Systems@ETH Zürich

Database Engines on Multicores
Why Parallelize When You Can Distribute

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Multimed is a system that scales

with the **number of cores**

with the **number of clients**

Scalability throughput for 200 clients

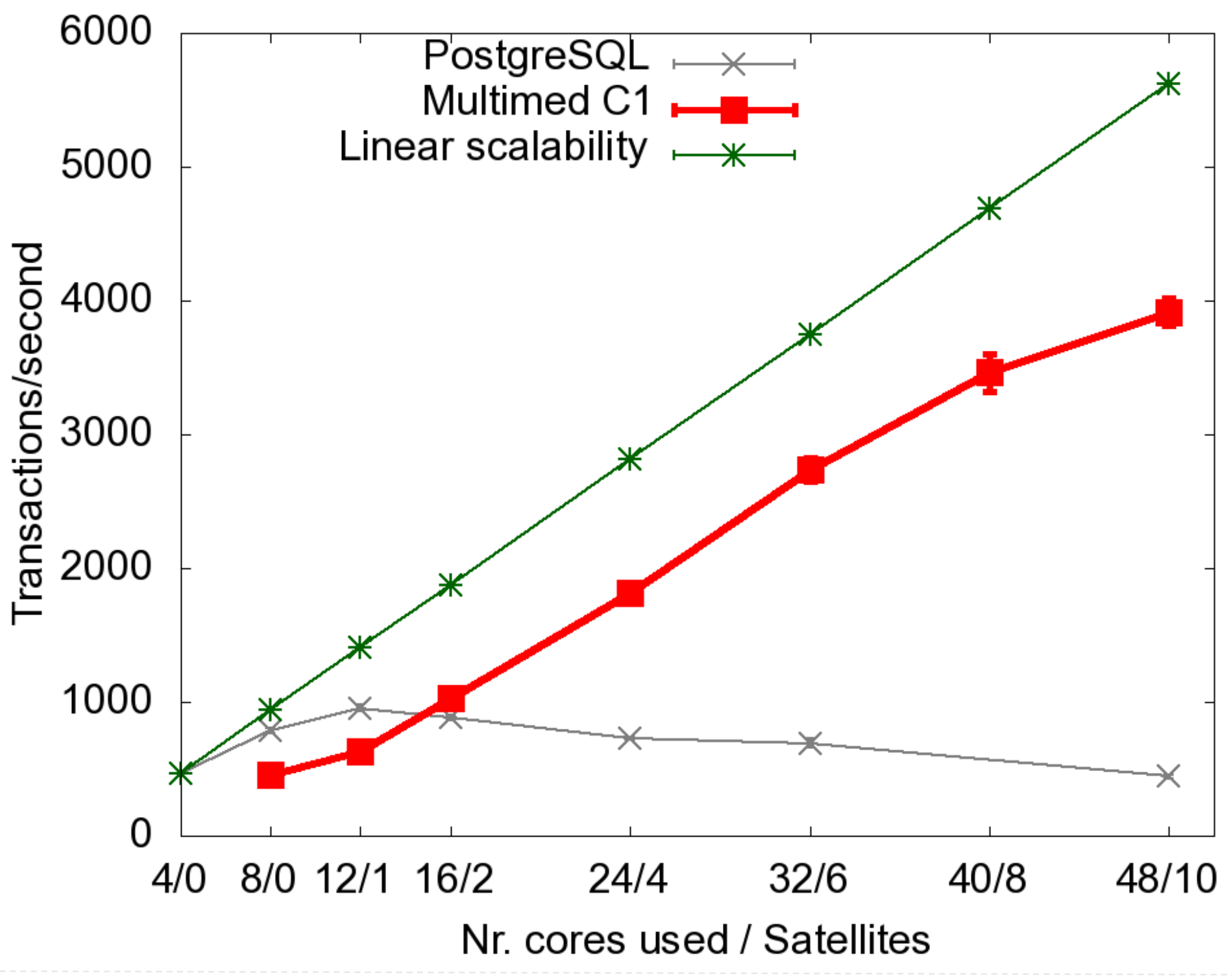
Throughput when varying the number of clients

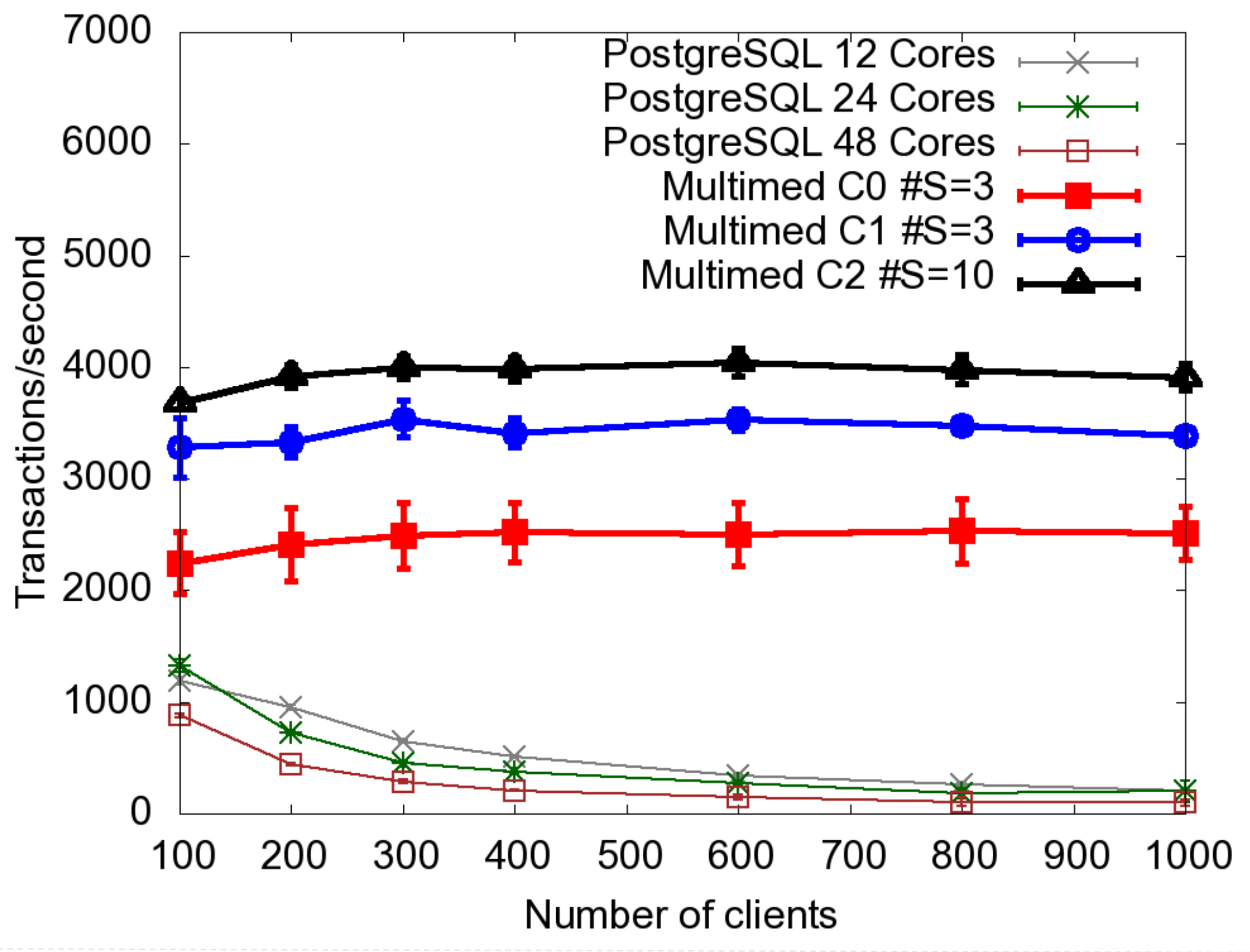
TPC-WB , database size **2GB**

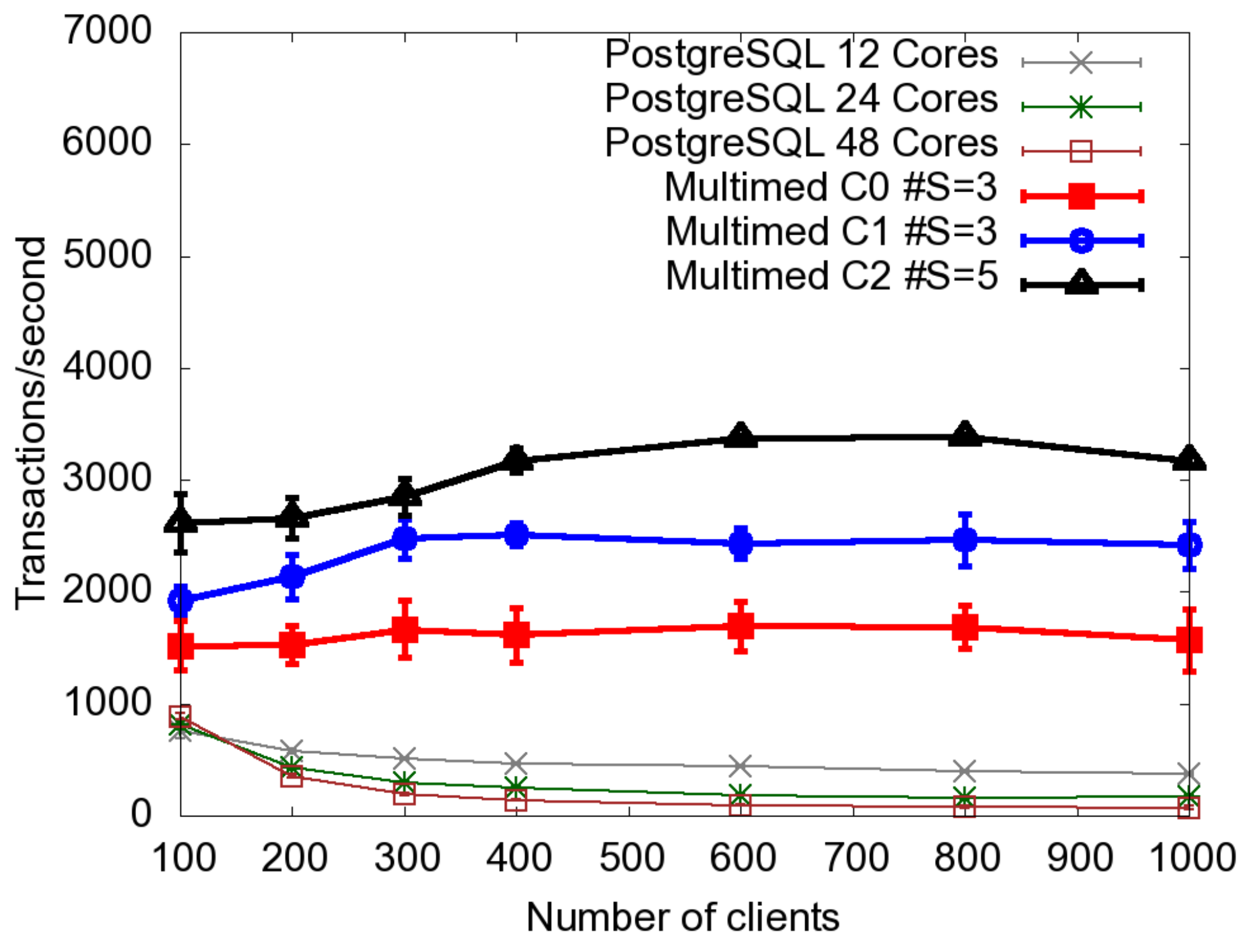
TPC-WB , Database size **2GB**

Database size **20GB**

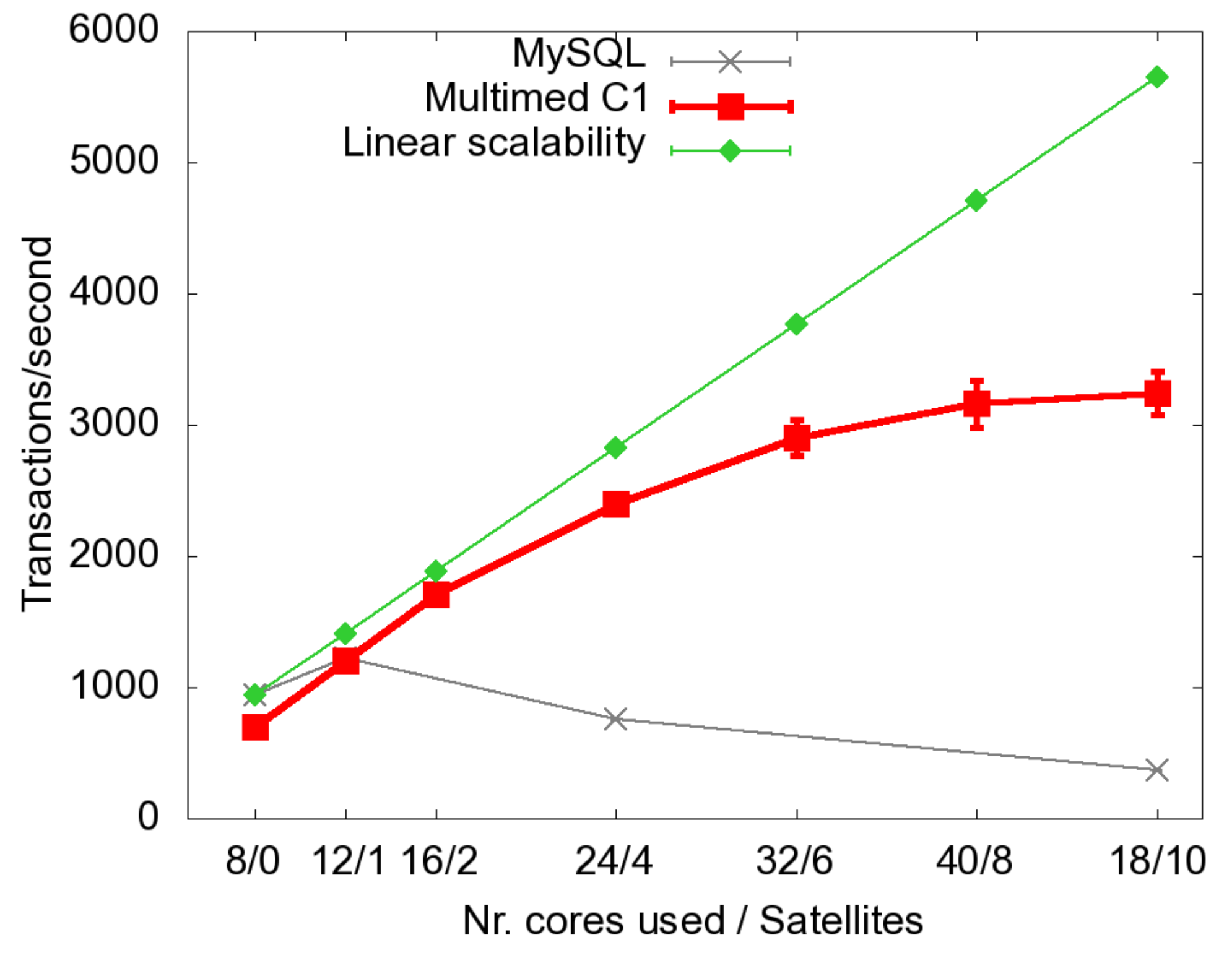
PostgreSQL

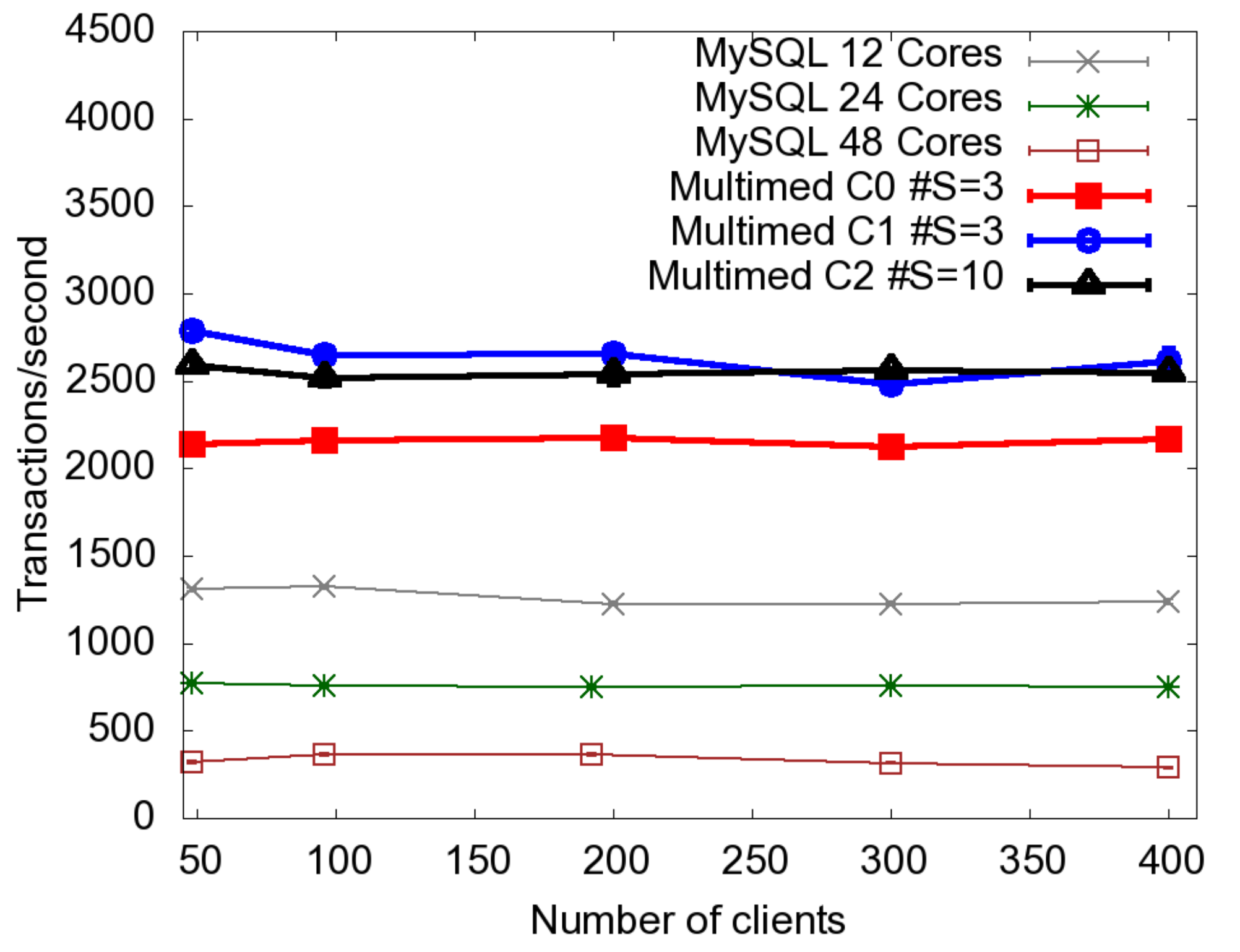


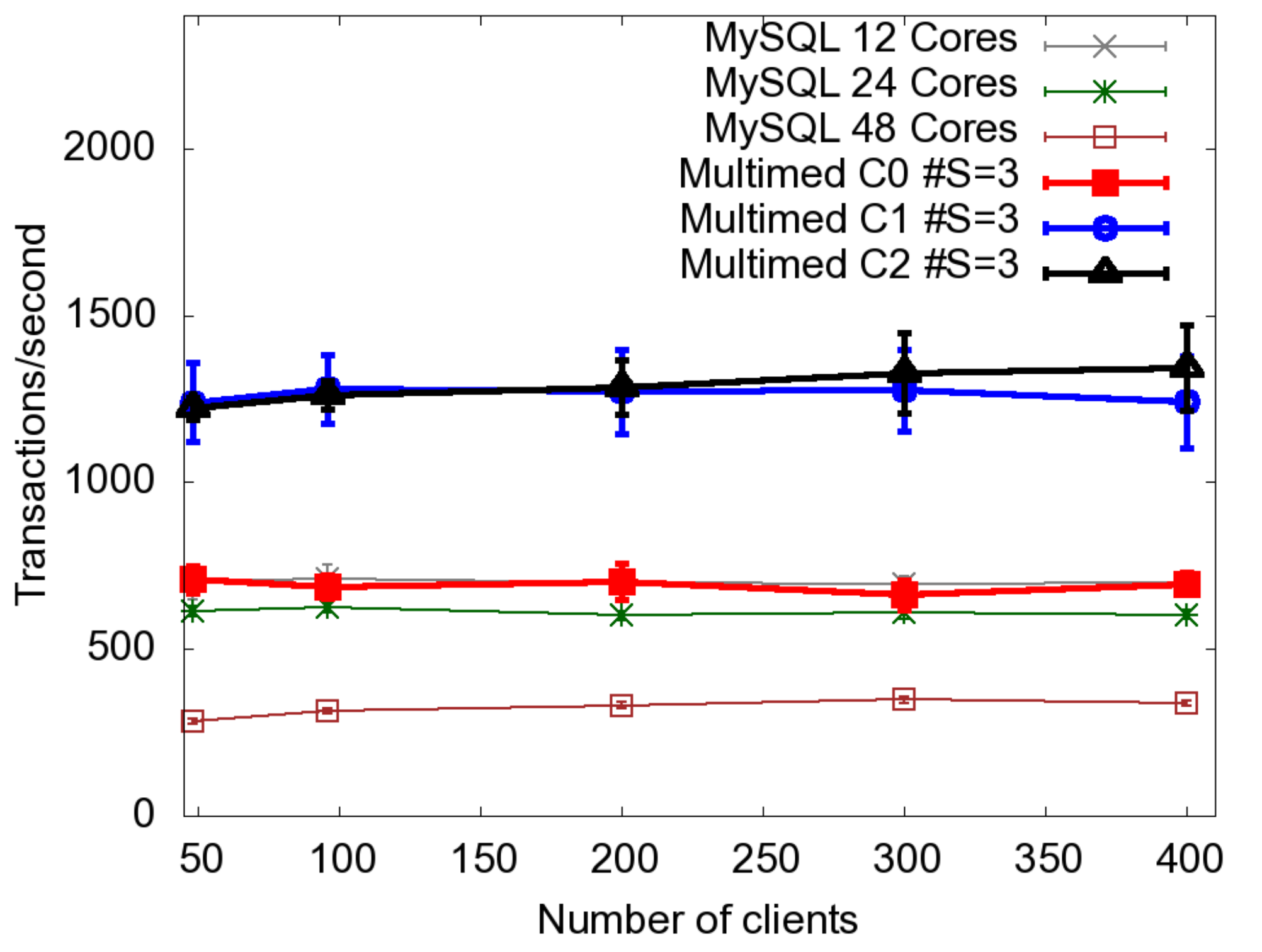




MySQL







Multimed adapts techniques used in database clusters to multicores.

The system **scales** with increasing number of cores and satellites and **separates loads** across databases

Different **optimizations** can be used to improve performance:

- **C0** full replication on disk
- **C1** full replication in main memory
- **C2** partial or full replication in main memory

Evaluation setup

Hardware
4 way AMD Magny Cours (6174), 48 cores, 128GB of RAM
Two dies per CPU, 6 cores per die. Each core has a local L1 (128KB) and L2 cache (512KB). Each die has a shared L3 cache (12MB).

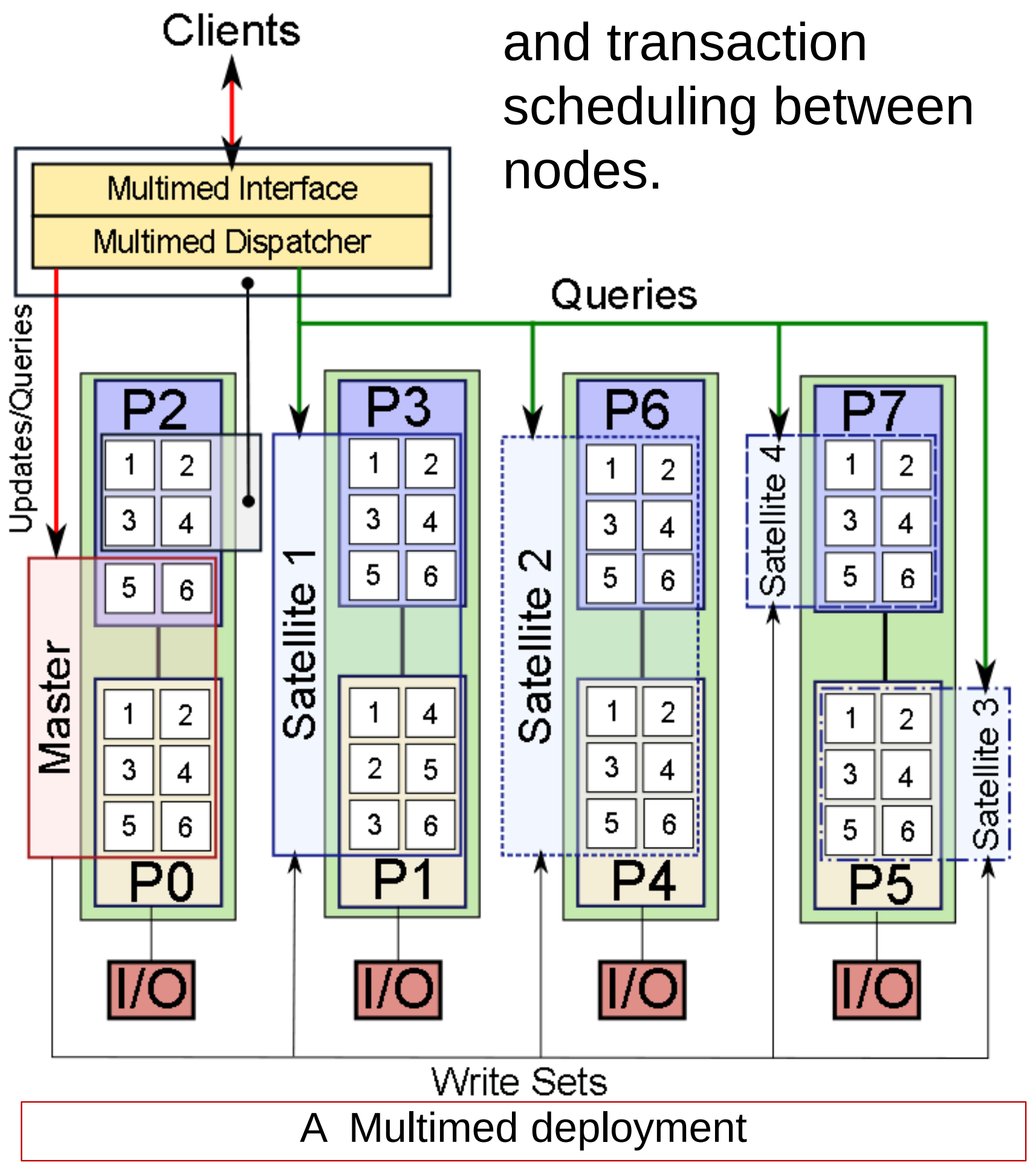
TPC-W Benchmark mixes:
TPC-W Browsing (10% Upd), **TPC-WB**
TPC-W Shopping (20% Upd), **TPC-WS**
TPC-W Ordering (50% Upd), **TPC-WO**

What is Multimed?

Multimed is a **replication** system designed **for multicore architectures** using **single-master**, multi-satellite replication.

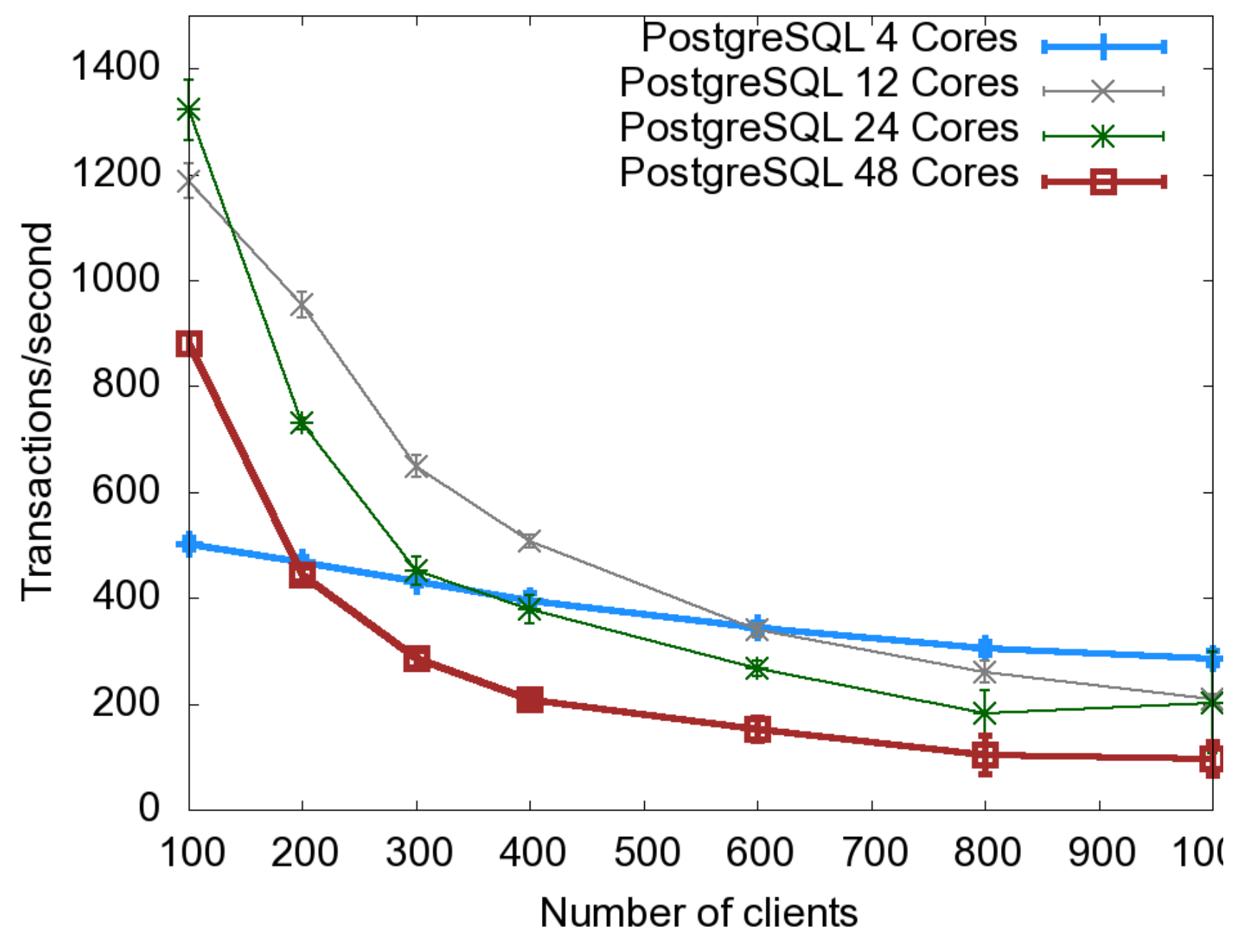
Supports **full and partial replication**. Using RSI-PC replication protocol.

Does load distribution and transaction scheduling between nodes.

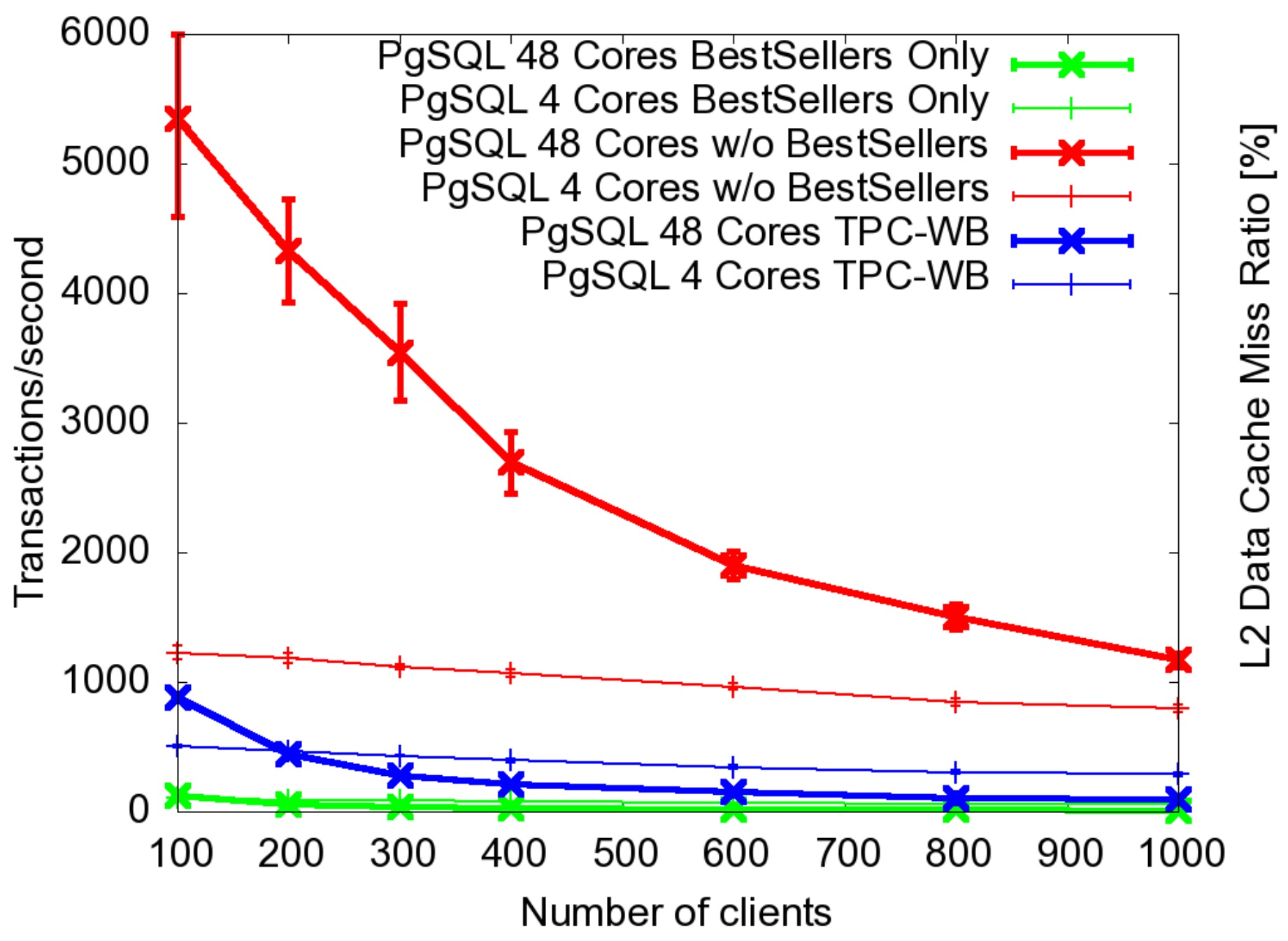


A Multimed deployment

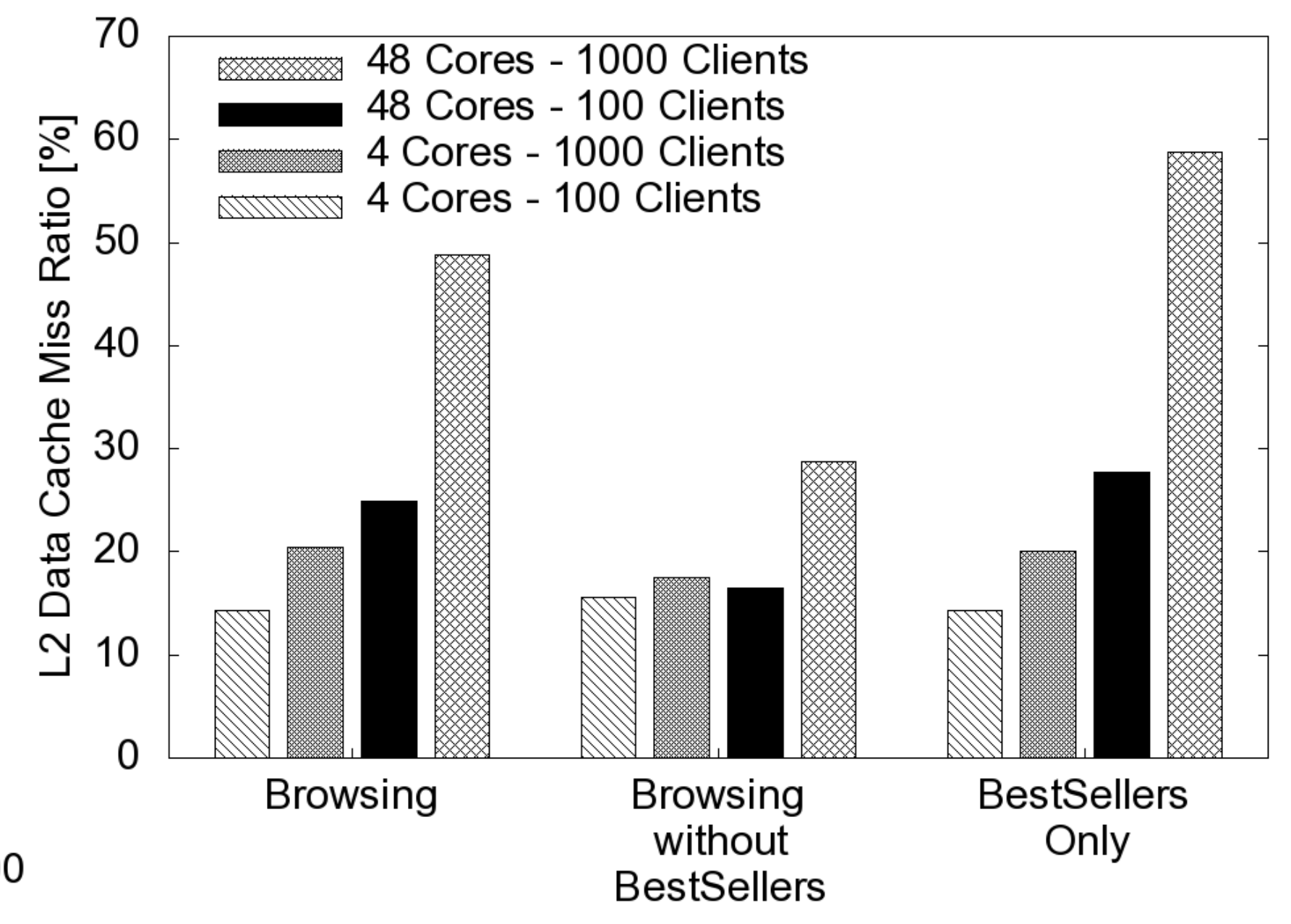
Database Engines on Multicores



PostgreSQL: TPC-WB Throughput



PostgreSQL: Load Interaction



PostgreSQL: L2 data cache miss ratio

Multimed is **independent of the database engine** running underneath.

Write set extraction is done using triggers for portability.

In our paper we have benchmarked PostgreSQL and MySQL.

Load Interaction leads to performance and scalability degradation due to **concurrent transactions that significantly interfere** with each other.

Multicores amplify it due to increased number of hardware contexts.

Contention due to **concurrent access to locks and synchronization primitives**, increases with number of cores and clients.

The L2 data cache miss rations is computed using the formula :

$$L2DC\_Miss\_Ratio = \frac{100 \times L2Cache\_Misses}{(L2Cache\_Fills + L2Requests)}$$

The values were measured using CPU event counters.

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