Understanding the lock manager with the fb_lock_print utility

Dmitry Yemanov
mailto:dimitr@firebirdsql.org

Firebird Project
http://www.firebirdsql.org/

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
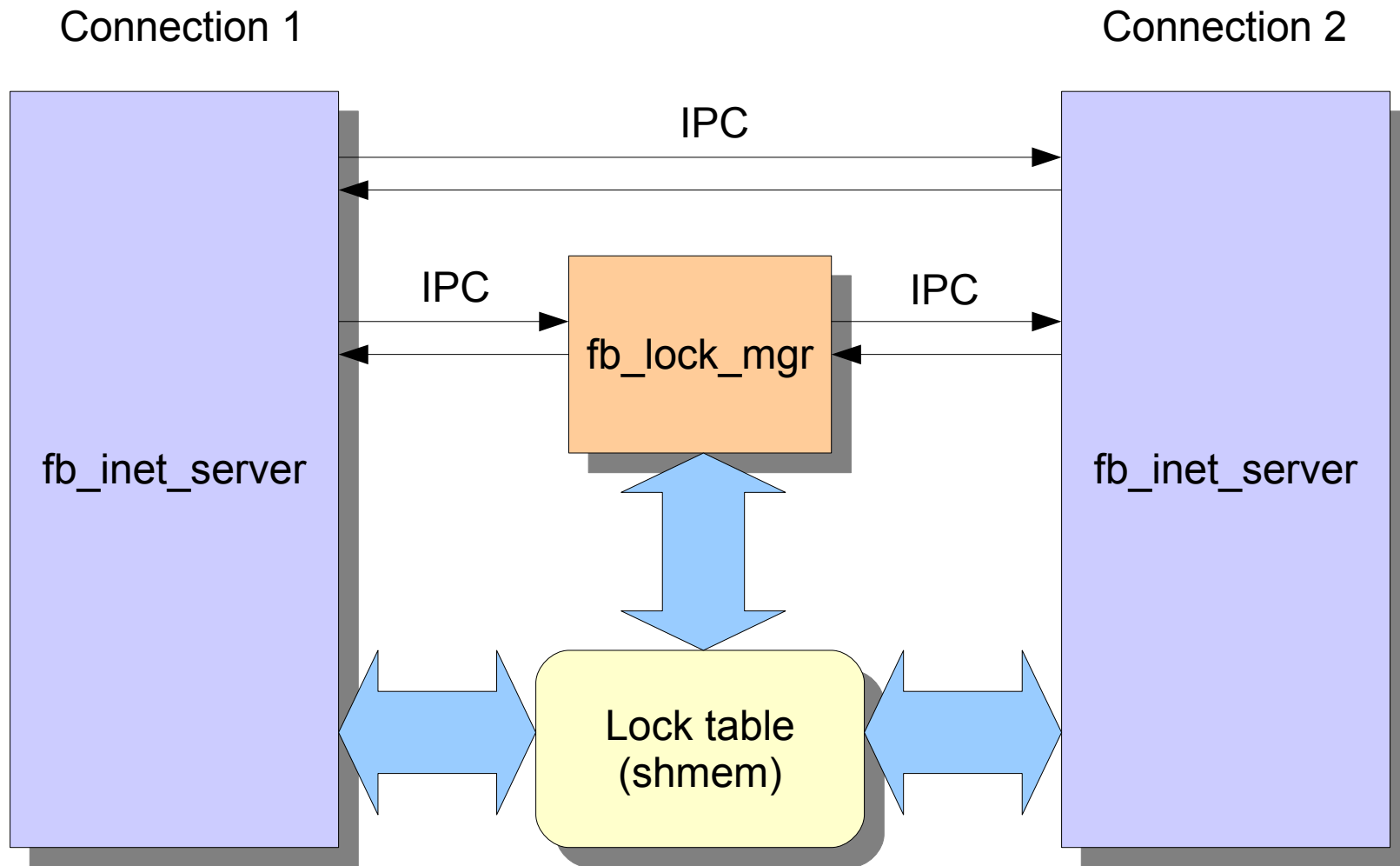
Fast LM operations

Classic and SuperClassic

Page locks are widely used

Large lock table

LM operations may require IPC

Lock Manager in Classic

Inside the Lock Table

Block types

Header section

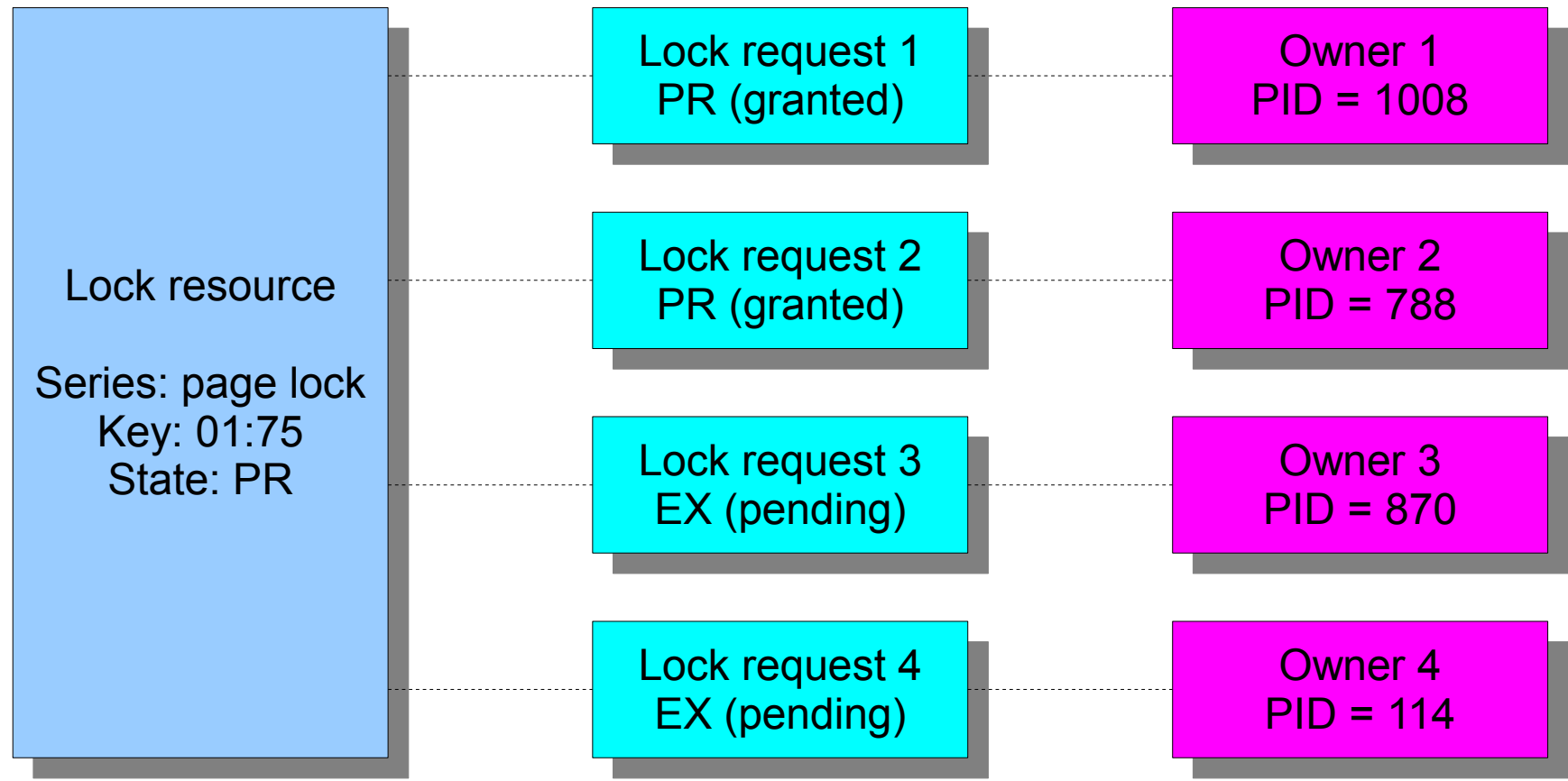Lock owners

Lock resources

Lock requests

Internals

Single mutex around the shmem region

Remappings

Hash table of lock keys

Inside the Lock Table

Lock resource

Series: page lock
Key: 01:75
State: PR

Lock request 1
PR (granted)

Lock request 2
PR (granted)

Lock request 3
EX (pending)

Lock request 4
EX (pending)

Owner 1
PID = 1008

Owner 2
PID = 788

Owner 3
PID = 870

Owner 4
PID = 114

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?