Big Storage for Big Problems

Petabyte File Systems on Tertiary Storage

Why Do We Care?

- **Data Explosion**
  - **Backup**
    - 1000 PCs = 2-3 TB Just for Backup
  - **Corporate Digital Assets**
    - Scanned Images
    - Video
    - Product

- **Long Term Storage Issues**
  - **Data Integrity**
  - **Vendor/Supplier Viability**

How Big is Big?

1.0 TB

0.5 TB

1.5 TB

30 TB

1,814 TB

Why Not Use Disk?

Next Question!

EMASS®
Storage Management Software

OK, So Now What?

- **Basic Requirements**
  - **Low Operational Cost**
    - Automated Library
    - Minimal Fixed Requirements
  - **Scalable**
    - Predictable Access
    - Manageable
    - Capacity
  - **Beneficial**
    - Catalog Service/Asset Manager

What is Scalability?

- **Quantity**
  - **Number of objects**
  - **Size of all objects**
- **Quality**
  - **System Response**
    - Administrative
    - User
  - **Data Integrity**
    - Long Term Management

Project Goals

- **Understand Operational Characteristics**
  - **Can it be managed?**
  - **How long do basic operations take?**
- **Take the User View**
  - **How does the system respond?**
- **Get a Feel for How System Grows**
  - **What resources run out?**
- **Publish Good and Bad**

Test Case Parameters

- ## 1,000 TB of Data Represented
  - **Metadata Access is the Issue**
  - **Could not Afford to write a PB**
- ## Just Over 16 Million Files
  - **XXXX levels of directories**
  - **512 Directories at the top**
- ## Sun SPARC 50 MHz Classic
- ## 8 GB of disk

VGIMPORT

ASCII
version of
metadata

```
Dkkkd
dkd s
sks skjkj;kljdfkjadf
klasdfkljkjdfkj
lkasdkkdkjd

asdfkl;kasd;
a;lkasd
a;laksdjflaskjdflkj
kdkdkasdf;kjasdf
akask;dd ;akdasd dlsa
 sadfkasdf;kl  asdfkasf
;aklsdf;ljkdf;kasdk
;laksdfj;klsdfkss
```

Archive

| Dir1 | Dir2 | ● ● ● | Dir 512 |

SubDir1

●
●
●

SubDir256
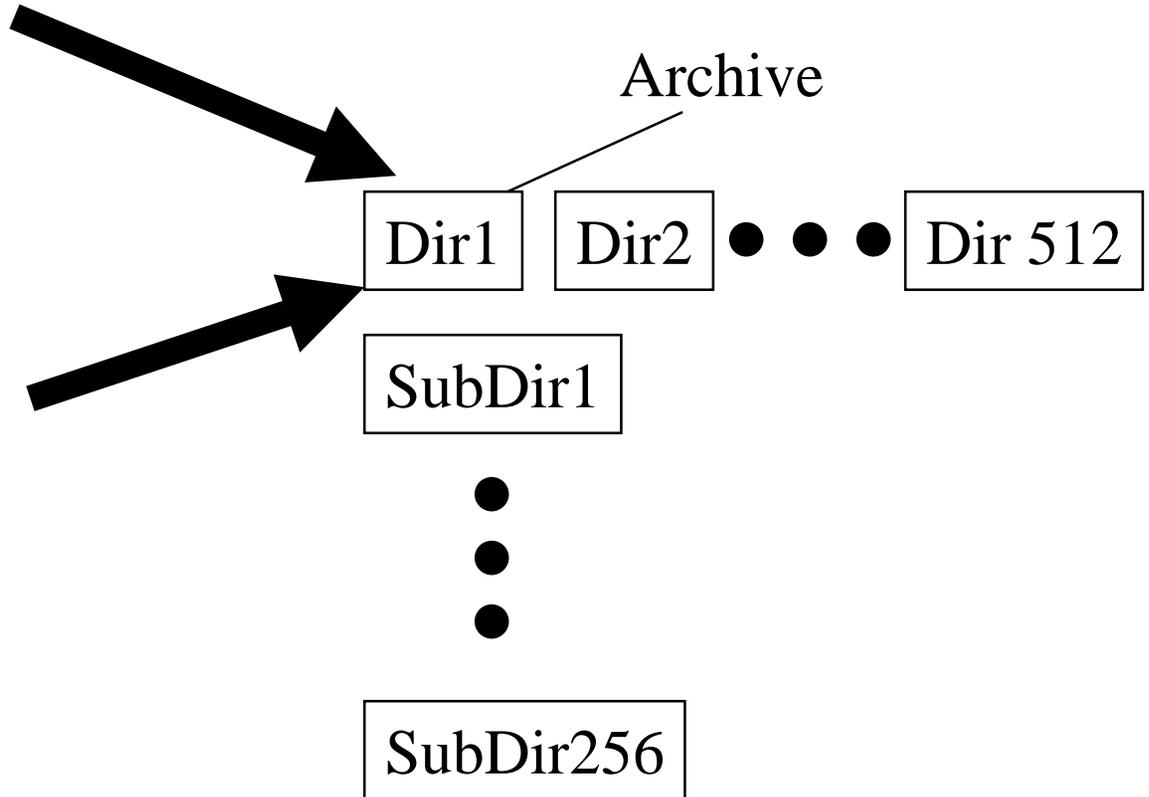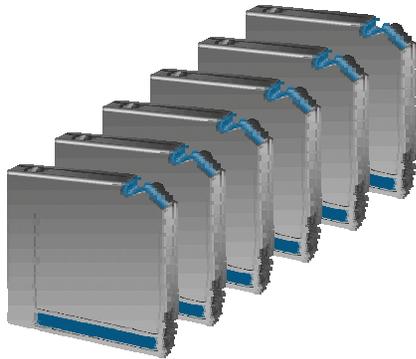
Results

- **Measure**

  - **User Level Commands**

    - ls, cd, pwd

  - **Size of Database**
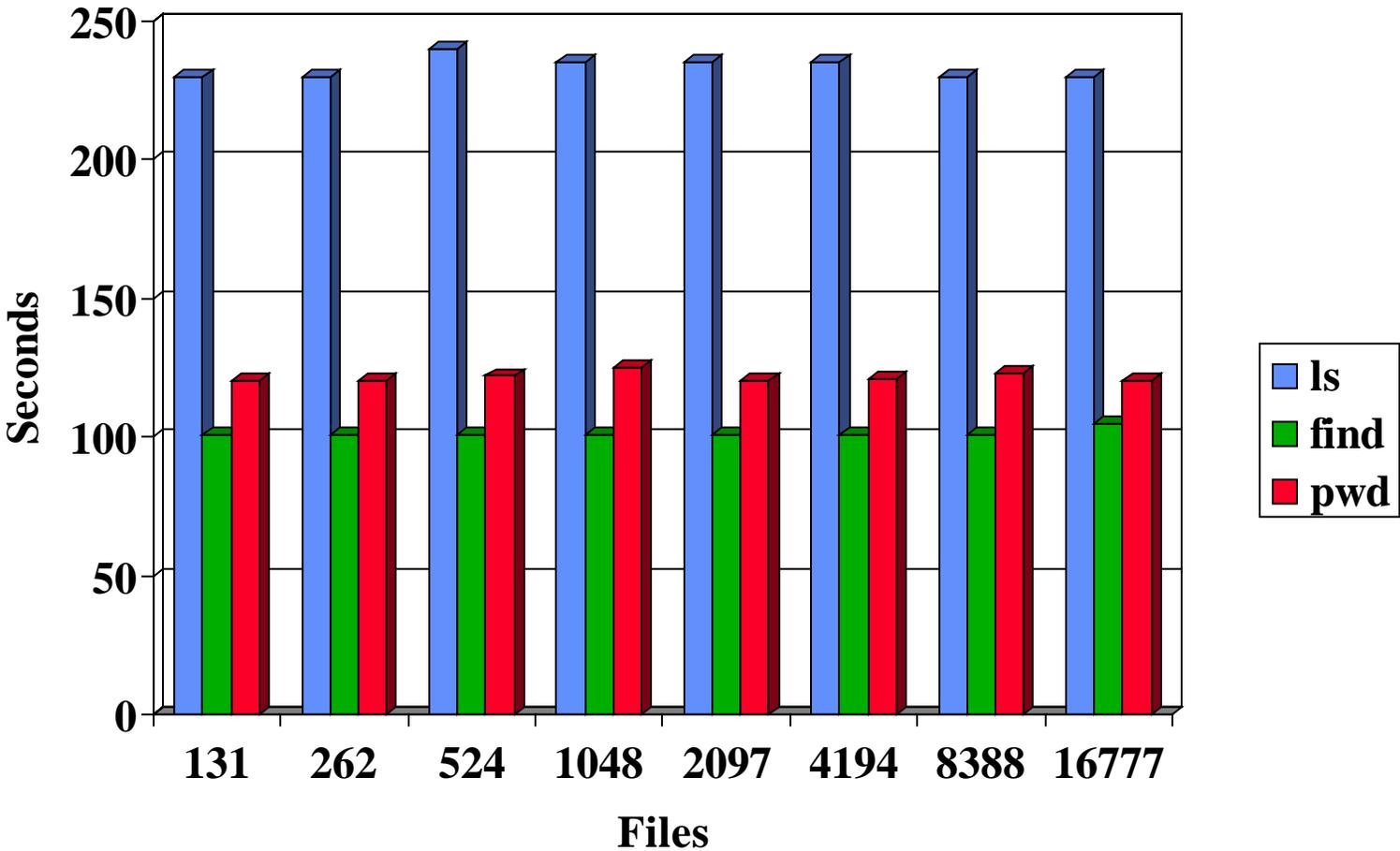
    - Interested in Maximum Size

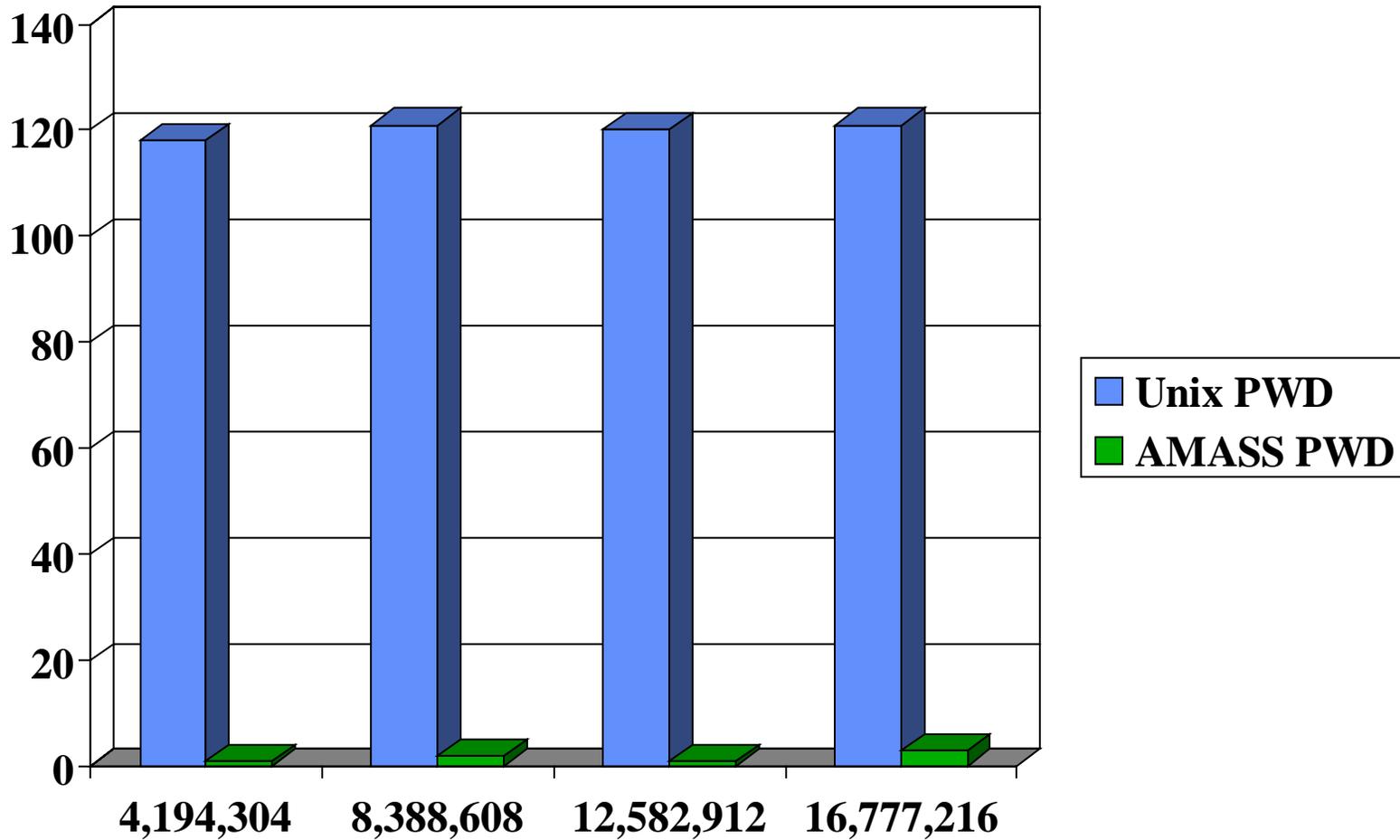 - **Administration Utilities**

    - Times for all required commands
    - Include recovery processing

EMASS®
Storage Management Software

Metadata Access

data storage solutions from
EMASS
Storage Management Software

Using the Database API

Database Size

- **AMASS**

  - **Minimum of 128 bytes/file**

  - **16 Million Files = 3.0 GB**

  - **90 Million Files = 10 GB**

- **File System + HSM**

  - **256 inode + 1024 HSM bytes/file**

  - **20 GB for 16 Million Files**

Phase II: Data Access

- **1 TB File**

- **100 IBM 3590**

- **Test**
  - **Single Reader**
  - **Multiple Reader**

- **Status**
  - **File was Written**
  - **Resources Moved to New Project**
  - **Will Resume this Summer**

Areas That Need Attention

- **Administration Commands**
  - **Database Verification & Repair**
  - **Other Products Suffer Similar Fate**
    - Backup, HSM, etc.

- **Some User Level Commands**
  - **Implementations Need to Change**
    - Memory and Algorithms, Browser Based Interfaces

- **Useability Features**
  - **Catalogers**
  - **Long Term Media Management**

Areas to Think About

- **Vendor Independence**
  - Hardware and Software

- **Storage and Access Paradigm**
  - Transparent vs Purposeful

- **Cost of Ownership**
  - Flexibility vs Simplicity