# Efficient Access Control for Distributed Hierarchical File Systems

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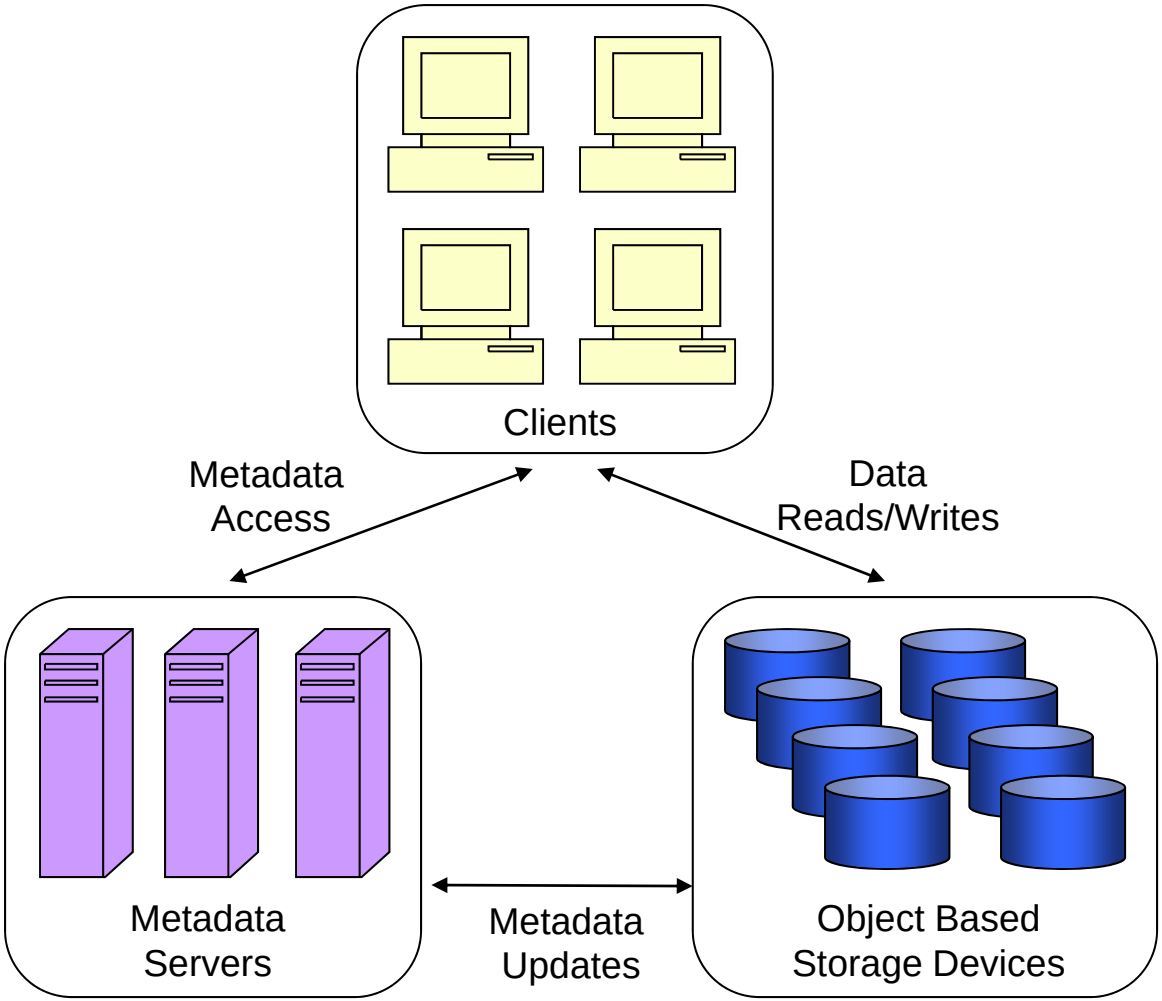
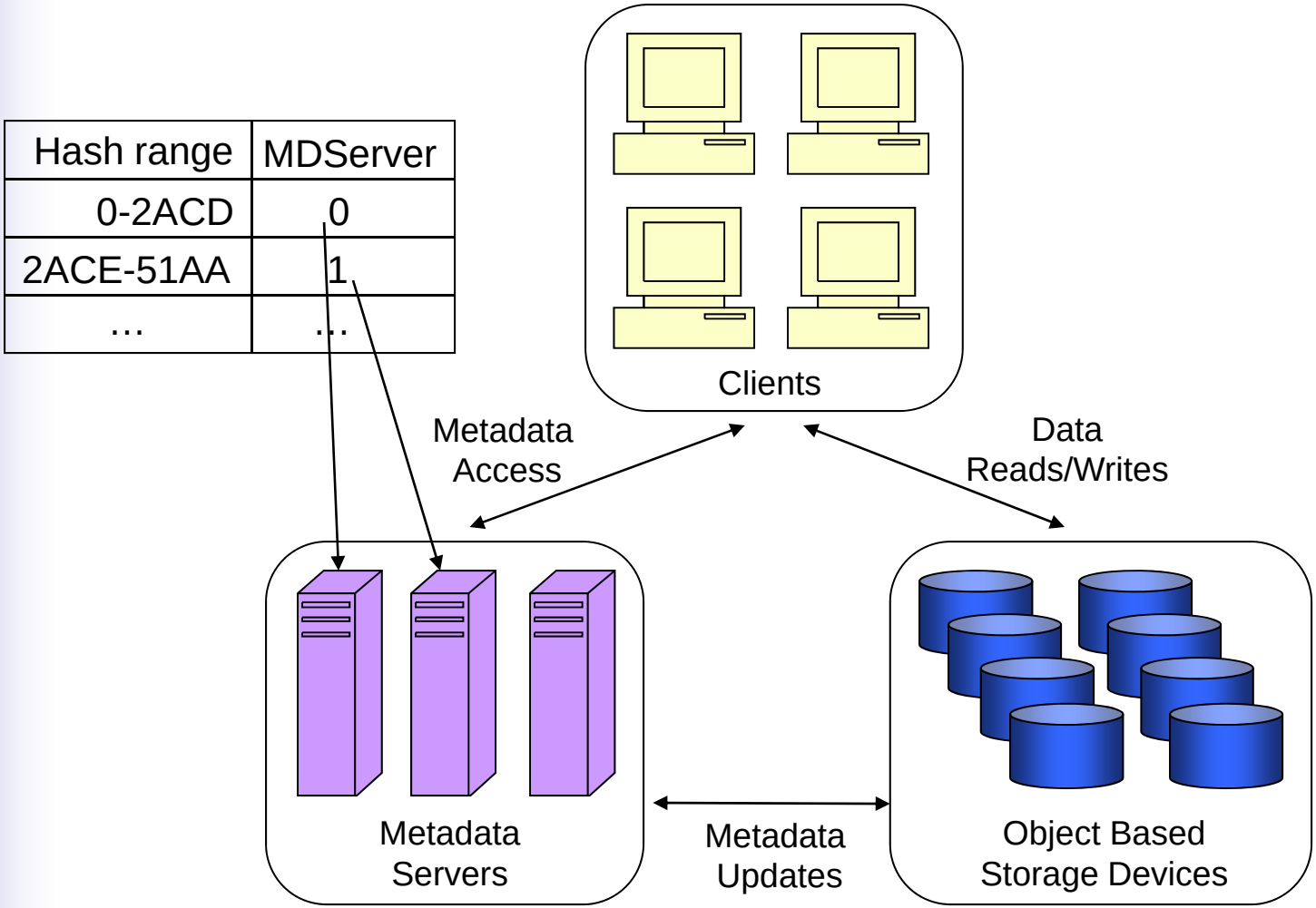
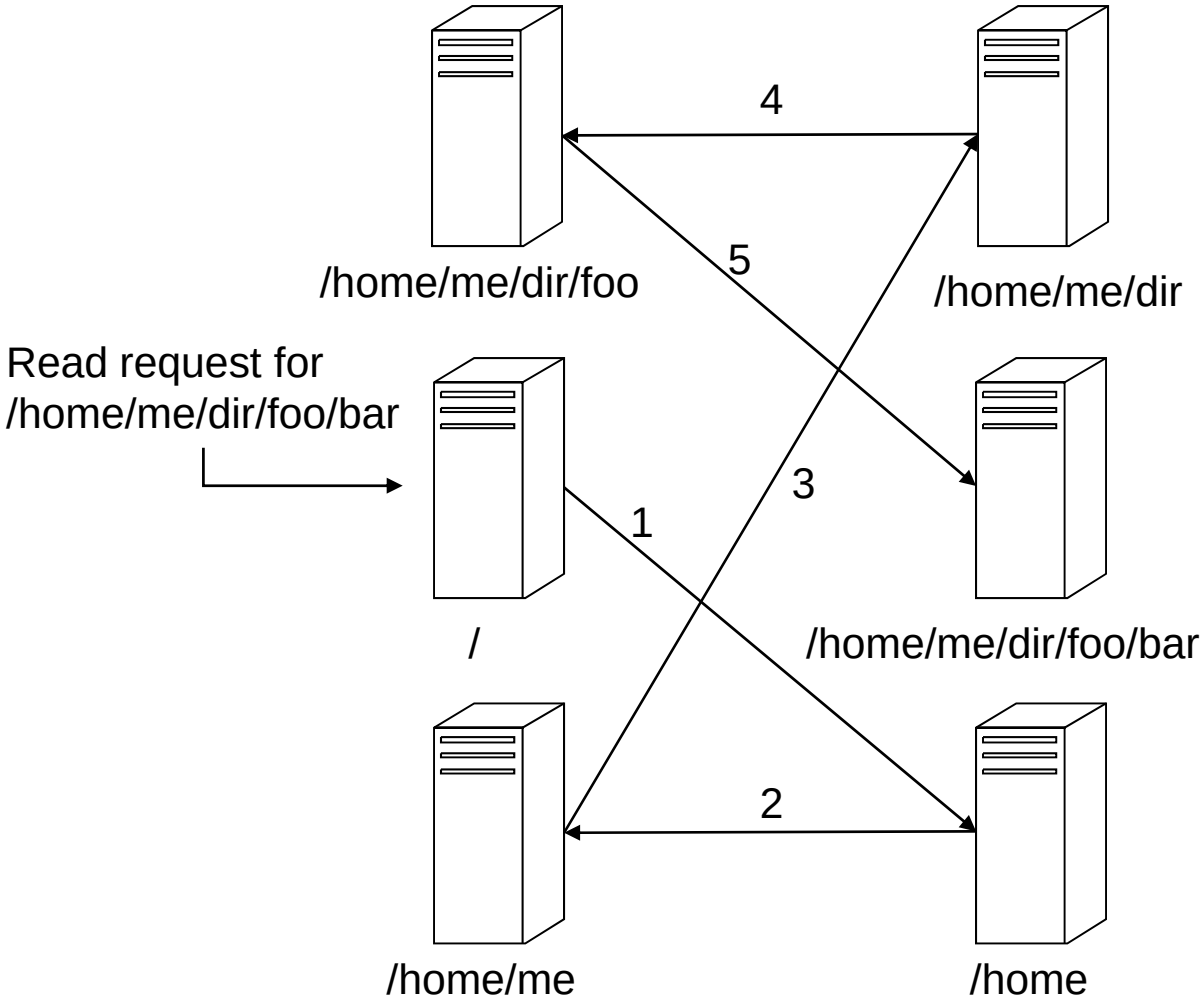
# Motivation


Clients
Metadata Access
Data Reads/Writes
Metadata Servers
Metadata Updates
Object Based Storage Devices

# Motivation

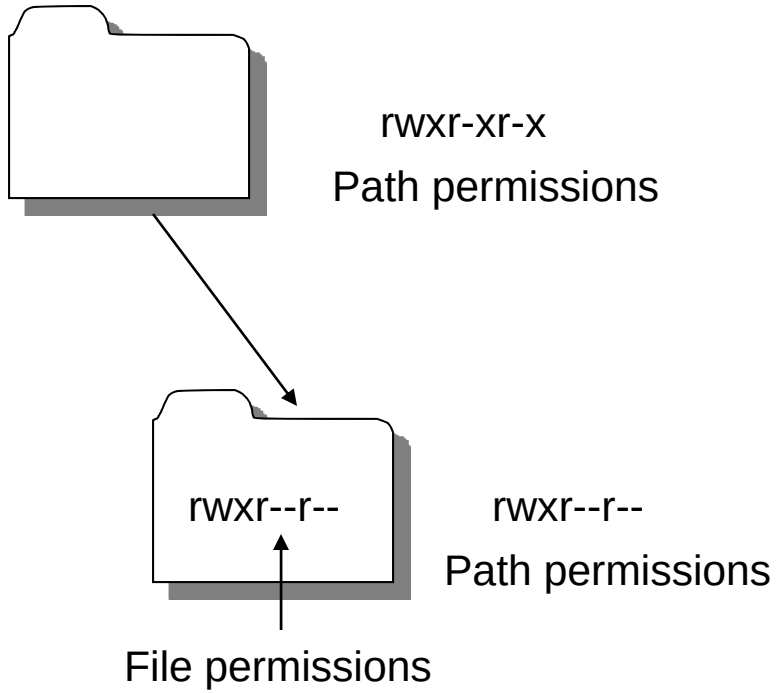

Hash range
MDServer
0-2ACD
0
2ACE-51AA
1
…
…
Clients
Metadata Access
Data Reads/Writes
Metadata Servers
Metadata Updates
Object Based Storage Devices

# Motivation (cont'd)

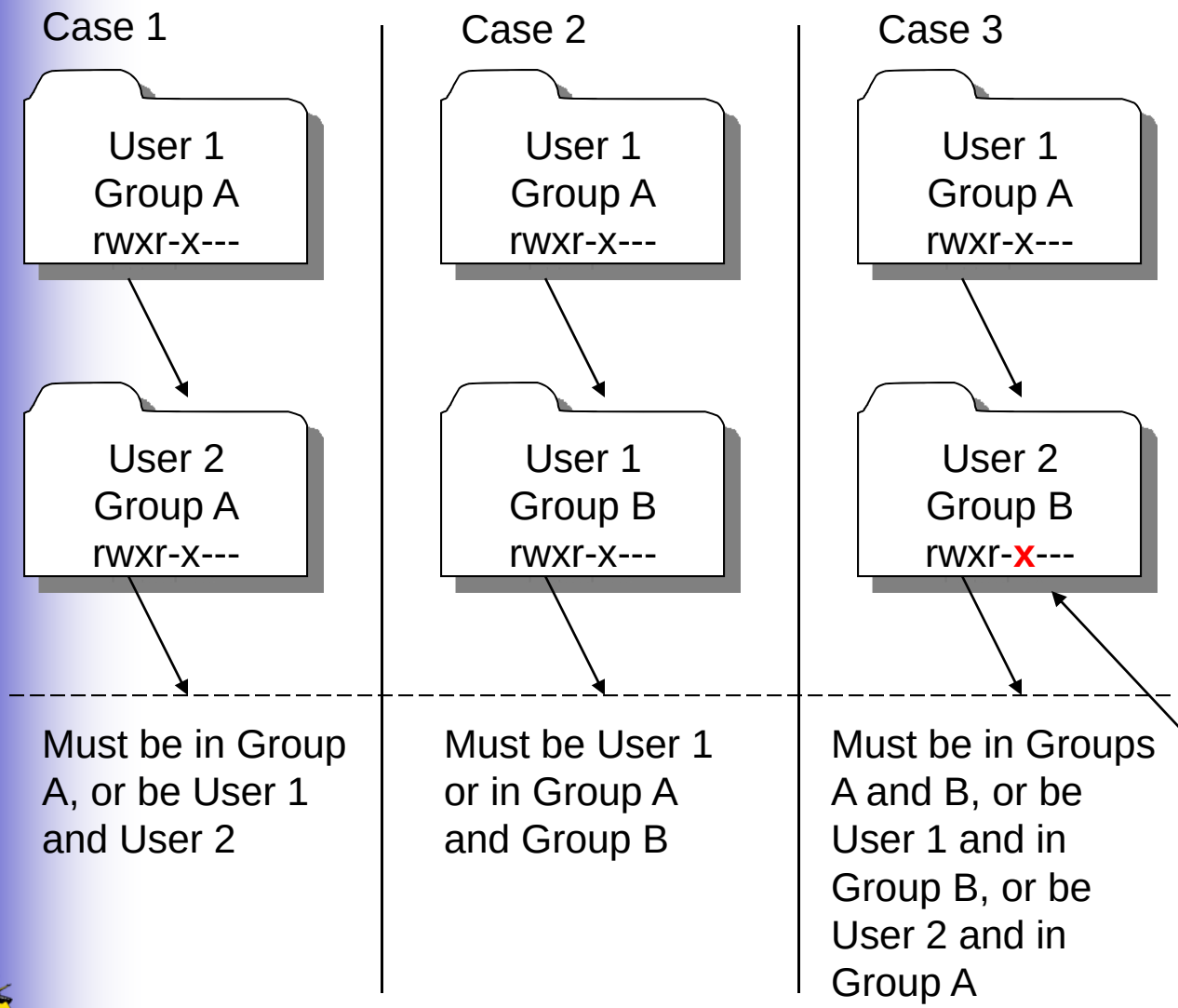


# Lazy-Hybrid Method

- Hash based location
- Maintains hierarchical directories
- Dual-entry access control list
  - Merge path permissions and file permissions



# Lazy Hybrid Example




Case 1
User 2, Group A

Case 2
User 1, Group B

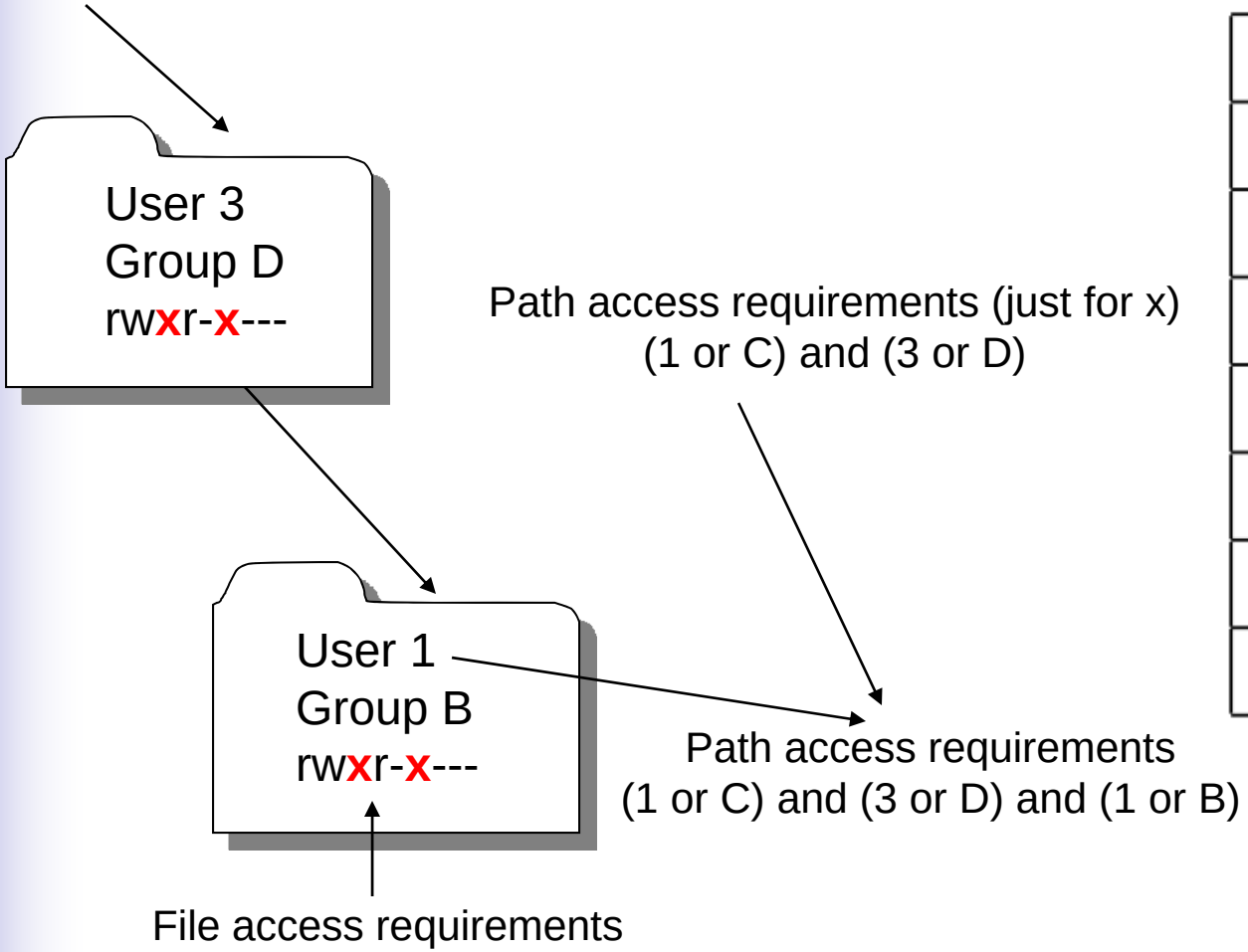
Case 3
User 2, Group B

# DNF and CNF

- DNF: Disjunctive Normal Form
  - Disjunction of conjunctions
  - “or”s of “and”s
- CNF: Conjunctive Normal Form
  - Conjunction of disjunctions
  - “and”s of “or”s

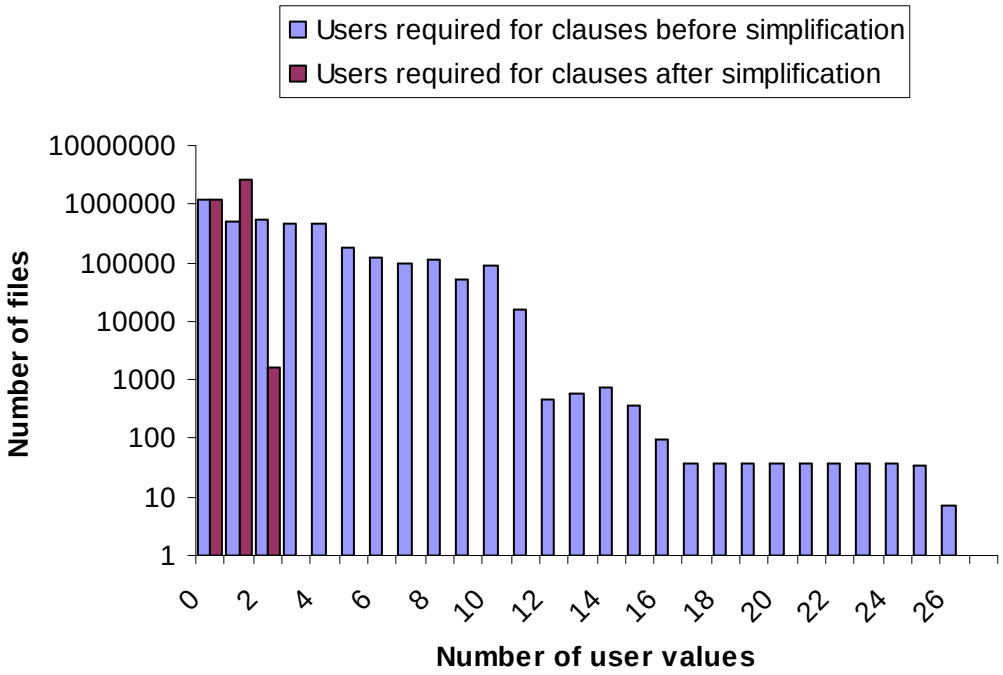


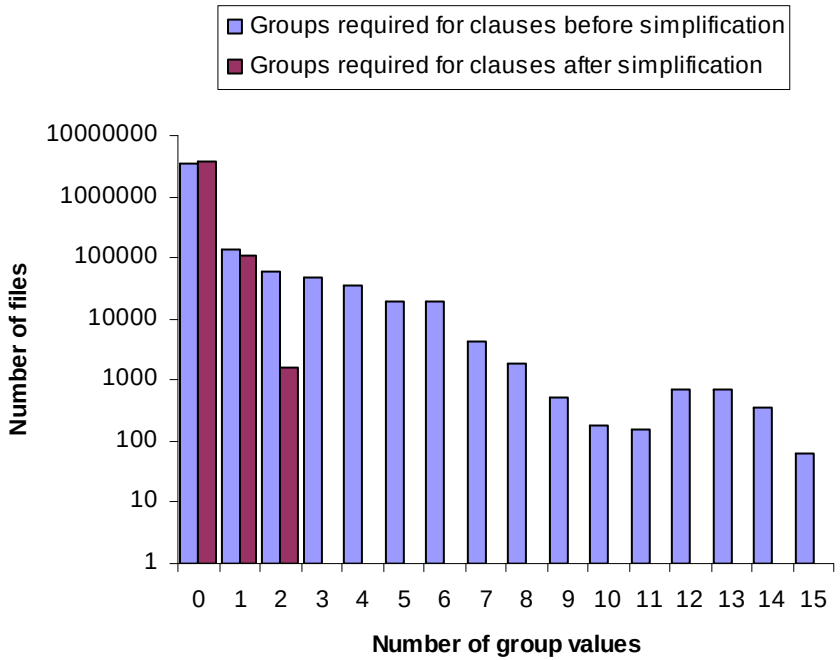
# Flattening Hierarchy




| | |
|---|---|
| 000 | $\bot$ |
| 001 | $\neg u \wedge \neg g$ |
| 010 | $\neg u \wedge g$ |
| 011 | $\neg u$ |
| 100 | $u$ |
| 101 | $u \vee \neg g$ |
| 110 | $u \vee g$ |
| 111 | $\top$ |

# Results




## Using CNF representation for files

31.7% no clauses

68.2% 1 clause

< 0.1% 2 clauses

1242 unique clauses (User V Group)