WORST.BUG.EVER.

A tale of the trickiest bug I've ever found

Background:

- **Picwell**: a recommendation engine for health care plans (and a corresponding API)
- **Recommendation**: a ranking for a given set of health care plans

The problem:

"As part of our client deliverables, we have been providing reporting derived from our recommendation logging service on a weekly basis... For the past week or so, we've noticed rather low throughput (as recorded by this service)"

What they're actually saying:

- "We've been parsing our logs to create reports for clients."
- "One of our clients decided to double-check our numbers."
- "And we've been kinda underreporting recommendations."
- "We don't know how that happened."
- "Help."

Clue #1: Logstash

Clue #1: Logstash

chef/templates/logstash.conf.erb:

```
input {
  file {
    path => "<%= @recommendations_path %>"
    tags => ["recommendations"]
    codec => "json"
  }
}
```

Clue #1: Logstash

chef/templates/logstash.conf.erb:

```
output {
  s3 {
    tags => ["recommendations"]
    region => "us-east-1"
    bucket => "picwell.recommendationlogs"
    prefix => "<%= @app_name %>/<%= @env_name %>/recommendations/"
    codec => "json_lines"
    size_file => 500000
    time_file => 15
  }
```

Clue #1: Logstash

chef/recipies/logstash.rb:

```
template "/etc/logstash/conf.d/logstash.conf" do
  source "logstash.conf.erb"
  owner "deploy"
  group "deploy"
  variables({
    :recommendations_path =>
        node['logstash']['recommendations_path'] +
        "recommendations.log",
  })
end
```

Clue #2:

`RotatingFileHandler`

Clue #2: RotatingFileHandler

commercial-api/log_helpers.py:

```
from logging.handlers import RotatingFileHandler
...
handler = RotatingFileHandler(
    log_path + name + '.log',
    maxBytes=10000000,
    backupCount=10
)
...
logger.addHandler(handler)
```

"Ah hah!"

Clue #3: Apache

Clue #3: Apache

apache2/sites-available/commercial.conf:

```
<VirtualHost *:80>
  ServerName commercial-api.picwell.net
  WSGIDaemonProcess commercial processes=8
    threads=1 display-name=commercial
  WSGIProcessGroup commercial
  WSGIScriptAlias / /home/deploy/commercial.wsgi
  ...
</VirtualHost>
```

Any guesses?

Hint: A Rollover in Action

Hint: A Rollover in Action

```
$ ls -lah /var/log/picwell/recommendations
total 20M
drwxr-xr-x 2 www-data www-data 4.0K Dec 14 21:59 .
drwxr-xr-x 4 deploy   deploy   4.0K Nov 11 02:10 ..
-rw-r--r-- 1 www-data www-data 9.9M Dec 14 21:59 recommendations.log
-rw-r--r-- 1 www-data www-data  38K Dec  2 17:18 recommendations.log.1
-rw-r--r-- 1 www-data www-data  59K Dec  2 17:17 recommendations.log.2
-rw-r--r-- 1 www-data www-data  80K Dec  2 17:18 recommendations.log.3
-rw-r--r-- 1 www-data www-data  30K Dec  2 17:18 recommendations.log.4
-rw-r--r-- 1 www-data www-data  47K Dec  2 17:18 recommendations.log.5
-rw-r--r-- 1 www-data www-data  99K Dec  2 17:18 recommendations.log.6
-rw-r--r-- 1 www-data www-data  43K Dec  2 17:18 recommendations.log.7
-rw-r--r-- 1 www-data www-data 9.6M Dec  2 15:28 recommendations.log.8
.
.
```

Hint: A Rollover in Action

```
$ ls -lah /var/log/picwell/recommendations
total 20M
drwxr-xr-x 2 www-data www-data 4.0K Dec 14 22:19 .
drwxr-xr-x 4 deploy   deploy   4.0K Nov 11 02:10 ..
-rw-r--r-- 1 www-data www-data 1.6K Dec 14 22:19 recommendations.log
-rw-r--r-- 1 www-data www-data 9.9M Dec 14 21:59 recommendations.log.1
-rw-r--r-- 1 www-data www-data  38K Dec  2 17:18 recommendations.log.2
-rw-r--r-- 1 www-data www-data  59K Dec  2 17:17 recommendations.log.3
-rw-r--r-- 1 www-data www-data  80K Dec  2 17:18 recommendations.log.4
-rw-r--r-- 1 www-data www-data  30K Dec  2 17:18 recommendations.log.5
-rw-r--r-- 1 www-data www-data  47K Dec  2 17:18 recommendations.log.6
-rw-r--r-- 1 www-data www-data  99K Dec  2 17:18 recommendations.log.7
-rw-r--r-- 1 www-data www-data  43K Dec  2 17:18 recommendations.log.8
-rw-r--r-- 1 www-data www-data 9.6M Dec  2 15:28 recommendations.log.9
.
```

Hint: A Rollover in Action

```
$ ls -lah /var/log/picwell/recommendations
total 11M
drwxr-xr-x 2 www-data www-data 4.0K Dec 14 22:20 .
drwxr-xr-x 4 deploy   deploy   4.0K Nov 11 02:10 ..
-rw-r--r-- 1 www-data www-data 3.2K Dec 14 22:21 recommendations.log
-rw-r--r-- 1 www-data www-data 8.0K Dec 14 22:21 recommendations.log.1
-rw-r--r-- 1 www-data www-data  12K Dec 14 22:21 recommendations.log.2
-rw-r--r-- 1 www-data www-data  18K Dec 14 22:21 recommendations.log.3
-rw-r--r-- 1 www-data www-data  42K Dec 14 22:21 recommendations.log.4
-rw-r--r-- 1 www-data www-data 9.9M Dec 14 21:59 recommendations.log.5
-rw-r--r-- 1 www-data www-data  38K Dec  2 17:18 recommendations.log.6
-rw-r--r-- 1 www-data www-data  59K Dec  2 17:17 recommendations.log.7
-rw-r--r-- 1 www-data www-data  80K Dec  2 17:18 recommendations.log.8
-rw-r--r-- 1 www-data www-data  30K Dec  2 17:18 recommendations.log.9
-rw-r--r-- 1 www-data www-data  47K Dec  2 17:18 recommendations.log.10
```

Why?

Answer: inodes

Answer: inodes

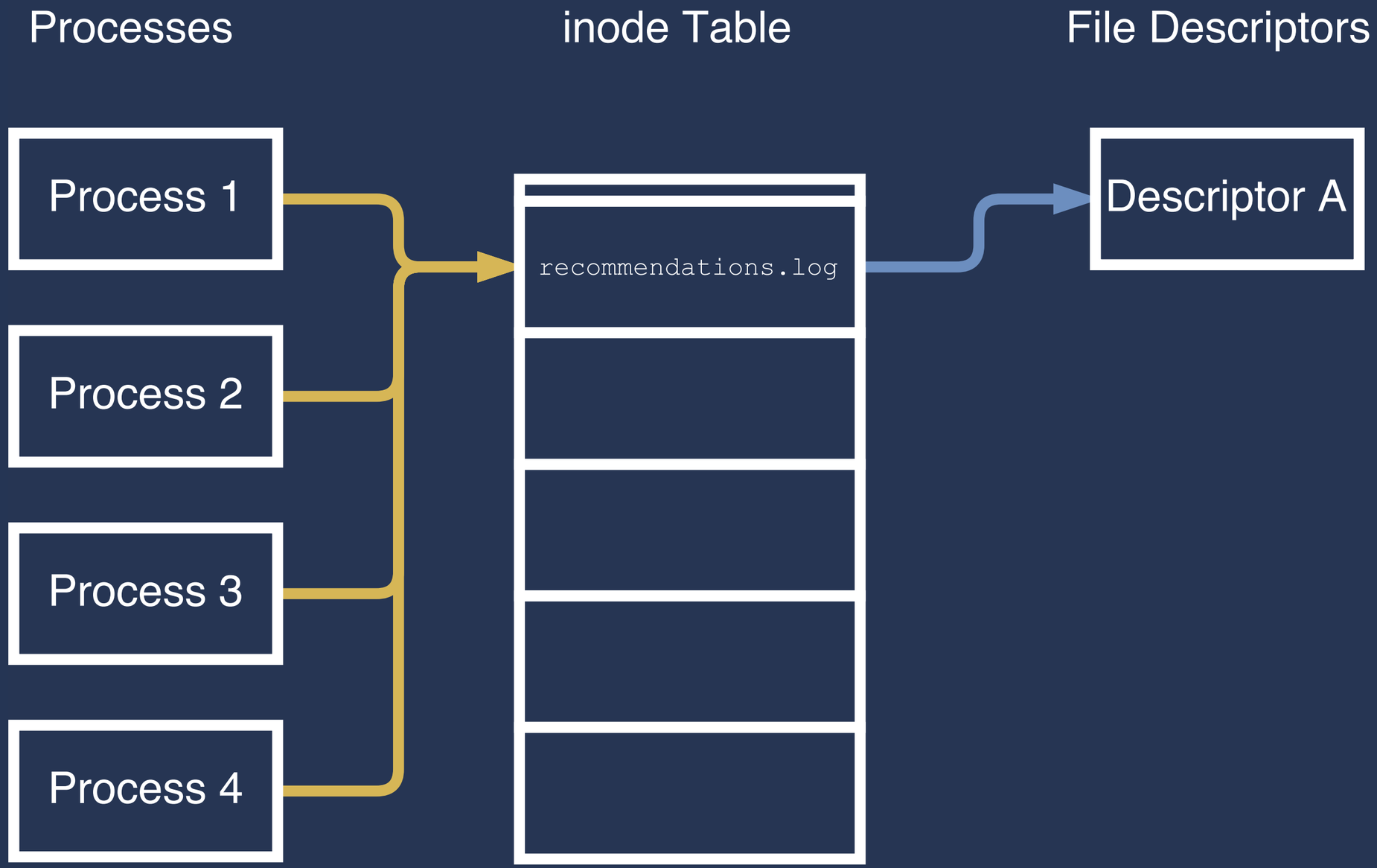
"In a Unix-style file system, the inode is a data structure used to represent a filesystem object, which can be one of various things including a file or a directory. Each inode stores the attributes and disk block location(s) of the filesystem object's data."

Answer: inodes

- When you open the file `recommendations.log`, you're following a pointer in the inode table to a file descriptor
- When your script has a file open, and the pointer in the inode table changes, you're still writing to the same file descriptor

Answer: inodes

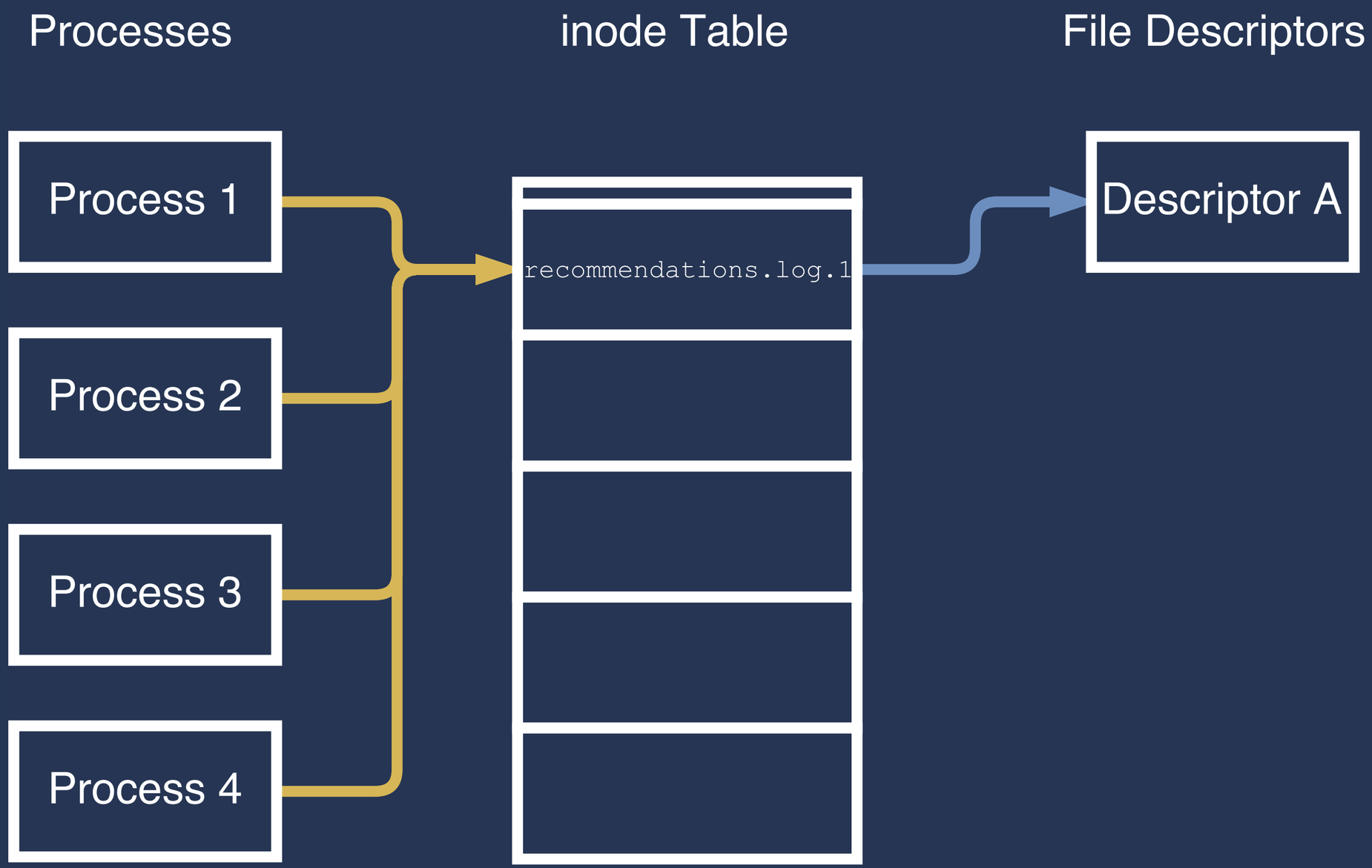
At first, when the server starts, all eight processes are looking at the file called `recommendations.log`, which points to file descriptor *A*;

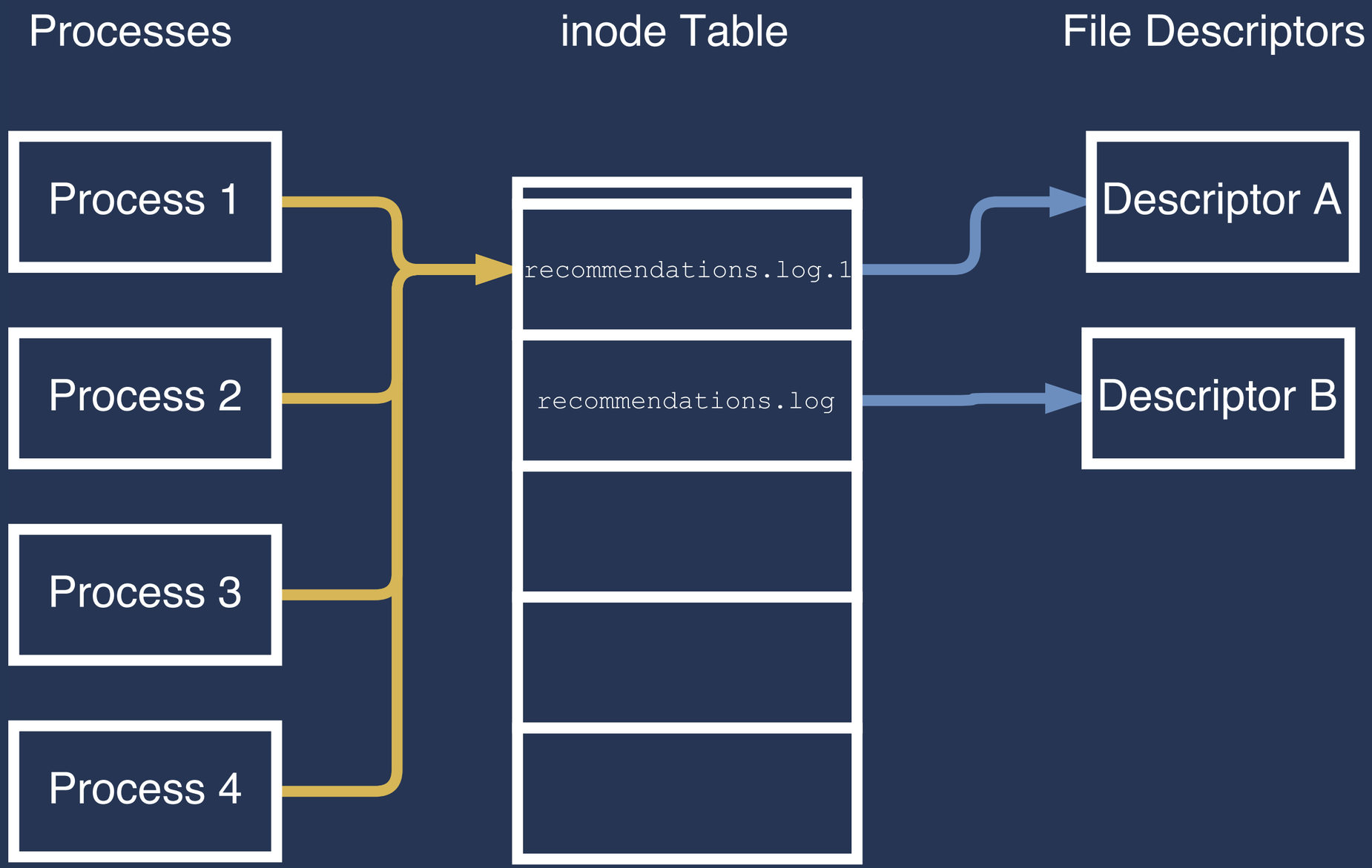

Processes
inode Table
File Descriptors
Process 1
Process 2
Process 3
Process 4
recommendations.log
Descriptor A

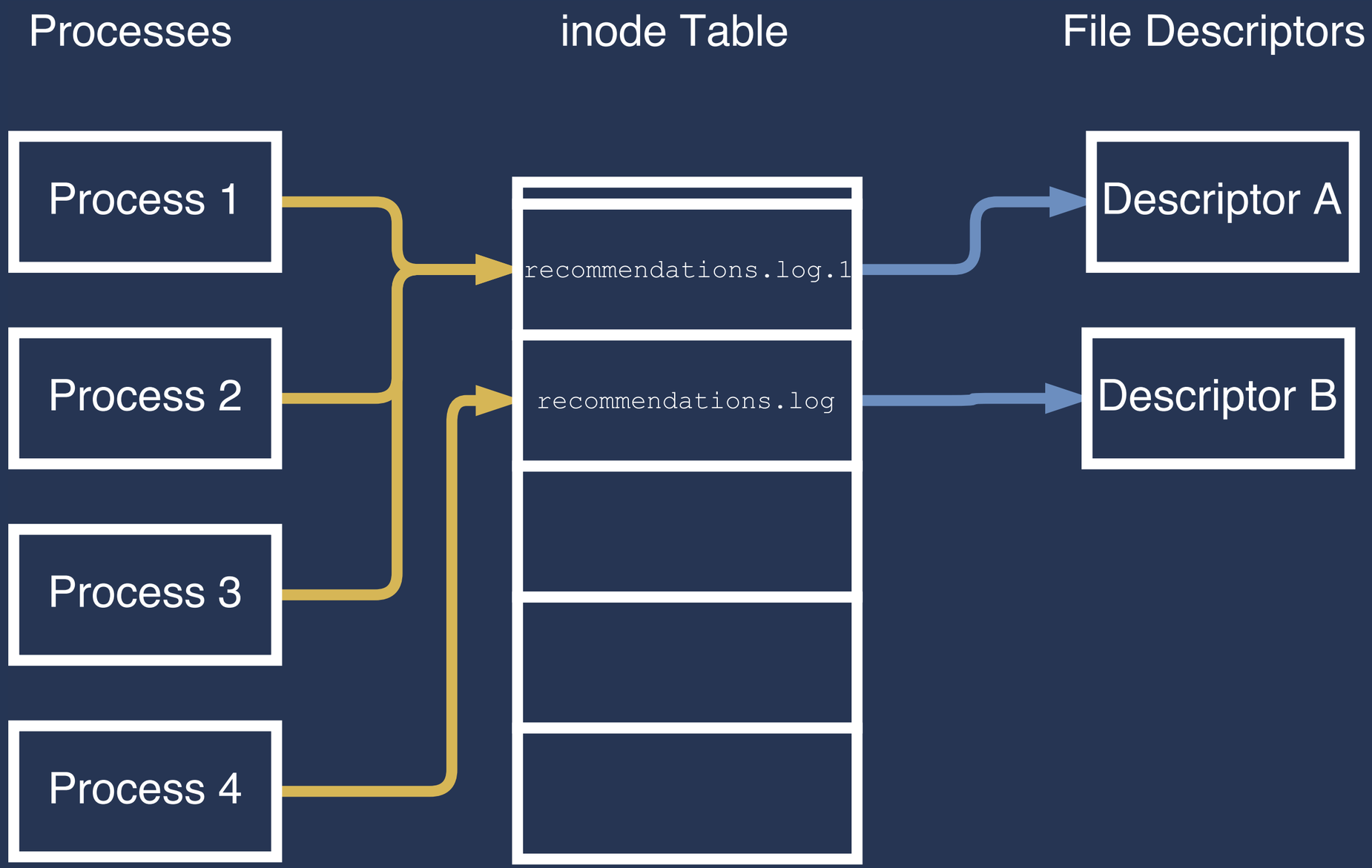
Answer: inodes

Then, one process tries to write a log at the max size:

- It closes the file;
- It moves the file from `recommendations.log` to `recommendations.log.1`;
- Then it opens a new file, `recommendations.log`, which points to file descriptor *B*;
- And writes the log to the file.

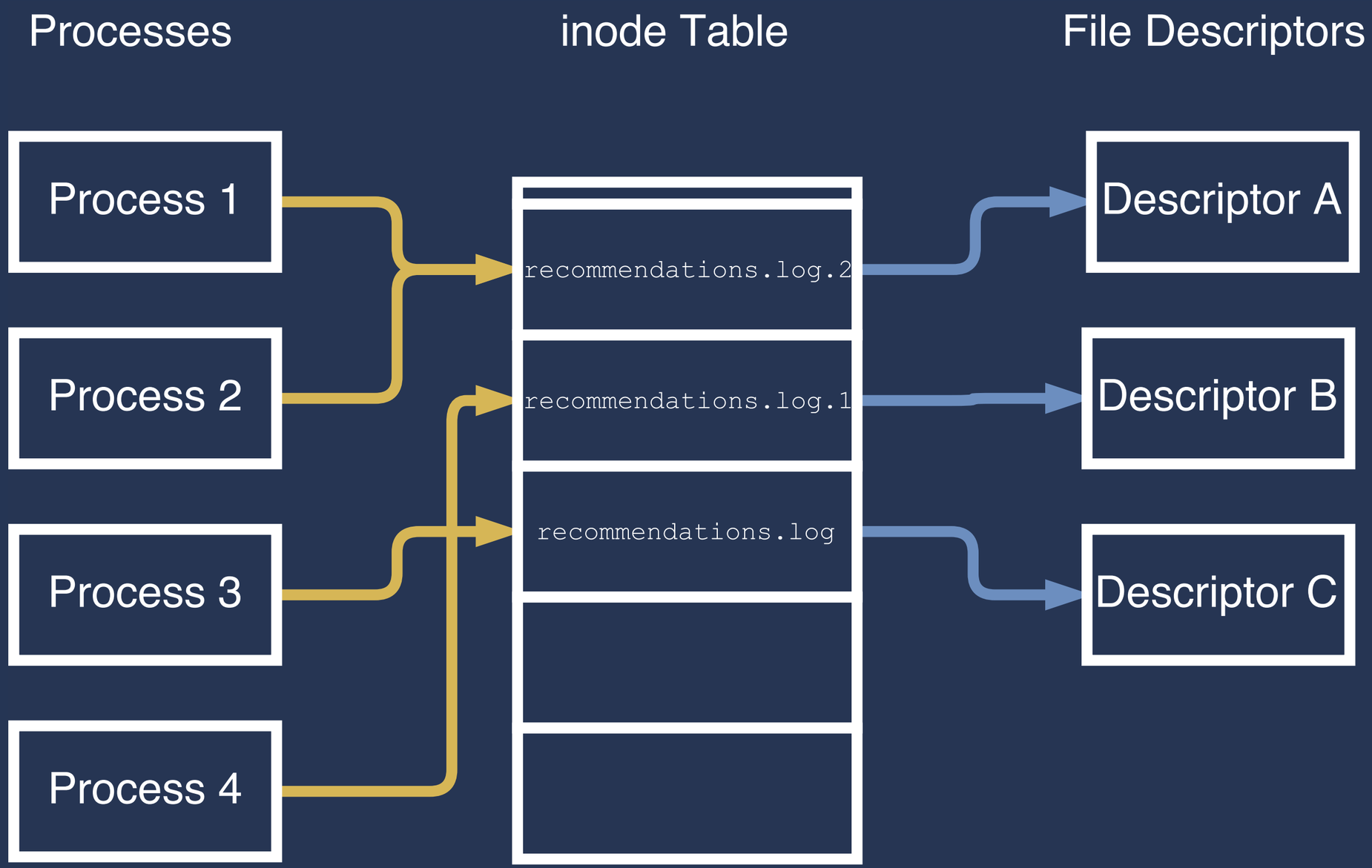

Processes
inode Table
File Descriptors
Process 1
Process 2
Process 3
Process 4
recommendations.log.1
Descriptor A

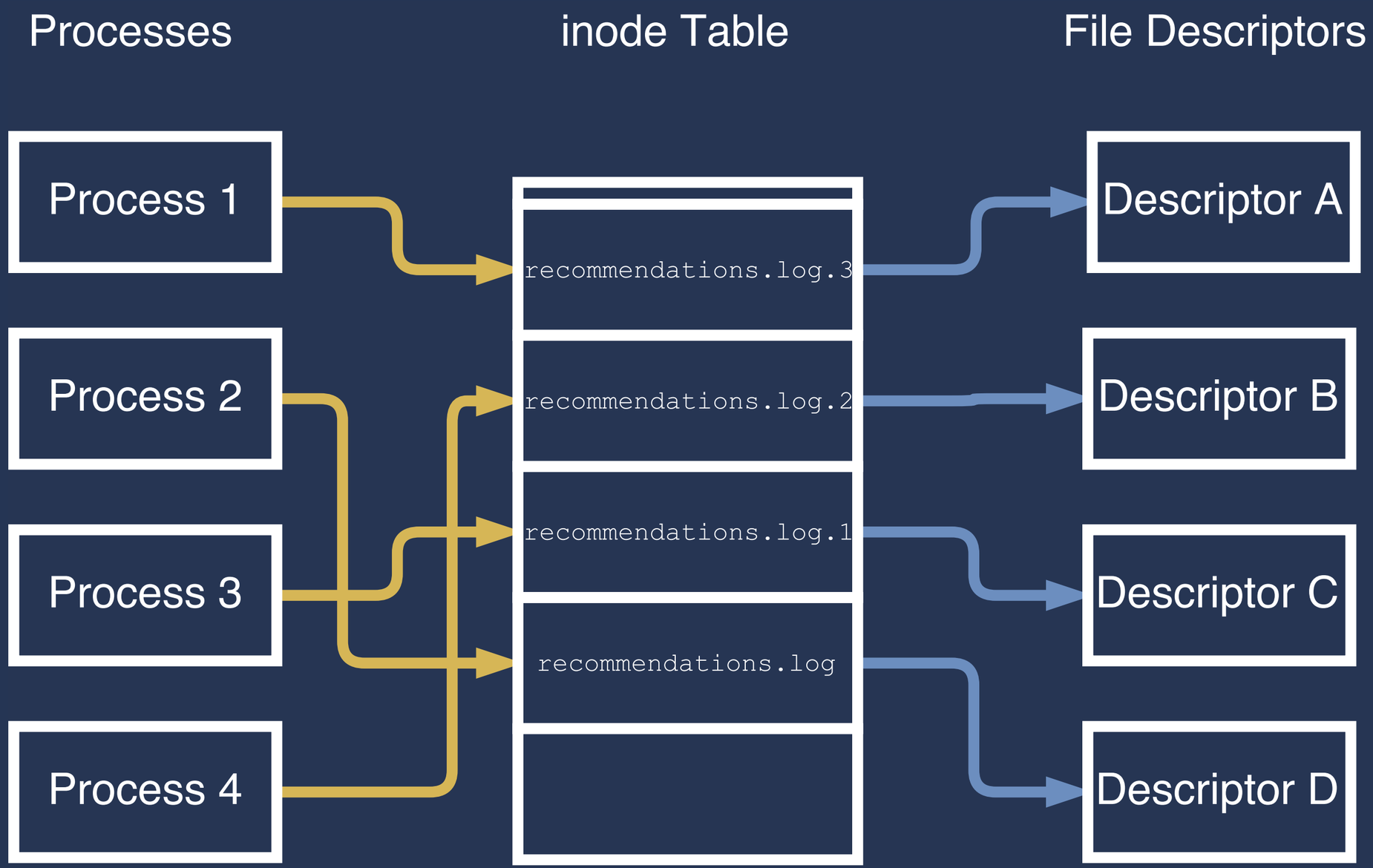

Processes
inode Table
File Descriptors
Process 1
Process 2
Process 3
Process 4
recommendations.log.1
recommendations.log
Descriptor A
Descriptor B


Processes
inode Table
File Descriptors
Process 1
Process 2
Process 3
Process 4
recommendations.log.1
recommendations.log
Descriptor A
Descriptor B

Answer: inodes

Eventually, all eight processes are writing to eight different files on disk, but only *one* is getting backed up to S3!


Processes
inode Table
File Descriptors
Process 1
Process 2
Process 3
Process 4
recommendations.log.2
recommendations.log.1
recommendations.log
Descriptor A
Descriptor B
Descriptor C


Processes
inode Table
File Descriptors
Process 1
Process 2
Process 3
Process 4
recommendations.log.3
recommendations.log.2
recommendations.log.1
recommendations.log
Descriptor A
Descriptor B
Descriptor C
Descriptor D

Estimating data loss

I estimated the % of logs lost to be 7/8ths, or 87.5%; the actual stats:

- Total recommendations recorded in logs: 42,509
- Total recommendations actually made: 323,603
- Percent lost: ~86.9%

Takeaways:

- Maybe log files shouldn't be relied on to be the end-all-be-all source of important data
- Maybe don't hire short-term contractors who don't know what they're doing
- Definitely keep hiring PromptWorks, though!