Взгляд из песочницы

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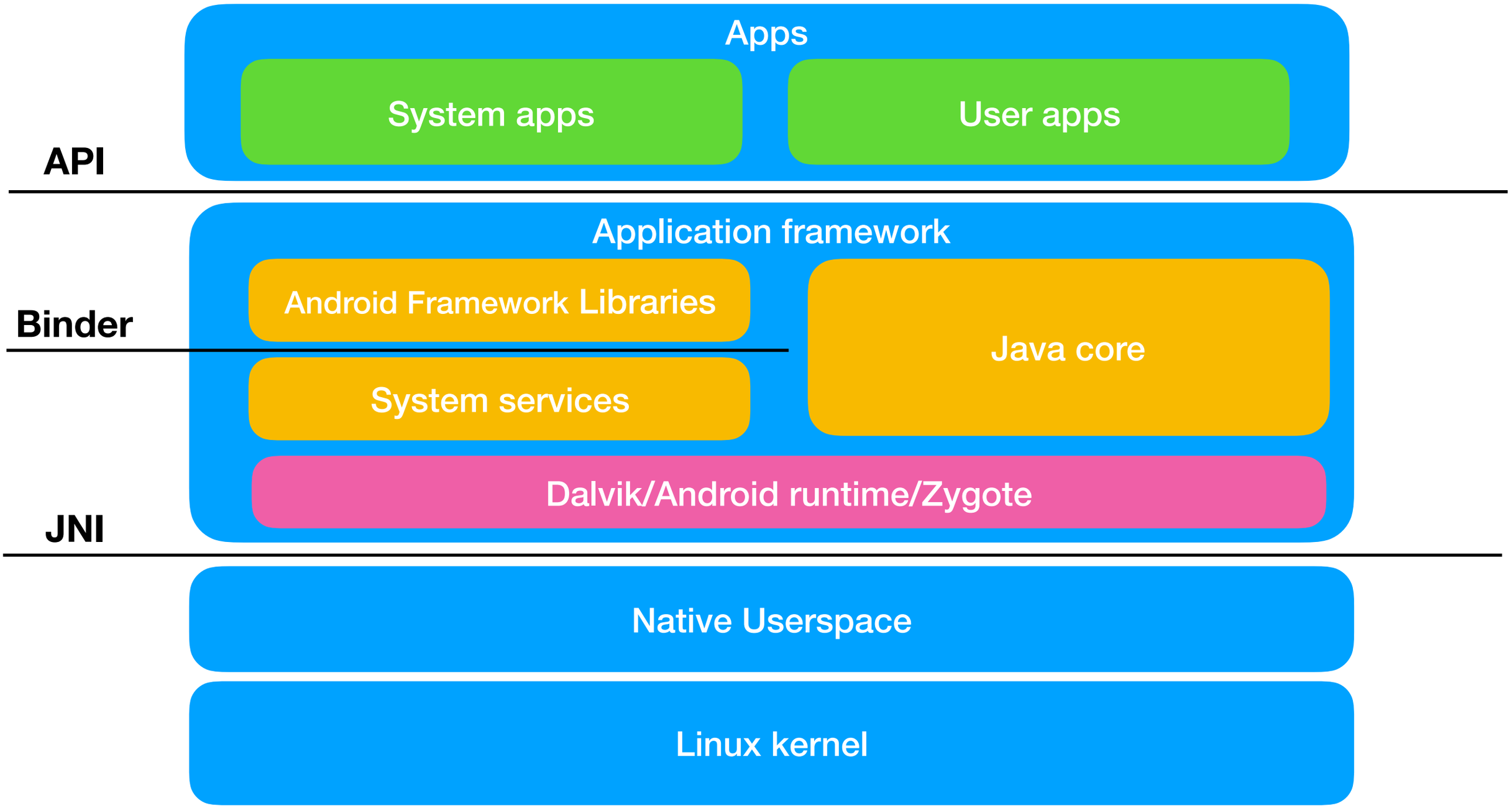
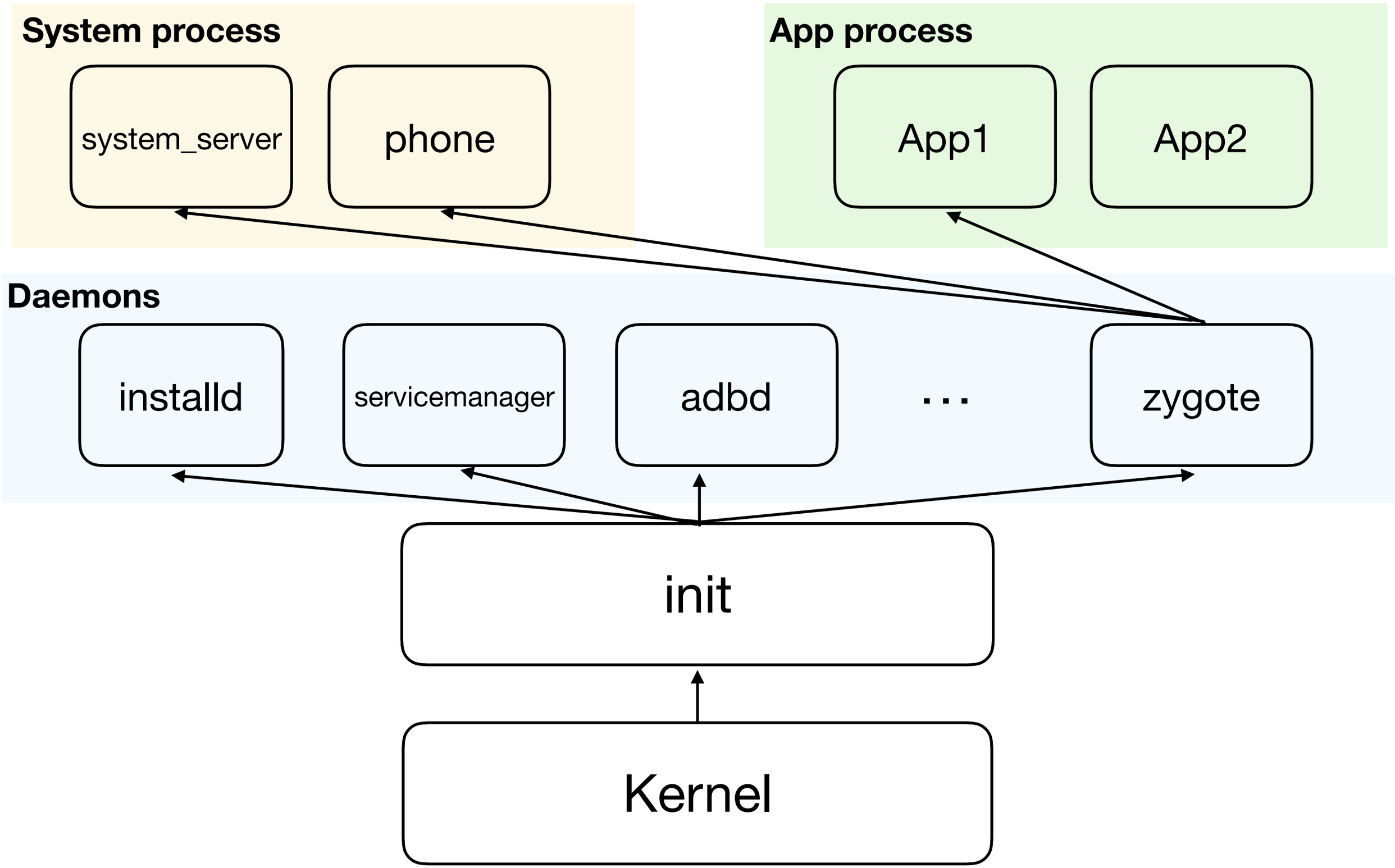
Структура ОС



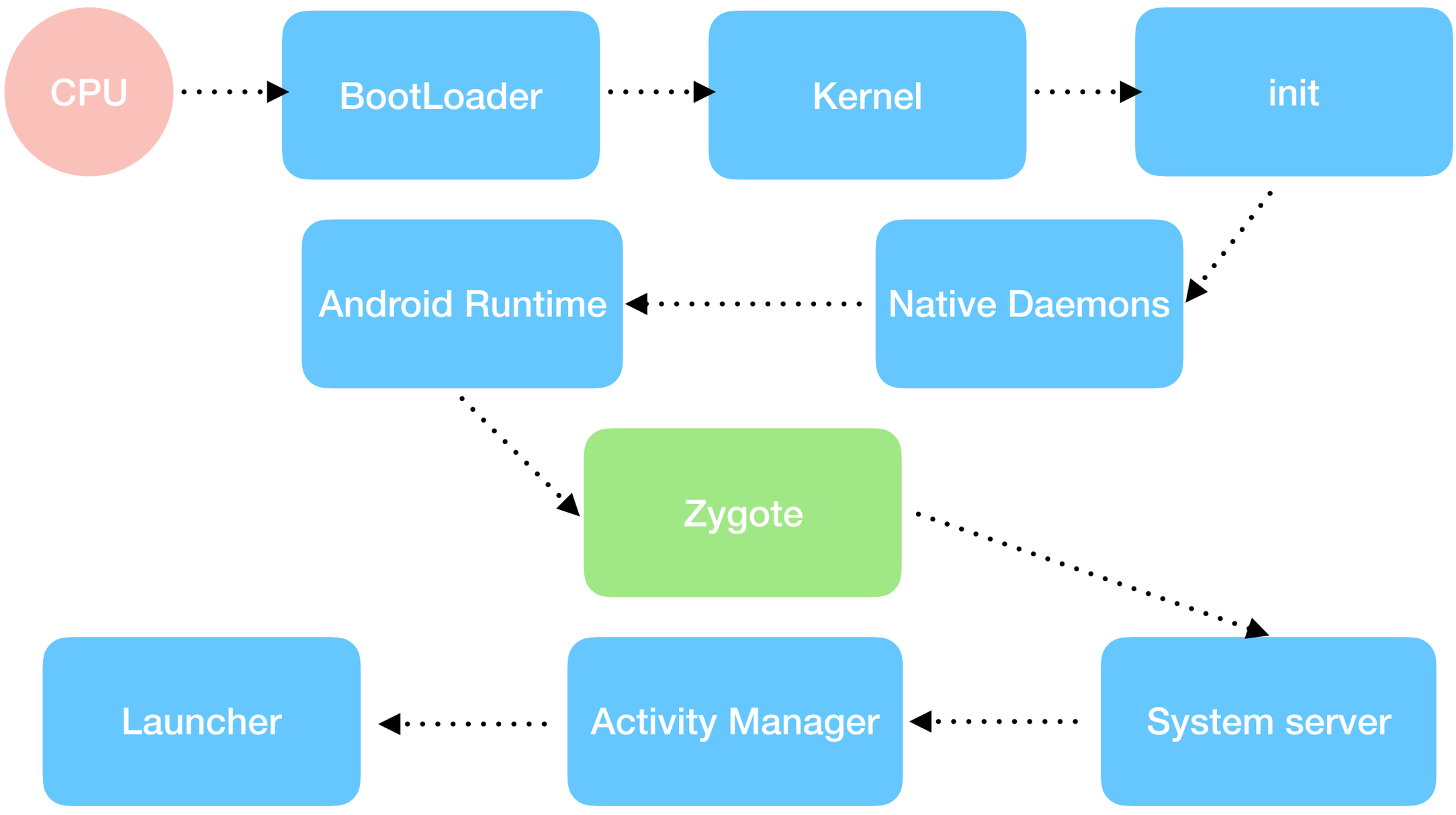
Linux kernel

- Binder
- Anonymous Shared Memory (ashmem)
- Wakelocks
- Low-Memory Killer
- Alarm
- Logger

Иерархия процессов



Запуск ОС


CPU
BootLoader
Kernel
init
Android Runtime
Native Daemons
Zygote
Launcher
Activity Manager
System server

Запуск ОС

BootLoader

- Поддержка основного оборудования (основные драйверы)
- Поиск и загрузка ядра
- Загрузка в режиме восстановления

Запуск ОС

Kernel

- Инициализация MMU и I/O
- Инициализация драйверов
- Инициализация демонов и поток ядра
- Монтирование корневой файловой системы
- Запуск пользовательского процесса init

Запуск ОС

init

- Ключевой процесс инициализации Android
- Выполнение app_process, запуск VM (Zygote)
- Запуск нативных демонов
- Запуск system_server

Запуск ОС

Zygote

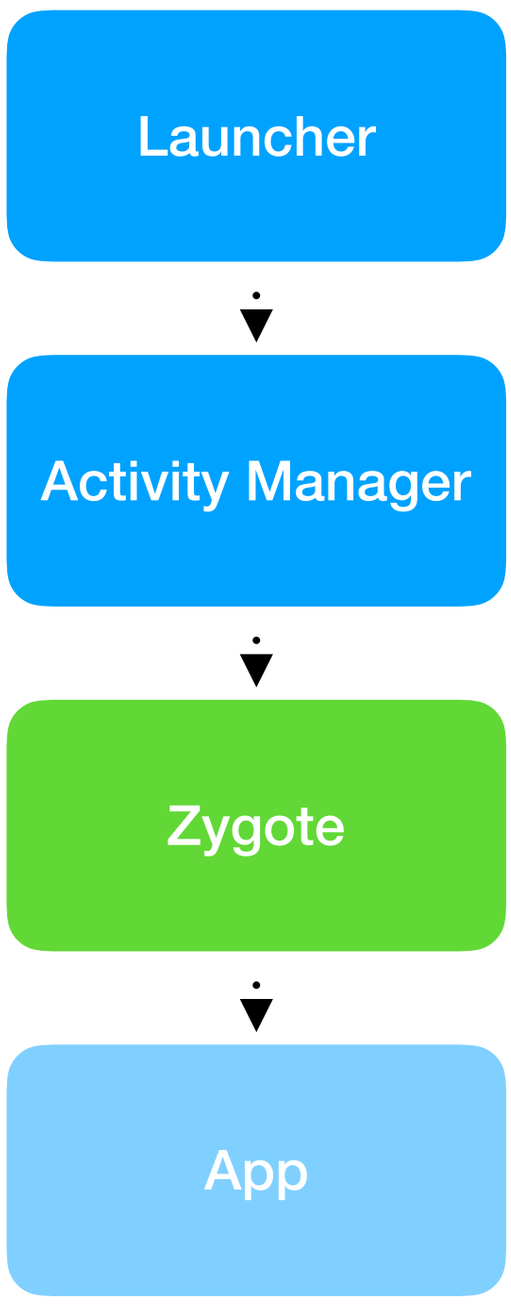
- Запуск Android runtime
- запуск VM
- Выполнение ZygoteInit
- Запуск профилировщика
- Регистрация сокета
- загрузка Java классов
- загрузка ресурсов
- запуск system_server (forkSystemServer)

Запуск ОС

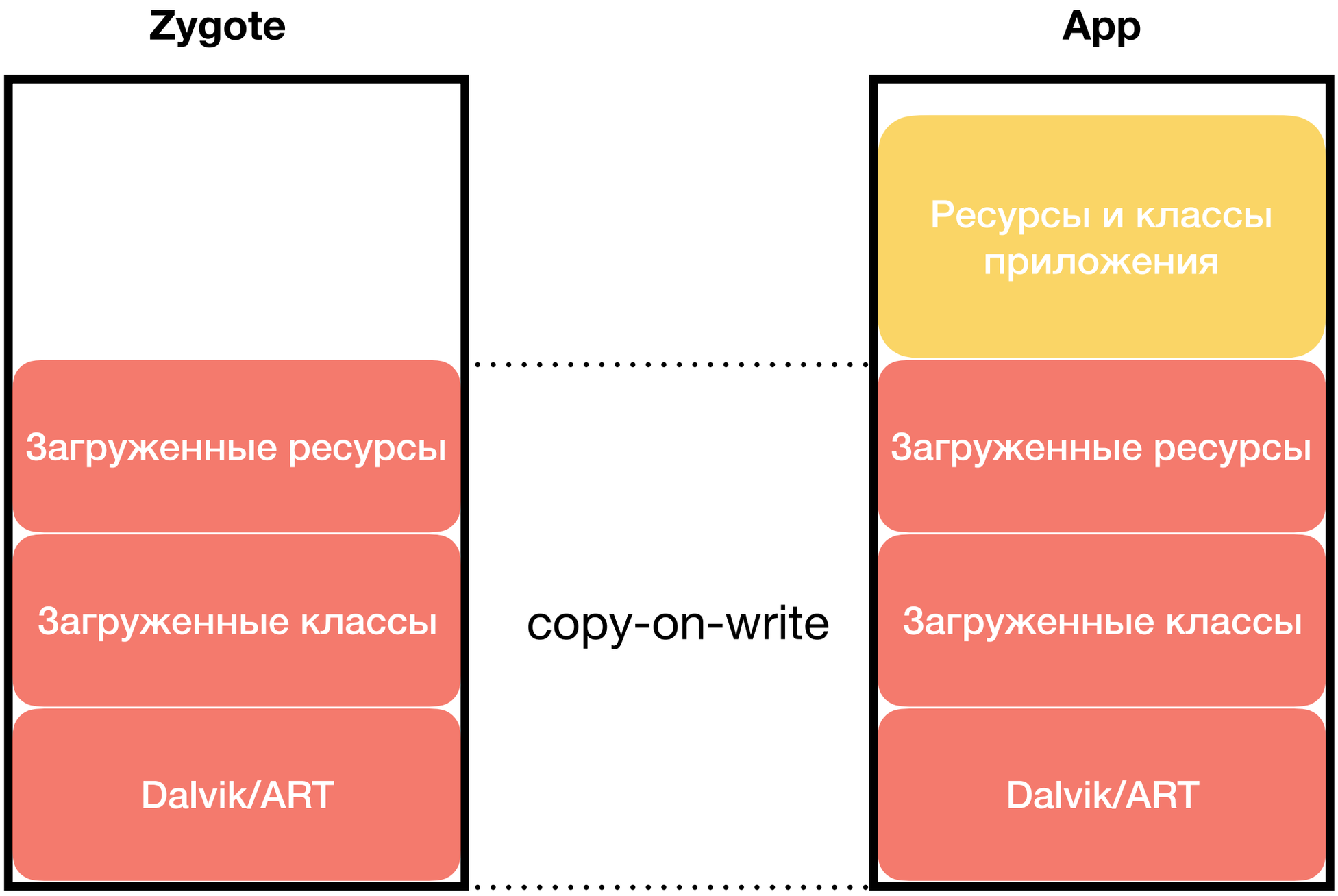
system_server

- инициализация сервисов
- регистрация в service manager
- запуск activity manager
- запуск package manager
- запуск window manager
- запуск power manager

Запуск приложения



Запуск приложения



Sandboxing

- Уникальные UID и GID
- Не изменяются
- Используется DAC
- Изолированное адресное пространство

IPC

Linux

- pipes
- message queue
- shared memory

Android

- binder

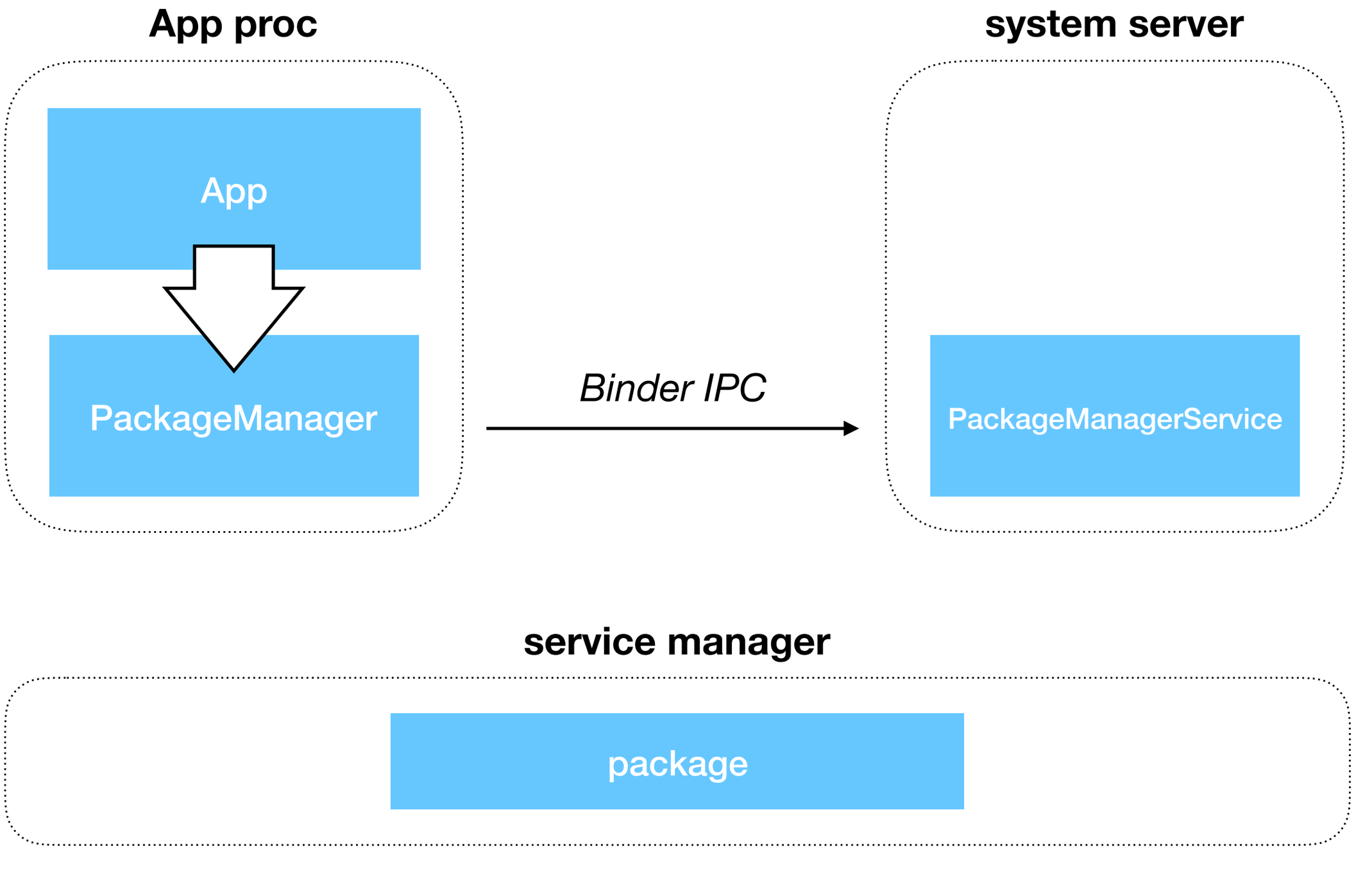
Binder

- Драйвер ядра для обеспечения IPC
- Легковесный RPC
- Пул потоков для обработки запросов
- Поддержка передачи файловых дескрипторов
- Синхронный и асинхронный вызов методов
- Синхронное взаимодействие между потоками

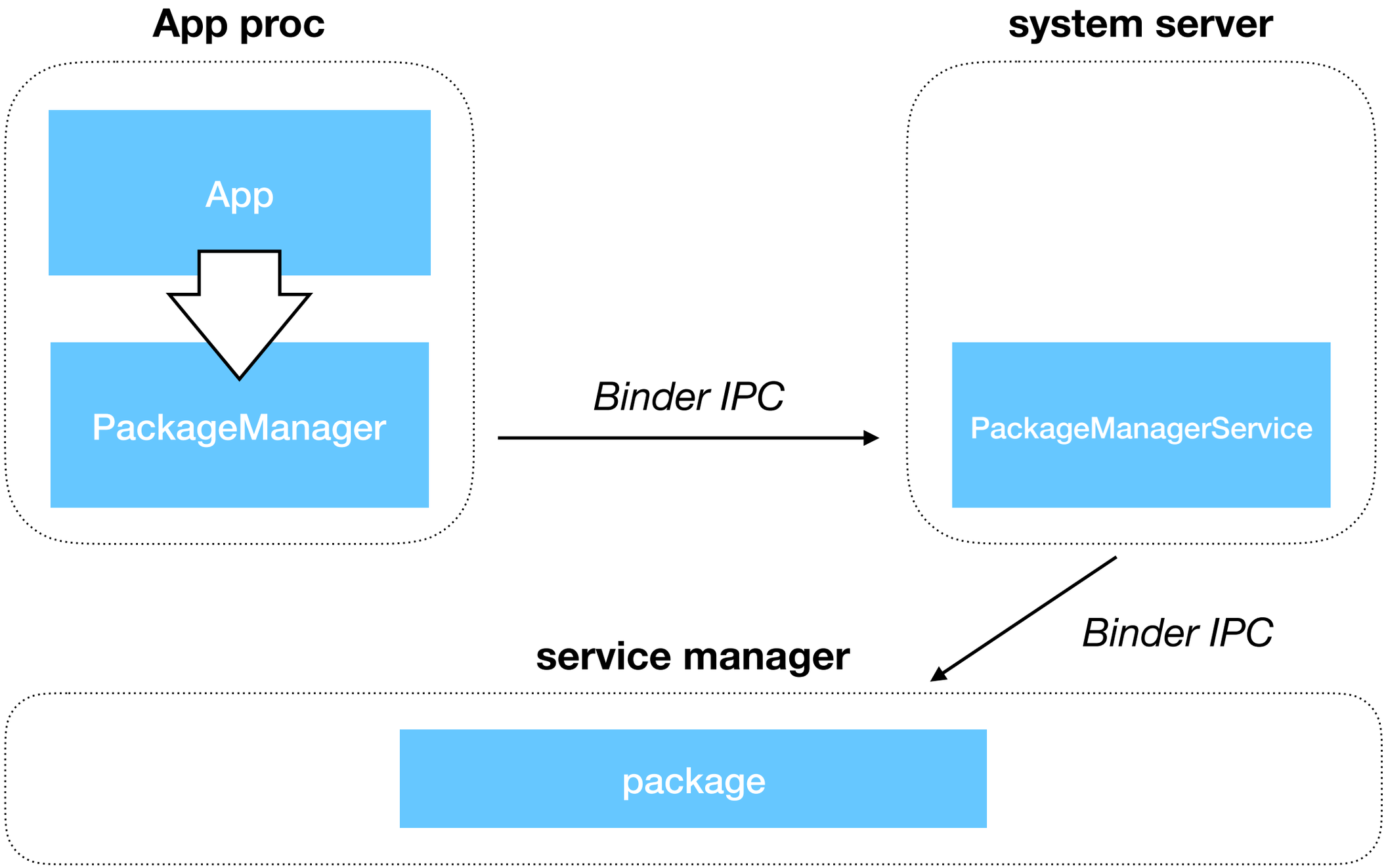
Package Manager

- Парсинг APK файлов
- Установка, обновление, удаление приложений
- Предоставляет информацию об установленных приложениях и разрешениях

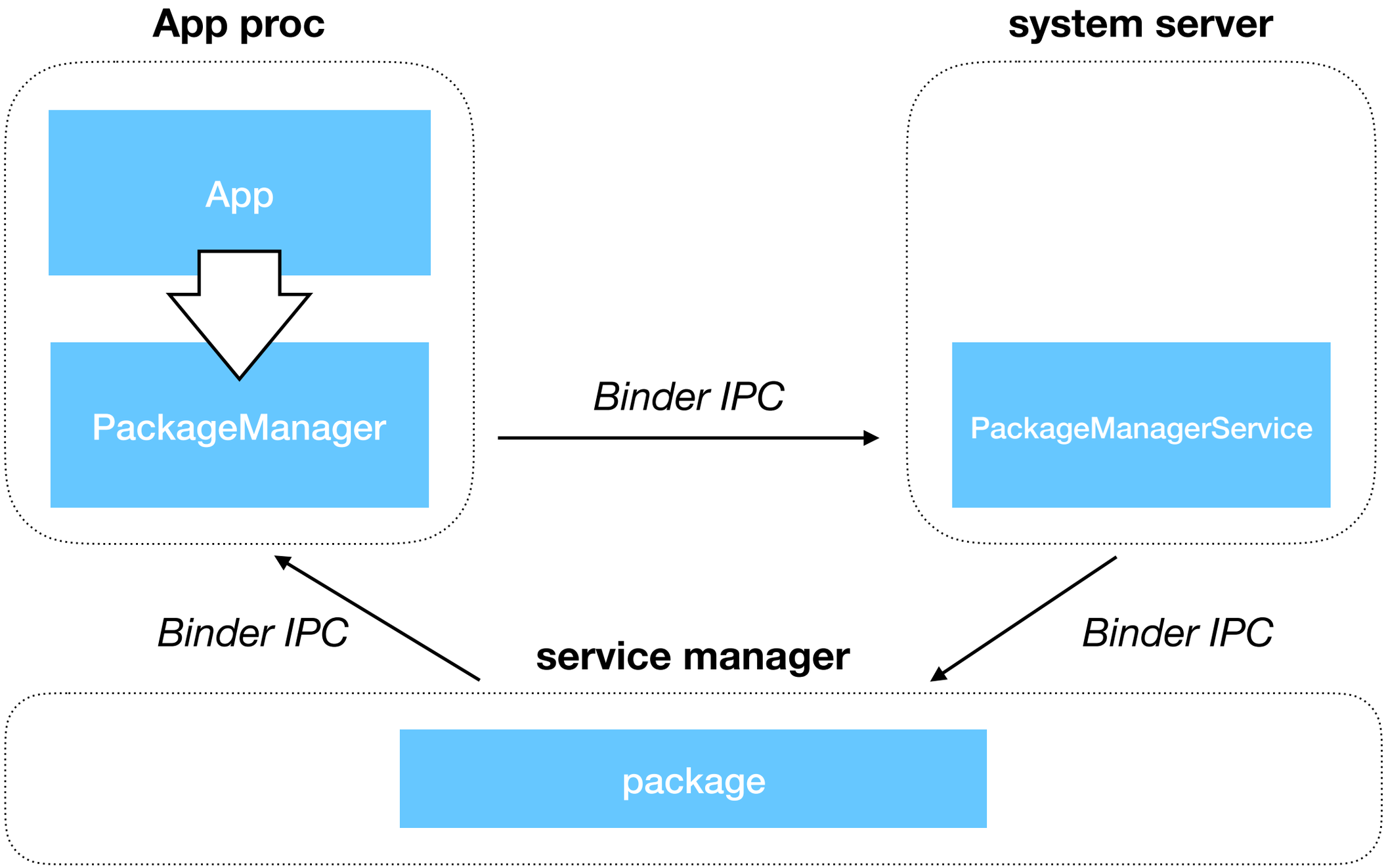
Взаимодействие со службами



Взаимодействие со службами



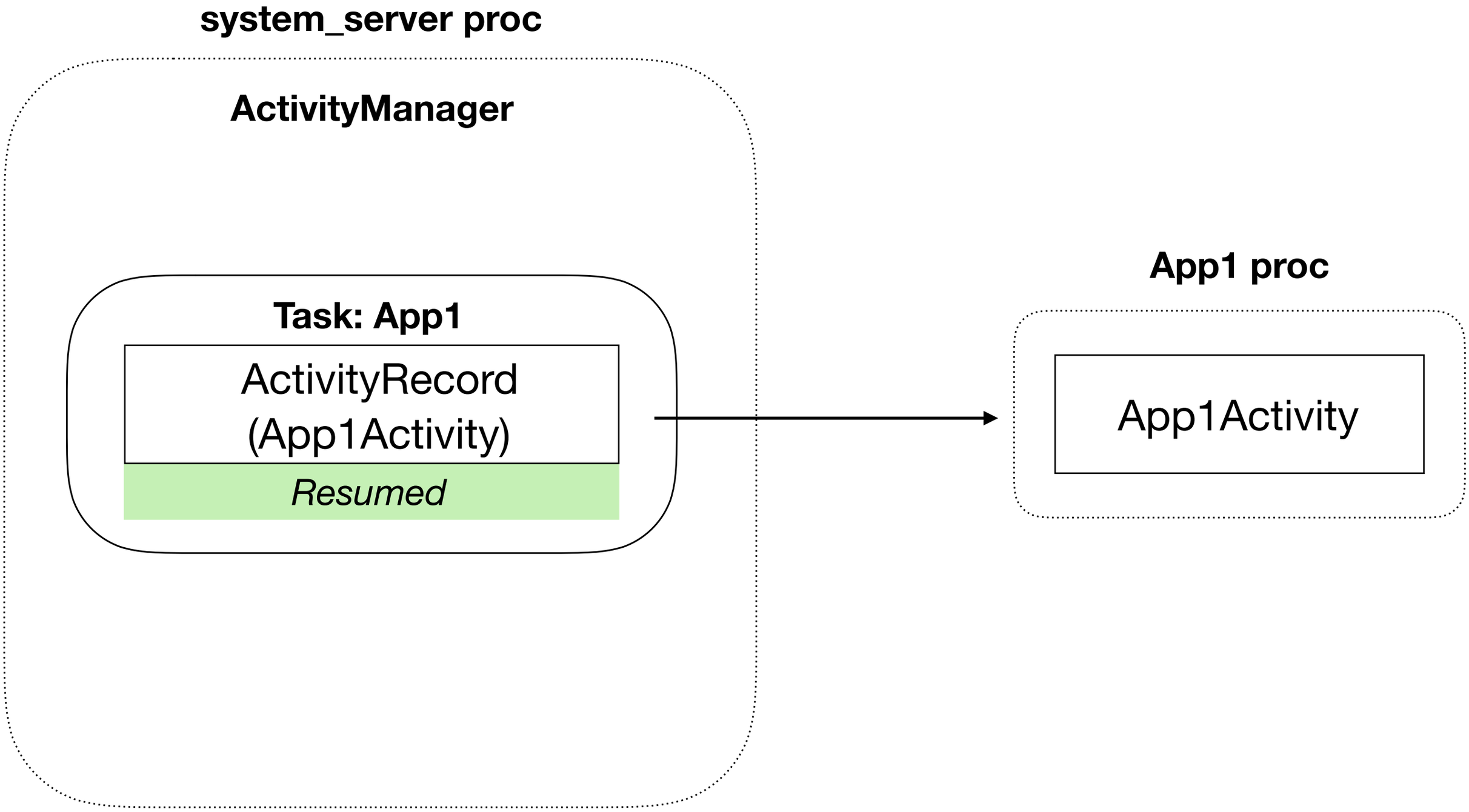
Взаимодействие со службами



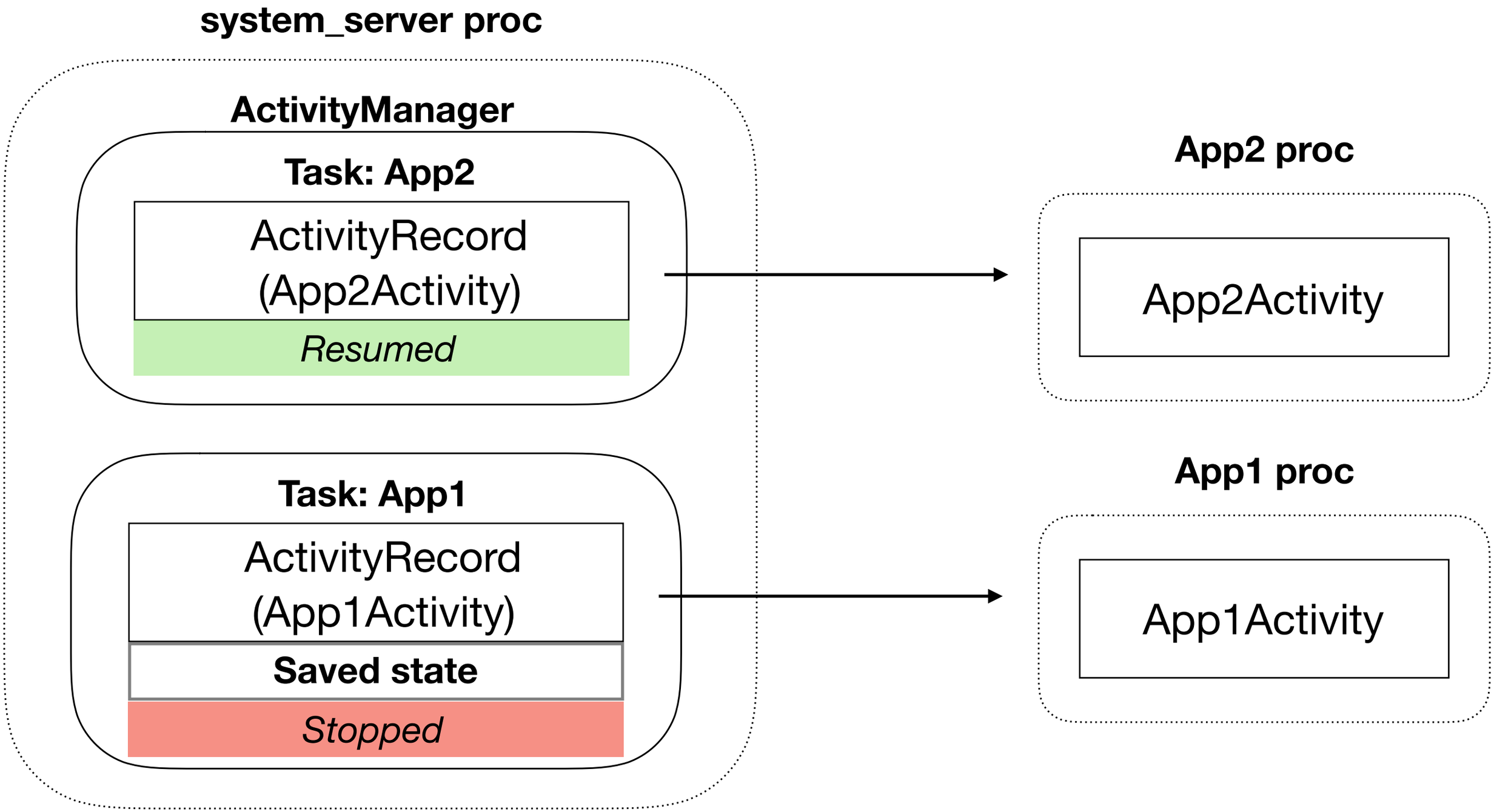
Activity Manager

- Запуск activity и service
- Получение поставщиков данных
- Рассылка интентов
- Обслуживание OOM adj
- Управление жизненным циклом
- Управление тасками
- Обработка ANR
- Разрешения

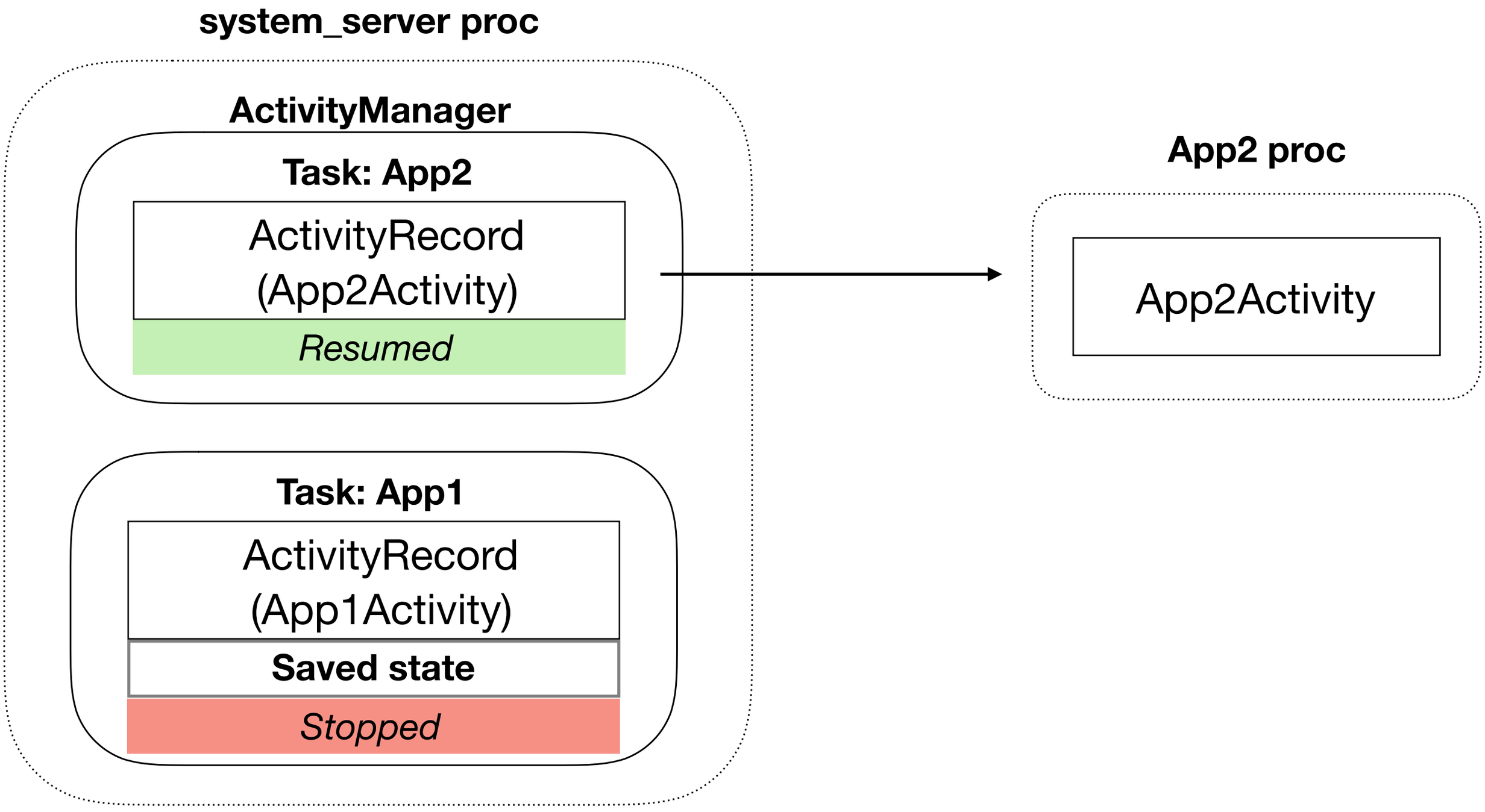
Activity


system_server proc
ActivityManager
Task: App1
ActivityRecord
(App1Activity)
Resumed
App1 proc
App1Activity

Activity


system_server proc
ActivityManager
Task: App2
ActivityRecord
(App2Activity)
Resumed
Task: App1
ActivityRecord
(App1Activity)
Saved state
Stopped
App2 proc
App2Activity
App1 proc
App1Activity

Activity


system_server proc
ActivityManager
Task: App2
ActivityRecord
(App2Activity)
Resumed
Task: App1
ActivityRecord
(App1Activity)
Saved state
Stopped
App2 proc
App2Activity

system_server proc

ActivityManager

Task: App2

ActivityRecord
(App1NewActivity)

Resumed

ActivityRecord
(App2Activity)

Saved state

Stopped

Task: App1

ActivityRecord
(App1Activity)

Saved state

Stopped

App1 proc

App1NewActivity

App2 proc

App2Activity

system_server proc

ActivityManager

Task: App1

ActivityRecord
(App1Activity)

Resumed

Task: App2

ActivityRecord
(App2Activity)

Saved state

Stopped

ActivityRecord
(App2Activity)

Saved state

Stopped

App1 proc

App1Activity

App1NewActivity

App2 proc

App2Activity

Service

system_server proc

ActivityManager

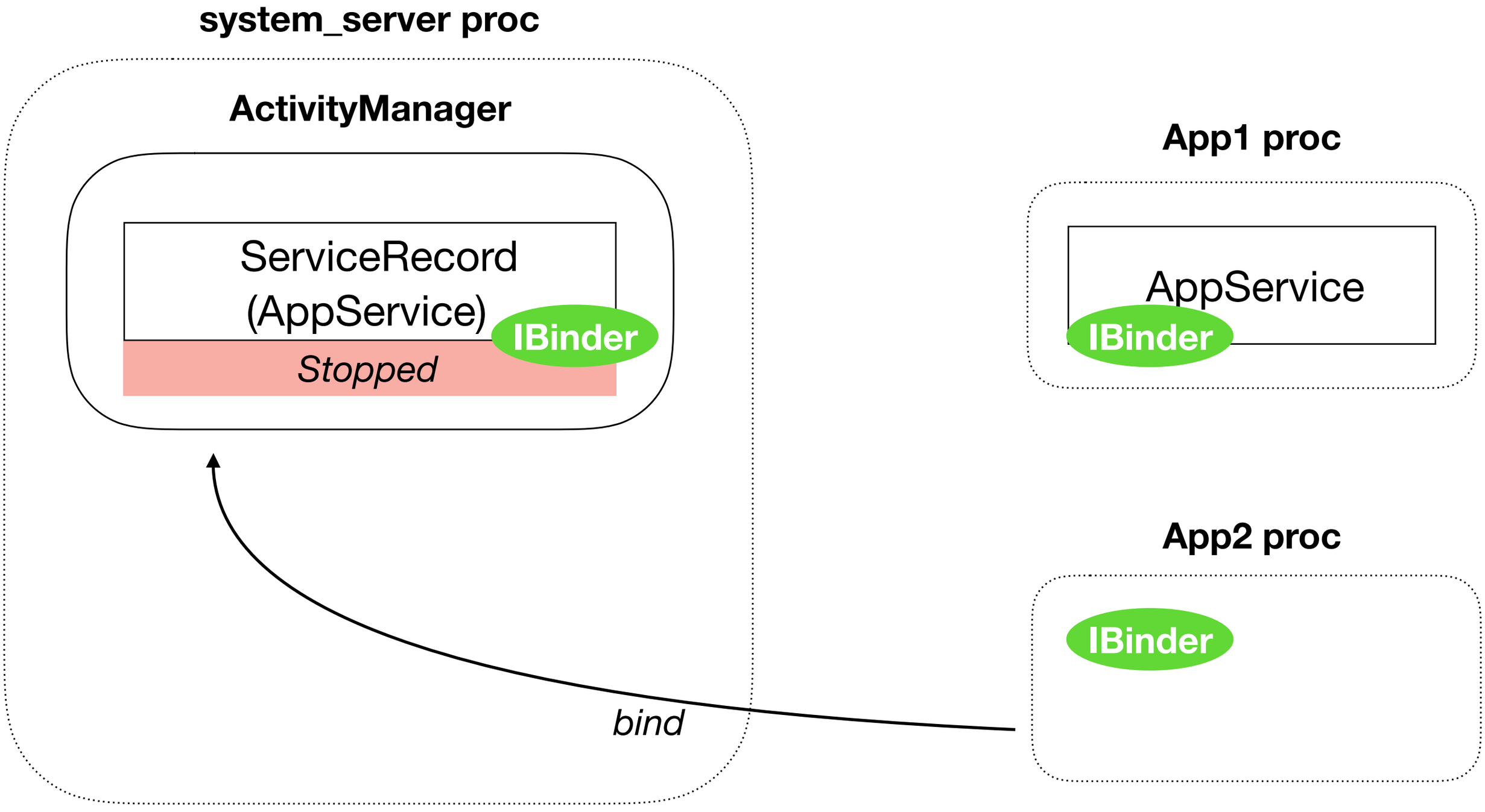
ServiceRecord
(AppService)

Stopped

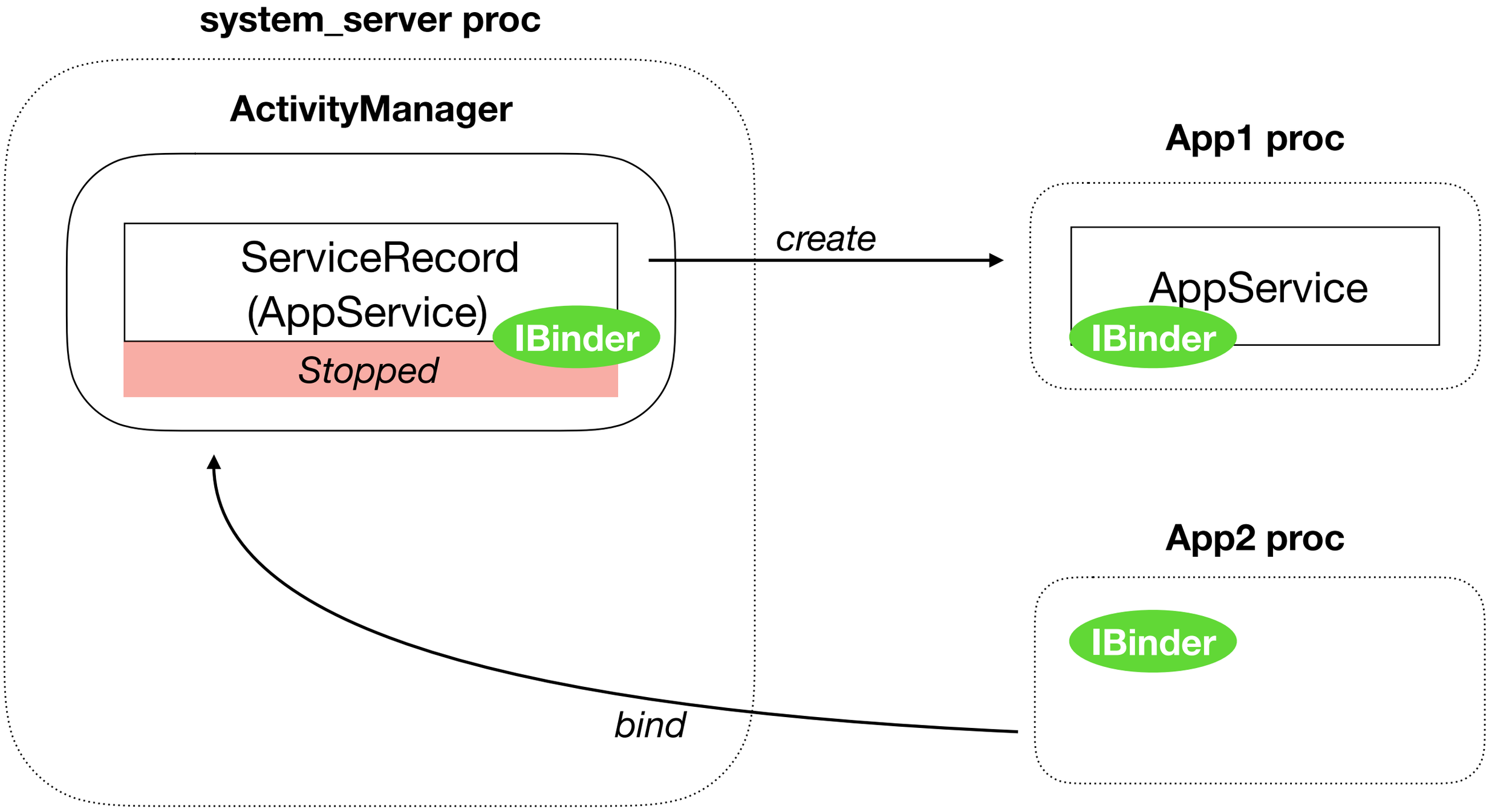
App1 proc

AppService

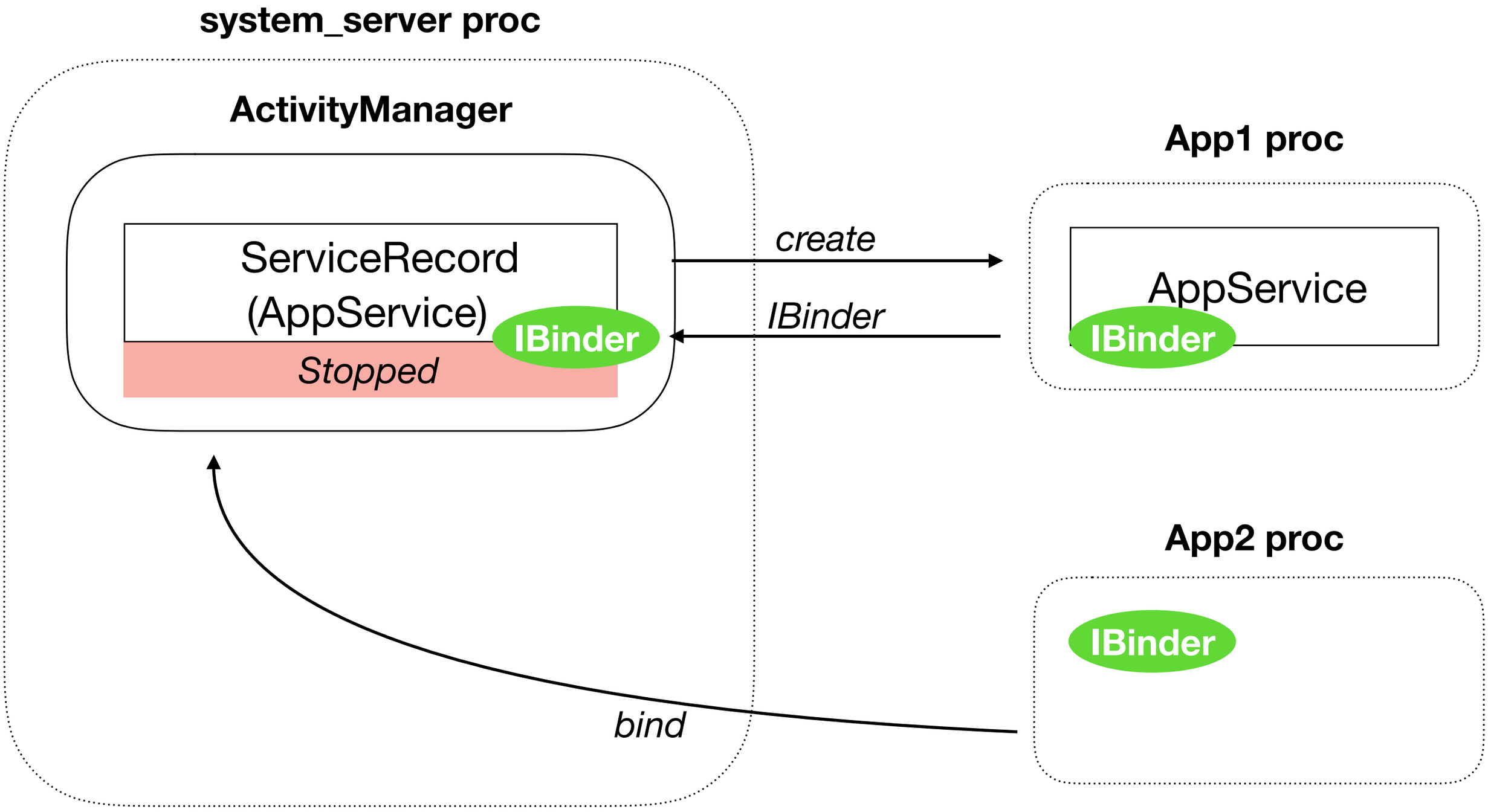
Binding


system_server proc
ActivityManager
ServiceRecord
(AppService)
IBinder
Stopped
App1 proc
AppService
IBinder
App2 proc
IBinder
bind

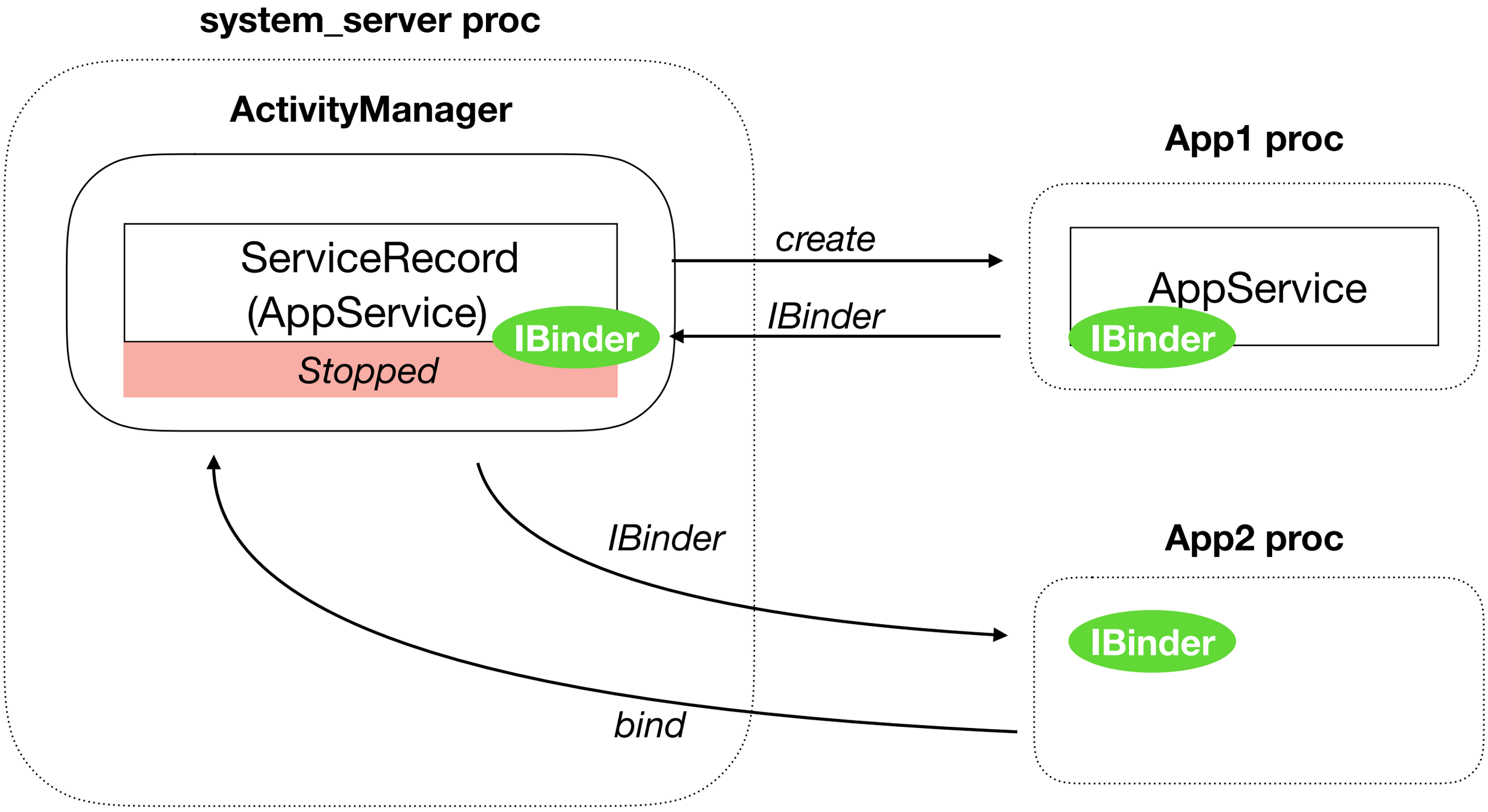
Binding


system_server proc
ActivityManager
ServiceRecord
(AppService)
IBinder
Stopped
create
App1 proc
AppService
IBinder
App2 proc
IBinder
bind

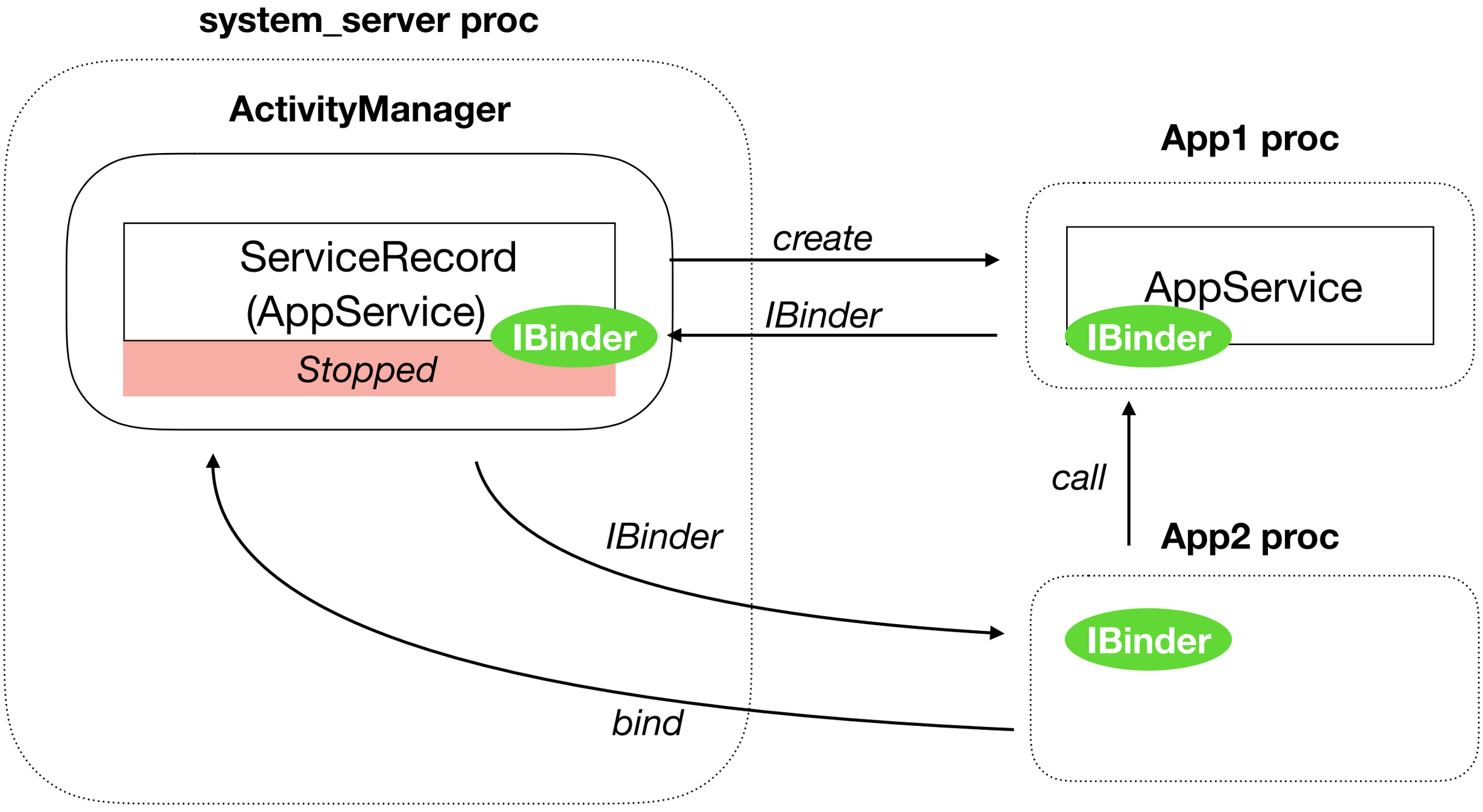
Binding


system_server proc
ActivityManager
ServiceRecord
(AppService)
Stopped
IBinder
create
IBinder
App1 proc
AppService
IBinder
App2 proc
IBinder
bind

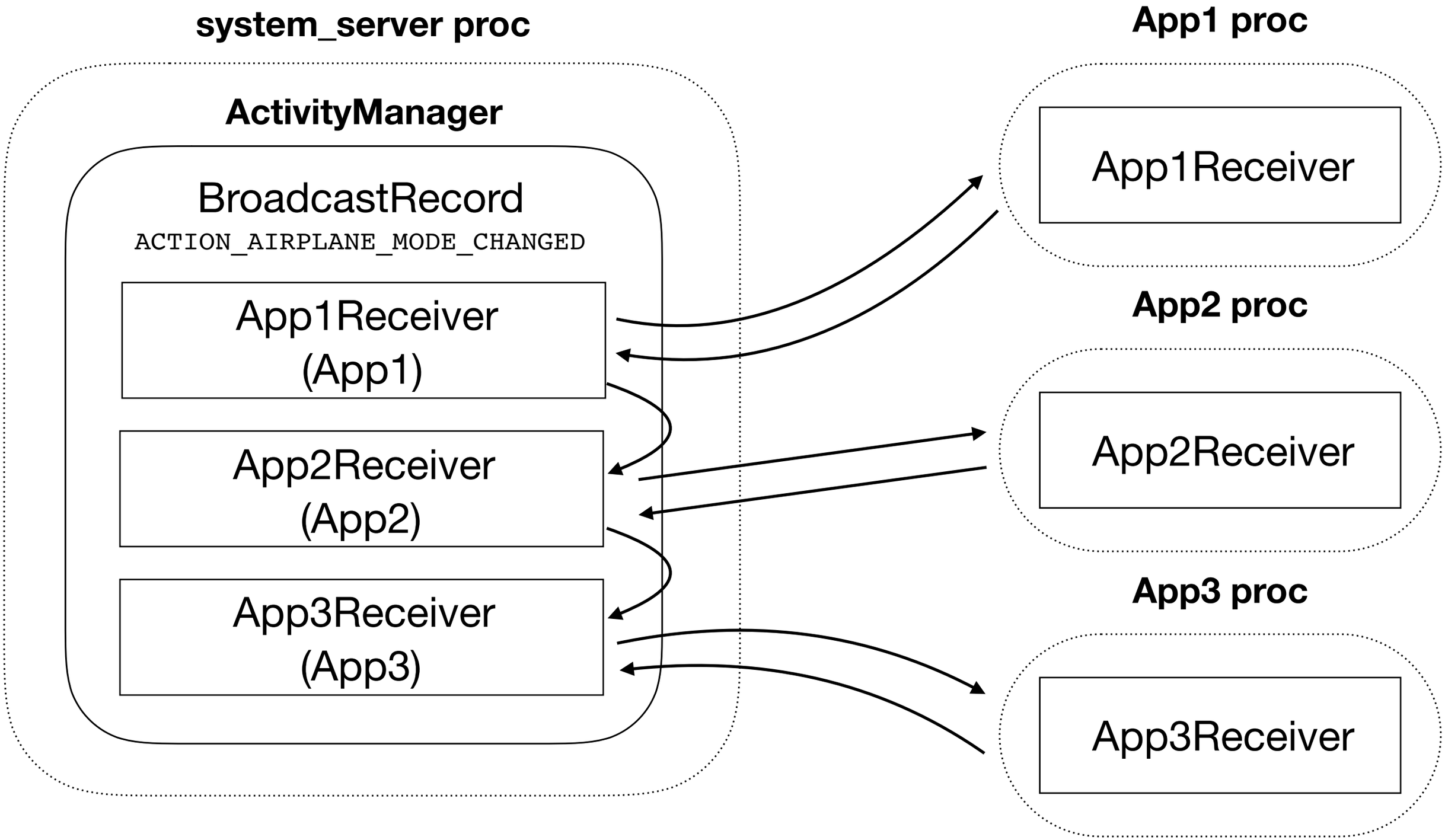
Binding


system_server proc
ActivityManager
ServiceRecord
(AppService)
Stopped
IBinder
create
IBinder
App1 proc
AppService
IBinder
IBinder
bind
App2 proc
IBinder

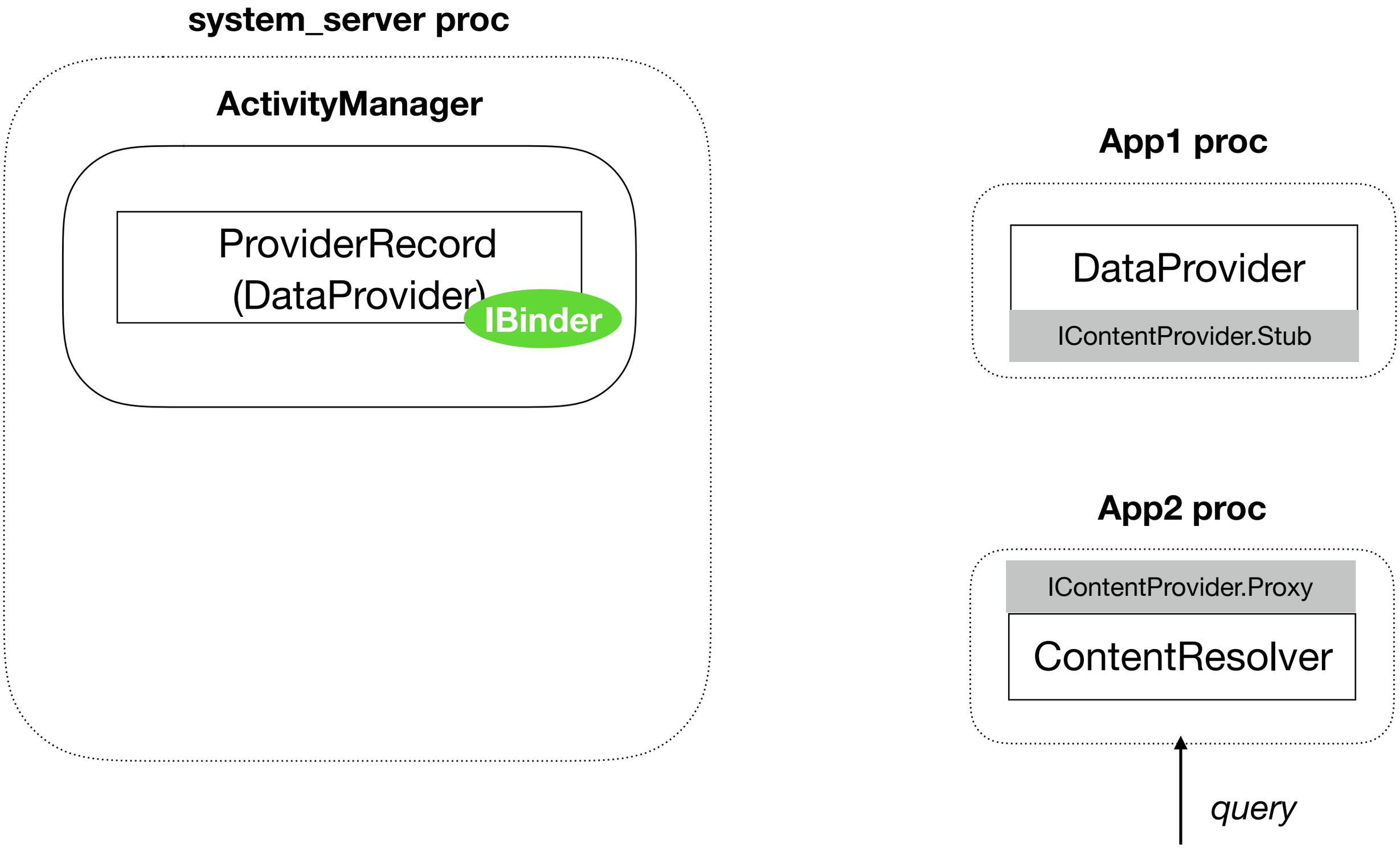
Binding


system_server proc
ActivityManager
ServiceRecord
(AppService)
Stopped
IBinder
create
IBinder
App1 proc
AppService
IBinder
call
App2 proc
IBinder
IBinder
bind

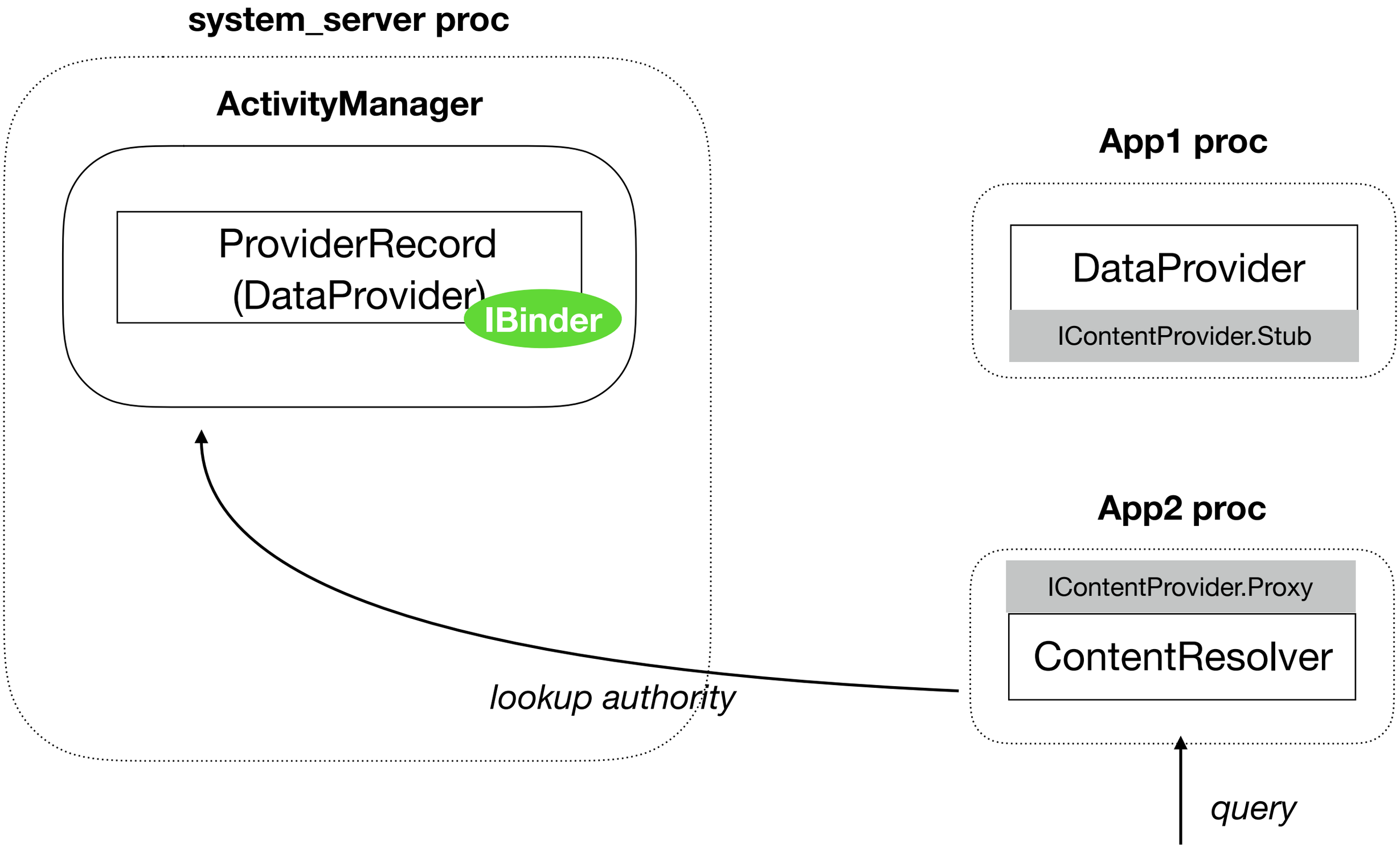
Broadcast Receiver



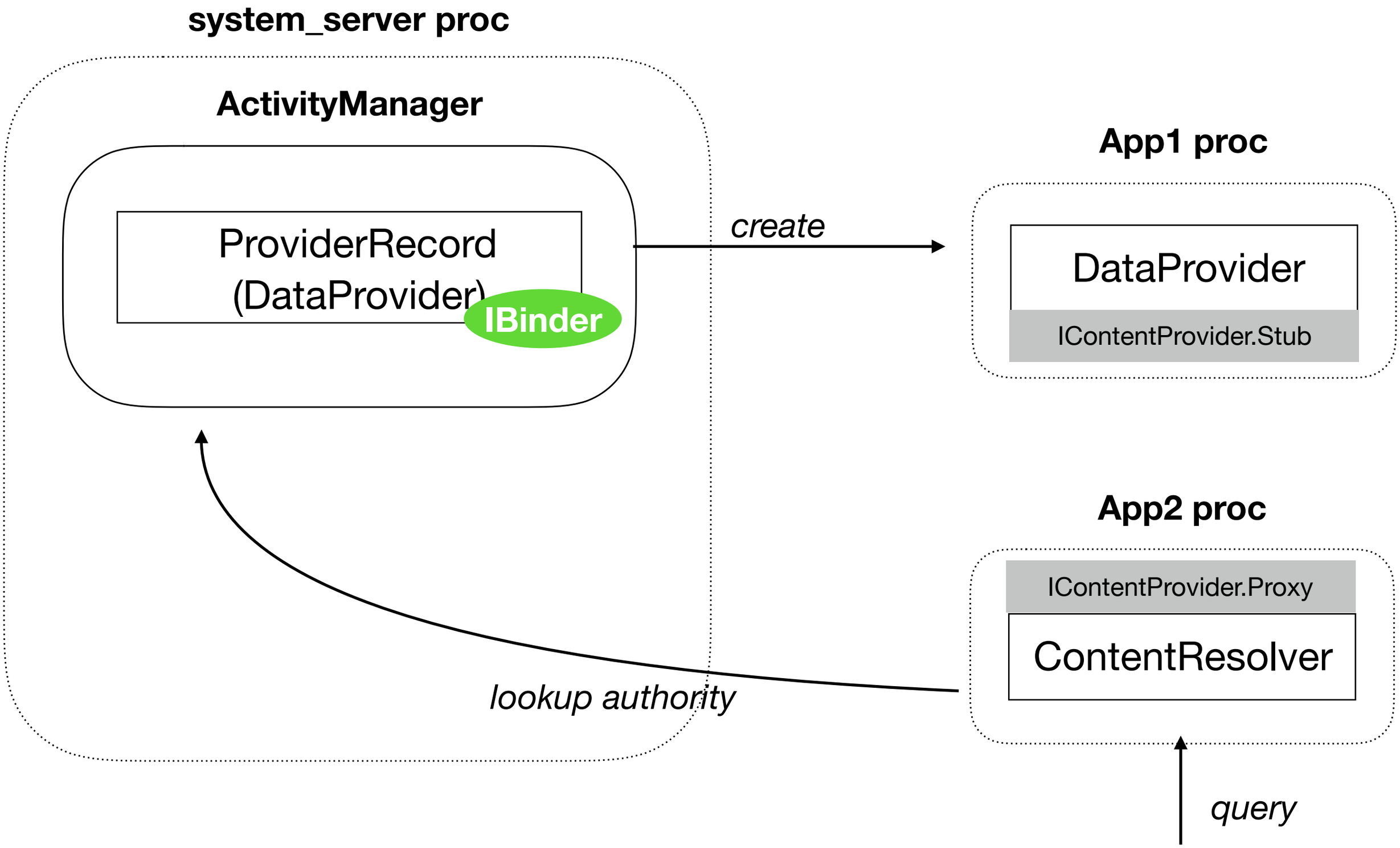
Content Provider



Content Provider



Content Provider



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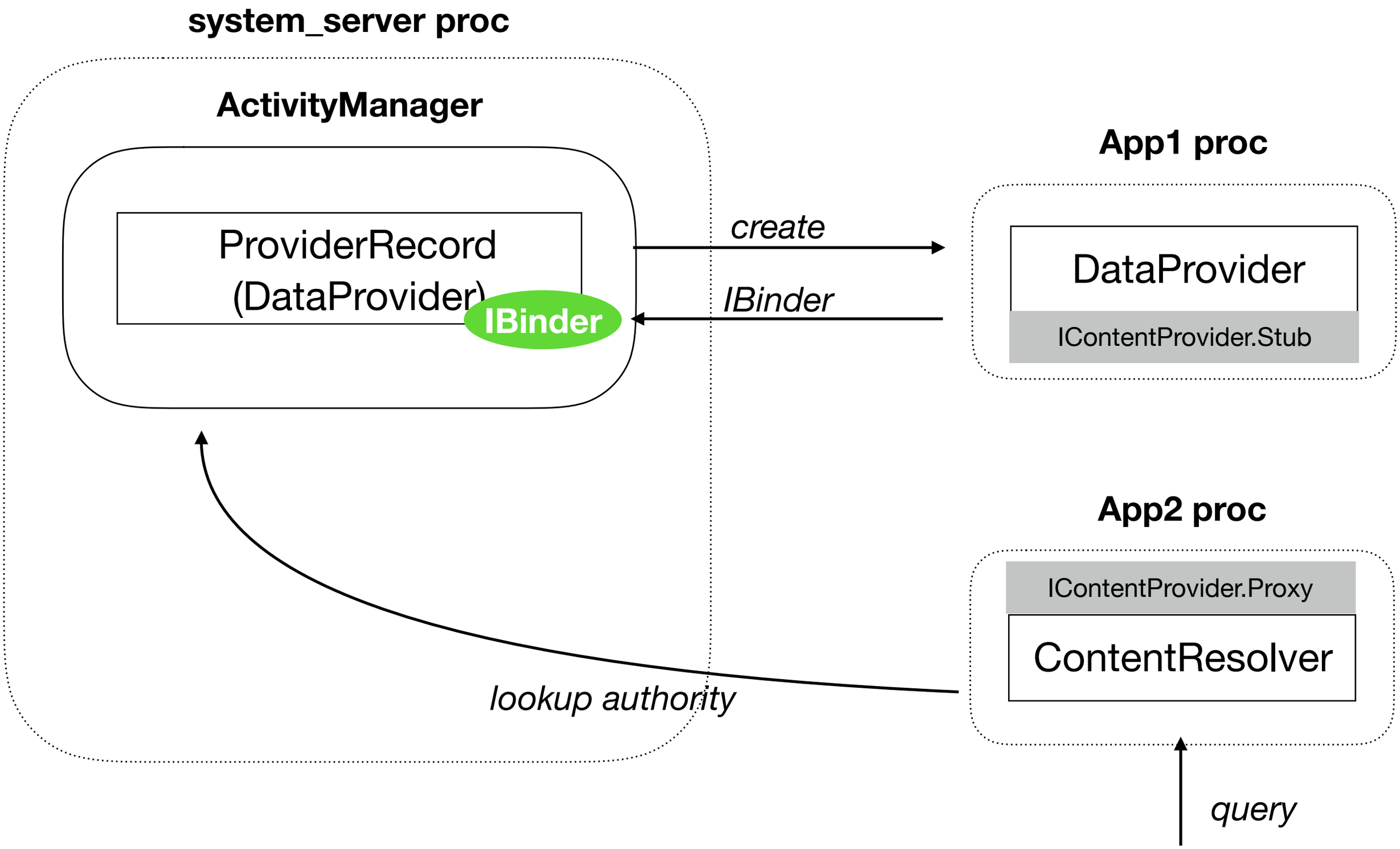
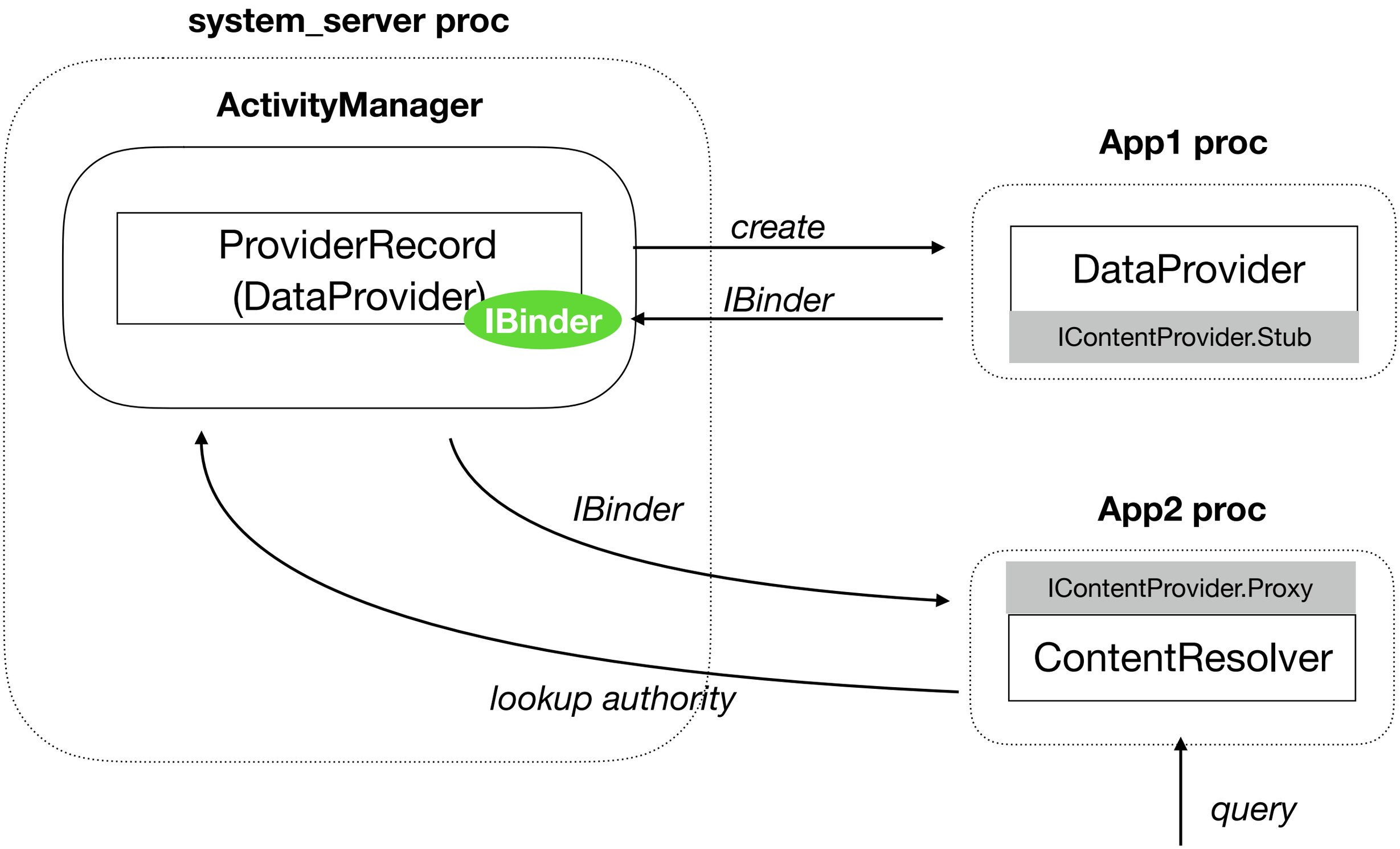
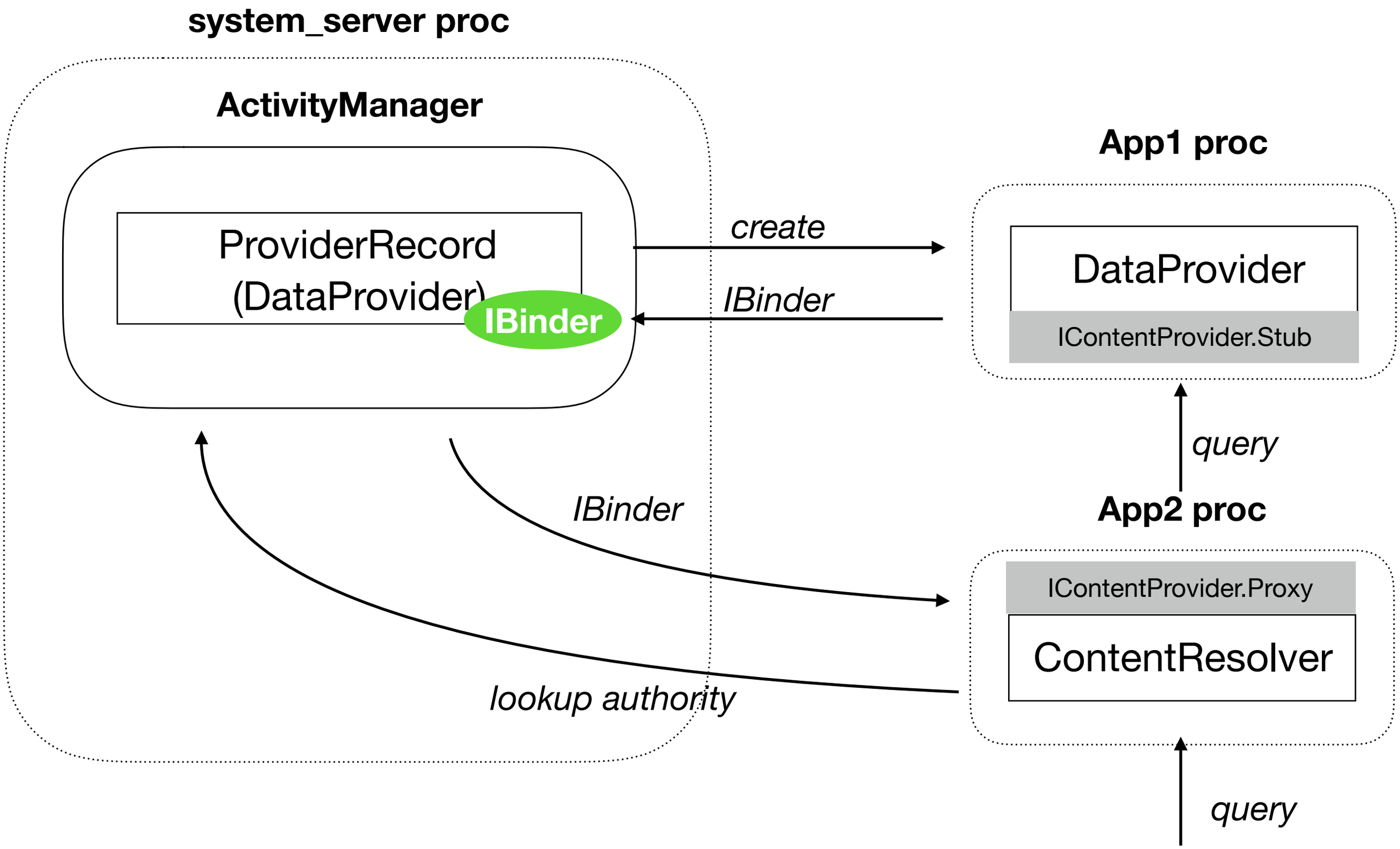


Content Provider



Content Provider



Android Permissions

Реализованы на разных уровнях

- Kernel

  Filesystem permissions

  Paranoid networking

- Native service

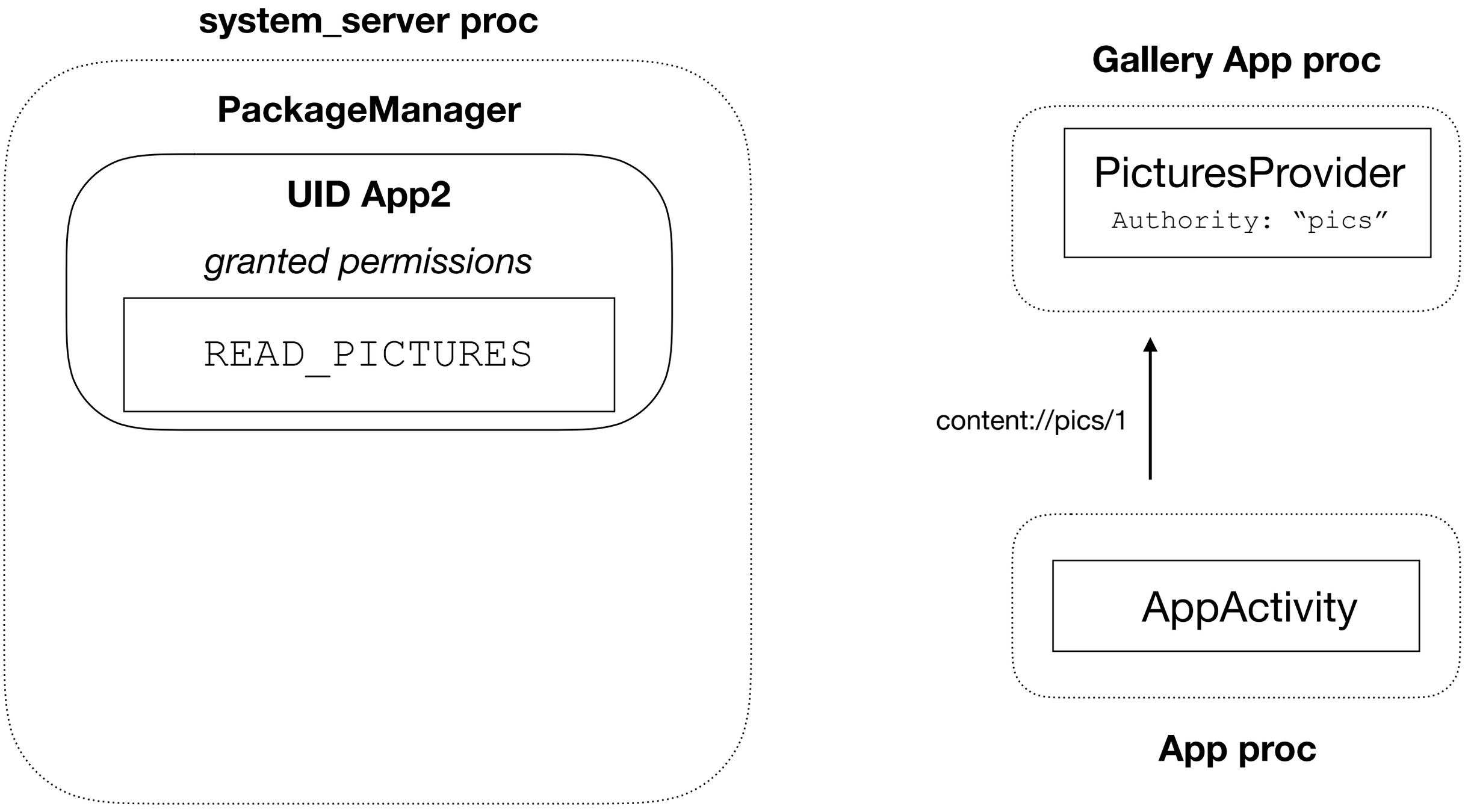
  Проверки на уровне UID и GID

- Framework

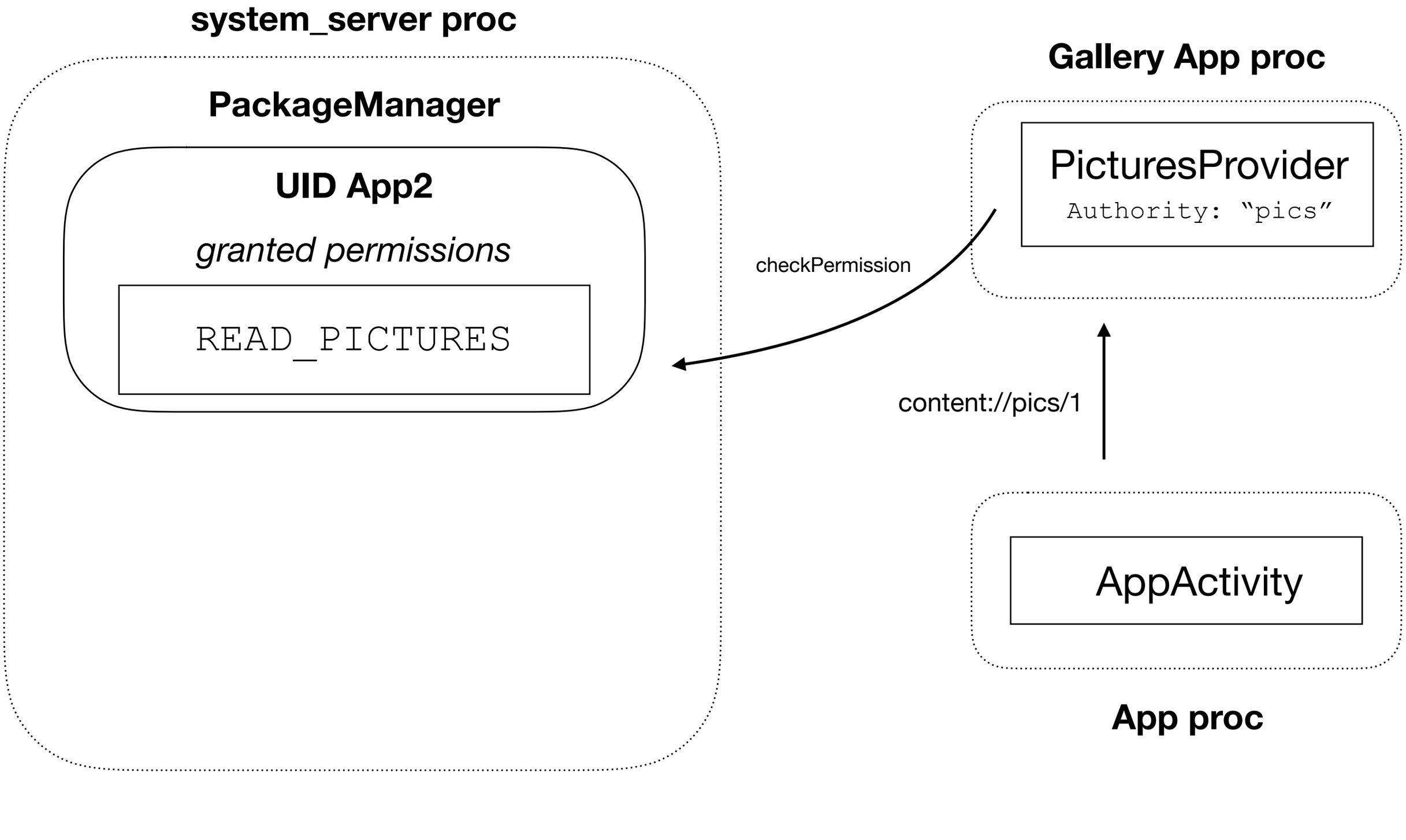
  PackageManager

  ActivityManager

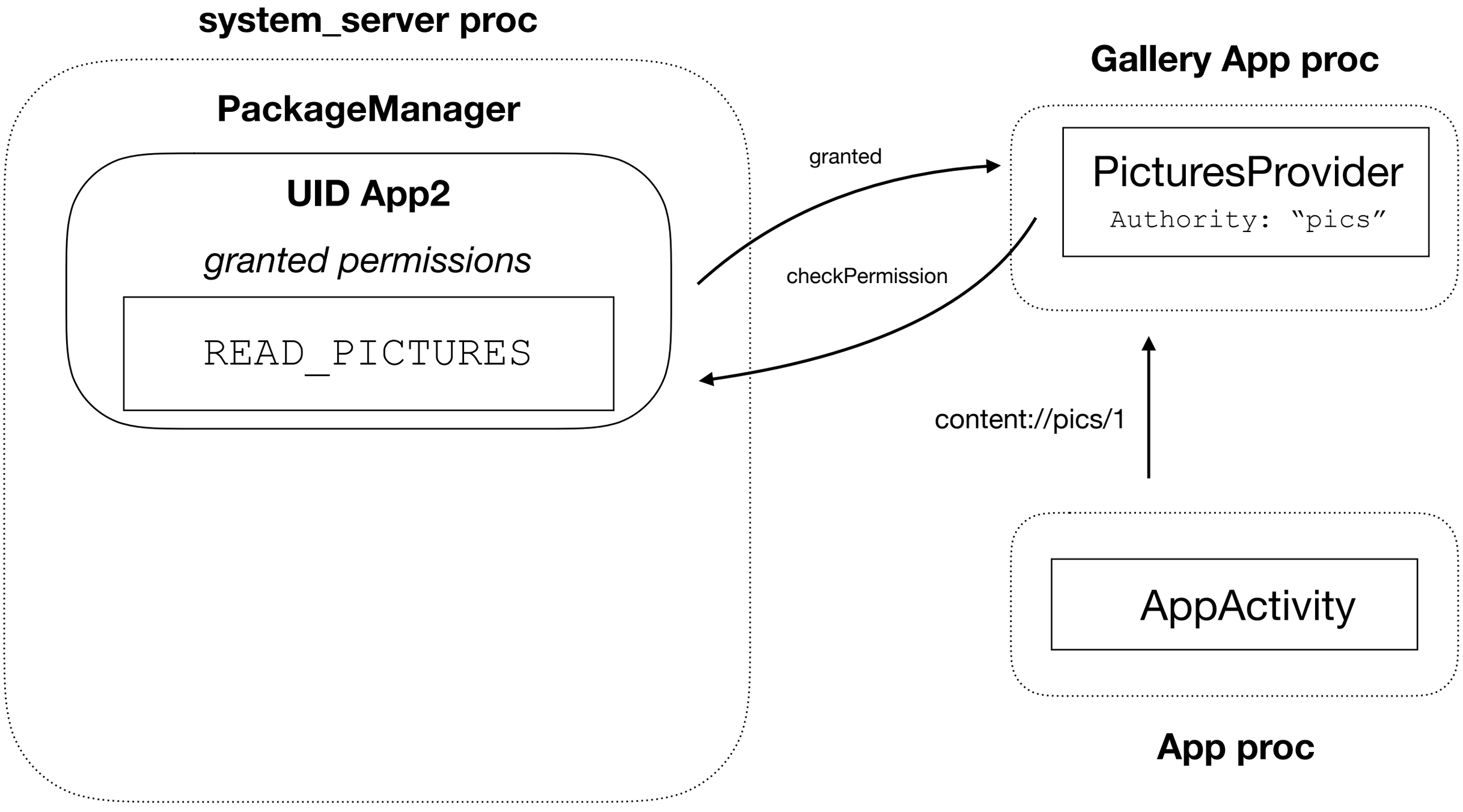
Android Permissions



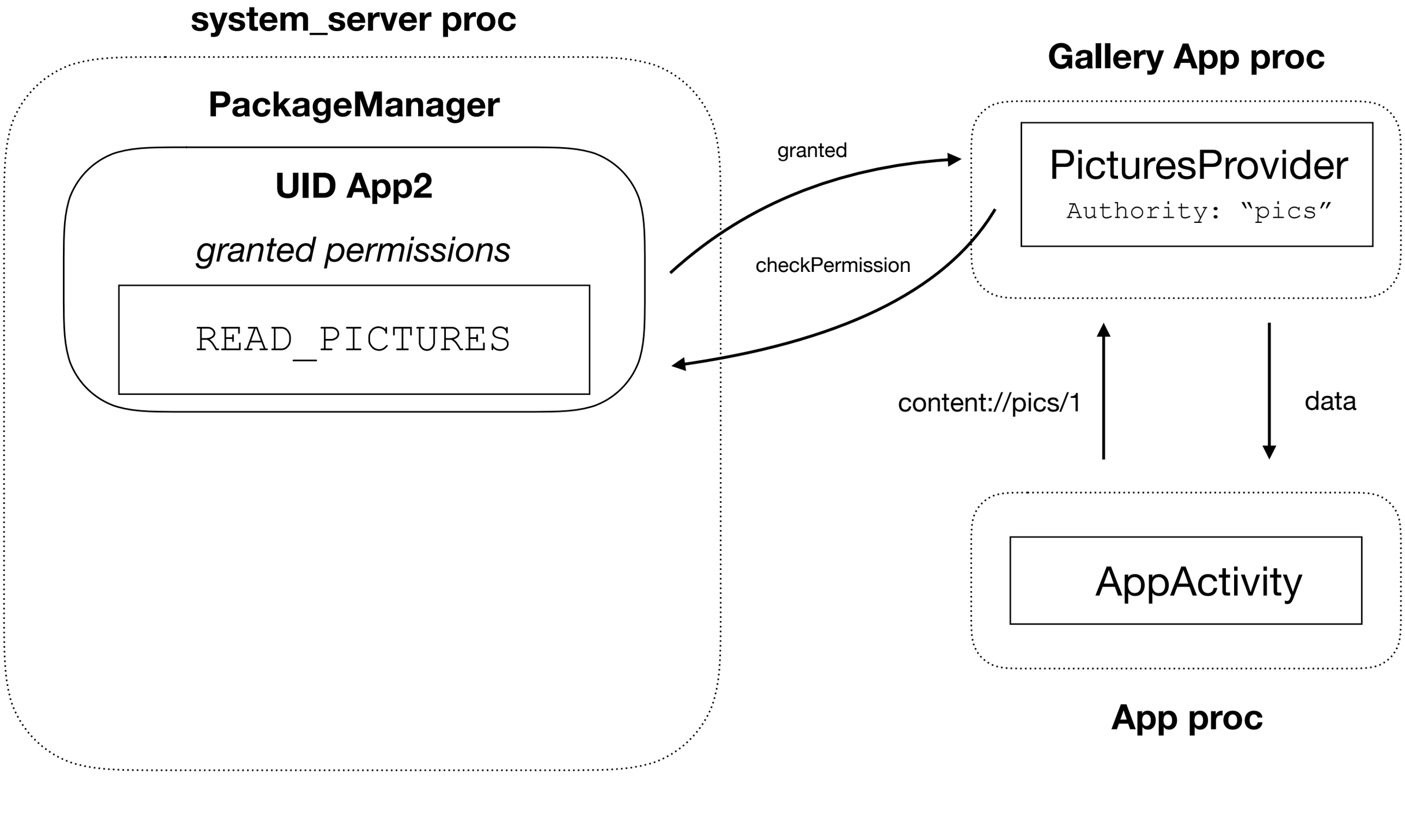
Android Permissions



Android Permissions



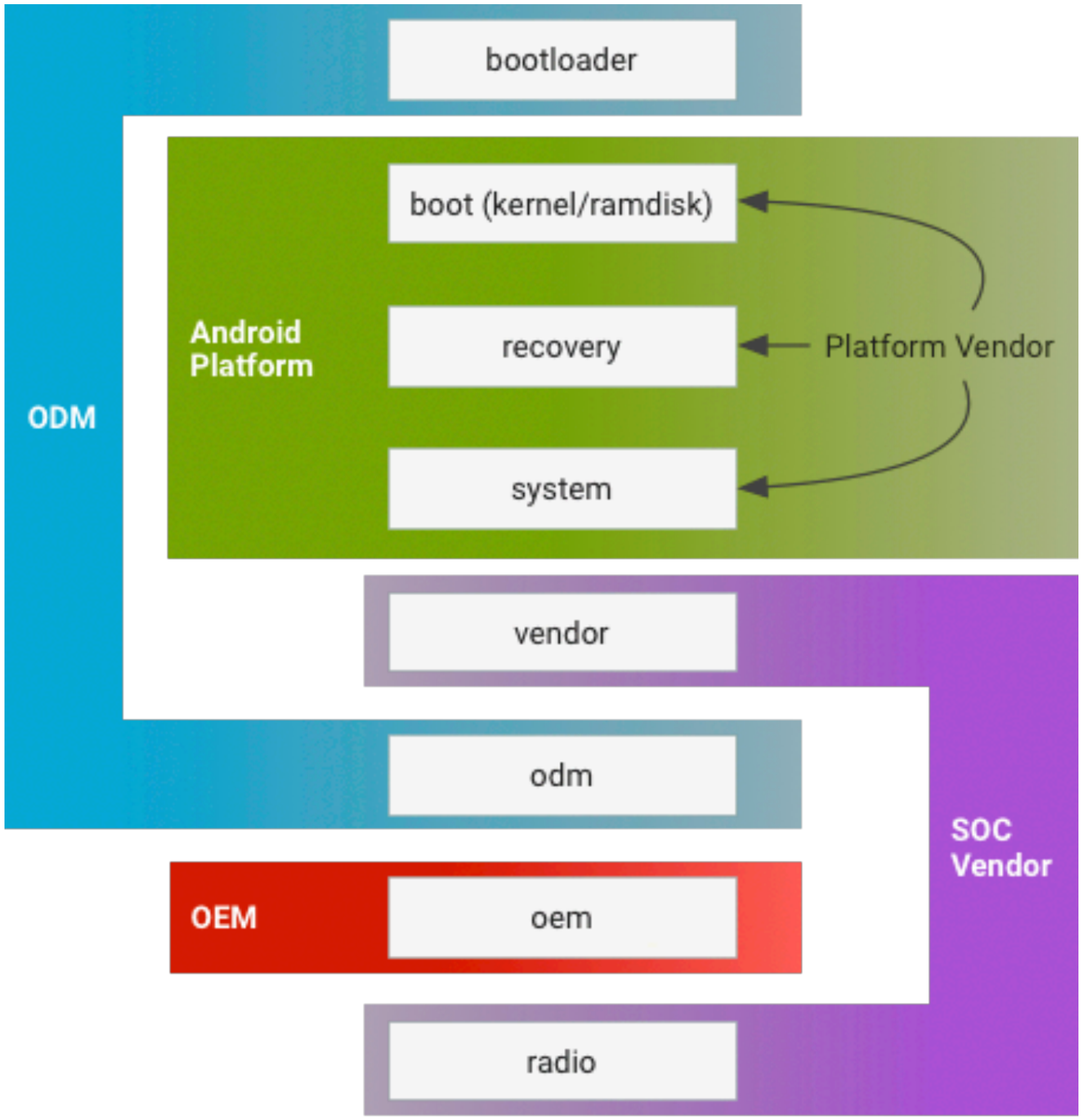
Android Permissions



Безопасность

- DAC (UID и GID)
- MAC (SELinux)
- Code signing

Android O


bootloader
boot (kernel/ramdisk)
Android Platform
recovery
Platform Vendor
system
ODM
vendor
odm
SOC Vendor
OEM
oem
radio

“Knowledge is power.”

–Francis Bacon

“Linux is obsolete.”

–Andrew Tanenbaum