located at / dev/binder. if (mBinderServiceTest.get() == 0) { 9. // Add Service "my.binder.test" to Service Manager. 37. sum = mBinderServiceTest->add(3, 4); 29. // one to avoid performing an initial transaction in the background. The transact function of the BBinder class finally calls the onTransact function of the BnBinderServiceTest class.Next, start with the Server startup. if (obj != NULL) { \ 23. return gProcess; 8. The directory structure of the test program is as follows. Client receives the return result from Server. intr = static_cast 13. In addition, various system components are also running in independent processes. String8 name = makeBinderThreadName(); 16. { \ 21. They may run in the same process or in different processes. If Client wants to communicate with Server, it must first obtain the remote interface of Server, which is implemented by Service Manager. 1.---> IPCThreadState.cpp 2. ALOGI("BnBinderServiceTest add, a = %d b = %d", a, b); 15. Proxy sends user request information to Linux kernel space (actually memory sharing) via Binder device node (/dev/binder), which is acquired by Binder driver and sent to Server. 3.class BpBinderServiceTest: public BpInterface 4.{ 5.public: 6. int sum = 0; 6. 44. data.writeInterfaceToken(IBinderServiceTest::getInterfaceDescriptor()); 17. 17. 63. 1.---> BinderClientRun.cpp 2. android has a wide range of product lines and chips at all levels. Service Manager: This is mainly used to manage services. // The Parcel class is used to serialize inter-process communication data. spawnPooledThread(true); 9. // foreground cgroup before rejoining the pool. From the application point of view, there is no difference between the proxy object and the local object. // Write the header of the Binder transport data, where the Service descriptor "android. if (!mThreadPoolStarted) { 7. static android::sp asInterface 7. if (binder != 0) 17. return sum; 27. I##INTERFACE::~I##INTERFACE() { } These two macros will be used in the program 1.---> IBinderServiceTest.h 2. 20.void BinderServiceTest::instantiate() { 21. virtual int add(int a, int b) = 0; 8.}; 9. // our group so we want to make absolutely sure it is put back. 12. PoolThread(bool isMain) 7. { 9. But asInterface is not directly implemented in our source code, so where is it implemented? data.writeInt32(a); 19. 6. } 17. 20. const android::sp& obj); \ 7. 3.status_t BnBinderServiceTest::onTransact(uint32_t code, const Parcel& data, 4. Binder is based on OpenBinder. The class diagram is shown below. The goal is process and IPC, not cross-network communication. status_t st = defaultServiceManager()->addService(24. int b = data.readInt32(); 14. 12.void ProcessState::spawnPooledThread(bool isMain) 13.{ 14. BinderServiceTest::instantiate(); 12. In order to run smoothly on low-end machines, the performance requirements of the software itself are still very important. (obj->queryLocalInterface(IBinderServiceTest ::descriptor).get()); 14. } \ 18. gProcess = new ProcessState; 10. threadLoop() also calls joinThreadPool() to complete the work. const android::String16 IBinderServiceTest ::descriptor("android.test.IBinderServiceTest"); 4. } 26. status_t result; 45. 50. The code for joinThreadPool() is as follows. } 55. mThreadPoolStarted = true; 8. I##INTERFACE::descriptor).get()); \ 26. 11.protected: 12. queryLocalInterface(\ 25. 3.#define DECLARE_META_INTERFACE(INTERFACE) \ 4. This enables binder to support most traditional operating system platforms. } 20.} PoolThread is a Thread subclass defined in IPCThreadState. android::sp IBinderServiceTest ::asInterface 8. processPendingDerefs(); 47. } 10. mProcess->mDriverFD, result); 53. // Get the remote interface of Service Manager through defaultService Manager function 10. It can call its methods and access its variables like other local objects. do { 15. static const android::String16 descriptor; 6. They can call their methods, which are synchronous and return the corresponding results. if (obj != NULL) { 12. It can request services in Server. Popular, it actually provides remote procedure call (RPC) functions. // Use SM - > getService in the loop to constantly try to get a Service named "my.binder.test" and return it to binder 14. ALOGD("Destructor"); 34.} 35. IBinderServiceTest ::~IBinderServiceTest () { } In the expanded macro, we find the asInterface, where new a BpBinderService Test is returned. int a = data.readInt32(); 13. Parcel* reply, uint32_t flags) { 5. You can see that service manager is the management center of system service objects. do { 46. } 10.} 11..... sp binder; 12. Various threading models that support multi-threaded programming. 3.status_t IPCThreadState::getAndExecuteCommand() 4.{ 5. { 10. 23. static const android::String16 descriptor; \ 5. (const android::sp& obj) 9. 56. return intr; \ 31. IPCThreadState::self()->joinThreadPool(); 14. ALOGI("BpBinderServiceTest add, a = %d, b = %d", a, b); 14. server is on the left and client is on the right. } 17. : mIsMain(isMain) 8. ALOGI("BpBinderServiceTest sum = %d", sum); 26. 3.template 4.inline sp interface_cast(const sp& obj) 5.{ 6. // Read the input data. IBinderServiceTest ::IBinderServiceTest () { } 21. return false; 16. if(result == TIMED_OUT && !isMain) { 59. android::sp intr; 11. ALOGI("add a = %d, b = %d.", a, b); 38. // need to take care of that here in userspace. const android::String16 I##INTERFACE::descriptor(NAME); \ 14. result = getAndExecuteCommand(); 49. ALOGD("Constructor"); 30.} 31. IBinderServiceTest (); 10. 10. BpInterface (impl) { 8. return IBinderServiceTest ::descriptor; 6. } 7. 16. Note that we do make 24. The BBinder class's transact function is then called and the relevant parameters are passed in. 13.IMPLEMENT_META_INTERFACE(BinderServiceTest, "android.test.IBinderServiceTest"); Expanding these two macros will wait 1.---> IBinderServiceTest.h 2. mOut.writeInt32(BC_EXIT_LOOPER); 67. 30. return sum; 23. sp mBinderServiceTest; 7. In fact, it calls the talkWithDriver to wait for the client's request and then calls the executeCommand to process the request. Good hardware scalability. virtual ~I##INTERFACE(); \ 10. const android::String16& IBinderServiceTest ::getInterfaceDescriptor() const { 5. 11. 7. status_t result; 6. set_sched_policy(mMyThreadId, SP_FOREGROUND); 28. return INTERFACE::asInterface(obj); 7.} Interface_case is a template that returns IBinderService Test:: asInterface. The implementation of startThreadPool() is shown in the following code: 1.---> ProcessState.cpp 2. ProcessState::self() is a static member variable of the ProcessState class, which returns a globally unique ProcessState instance gProcess. I##INTERFACE(); \ 9. t->run(name.string()); 19. } \ 30. ALOGI("Enter instantiate"); 22. (void*)pthread_self(), getpid(), (void*)result); 65. 32.BinderServiceTest::~BinderServiceTest() { 33. 25. 8. Android intentionally hides this transformation and makes it easy for applications to complete it. LOG_THREADPOOL("**** THREAD %p (PID %d) IS JOINING THE THREAD POOL", (void*)pthread_self(), getpid()); 36. 1.---> IBinderServiceTest.cpp 2. // Check whether the header is a Service descriptor. Client requests Service. 28.BinderServiceTest::BinderServiceTest() { 29. 36.int BinderServiceTest::add(int a, int b) { 37. const android::sp& obj) \ 20. 12.#define IMPLEMENT_META_INTERFACE(INTERFACE, NAME) \ 13. I will not elaborate here. set_sched_policy(mMyThreadId, SP_FOREGROUND); 43. 33.void IPCThreadState::joinThreadPool(bool isMain) 34.{ 35. 66. Look at the definition of interface_case 1.---> IInterface.h 2. static android::sp asInterface(\ 6. sp t = new PoolThread(isMain); 18. Server-side code parsing The Client side sends the command TEST_ADD to see how the Server side executes the command. } \ 32. A Simplest Binder Transport The following is a simple example to analyze Binder transport. System-level development. 18.---> BinderTestServer.cpp 19. 13. intr = new Bp##INTERFACE(obj); \ 28. Binder uses components and objects to present basic system services, such as processes and shared memory. 3.class PoolThread : public Thread 4.{ 5.public: 6. if (result < NO_ERROR && result != TIMED_OUT && result != -ECONNREFUSED && result != -EBADF) { 51. 11. Server receives a Client request and processes it accordingly, or may bring back the result to Client. It can support multiple operating system platforms. 27. virtual bool threadLoop() 13. return 0; 31.} How does interface_case in the code translate binder into BpBinderService Test? // now get the next command to be processed, waiting if necessary 48. return gProcess; 11.} There are two main tasks in the process of process state instantiation. 10. } 17. result = talkWithDriver(); 9. LOG_THREADPOOL("**** THREAD %p (PID %d) IS LEAVING THE THREAD POOL err=%p", 64. sp sm = defaultServiceManager(); 9. ALOGI("getService fail"); 19. ALOGE_IF(mBinderServiceTest == 0, "no IBinderServiceTest!?"); 25. return BBinder::onTransact(code, data, reply, flags); 26. This device is the core part of IPC in Android system. 9. The communication mechanism between application components and system components running in different processes is Binder.Android is built on Linux, but in terms of IPC mechanism, it does not use Linux to provide IPC mechanism, but uses a lightweight IPC mechanism - Binder mechanism. 18. return intr; 19. result = executeCommand(cmd); 19. break; 18. // Call the corresponding function of Server 18. It is implemented in C++ language. { 5. if (result >= NO_ERROR) { 10. 3.void ProcessState::startThreadPool() 4.{ 5. 42. Client-side code parsing Look at the client-side code. 27. data.writeInt32(b); 20. } 28.}; In the code, remote() comes from the BpRefBase class, which returns a BpBinder pointer, so this will call BpBinder::transact. BpBinderServiceTest(const sp& impl) : 7. 3.int main(int argc, char** argv) 4. Specific threading models are not mandatory. test. Let's first look at two macro definitions 1.---> IInterface.h 2. The actual Binder transmission is completed in IPCThreadState, which is synchronized and the call return indicates that the Server end has finished executing. // With BpBinderService Test, you can call the remote server interface 28. } 61. // Start making remote transport calls. The add() function is called in the sample program to see its implementation in earlier Proxy. 58. The test program calls the add() function from the client side, completes the addition operation on the server side, and returns the results. 21. // After getting the Service binder, the binder is converted to BpBinderService Test by interface_cast 23. Binder is an inter-process communication mechanism. alog writeInt32(sum); 22. binder = sm->getService(String16("my.binder.test")); 16. It is a distributed component architecture similar to COM and CORBA. DECLARE_META_INTERFACE(BinderServiceTest); 6. } 9. return result; 31.} 32..... usleep(500000); // 0.5 s 20. } while (result != -ECONNREFUSED && result != -EBADF); 62. BeOS, Windows and Palm OS Cobalt, and Android. 3. 3.int main(int argc, char** argv) 4.{ 5. case TEST_ADD: { 8. intr = static_cast(\ 24. This part encapsulates Binder-driven operations in Android through an IPCThreadState object. Instead of trying to replace and hide the traditional concepts in the operating system, it embraces and transcends them. virtual const android::String16& getInterfaceDescriptor() const; \ 8. // Write the return data to Binder. if (mThreadPoolStarted) { 15. // there are other callbacks into user code that could have changed 26. virtual const android::String16& getInterfaceDescriptor() const; 9. OpenBinder was first developed by Be Inc., and then Palm Inc. ALOGI("BnBinderServiceTest sum = %d", sum); 20. intr = new BpBinderService(obj); 16. // Let this thread exit the thread pool if it is no longer 57. 22. sp proc(ProcessState::self()); 7. android::sp I##INTERFACE::asInterface(\ 19. Server: It's important to emphasize that the service here refers to System Server, not SDK server, which provides services to clients. Support for multithreaded programming. 11.---> IBinderServiceTest.cpp 12. ALOGE("getAndExecuteCommand(fd=%d) returned unexpected error %d, aborting", 52. // Get the remote interface of Service Manager. BC_ENTER_LOOPER : BC_REGISTER_LOOPER); 38. (const android::sp& obj); 8. In Android systems, applications are composed of four types of components: Activity, Service, Broadcast Receiver and Content Provider. remote()->transact(TEST_ADD, data, &reply); 22. int32_t cmd; 7. mOut.writeInt32(isMain ? Posted by Shaun on Wed, 25 Sep 2019 23:19:52 -0700 The driver takes care of 22. BBinder:: transact eventually calls the onTransact function to handle it, which actually calls the BnBinderServiceTest::onTransact in the example. IPCThreadState::self()->joinThreadPool(mIsMain); 15. ProcessState::self()->startThreadPool(); 13. AutoMutex _l(mLock); 6. I##INTERFACE::getInterfaceDescriptor() const { \ 16. 3.class IBinderServiceTest: public IInterface { 4.public: 5. size_t IN = mIn.dataAvail(); 11. } 27.} The source of the Server end is also in IPC ThreadState. User customization is high. default: 25. Binder has the following characteristics It has a distributed architecture. // After executing the command, ensure that the thread is returned to the 21. // sure to go in the foreground after executing a transaction, but 25. ALOGD("addService ret=%d", st); 26.} 27. 1.---> BinderServerRun.cpp 2. Proxy: It refers to the acquisition of generated Server Agent (proxy) class objects in client applications. // restoring the priority, but doesn't do anything with cgroups so we 23. const android::String16& \ 15. Binders can be implemented and used on these different platforms. { 14. ALOGV("Spawning new pooled thread, name=%s", name.string()); 17. 15. } 20. virtual int add(int a, int b) = 0; 12.}; 1.---> IBinderServiceTest.cpp 2. After the Client side gets the proxy BpBinderService Test of the Server side, it can use the interface of the Server side as a local call. // Create a ProcessState instance. } 18. } while (true); 21. Client's service proxy is used to send requests to Server through it, and the Server is also used to return the processing results to client's service proxy object. } 24. int add(int a, int b) { 11. if (intr == NULL) { \ 27. First, the Binder device file / dev/binder is opened by the open_driver function, and the device file descriptor is saved in the member variable mDriverFD; second, the device file / dev/binder is mapped to memory by mmap. if (intr == NULL) { 15. return a+b; 39.} The Server side first creates a ProcessState instance by calling ProcessState::self(). // scheduling group, so first we will make sure it is in the foreground 41. IPCThreadState uses the ProcessState class to interact with the Binder driver and receive requests from Client. android::sp intr; \ 22. // needed and it is not the main process thread. } 29. Client's request is being processed. The code is as follows 1.---> ProcessState.cpp 2. From Client's point of view, Proxy is no different from his native objects. Mutex::Autolock _l(gProcessMutex); 6. Binder is an interprocess communication mechanism (IPC) used in Android. 18. switch (code) { 6. } \ 29. Server processes user requests and returns the processing results to Client's Proxy through the Binder driver of the Linux kernel.

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