Virtual Meow Virtual File System on Android

Kam Cheung Ting Tian Xia Ruogu Zeng



Background

Growing Demand for Phone Storage
 Faster Mobile Network
 More Videos, Images, Musics
 Larger Size Application and Data Package
 Ex. 3D Games on Mobile Phone

Problem

Storage of Android-Phone disk is limited Extended by SD card Limited disk extension(64GB) Slower (2MB/s – 10 MB/s) Backup in Cloud Drive More Storage Much Slower Backup in PC and other devices Have to connect to a computer

Problem

SD card, Cloud Drive, PC backup
 Require Manual File management
 Complex, awful user experience!!!!

Problem

SD card, Cloud Drive, PC backup
 Require Manual File management
 Complex, awful user experience!!!!



Our Solution: Virtual File System



Our Solution: Vitual File System

Based on Cloud Drive
 Use limited local disk as a cache

Transparent File Transfer
between local disk and cloud drive

Automatically File Management
 No need for root, run in Userspace

Our Solution: Virtual File System

	1 💵 🚥		×	0 7	24 2	23:20	
۲	Virutal	Meow				÷	
	sdcard						
	.um						
	TZ_App	leList_Lptop	os.pdf				
6	1 Co	onfirm					
6	Do you want to add this file?						
100						_	
60						- 68	
Contraction of the	N	10		YES			
	N	10		YES		J	
	N 2014M	P1.pdf		YES			
	N 2014MI HW2_u	0 P1.pdf pdated.pdf		YES			
	N 2014MI HW2_u corona.	IO P1.pdf pdated.pdf		YES			
	N 2014MI HW2_u corona.	P1.pdf pdated.pdf		YES			

⊾ S	aving screenshot		
۲	/storage/emulated/0/	'Virtual	
	TZ_AppleList_Lptops.pdf 129259 Byte	2014-04-23 2	3:20:36
	Open		
L	Delete		
	↔ △		

ന് ത		\$ © \$1	23:33
. 🐸	/storage/emulated,	/0/Virtual	i
	2014MP1.pdf 97862 Byte	2014-04-23	3 23:32:18
	C3 Energy - Director Ma 19273 Byte	achine Learning 2014-04-23	. docx 3 23:32:23
· · · · (corona.pdf 495078 Byte	2014-04-23	3 23:32:23
	cs241fa13_midterm_ste 17999 Byte	udy_guide.docx 2014-04-23	3 23:32:33
	HW2_updated.pdf 274570 Byte	2014-04-23	3 23:32:23
	Idd3.pdf 12825921 Byte	2014-04-23	3 23:32:35
	log 40 Byte	2014-04-23	3 23:32:28
	pimsdkcontactlog1.txt 0 Byte	2014-04-23	3 23:33:00
	Resume_of_Vanessa_Li 1579606 Byte	i _01032014.pdf 2014-04-23	3 23:32:24
	thinkpad-helix-datashe 691854 Byte	et.pdf 2014-04-23	3 23:32:28
1	77 4 11.4	16	
	\bigcirc		

Architecture



SQLite Database

O Id – each file will have a unique id

- Name the name of the file
- Path absolute path of the file
- O last_visit_time -time that the file is last visited
- O Is_local is the file stored locally
- O Size the size of the file
- is_directory the file item a directory
- Probabiilty used be the GDFS algorithm

Scheduler

- For download, the scheduler will schedule the download immediately.
- For upload, the scheduler will schedule to upload one file per minute.
 - If the file system needs to upload 5 files, the upload task will finish in 5 min.

File Cache Algorithm

Greed-Dual-Frequency-Size (GDFS)
Combination of
Greedy-Dual-Size(GDS)
Higher file hit ratio, lower bit hit ratio
Greedy-Dual-Frequency(GDF)
Lower file hit ratio, higher file hit ratio

 Elegant performance for both file hit ratio and bit hit ratio

GDFS Cache Algorithm

OPriority Queue **O**Priority Value OPr(f) = Clock + Fr(f)/Size(f)• Pr(f) : Priority of f • Fr(f) : Frequency count of f OSize(f) : File size of f ODefine Used and Total OUsed as current usage for local storage OTotal as max usage for local storage

GDFS Cache Algorithm

Pr(f) = Clock + Fr(f)/Size(f)
If request for f is a hit
Fr(f) ++
Update Pr(f)

If request for f is a miss
 Fr(f) is set to 1
 Update Pr(f)
 Used += Size(f)

GDFS Cache Algorithm – cache f



Cache f, completed

If Used > Total

• Identify the smallest set {f1,f2, ..., fk} to evict to satisfy Used - $\sum_{i=0}^{k} Size(fi) \leq Total$

GDFS Cache Algorithm – cache f

Evict {f1, f2, ... fk} • If f is not among $\{f1, f2, \dots, fk\}$ Set Clock to Max (Pr(fi)) • Used $-=\sum_{i=0}^{k} Size(fi)$ Evict {f1, f2, ..., fk} and cache f <u>Otherwise, do not cache f</u> Happens when Pr(f) is too low. Ex. Size(f) is too large

• Use system default settings to download and open

Future Work

Support More Storage Extension Solution Support more APIs Commercial Cloud Drive ex. Dropbox, Google Drive Bluetooth Connection to Storage Devices PC and configured server File Encryption Divide Large File into manageable size

Virtual Meow Demo



Thanks!

Collaboration

- Kam Cheung Ting, Tian Xia, Ruogu Zeng
- {cting4, txia, rzeng4}@illinois.edu

Reference

 Cherkasova, Ludmila, and Gianfranco Ciardo. "Role of aging, frequency, and size in web cache replacement policies." *High-Performance Computing* and Networking. Springer Berlin Heidelberg, 2001.



