Understanding the lock manager with the fb_lock_print utility

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Synchronization in Firebird

Internal vs external locks

- Mutexes, spinlocks, RW locks, latches

- Lock manager

Features of the global locks

- Multiple states (SR, PR, SW, PW, EX)

- Blocking notifications

- Deadlock detection

- Monitoring abilities

Lock Types and their Usage

Lock types

- Database lock

- Existence locks (table, procedure, index, collation)

- Table access locks

- Transaction locks

- Sweep, shadow, monitoring, etc locks

- Page locks (!)

Lock Types and their Usage

□ **Lock types**

```
LCK_database = 1           // Root of lock tree
LCK_relation = 2           // Individual relation
lock
LCK_bdb = 3                    // Individual buffer
block
LCK_tra = 4                      // Individual
transaction lock
LCK_rel_exist = 5          // Relation existence lock
LCK_idx_exist = 6          // Index existence lock
LCK_attachment = 7   // Attachment lock

...
```
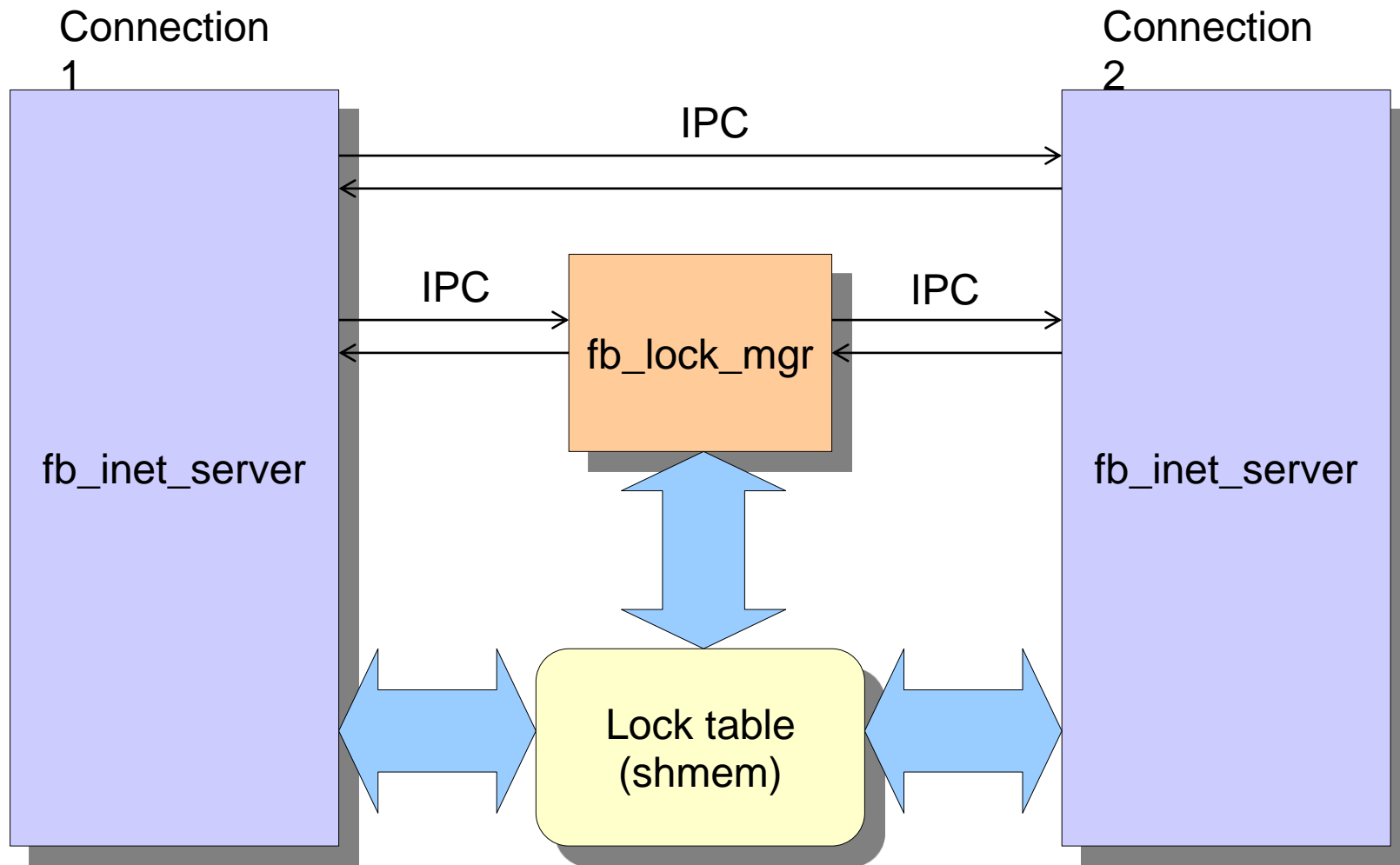
Locks and Firebird Architectures

SuperServer

- No page locks

- Small lock table

- Fast LM operations

Classic and SuperClassic

- Page locks are widely used

- Large lock table

- LM operations may require IPC

Lock Manager in Classic

Connection 1 — fb_inet_server
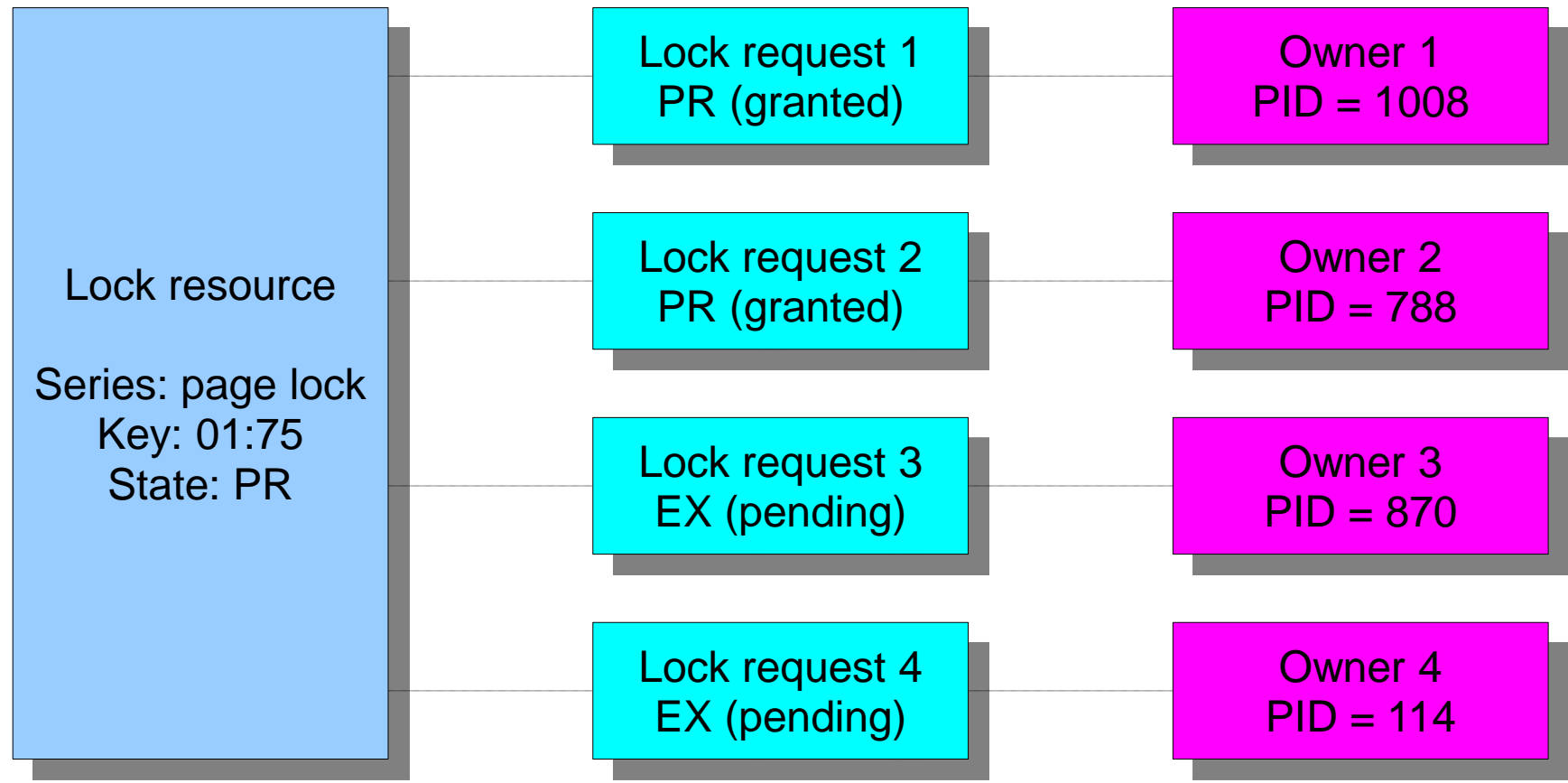
Connection 2 — fb_inet_server

IPC

fb_lock_mgr

Lock table (shmem)

Inside the Lock Table

Block types

- Header section

- Lock owners

- Lock resources

- Lock requests

Internals

- Single mutex around the shmem region

- Remappings

- Hash table of lock keys

Inside the Lock Table

Inside the Lock Table

Owner states

- Waiting = 0x4

- Signaled = 0x10

Request states

- Pending = 0x2

- Blocking = 0x1

- Blocking seen = 0x100

Tuning the Lock Manager

Configuration options

- LockMemSize (1MB)
~= <cache pages> * <max connections> * 100

- LockSemCount (32) – deprecated in v2.5

- LockHashSlots (1009)

Other considerations

- FIREBIRD_LOCK envvar

Using the Lock Print Utility

Output control switches

- -o [wners]

- -l [ocks]

- -r [equests]

- -s [eries] <number>

- -a [ll]

- -w [ait list]

Default output

- Header and owners only

Using the Lock Print Utility

Interactive mode

- -i [aotw] <number> <number>

- Acquires, operations, types, waits

- Seconds and intervals

Other options

- -c

- -d <database> or -f <lock file>

- -m

Questions?