Virtual machine images as structured data
The Mirage image library

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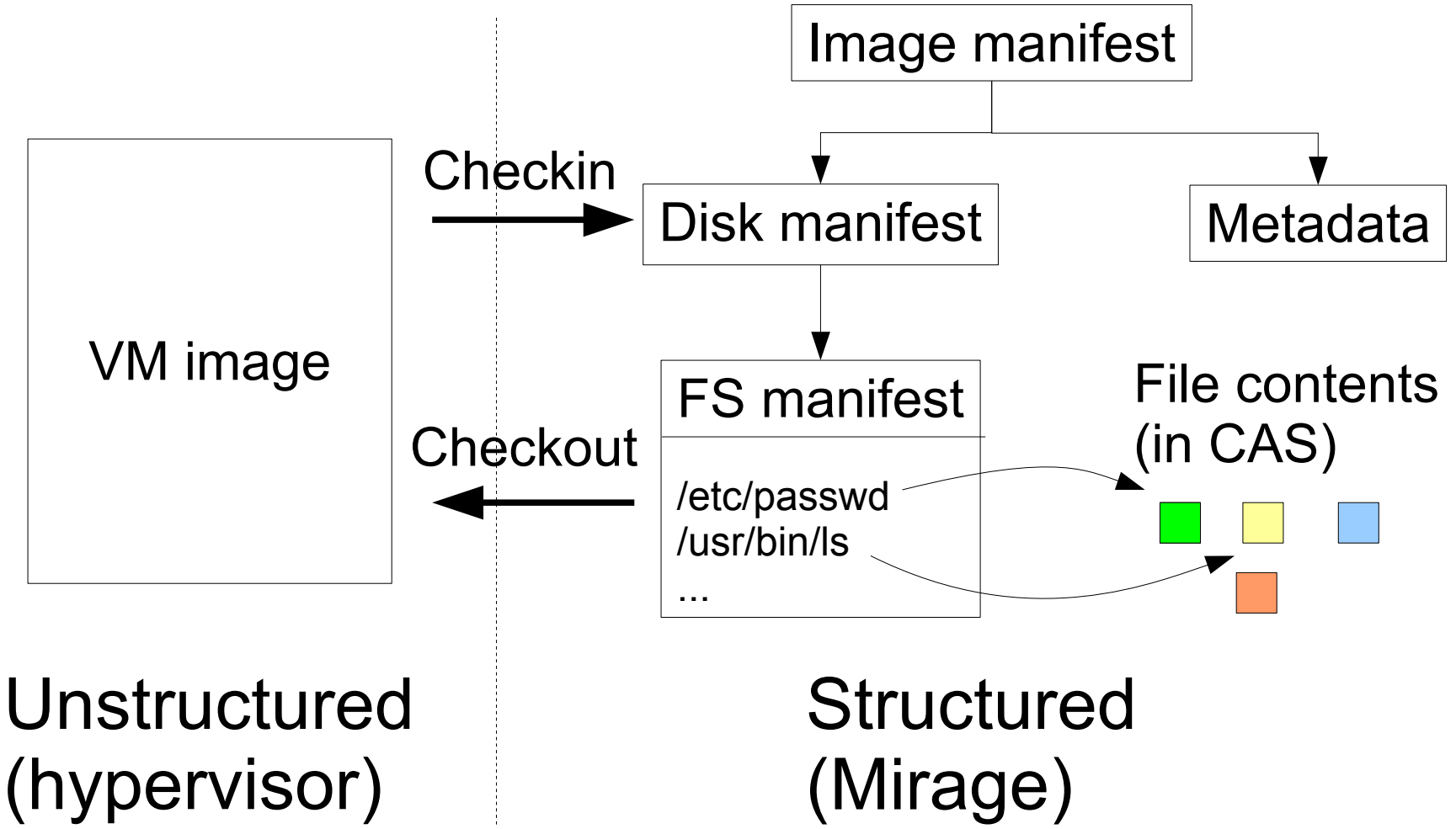
Why image libraries?

- VM image puts app config in one place; image library puts enterprise config in one place
  - Improve maintenance: scans, patches
  - Permit analyses: search, mine, compare
    - What DBMSs do we use? Why did our webapp break?
- Image libraries: go beyond deploy/capture
  - Provenance
  - Version and access control
  - Efficient, offline maintenance and analyses

VM images as structured data

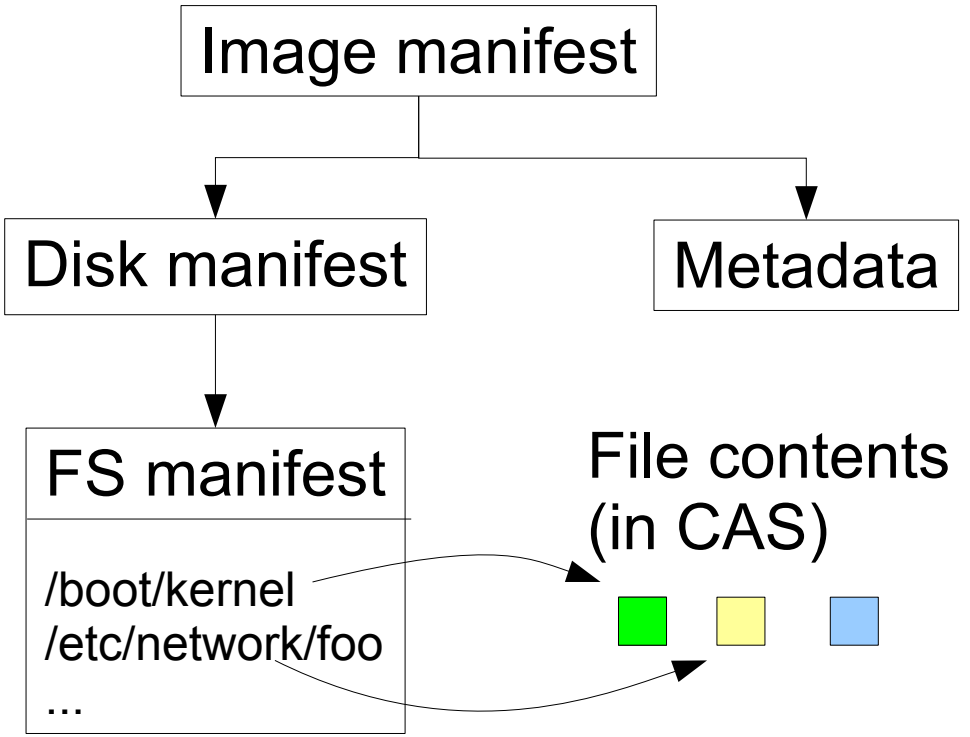


Experience: RC2

- Problem: convert all images from Xen to KVM
  - No downtime, low resource use, user transparency
  - Must install kernels, kernel modules, change config.
- Iterative: fail → find bug → fix → try again
  - Version control useful
    - Rollback
    - Comparisons for debugging
- Used virtual mount to speed conversion

Virtual mount

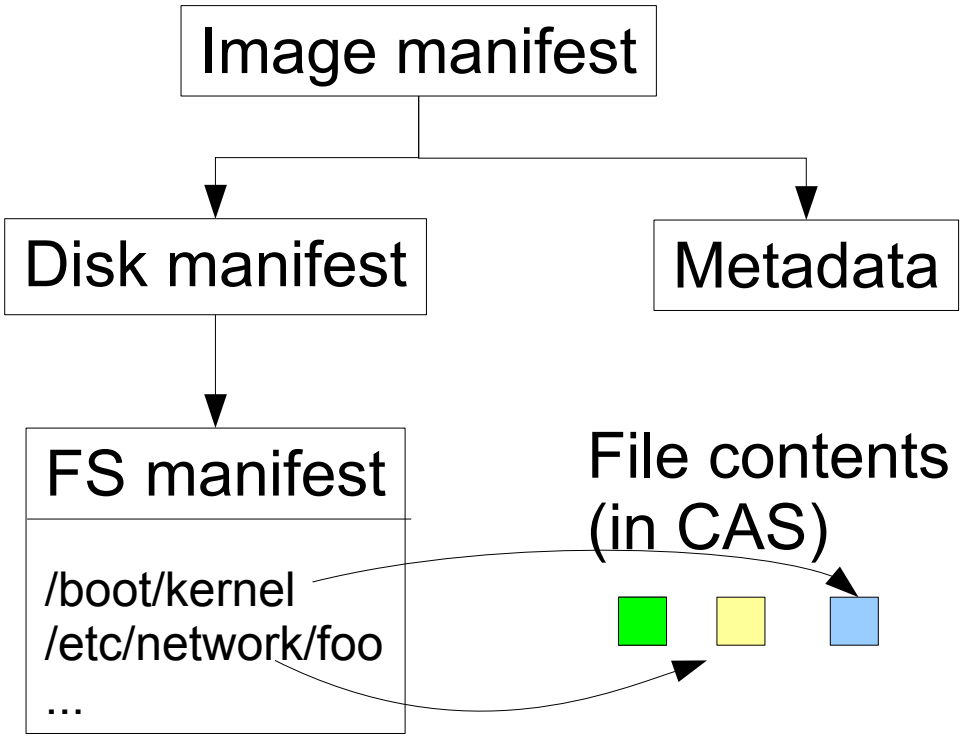
```
% import kvm-kernel
% vmount IMAGE /mnt
```



Structured
(Mirage)

Virtual mount

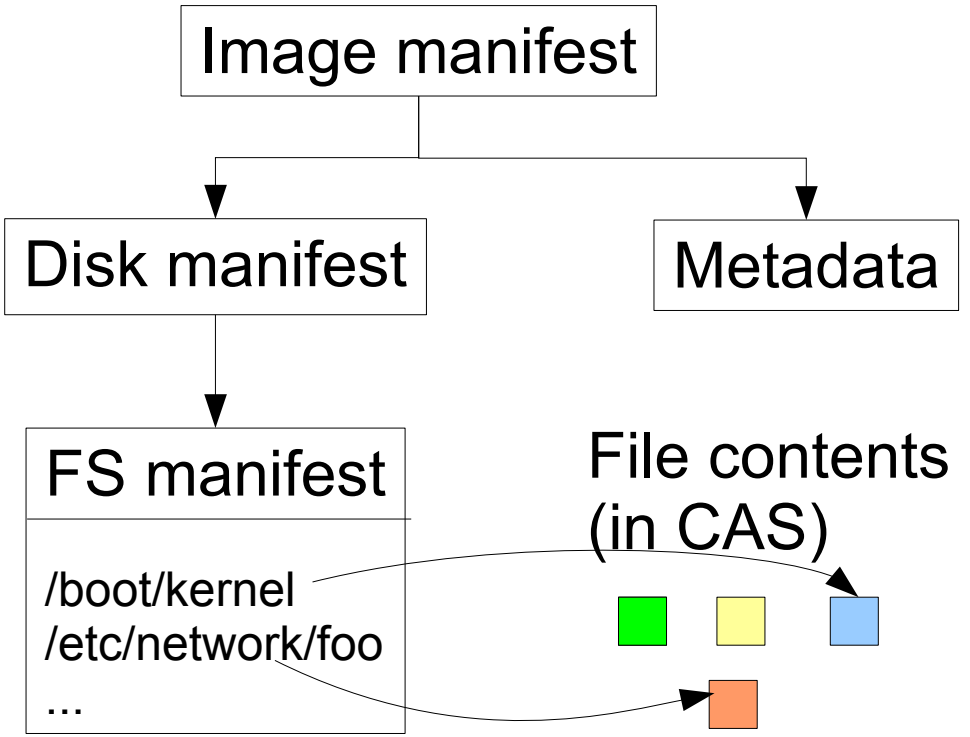
```
% import kvm-kernel
% vmount IMAGE /mnt
% replace-content \
  /boot/kernel
```



Structured
(Mirage)

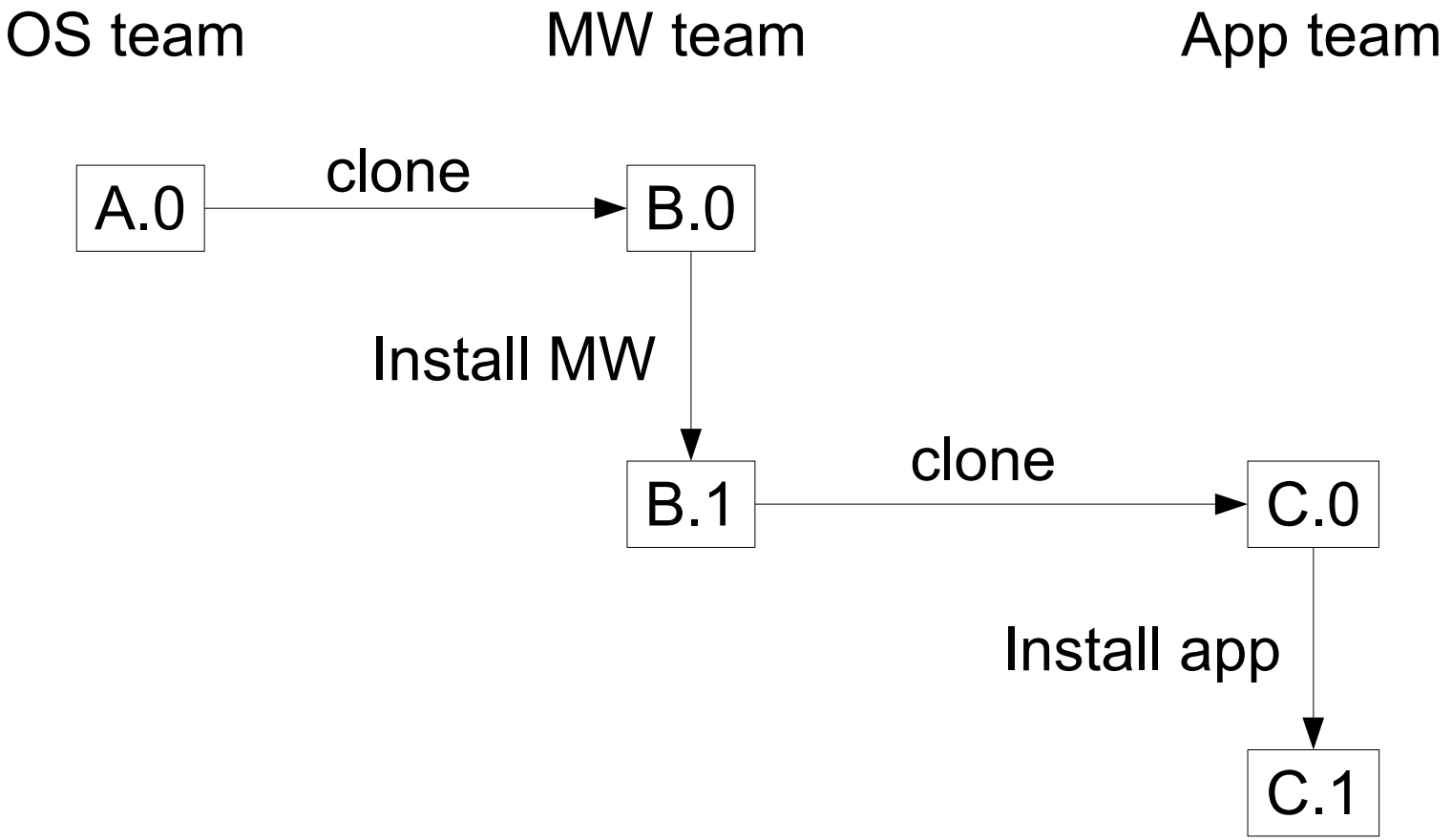
Virtual mount

```
% import kvm-kernel
% vmount IMAGE /mnt
% replace-content \
  /boot/kernel
% vi /etc/network/foo
```

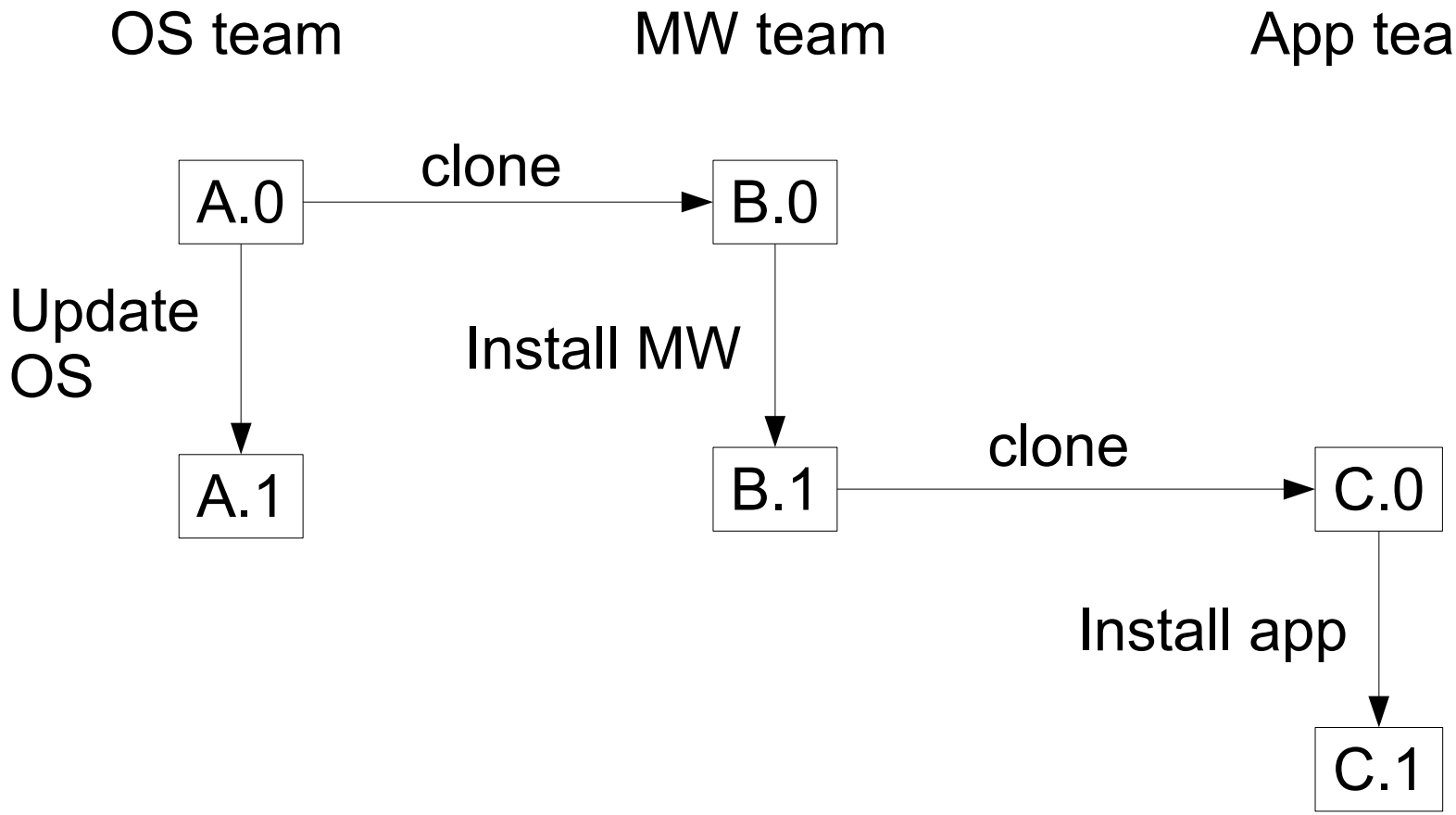


Structured
(Mirage)

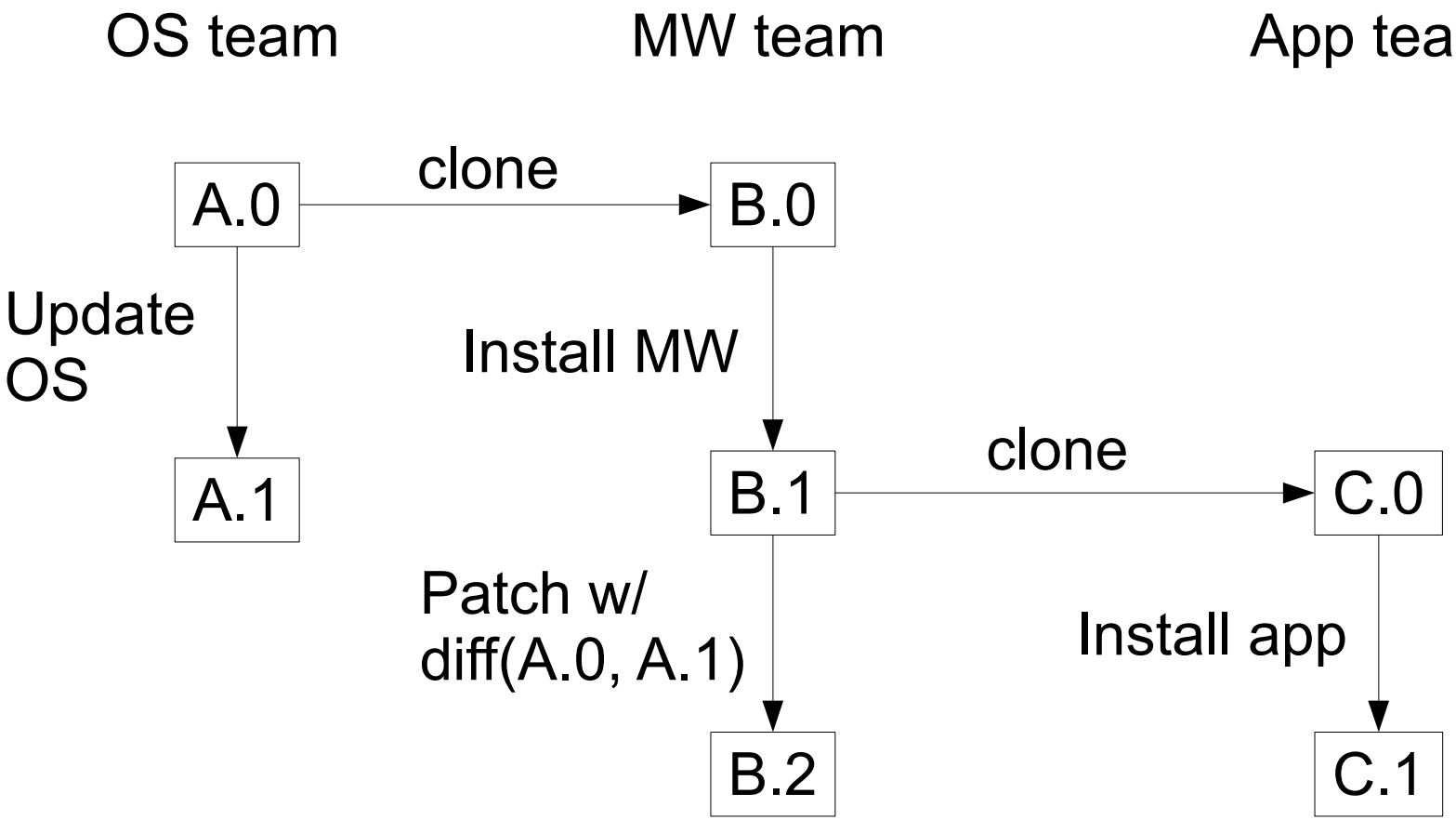
Experience: IBM Workload Deployer



Experience: IBM Workload Deployer

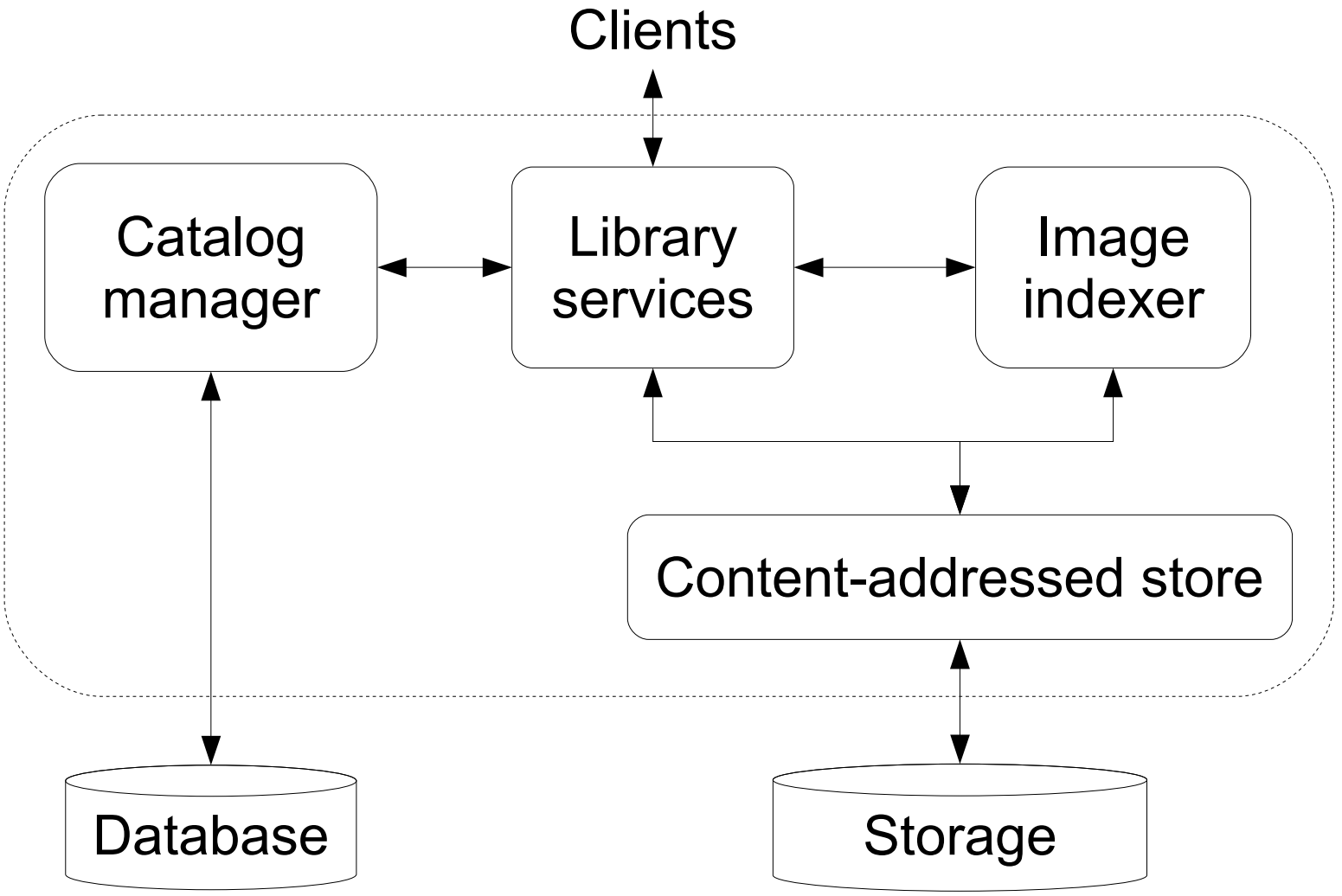


Experience: IBM Workload Deployer

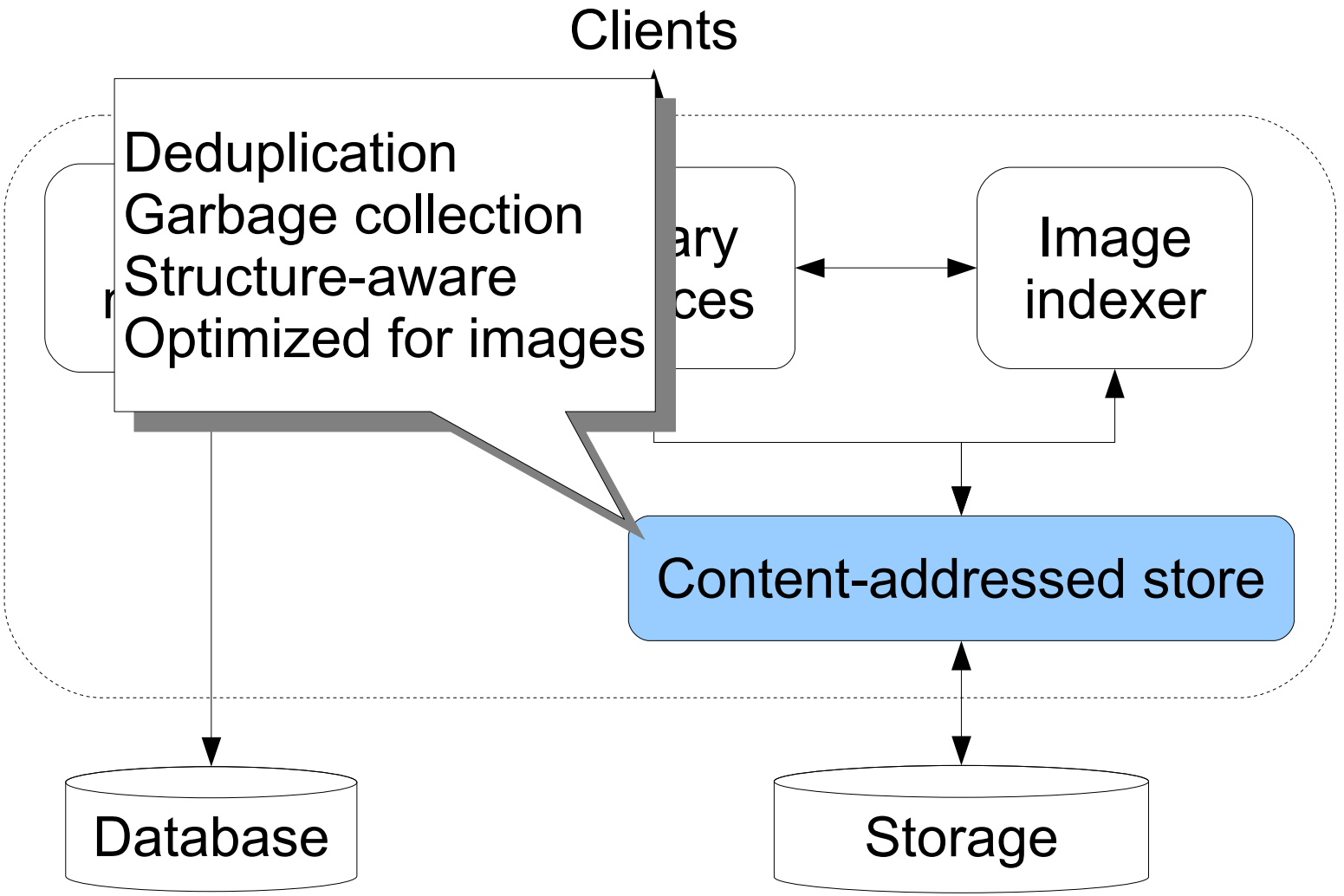


Backup slides

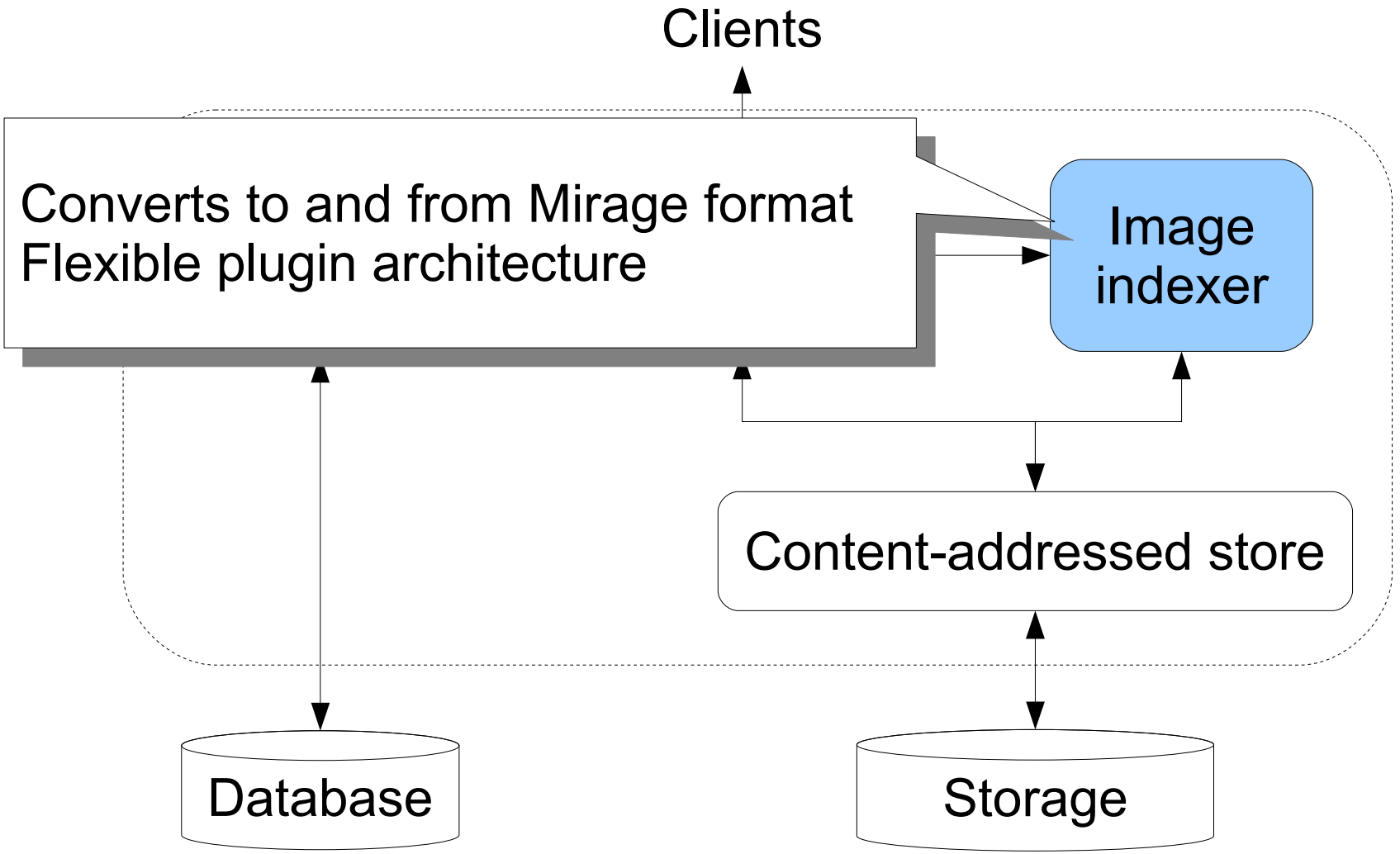
Mirage architecture



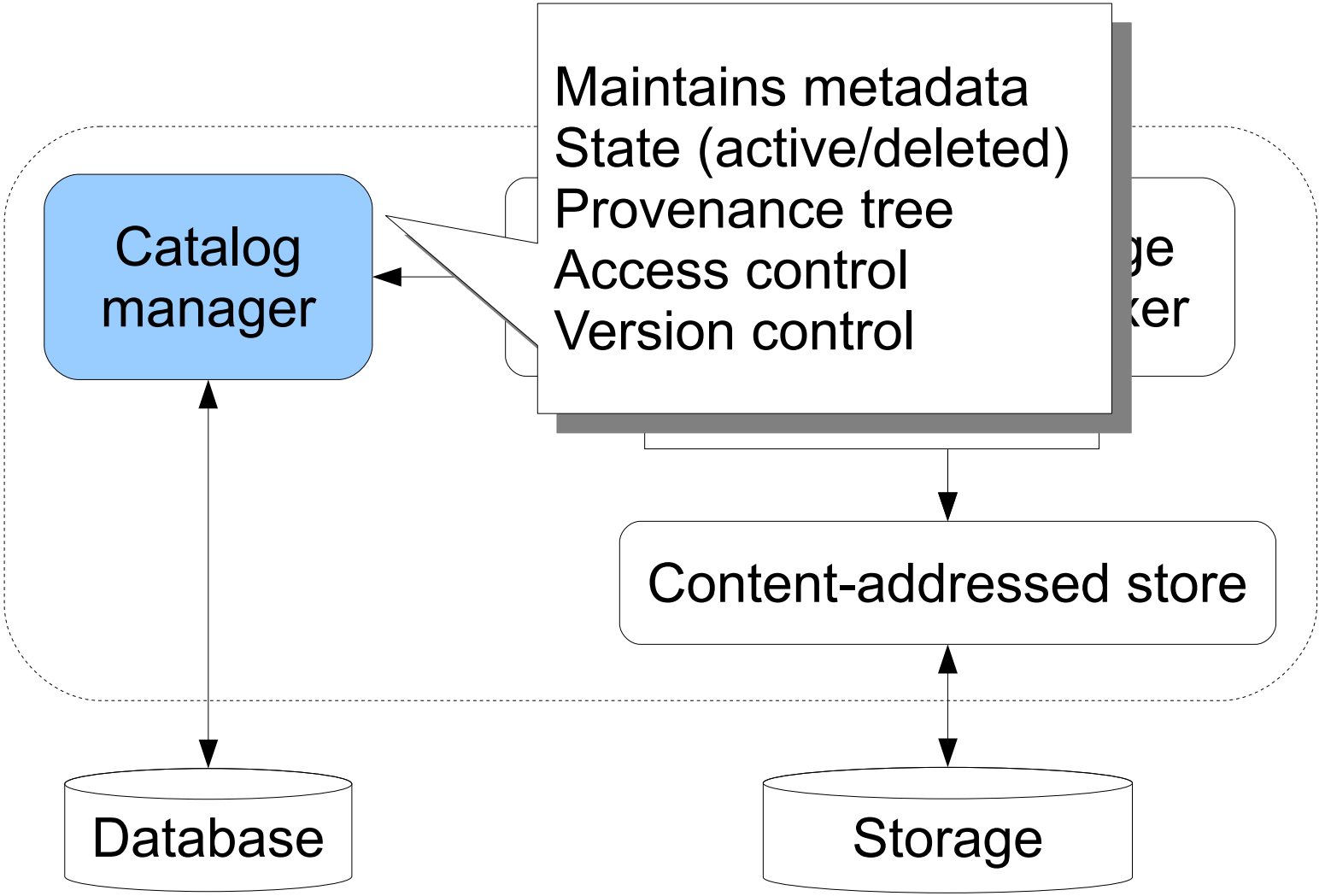
Mirage architecture



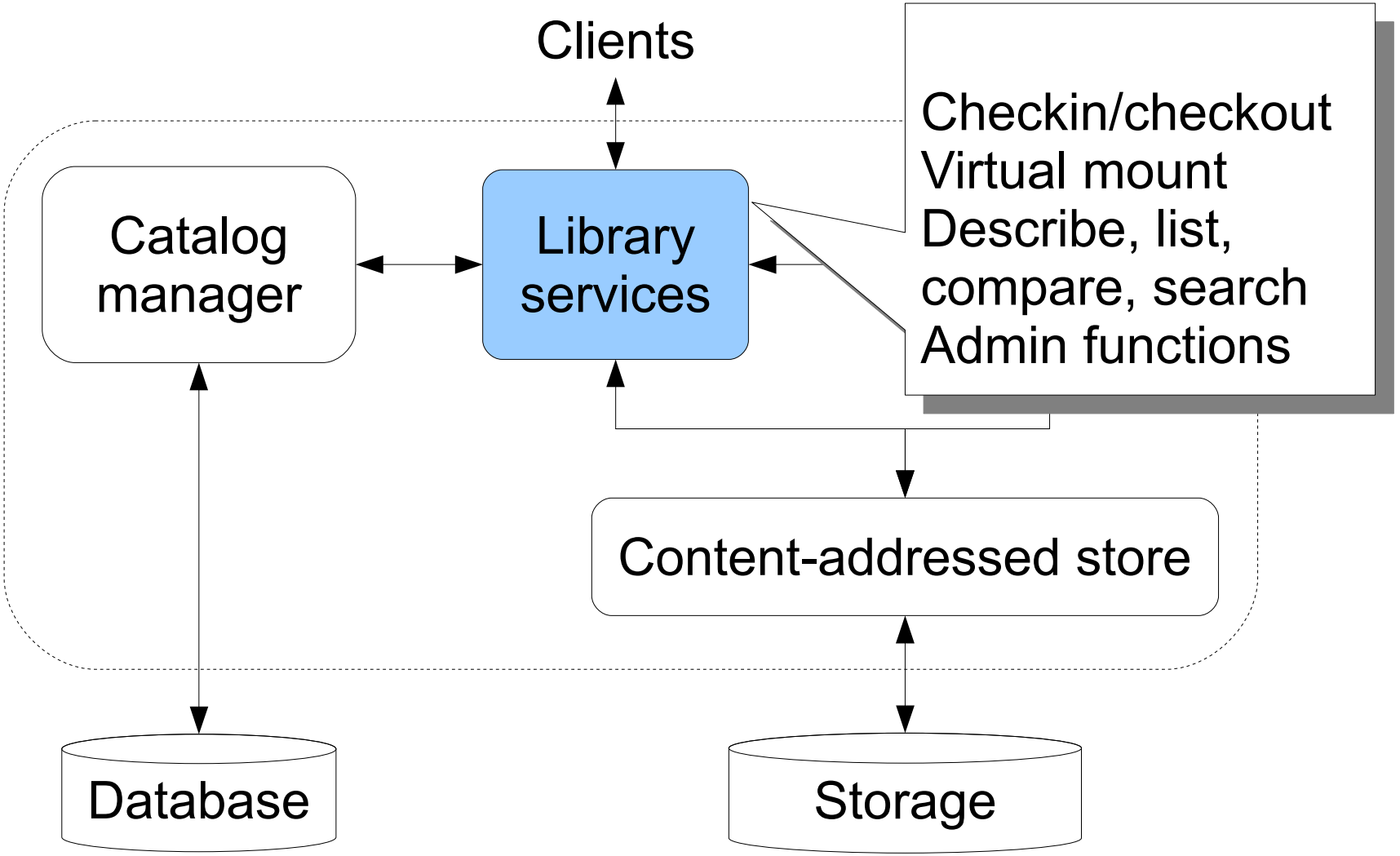
Mirage architecture



Mirage architecture



Mirage architecture



Reducing translation costs

- Runtime translation costs reduced by
  - Structure-aware CAS (faster lookups)
  - Virtual mount (avoids translation)
  - Delta deployment (exploits sharing)
- Hybrid indexing reduces dev. Costs
  - Offloads grotty details to backup/restore tools
- See paper for details