MANAGING EXTERNAL DATA



DIRECTORY MANAGEMENT

File systems use B-Trees to store sorted attributes ppp.txt? File Name Node Holds up to n values Security Information Quotas ttt.txt eee.txt mmm.txt aaa.txt Children bbb.txt $\max n + 1$ children eee.txt fff.txt ggg.txt hhh.txt bbb.txt vvv.txt zzz.txt aaa.txt ppp.txt rrr.txt mmm.txt ppp.txt rrr.txt vvv.txt fff.txt ggg.txt hhh.txt zzz.txt

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DIRECTORY MANAGEMENT

File systems use B-Trees to store sorted attributes

ggg.txt

fff.txt

 File Name Node Holds up to n values Security Information Quotas ttt.txt eee.txt mmm.txt Children $\max n + 1$ children rrr.txt bbb.txt vvv.txt zzz.txt aaa.txt ppp.txt

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This scenario resulted in: 5 new nodes 2 deleted nodes

hhh.txt

DIRECTORY MANAGEMENT

File systems use B-Trees to store sorted attributes

File Name

Security Information

Quotas

aaa.txt bbb.txt

ppp.txt rrr.txt vvv.txt zzz.txt

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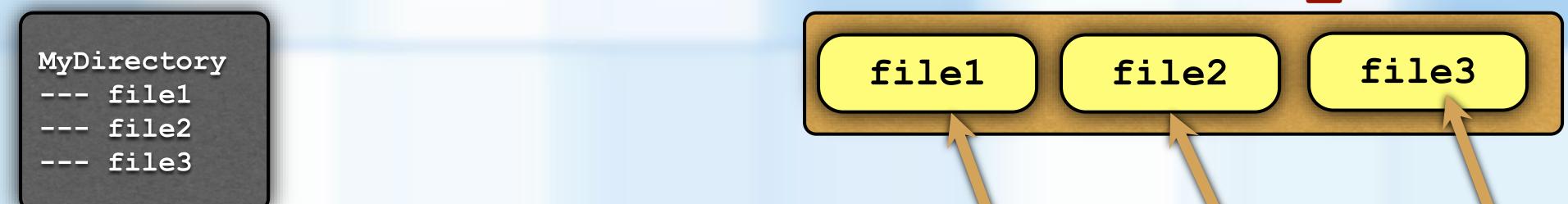
fff.txt

hhh.txt jjj.txt

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NTFS \$MFT DIRECTORY ENTRIES

- Two types of \$MFT Records for Folders (directories)
 - B-Tree of files and subfolders is resident in \$INDEX_ROOT attribute (0x90)



Leaf Node in B-Tree



\$MFT DIRECTORY ENTRIES

- Two types of \$MFT Records for Folders (directories)
 - B-Tree of files and subfolders is resident in \$INDEX_ROOT attribute (0x90)
 - B-Tree of files and subfolders is external to \$MFT Record
 - \$INDEX_ROOT attribute contains basic information (0x90)
 - \$INDEX_ALLOCATION attribute stores data runs for file containing B-Tree (0xA0)

Interior Node in B-Tree





INDX RECORDS

- File containing B-Tree Nodes is the *Index Buffer* file
 - Comprised of INDX Records one per node
 - Each record is typically one cluster
 - Record contains \$FILE_HEADER attributes for files and subfolders

