Bareos in Radio Astronomy – Scaling up using Virtual Full Backups

Jan Behrend

Max Planck Institute for Radio Astronomy

Open Source Backup Conference
September 23rd 2014

Overview

- About the Institute
- Backup Goals and Limitations
- The Challenge
- Implementation
- Configuraton Strategy
- Virtual Full Backups
- Integration with DRBD
- Integration with REAR
- Wishlist

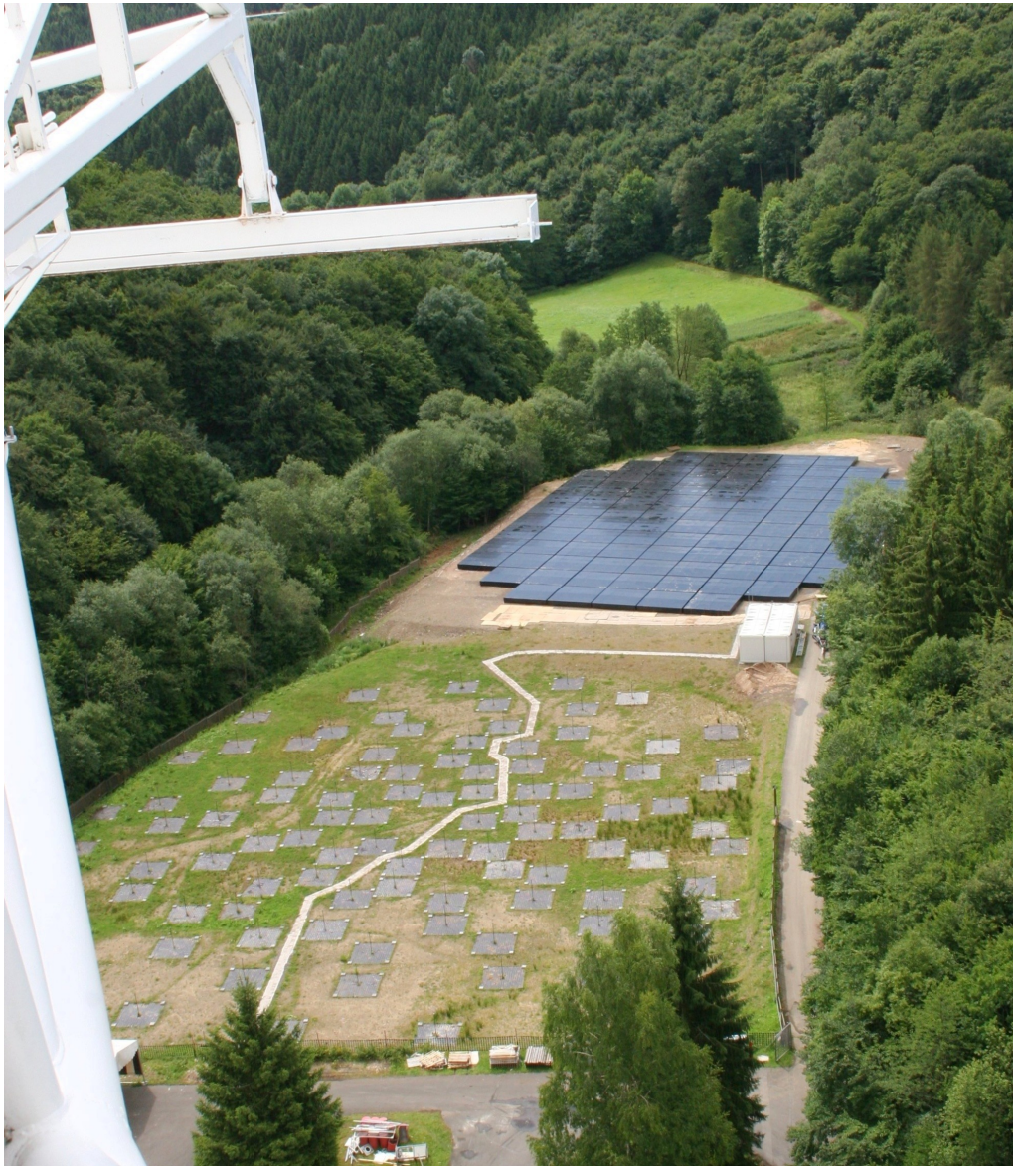
Max Planck Institute for Radio Astronomy

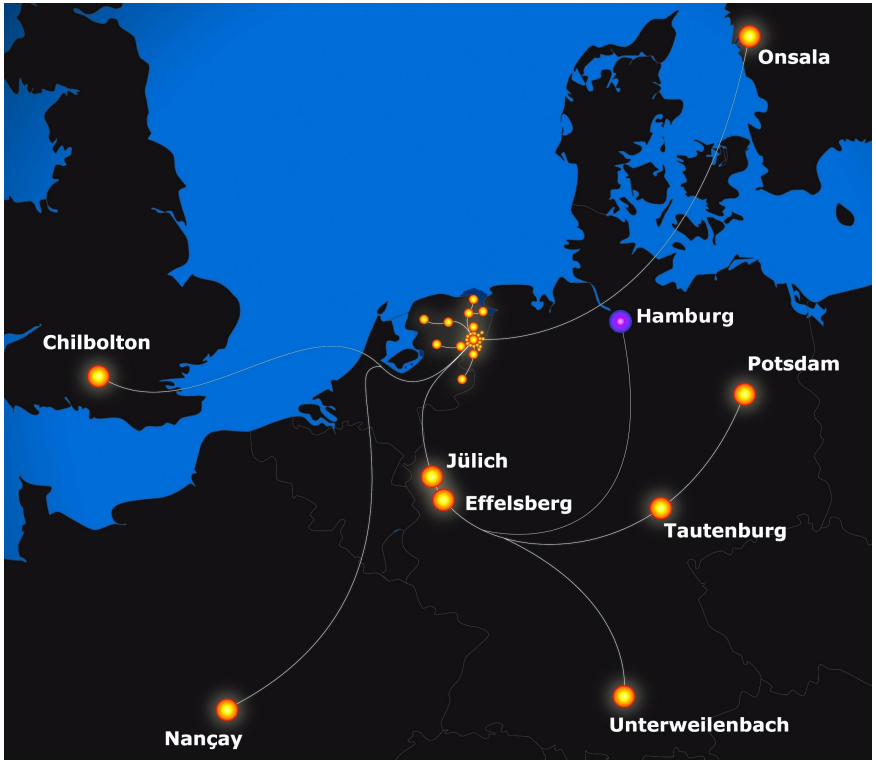
- Founded in 1966
- Main Building Bonn / 100m Radio Telescope Effelsberg
- Apex Telescope in the Atacama Desert, Chile

- IT staff of 11 people
- 204 servers (132 virtualized, 110 Bareos clients)
- 64 node cluster
- ...

http://mpifr.de

Lofar Antenna Field





- “Software” Telescope
- 44 Stations

Scientific Raw Data

Project Output per Observation Run

K-Band receiver:	2 TiB
H1-Survey:	3 TiB
Pulsar search:	4 TiB
Leap:	7 TiB
Lofar:	50 TiB
Glow:	120 TiB
...	

$\sum$	186 TiB

Scientific Raw Data

Project Output per Observation Run

K-Band receiver:	2 TiB
H1-Survey:	3 TiB
Pulsar search:	4 TiB
Leap:	7 TiB
Lofar:	50 TiB
Glow:	120 TiB
...	
$\sum$	186 TiB

Forget it!

Goals

Fast recovery of:

- specific files / directories
- (many) complete systems

Goals

Fast recovery of:

- specific files / directories
- (many) complete systems

Limitations

- Time
  - Backup window (scientists are night birds)
  - Network bandwidth (usually 1GBit/s)
  - Resources on backup clients (I/O, RAM, CPU)
- Storage space (disk and tape)

Goals

Fast recovery of:

- specific files / directories
- (many) complete systems

Limitations

- Time
  - Backup window (scientists are night birds)
  - Network bandwidth (usually 1GBit/s)
  - Resources on backup clients (I/O, RAM, CPU)
- Storage space (disk and tape)

What can we do?

- parallel jobs, Virtual Full Backups
- volume retention

“The Remains of the Day” without Raw Data

- Full Backup Volume: 55 TiB (1.5M files / TiB)
- Differential Backup Volume: 566 GiB (4K files / GiB)
- Incremental Backup Volume: 102 GiB
- Two backup copies

“The Remains of the Day” without Raw Data

- Full Backup Volume: 55 TiB (1.5M files / TiB)
- Differential Backup Volume: 566 GiB (4K files / GiB)
- Incremental Backup Volume: 102 GiB
- Two backup copies

Time for a complete Full Backup and its 2nd copy

$$\frac{55\ \text{TiB}}{130\ \frac{\text{MiB}}{\text{s}}}$$

“The Remains of the Day” without Raw Data

- Full Backup Volume: 55 TiB (1.5M files / TiB)
- Differential Backup Volume: 566 GiB (4K files / GiB)
- Incremental Backup Volume: 102 GiB
- Two backup copies

Time for a complete Full Backup and its 2nd copy

$$\frac{55\ \text{TiB}}{130\ \frac{\text{MiB}}{\text{s}}} \cdot 2$$

“The Remains of the Day” without Raw Data

- Full Backup Volume: 55 TiB (1.5M files / TiB)
- Differential Backup Volume: 566 GiB (4K files / GiB)
- Incremental Backup Volume: 102 GiB
- Two backup copies

Time for a complete Full Backup and its 2nd copy

$$\frac{55\ \text{TiB}}{130\ \frac{\text{MiB}}{\text{s}}} \cdot 2 \cdot 2$$

"The Remains of the Day" without Raw Data

- Full Backup Volume: 55 TiB (1.5M files / TiB)
- Differential Backup Volume: 566 GiB (4K files / GiB)
- Incremental Backup Volume: 102 GiB
- Two backup copies

Time for a complete Full Backup and its 2nd copy

$$\frac{55\ \text{TiB}}{130\ \frac{\text{MiB}}{\text{s}}} \cdot 2 \cdot 2 \cdot \frac{1\,\text{d}}{60 \cdot 60 \cdot 24\ \text{s}} = 20.54\ \text{days}$$

"The Remains of the Day" without Raw Data

- Full Backup Volume: 55 TiB (1.5M files / TiB)
- Differential Backup Volume: 566 GiB (4K files / GiB)
- Incremental Backup Volume: 102 GiB
- Two backup copies

Time for a complete Full Backup and its 2nd copy

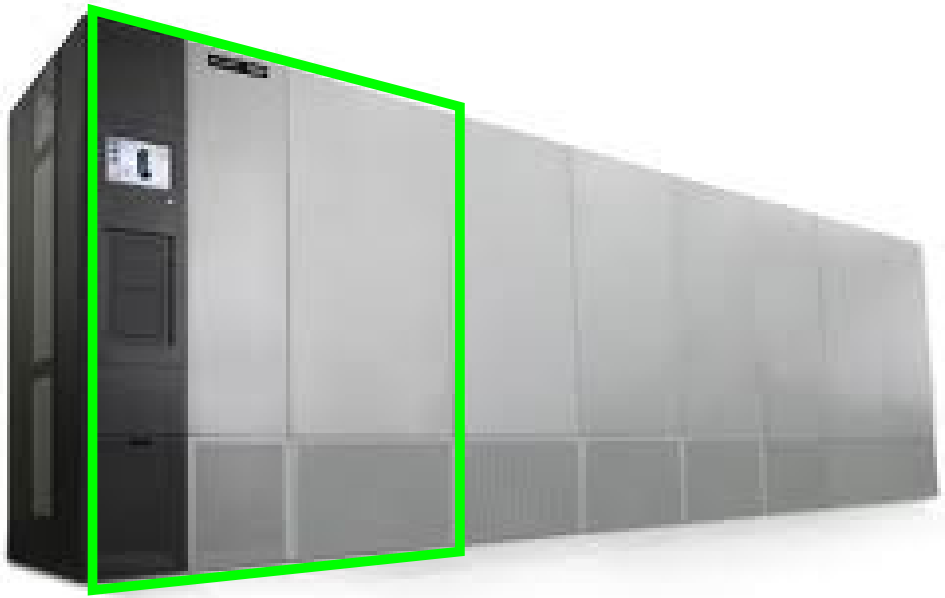
$$\frac{55\ \text{TiB}}{130\ \frac{\text{MiB}}{\text{s}}} \cdot 2 \cdot 2 \cdot \frac{1\,\text{d}}{60 \cdot 60 \cdot 24\ \text{s}} = 20.54\ \text{days}$$

High Volume "Longterm" Clients

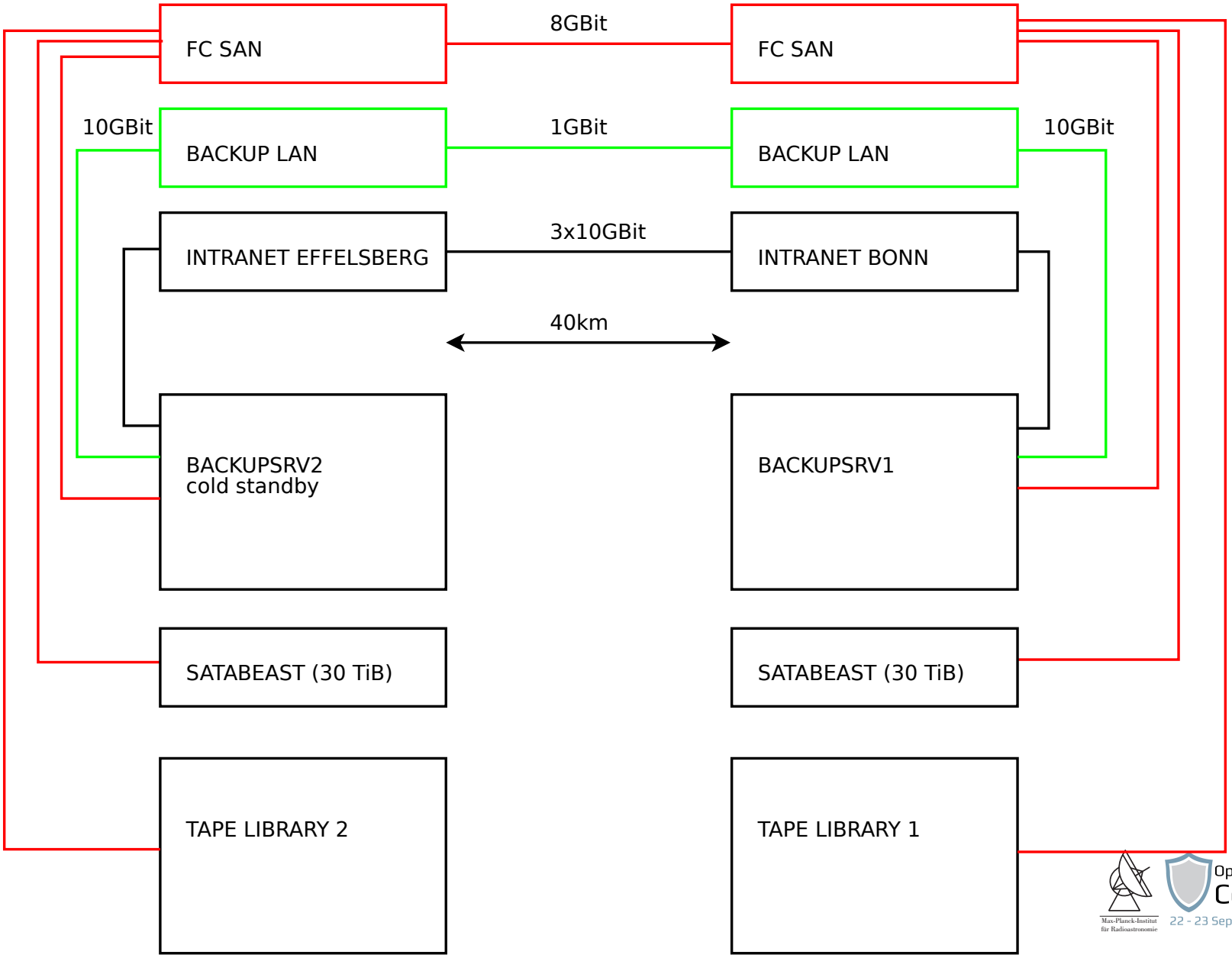
- Virtual Fulls every half year, Incrementals every Saturday
- Longterm Full Backup Volume: - 50 TiB (1M files / TiB)
  $\Rightarrow$ Full Volume every 8 weeks: 5 TiB (6M files / TiB)

Backup Hardware

- 2 Tape Libraries: Spectra Logic T950
  - 2 x LTO5 drives
  - 80 Slots à 1,5 TiB = 160 TiB (too small by now)
  - Dedicated cleaning partition
- 2 physical servers (Fujitsu RX300S6)
- 2x 30 TiB RAID storage (Nexan Satabeast2)
- (Mostly) dedicated 1GbE/10GbE backup network



Hardware Infrastructure

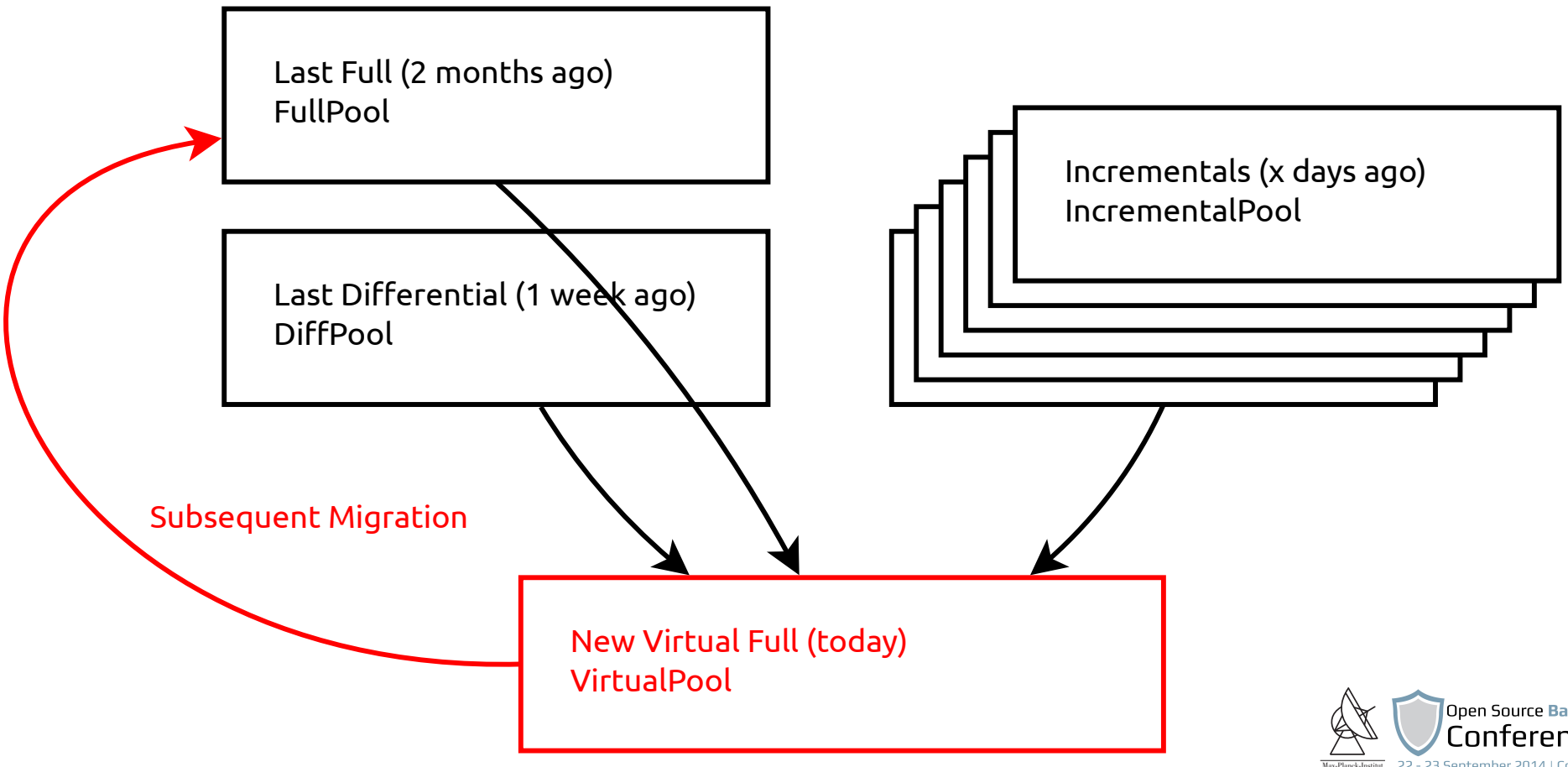


Configuration Strategy

- Incrementals to disk for better restore performance
- Fulls and Differentials to cheaper tape storage
- Per client config (DIR and SD) for easier config management:
  - compression, quota, reservation, encryption ...
  - easy templating for new backup clients
- Focus on schedules / retention
- Daily backup summary (3rd party tools)
- Dedicated DB partition
- . . .

Virtual Full Backups

Reorganizes existing backups to create a new Full



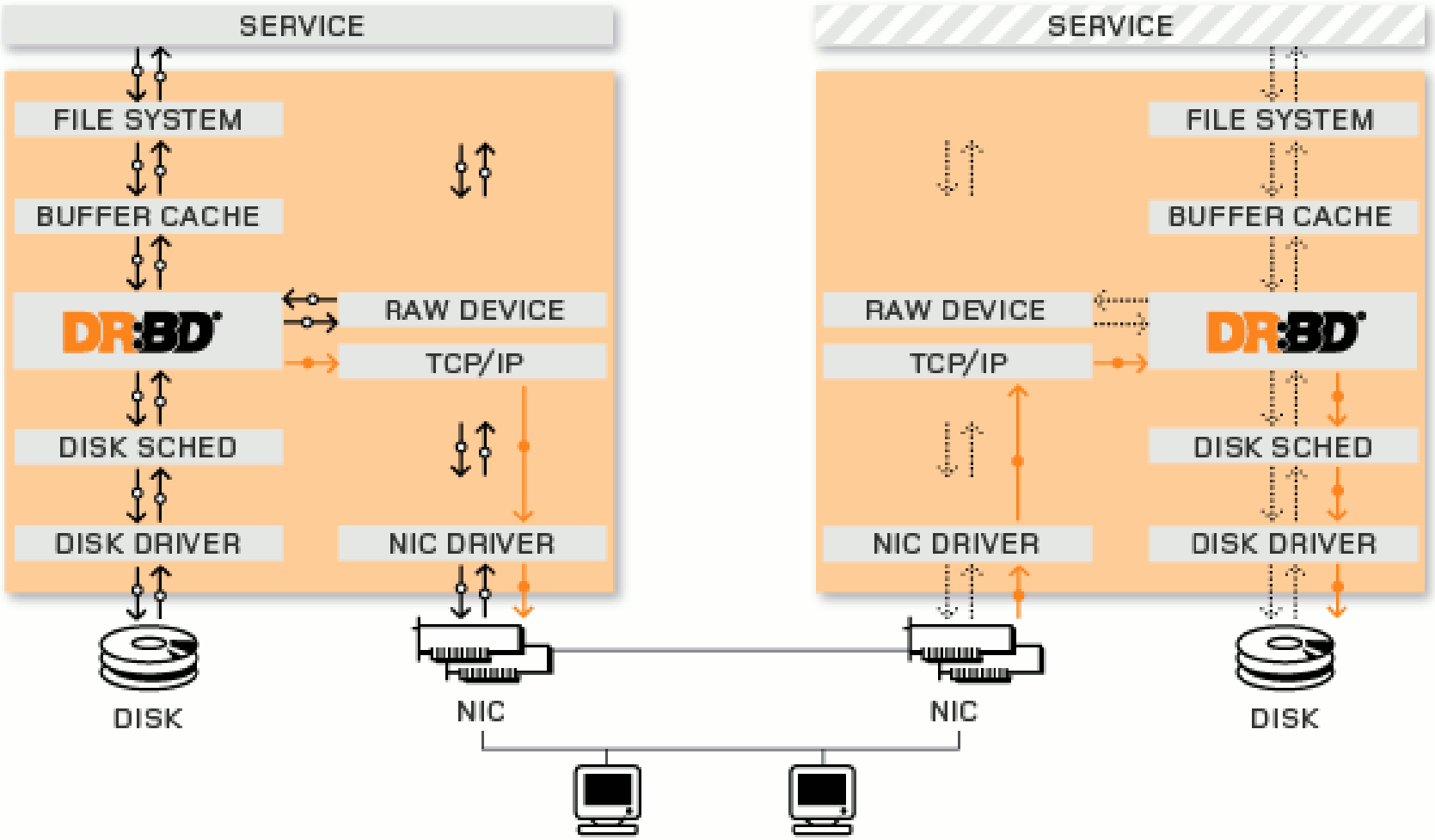
Virtual Full Backups

+++ No backup client interaction!
- (basically) no backup time limit

– Needs designated pool to avoid lockups

– No “MaxFullInterval” config option

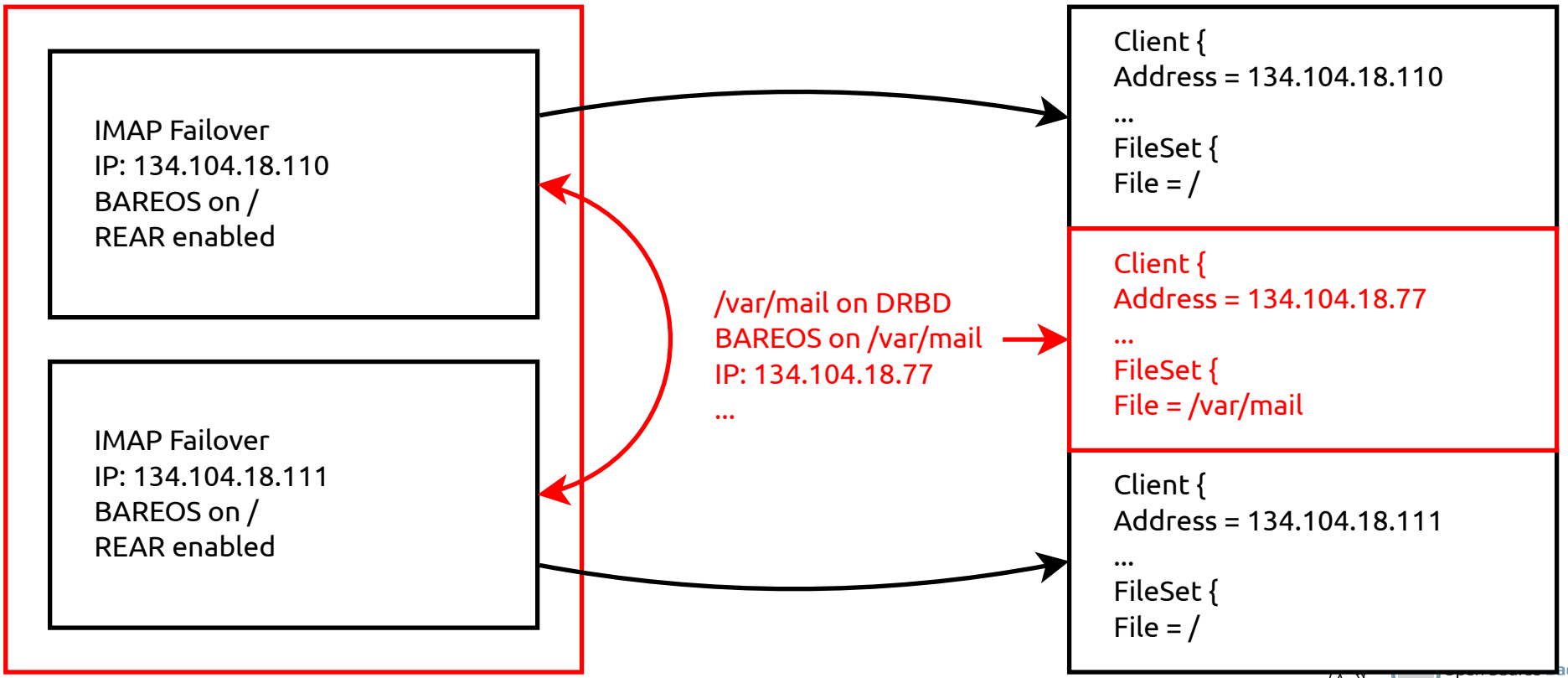
What is DRBD?



Taken from http://www.drbd.org/home/what-is-drbd

Integrating Bareos with HA / DRBD

DRBD volume backed up by HA controlled BAREOS instance



REAR: Relax and Recover

- Linux bare metal disaster recovery solution
- Creates bootable media
- Recovery takes care of all disk configuration
- Can use Bareos to restore content

Bareos Client config

/etc/rear/local.conf

```
GRUB_RESCUE=
OUTPUT=ISO
BACKUP=BAREOS
BACKUP_URL="rsync://backupsrv/srv/rear/"
```

Bareos Client config

/etc/rear/local.conf

```
GRUB_RESCUE=
OUTPUT=ISO
BACKUP=BAREOS
BACKUP_URL="rsync://backupsrv/srv/rear/"
```

/etc/bareos/bconsole.conf

```
Console {
   Name     = client-restore
   Password = "password"
}
```

Bareos Server config

/etc/bareos/conf.d/client.dir.conf

```
Console {
  Name          = client-restore
  Password      = "password"
  ClientACL     = client-fd
  JobACL        = Restore, client
  FileSetACL    = client
  CommandACL    = status, restore
  [...]
}
```

http://relax-and-recover.org

Wishlist

- Integration of virtualization solutions on hypervisor level
- Write to more than one destination at once
- Rolling Spool/Despool
- Automatic spooling when writing to tape
- No copy of jobs using a base job?
- ”MaxFullInterval“ for Virtual Full Backups

Want configs? Send me a mail to jb@mpifr.de

Want configs? Send me a mail to jb@mpifr.de

Any questions?

Notable reference:
http://myunix.dk/category/bacula