Jump Distance Based Synthetic Disk Access Patterns

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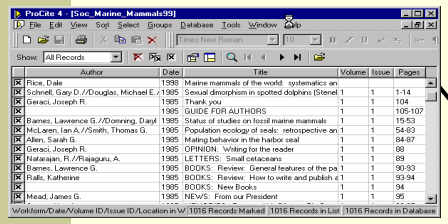
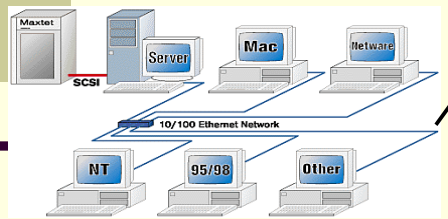
New storage systems must be evaluated with respect to many different workloads



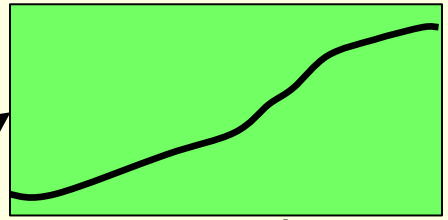
Database workload

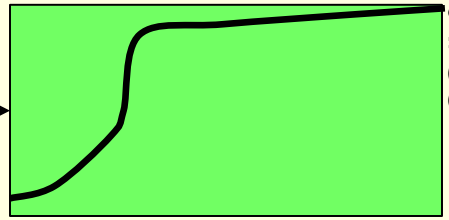
Email server workload

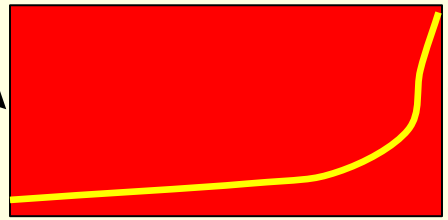


File server workload

Disk array







Example Workloads

Performance
(CDF of latency)

An design may be good for some workloads and bad for others.

Sources of Evaluation Workloads

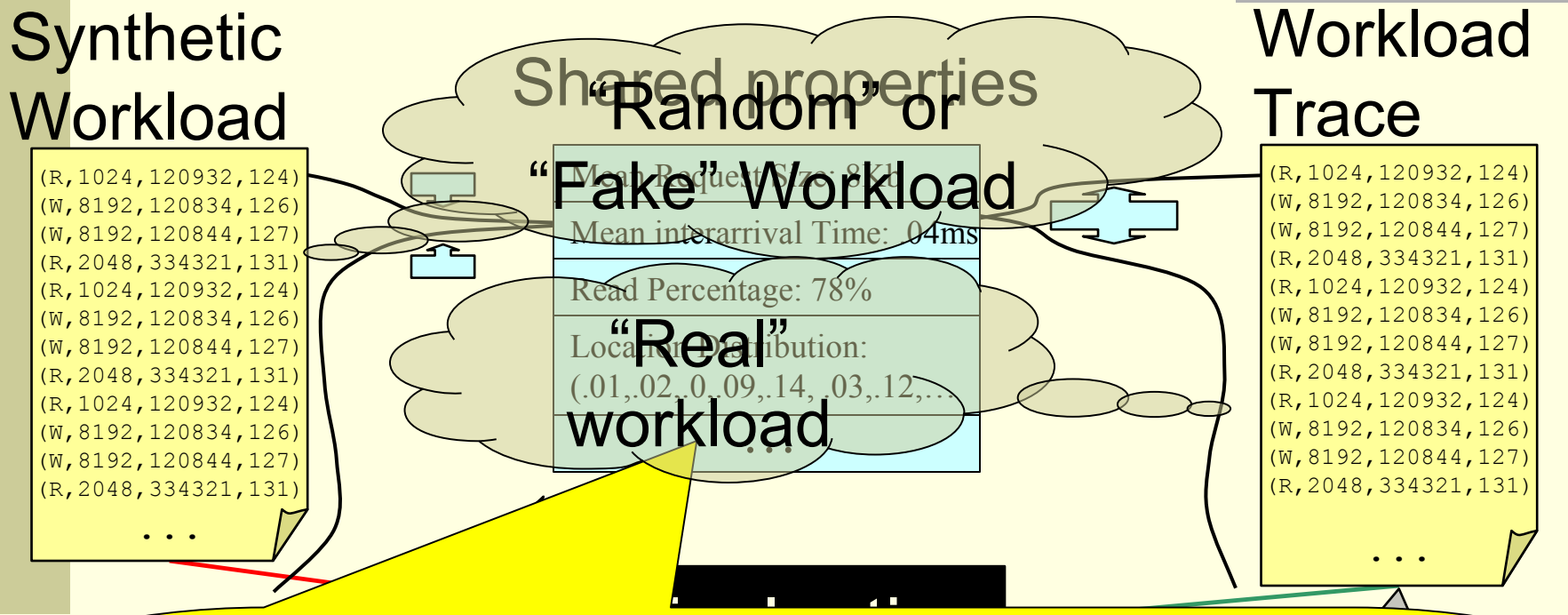
Trace of real workloads

- List of I/O requests made by production workload
- Accurate
- Large
- Inflexible
- Difficult to obtain (due to security concerns)

Synthetic workloads

- Randomly generated model of some workload
- Usually Inaccurate
- Compact representation
- Easily modified
- Compact representation contains no specific data

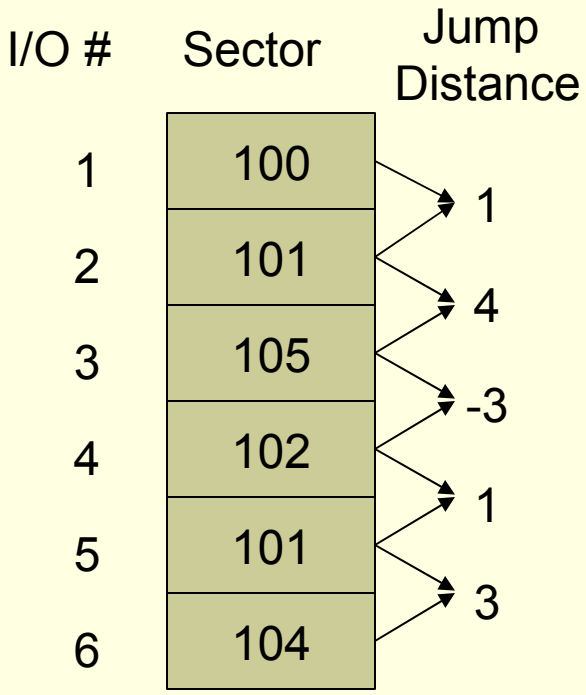
My goal: Accurate synthetic workload



$64,000 question:

What goes in here?

Jump Distance



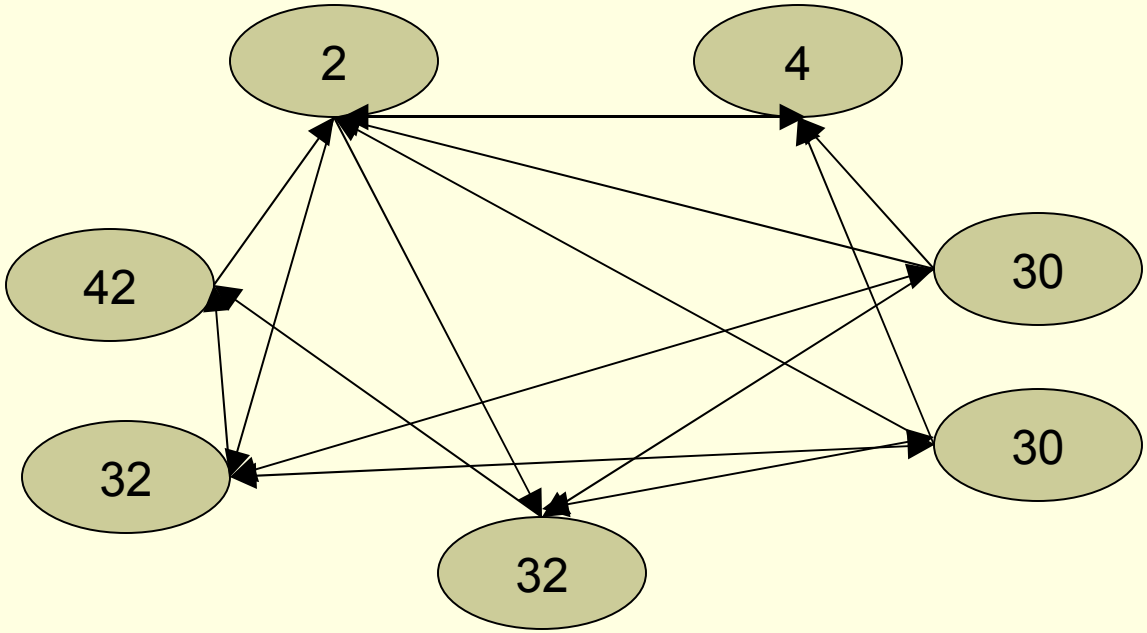
- Our poster presents a synthetic workload generation technique called “Jump Distance”
- Each jump distance approximates distance traveled by disk head
- Goal: Synthetic and target workloads make disk heads move the same amount

Distribution of Observed Jump Distances

Jump Distance:	-3	1	3	4
Frequency:	1	2	1	1

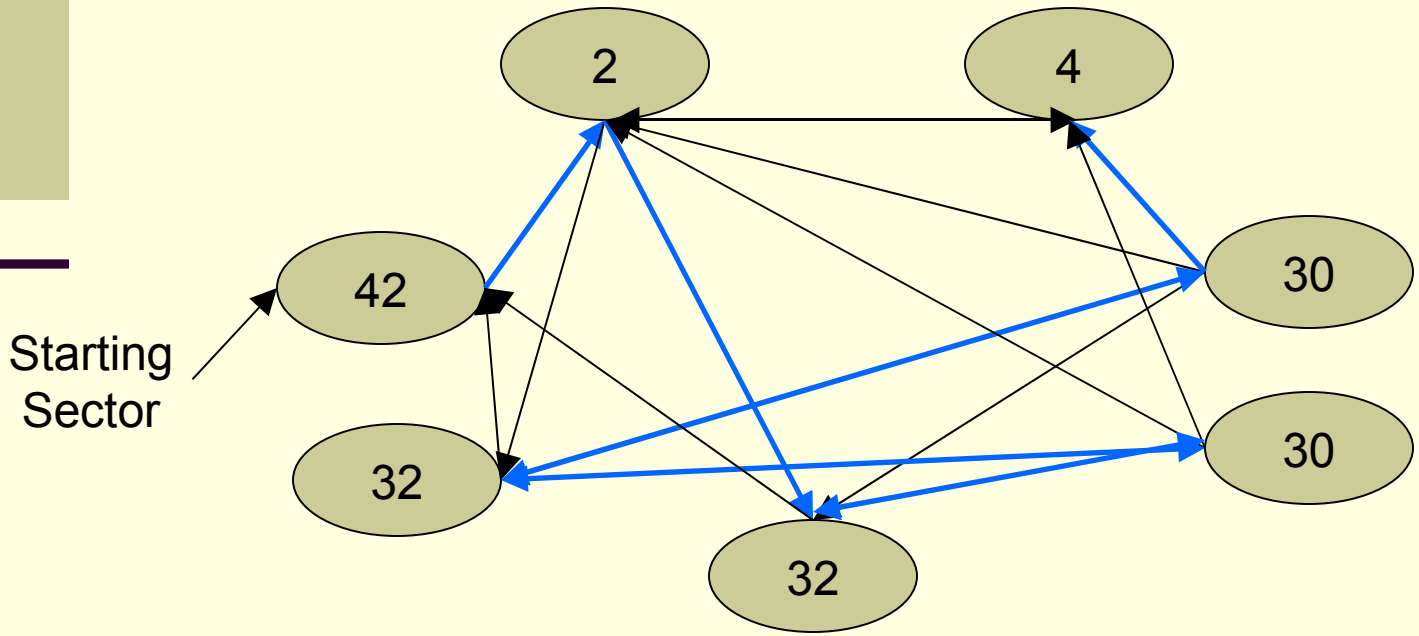
NP-Complete Problem

- Problem: If we also require that the synthetic workload maintain the same distribution of sectors accessed, the problem becomes a form of the NP-Complete Hamiltonian Path problem.



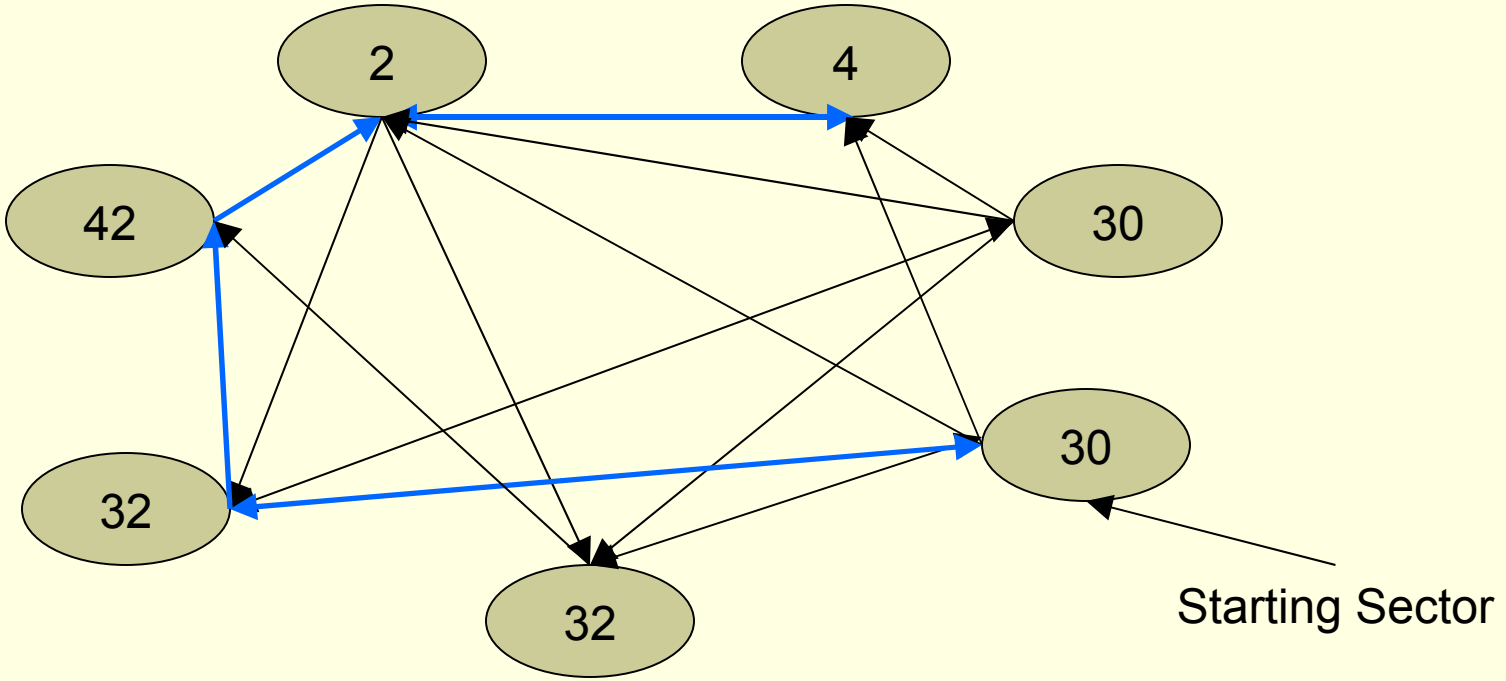
Solution

- Perform depth-first search for Hamiltonian Path
- Complete path represents synthetic disk access pattern with identical jump distance and location distributions



Solution #2

- Partial path completed randomly for an approximate solution



Results

- Partial paths average just under 80% of maximum length
- Resulting Jump Distance distributions not perfectly accurate, but reasonably accurate
- Results in reasonably accurate synthetic workloads --- if workload behavior dominated by disk head movement