Life Cycle of Data and Storage Strategies for File-Services

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Some basic Facts

- Datavolumes are growing by factor 1.7 per year
- Costs/GB for storage capacity are falling by 30 % per year
- overall costs growing exponentially by 19 % per year

More basic Facts

Fileservers in industry today:

- serve 1.000 users
- store 10 million files
- 5 TB
- take 17 hours to backup to tape robots with LTO2 technology: 5.000 GB / 80MB/s = 17,4 h
- are backed up on weekends, >95% unchanged

Consequences of massive fileserver consolidation in industry!

What are people doing with their data?

Hypotheses

1. Bandwidth of man
   - Less than 10 files per day
   - Less than 3 MB/day
2. Data have short life cycle
3. But are stored for many years on premium storage

Hypotheses are

- ***plausible***
- ***checkable***
- ***quantifyable***

Consequences for Datamanagement

- Costs and charging
- Mirroring
- Backup, Recovery
- Availability
- Loss of data
- Lost work hours

Measurable Properties of Files

- Size of directories
- Distribution of file types
- Histograms cumulated per day
  - created
  - Last change
  - Last access
  - Growth phase
  - Read phase
  - **Life cycle**

Derived Properties for Storage

- Data volume and storage capacity
- Usage of data, e.g. archiving, reorganisation
- Backup volumes
- Access patterns by file types
- Transport volumes within storage hierarchies
- Days of high activities

Life Cycle of Files

Most files have a surprisingly short life of only one to three days from create time to last access:

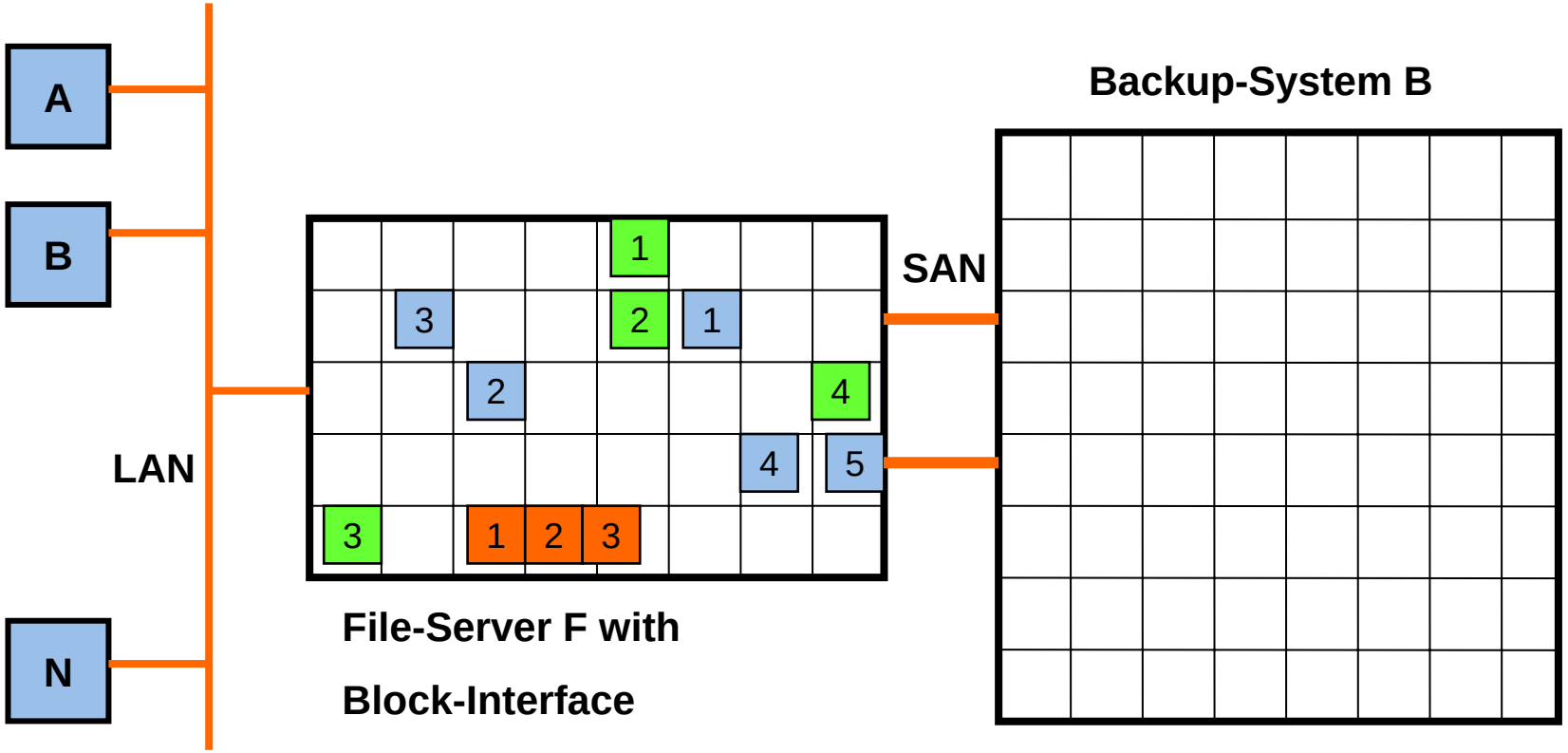
- ***Life of files is comparable to daily newspaper?***

Storage Classes

Client storage	DASD	
Server storage	performance disks	PD
Snap und mirror	SATA disk array	SA
Backup	tape	T

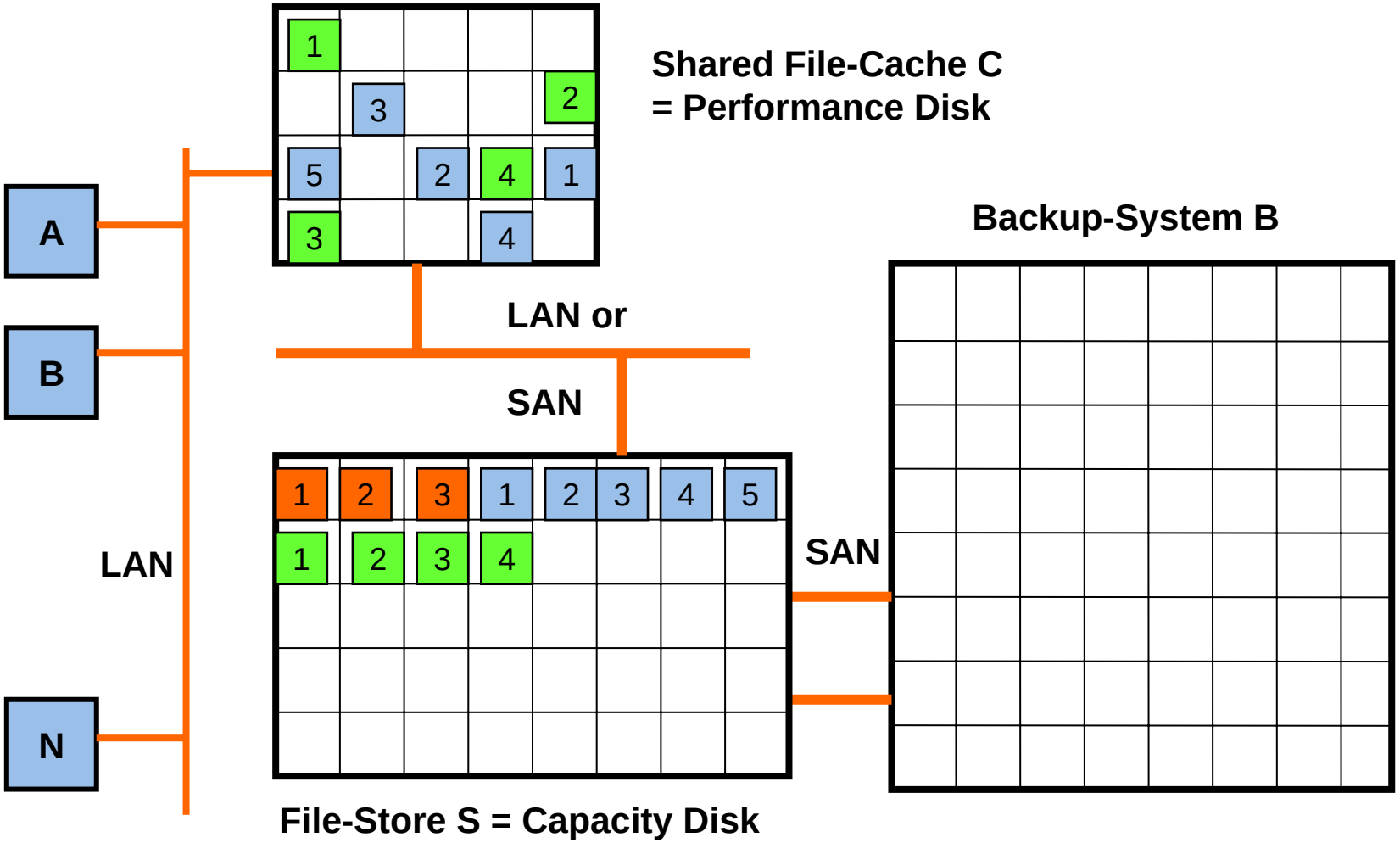
Consequences for Storage-Architectures?

Fileservers today



Fileserver stores **all** files

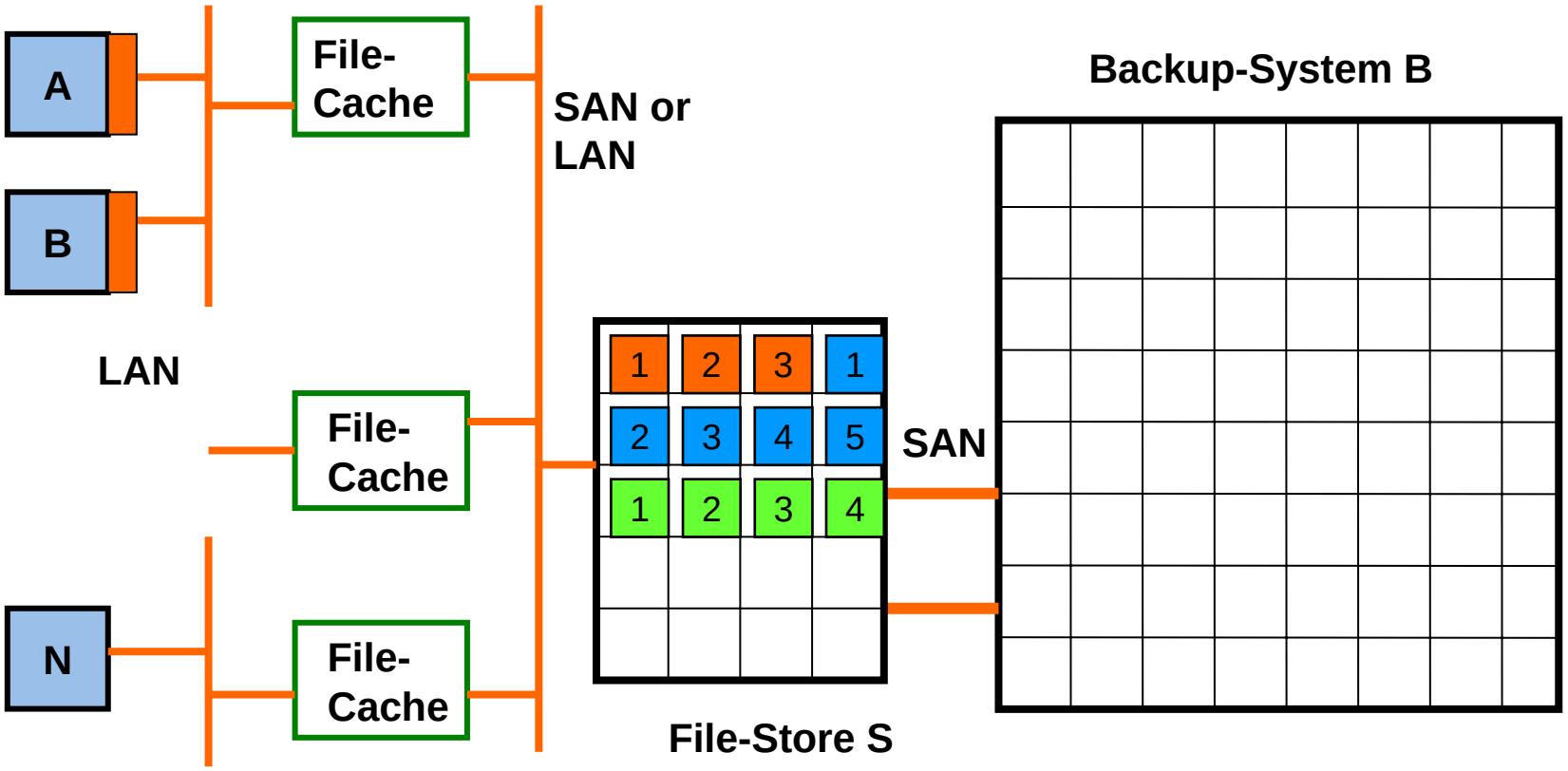
Simple Idea: Split of Fileserver



Multilevel Architektur

Clients with or without private File-Caches

Performance Disk ist keine kritische Ressource mehr !



Properties of FileCache Architecture 1

- **Mirroring of all important data**
- **True File-Cache:** with classical cache-management algorithms, **write through** replaces backup system, e. g. Tivoli TSM
- **Backup:** only for File-Store,
  - as background service, continuous backup
  - faster than File-Server Backup at least by factor 10,
  - backup windows disappear
- **Failure Modes:** F-Cache and F-Store have independent failure modes

Properties of FileCache Architecture 2

- **Recovery of File-Cache:** instant recovery, works as empty File-Cache
- **Recovery of File-Store:** by volume, background, minimal impact only for old files
- **Storage Capacity:** <10% of datavolume for File-Caches (32 % Metagroup) and 1/2 for File-Store
- **Storage Classes:** FC-disks for F-Cache, SATA-disk for F-Store
- **Cost:** lower than File-Servers, modulo SW cost
- **Availability:** extremely high, comparable to PLATIN system
- **No lost data!**

Cache Size and Algorithms

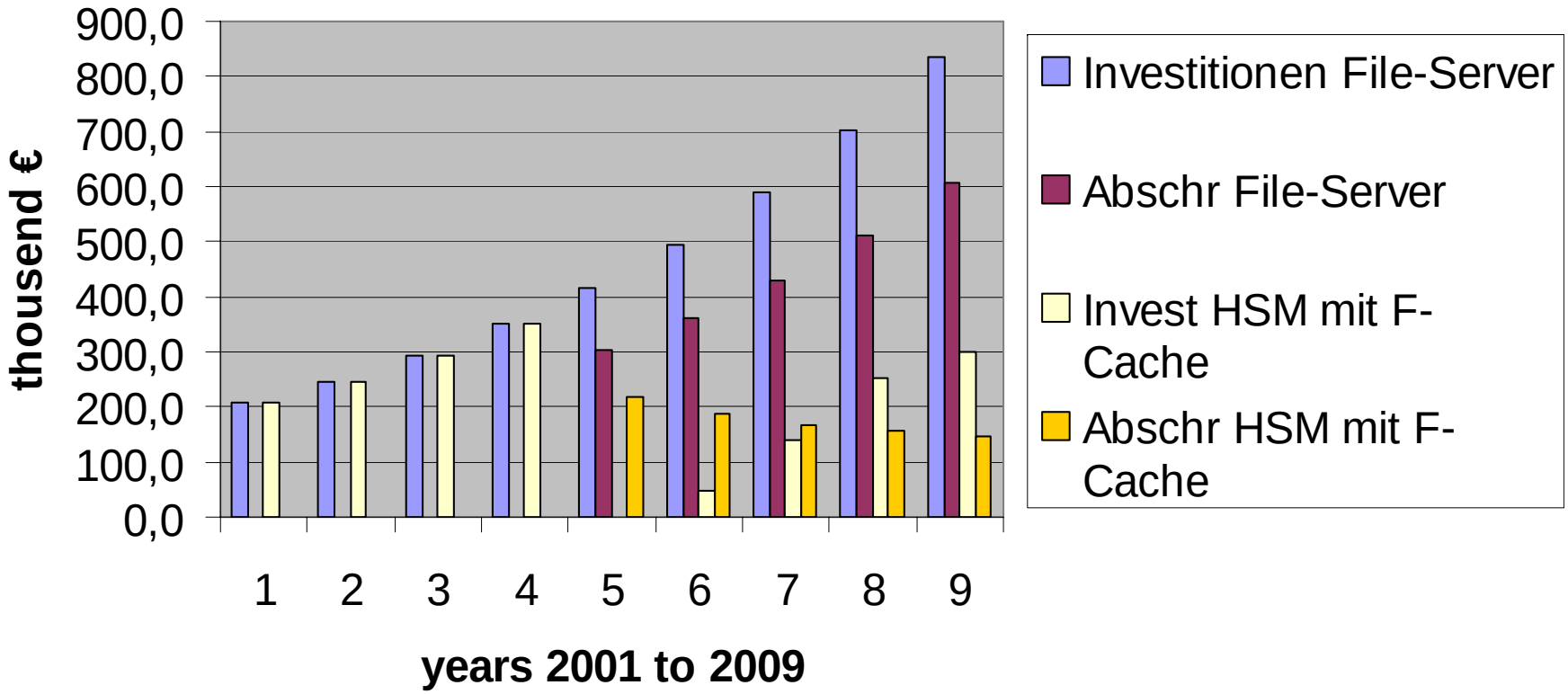
- My measurements show: very small FileCaches <10% of stored datavolume
- LRU replacement should work perfectly:
  - Only 5-10 days per year with high activity, e.g. collecting literature for your dissertation
  - Very short life cycle
  - LRU could displace files depending on access patterns, e.g. PDF and ZIP different from XLS files

Integration of FileStore with ILM

- FileStore has very low load
- Stores all data permanently and secured via backup
- Can manage versions
- Has database of meta data = 0.1 % of datavolume
  = 5 GB or 50 GB for 10 versions
- Can obey complex ILM rules according to **Oxley-Sabanes**
- **Multidimensional database plus fulltext**
  - Domain and user
  - Directory path
  - Filename
  - File extension
  - Time
  - Etc.

Investments and Depreciations

Comparison of costs between conventional File-Server solution and File-Cache



Business Case Criteria

- **Costs**
  - Savings in investment and depreciation
  - Availability
  - Lost data
  - Lost working hours
- **Management and operations**
  - Controllability
  - SW distribution
  - Access rights
  - Storage space management (virtualization is big issue today)
  - Reasons for massive fileserver consolidation in industry, seems dead alley to me!

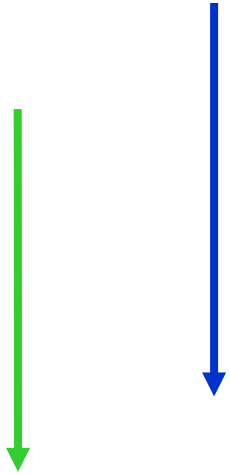
Food for Thought

Fileservers considered harmful?

Fileservers considered harmful

Legend:

- G = global directories = Home H for every user + O for organizational units and projekts: G = H + O
- S = mirrored directories, z.B. O_S
- FC = FileCache
- B = Backup of directories, e.g. via Tivoli TSM
- Blue arrow : mirroring of files
- Green arrow : Backup



Varianten bisher

	Server mirrored	Server mirrored	FileCache
Client DASD			
Performance Disk PD	G + S	G	G_{FC} = 30%
SATA Array		S	S = 50 %
Backup Tape TSM	B	B	B

Architektur mit Verlagerungen

	Home on clients	Groups on SATA	Home + FileCache	Home + Flash + FileCache
Client DASD	H	H	H_{FC} = 30%	H_{FC} = 30%
Performance Disk PD	O	**empty**	**empty**	**empty**
SATA Array	S	O +S	O +S	O +S
Backup Tape TSM	B	B	B	B

Thank you

and

good luck for your thesis