# Alex: a Global Filesystem

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# Background

# Outline

Previous approaches

Alex architecture

Alex implementation

Building on top of Alex

Status

Conclusions

# Existing FTP

Steps:

- login to remote place
- manually make a copy

Problems:

- multiple copies by multiple users
- copies become out of date
- forget where copies come from
- local programs can not use remote files

## Other Approaches

AFS

- general solution
- requires modifications to kernel

Prospero / Jade

- relinking / dynamic libraries
- user specific views

Ange-FTP / WWW / Gopher

- access from within a program

# Alex Goals

Work with existing FTP sites

Transparent access, clean namespace

Portable solution

Good performance

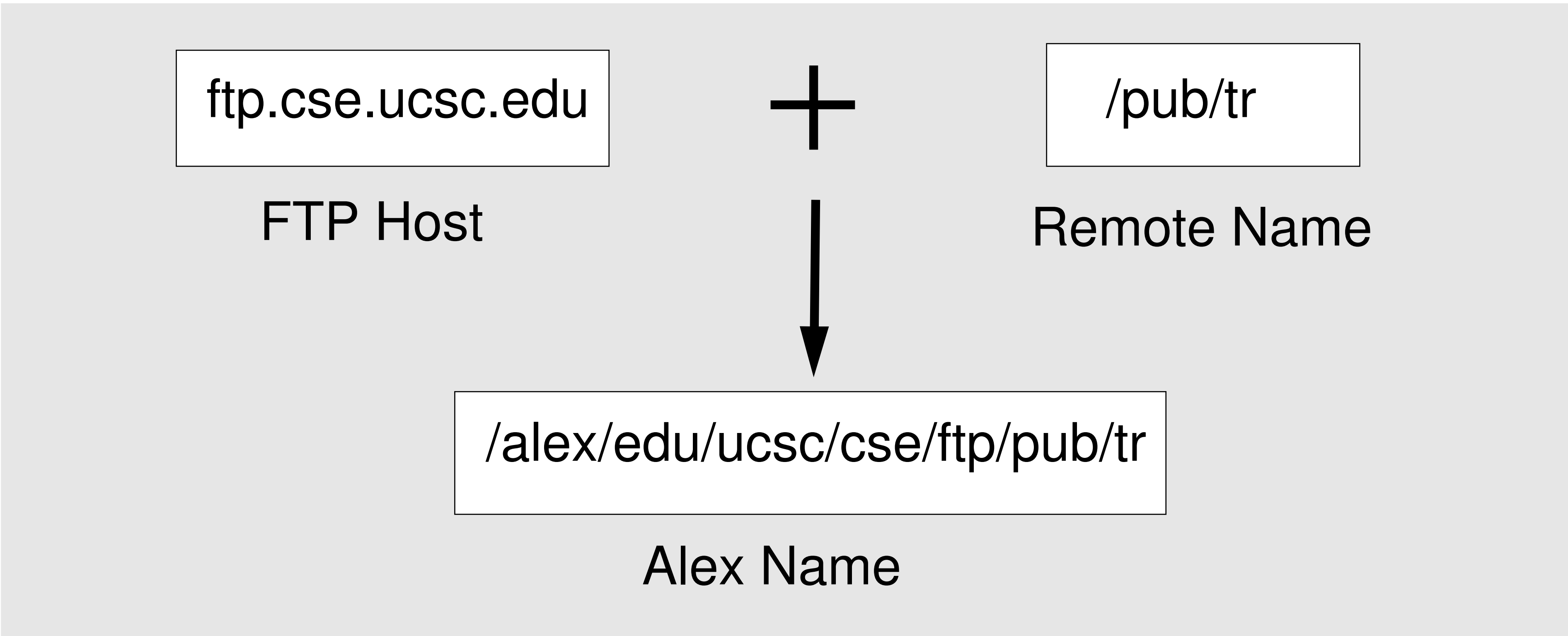
# User View

Standard Filesystem

Everything just works:

- ls / grep / more / xv / gs / ln / find ...

# Naming in Alex



# Consistency Problem

Downside of caching

FTP sites will not do callbacks

Too slow to check every time

Solution -

Relax consistency

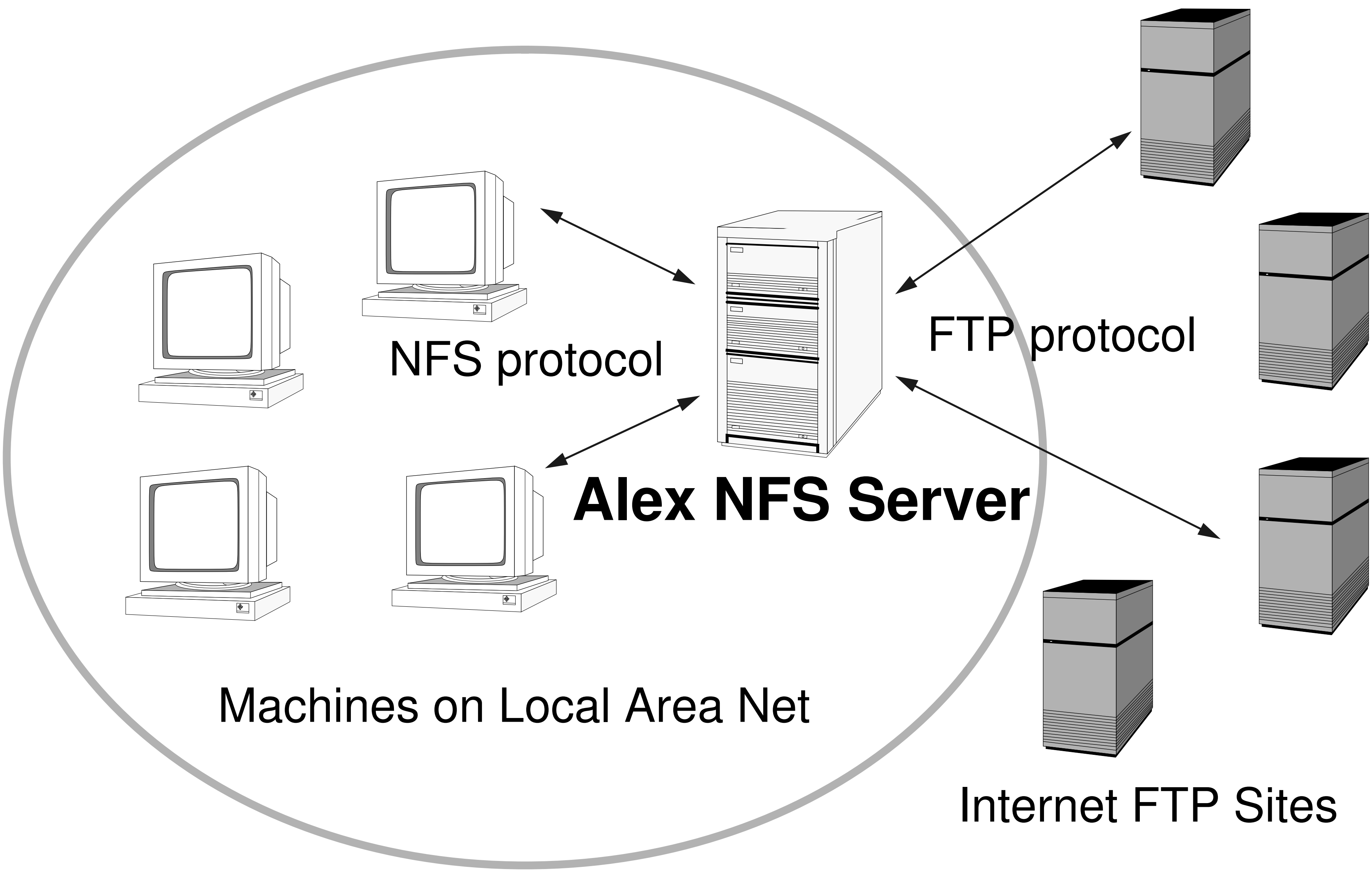
# Relaxed Consistency

Either the local copy is consistent or the new remote copy is at most 5% of the age of the local copy.

If file is shown as last updated 20 hours ago we might be missing an update that occurred in the last hour.

Any user can force an update at any time.

# Alex is implemented as an NFS Server



# Caching

Machine names

Open FTP connections

Type of FTP site

Time zone info

Directory info

Files

Failures

# Heterogeneous Directory Information

## DEC VMS:

**00README.TXT;7 6 9-APR-1991 18:14 [ANONYMOUS] (RWED,RE,RE,RE)**

**PUB.DIR;1 8 18-OCT-1990 07:20 [ANONYMOUS] (RWED,RE,RE,RE)**

## Unix:

**-rw-r--r-- 1 vac system 1134 Apr 20 23:04 README**

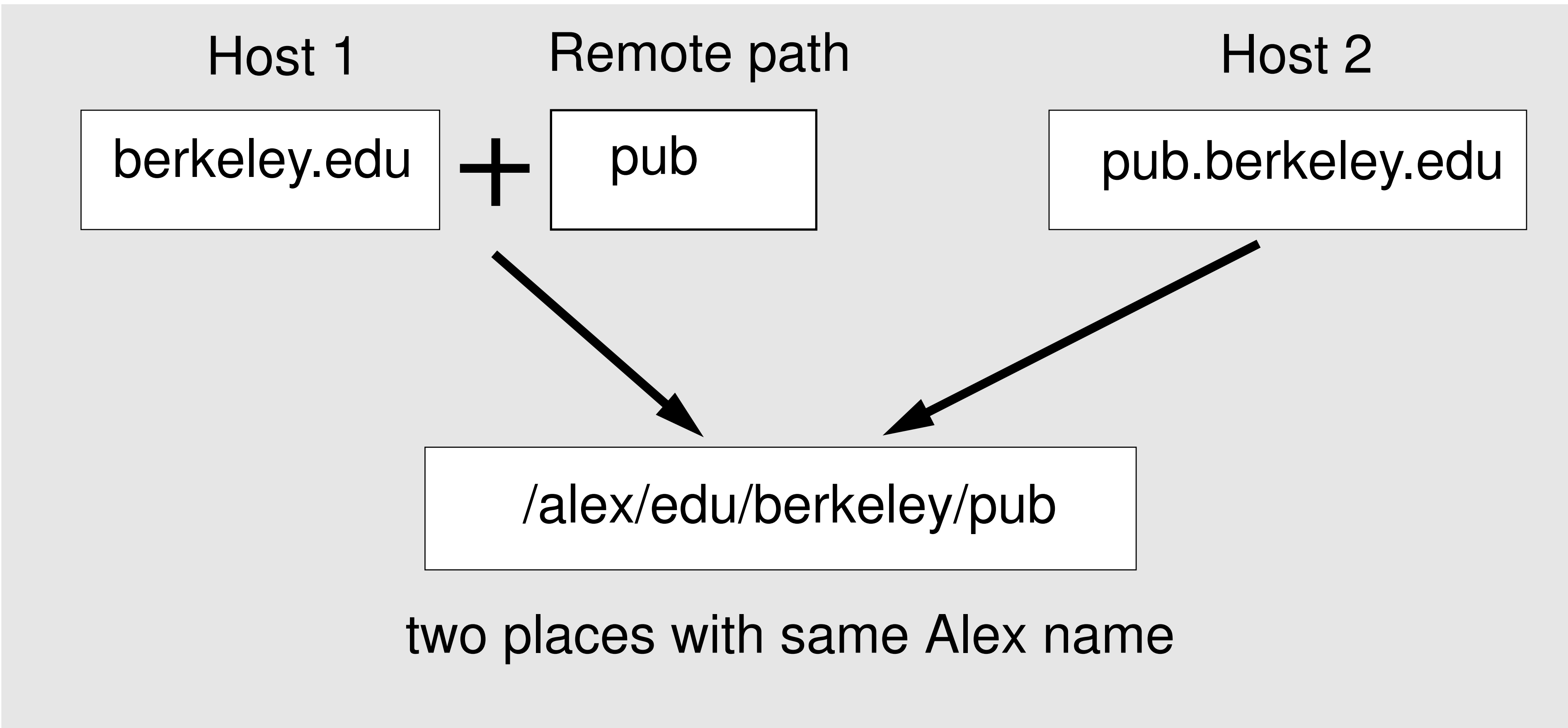
**drwxr-xr-x 3 vac system 512 Apr 20 23:19 doc**

## IBM VM/CMS

**FUSION BIBLIO4 V 80 2219 45 11/25/91 7:00:07 FUSION**

**FUSION BIBLIO5 V 78 132 3 11/27/91 10:01:11 FUSION**

# Name Ambiguity



# Symbolic Links

group things together (cs-tr)

short names as aliases

save disk space (no copy)

will see updates to file

document where file comes from

in FTP site ==> in Alex

# Building on Top of Alex

Archia/Archie

>archia earth.gif

/alex/gov/nasa/larc/vab02/gifs/space/misc/earth.gif

FILE -rw-r--r-- 404505 Jun 21 1991 earth.gif

WAIS

ftpable-readmes

cs-techreports

# Status

It is working

About 100 users

Stays up for days at a time
(then restarts in 2 seconds)

FTP to alex.sp.cs.cmu.edu for more info

# Research Agenda

Caching algorithms

Inter-user cache hits

Characterization of usage pattern

Naming ambiguity

Quantifying consistency

Latency -

- large files
- connection setup

# Conclusion

Accessing remote files around the world is now as easy as accessing local files