# GEOM
# in infrastructure we trust

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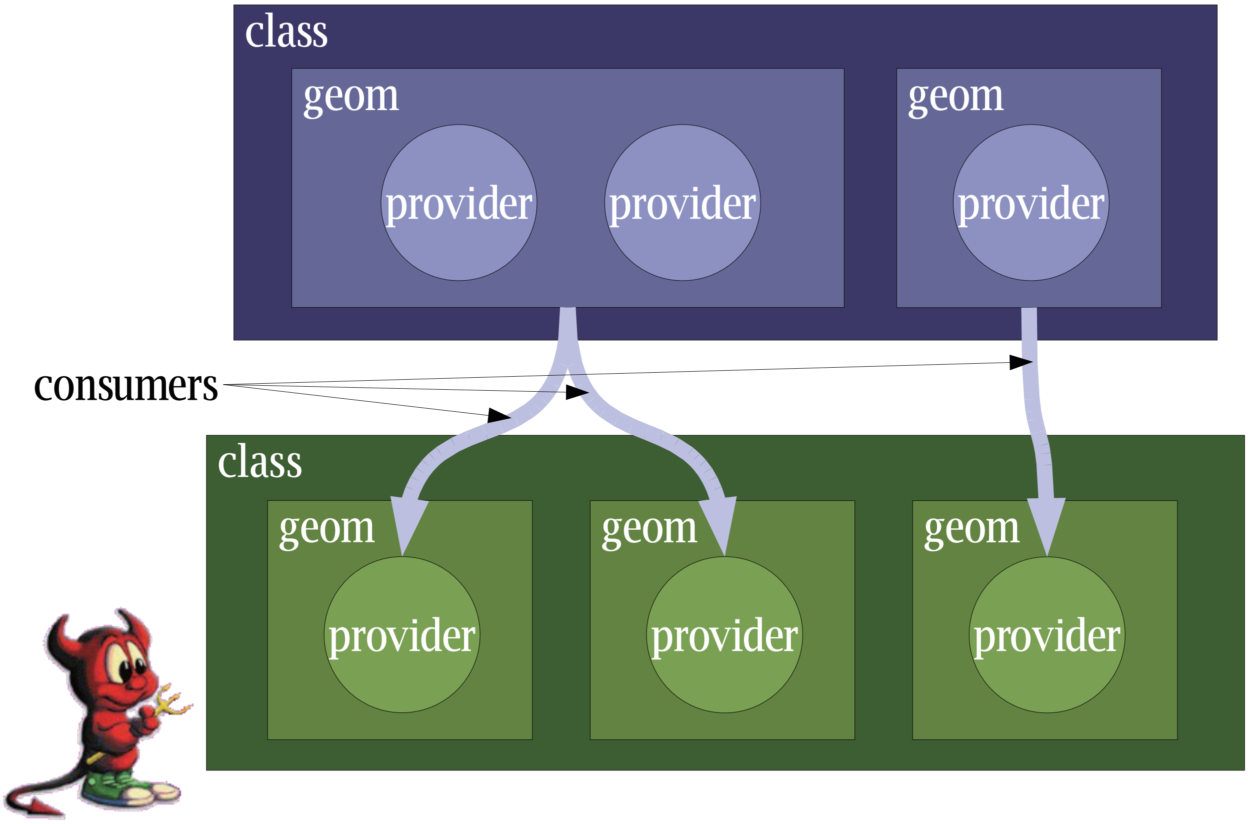
# History

- the GEOM framework first appeared in FreeBSD 5.0
- implemented by phk@
- sponsored by DARPA
- first commit in March 11, 2002

# Nomenclature

- **class** – a kind of I/O transformation (eg. mirror, stripe)
- **geom** – an instance of a class
- **provider** – provides storage (eg. /dev/da0)
- **consumer** – connection between geom and provider

# Nomenclature



class

geom

provider

provider

geom

provider

consumers

class

geom

provider

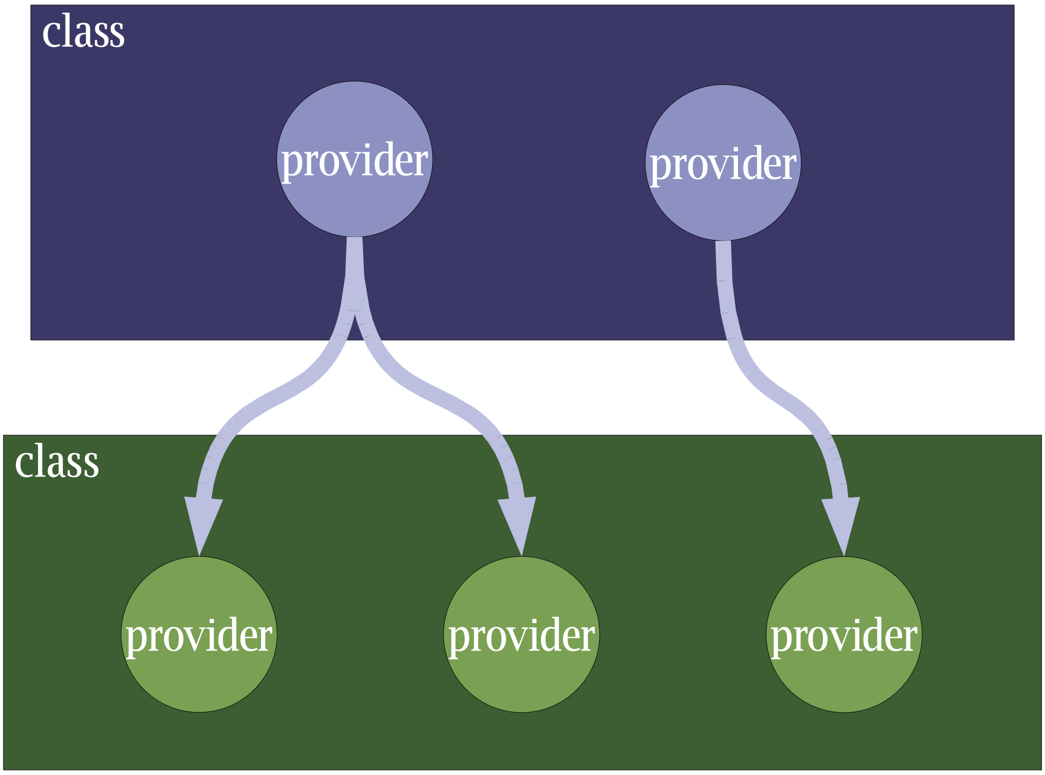
geom

provider

geom

provider

# What is worth to remember



# Access

- **read**
- **write** – can't be already open exclusively
- **exclusive** – can't be already open for write

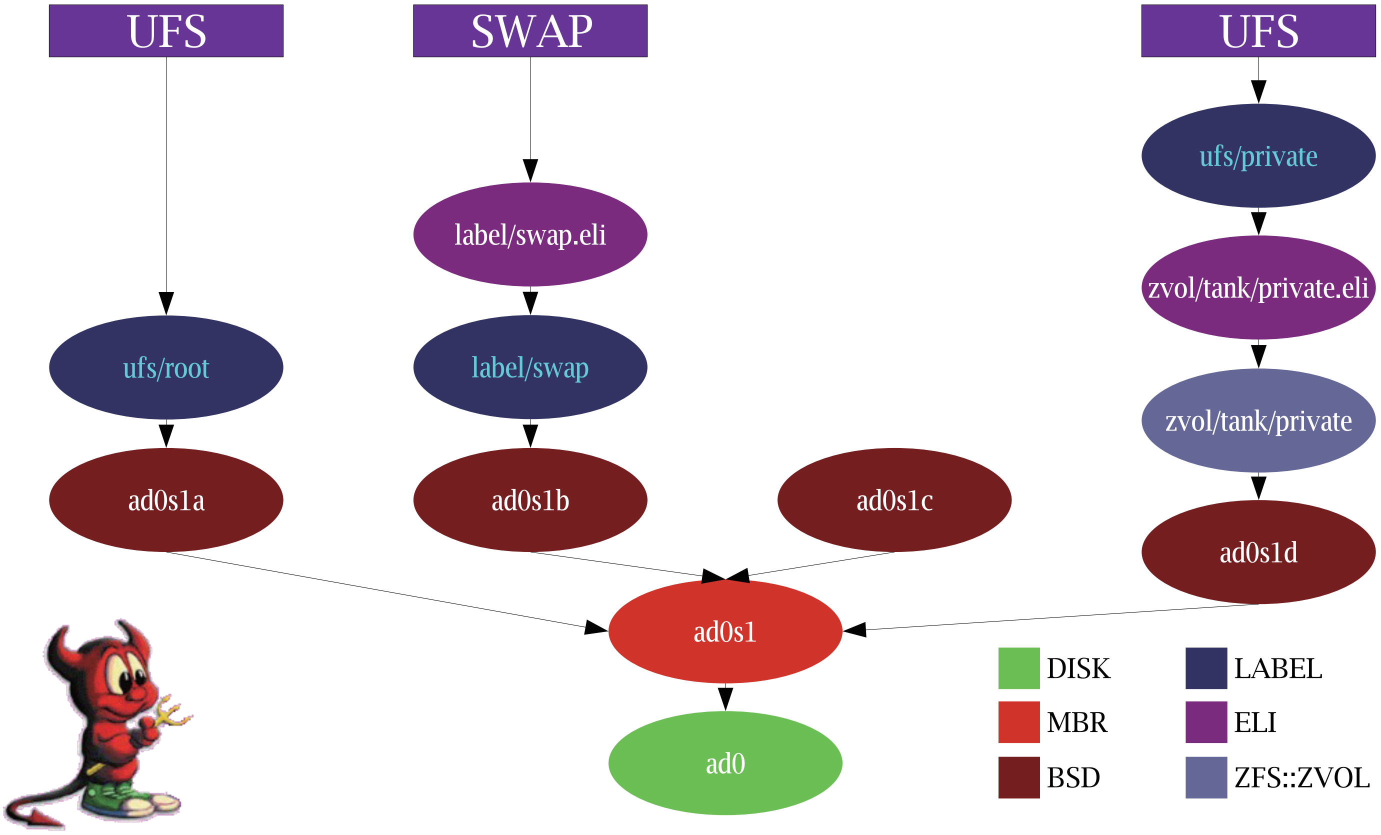
```
<provider id="0x84af5d00">
      <geom ref="0x84af5d80"/>
      <mode>r3w3e7</mode>
      <name>ad0</name>
      <mediasize>160041885696</mediasize>
      <sectorsize>512</sectorsize>
      <config>
            <fwheads>16</fwheads>
            <fwsectors>63</fwsectors>
      </config>
</provider>
```

# I/O requests

- **BIO_READ** – read data
- **BIO_WRITE** – write data

- **BIO_DELETE** – destroy/free data
- **BIO_FLUSH** – flush cache, put data onto stable storage
- **BIO_GETATTR** – ask about properties

# GEOM on my laptop



# *gconcat(8)*

- simple provider concatenation
- appears in /dev/concat/name
- usage:

```
# gconcat label name da0 da1s1 da2s2d
```

| da0 | da1s1 | da2s2d |
|---|---|---|
| 0 | 4 | 7 |
| 1 | 5 | 8 |
| 2 | 6 | 9 |
| 3 |  | 10 |
|  |  | 11 |

# *gstripe(8)*

- RAID0
- appears in /dev/stripe/name
- usage:

```
# gstripe label name da0 da1s1 da2s2d
```

| da0 | da1s1 | da2s2d |
|---|---|---|
| 0 | 1 | 2 |
| 3 | 4 | 5 |
| 6 | 7 | 8 |
| 9 | 10 | 11 |
| 12 | 13 | 14 |

# *gmirror(8)*

- RAID1
- appears in /dev/mirror/name
- autosynchronization
- usage:

```
# gmirror label name da0 da1s1 da2s2d
```

| da0 | da1s1 | da2s2d |
|---|---|---|
| 0 | 0 | 0 |
| 1 | 1 | 1 |
| 2 | 2 | 2 |
| 3 | 3 | 3 |
| 4 | 4 | 4 |

# *graid3(8)*

- RAID3
- appears in /dev/raid3/name
- bigger sector size
- $2^a+1$ providers
- usage:

```
# graid3 label name da0 da1s1 da2s2d
```

| da0 | da1s1 | da2s2d |
|---|---|---|
| 1/0 | 2/0 | 1^2/0 |
| 1/1 | 2/1 | 1^2/1 |
| 1/2 | 2/2 | 1^2/2 |
| 1/3 | 2/3 | 1^2/3 |
| 1/4 | 2/4 | 1^2/4 |

# *gjournal(8)*

- block-level journaling (not file system level journaling)
- file system independent
- can be used for file system journaling with minimal knowledge on FS side
- currently can be used for UFS journaling
- usage:

```
# gjournal label da0
# newfs -J /dev/da0.journal
# mount -o async /dev/da0.journal /mnt
```

# *ggatec(8), ggated(8)*

- exports storage over the network
- server usage:

```
# echo „10.0.0.0/24 RO /dev/acd0" > /etc/gg.exports
# echo „10.0.0.8/32 RW /dev/da1” >> /dev/gg.exports
# ggated
```

- client usage:

```
# ggatec create -o server /dev/acd0
ggate0
# mount_cd9660 /dev/ggate0 /mnt/cdrom
# ggatec create server /dev/da1
ggate1
# newfs -J /dev/ggate1
# mount /dev/ggate1 /mnt/data
```

# gshsec(8)

- implements shared secret functionality
- all providers are needed to read the data
- appears in /dev/shsec/name
- usage:

```
# gshsec label name da0 da1s1 da2s2d
```

| da0 | da1s1 | da2s2d |
|---|---|---|
| 1/0 | 2/0 | 3/0 |
| 1/1 | 2/1 | 3/1 |
| 1/2 | 2/2 | 3/2 |
| 1/3 | 2/3 | 3/3 |
| 1/4 | 2/4 | 3/4 |

# geli(8) 1/2

- provides encryption and integrity verification
- utilizes crypto(9) framework – uses crypto hardware automatically
- supports various encryption algorithms (AES, camellia, blowfish, 3DES)
- supports various authentication algorithms (HMAC/md5, sha1, ripemd160, sha256, sha384, sha512)
- key can be split over serval components (passphrase, random bits from a file, etc.)

# *geli(8)* 2/2

- allows to encrypt even root provider
- passphrase strengthened with PKCS#5v2
- two independent keys can be used
- starts as many worked threads as many CPU cores the system has

Comming soon (currently in perforce only):

- suspend/resume support

# *ZFS*

- FreeBSD port implements two GEOM classes:
  - ZFS::VDEV – consumers-only class used to access GEOM providers
  - ZFS::ZVOL – providers-only class used for ZVOLs

# geom(8) 1/2

- control utility for most GEOM classes
- few standard commands that work with all classes (list, status, load, unload)
- usage:

```
# geom disk list
# geom bsd status
```

# geom(8) 2/2

- class-specific functions implemented via libraries (/lib/geom/)
- for the above, one can use g<class> command
- classes aware of geom(8):
  - cache
  - concat
  - eli
  - journal
  - label
  - mirror
  - multipath
  - nop
  - part
  - raid3
  - shsec
  - stripe
  - virstor

# *Questions?*