Parameter servers for machine learning do not scale?

Well, **one size does not fit all.**

NuPS: A Parameter Server for Machine Learning with Non-Uniform Parameter Access

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Motivation

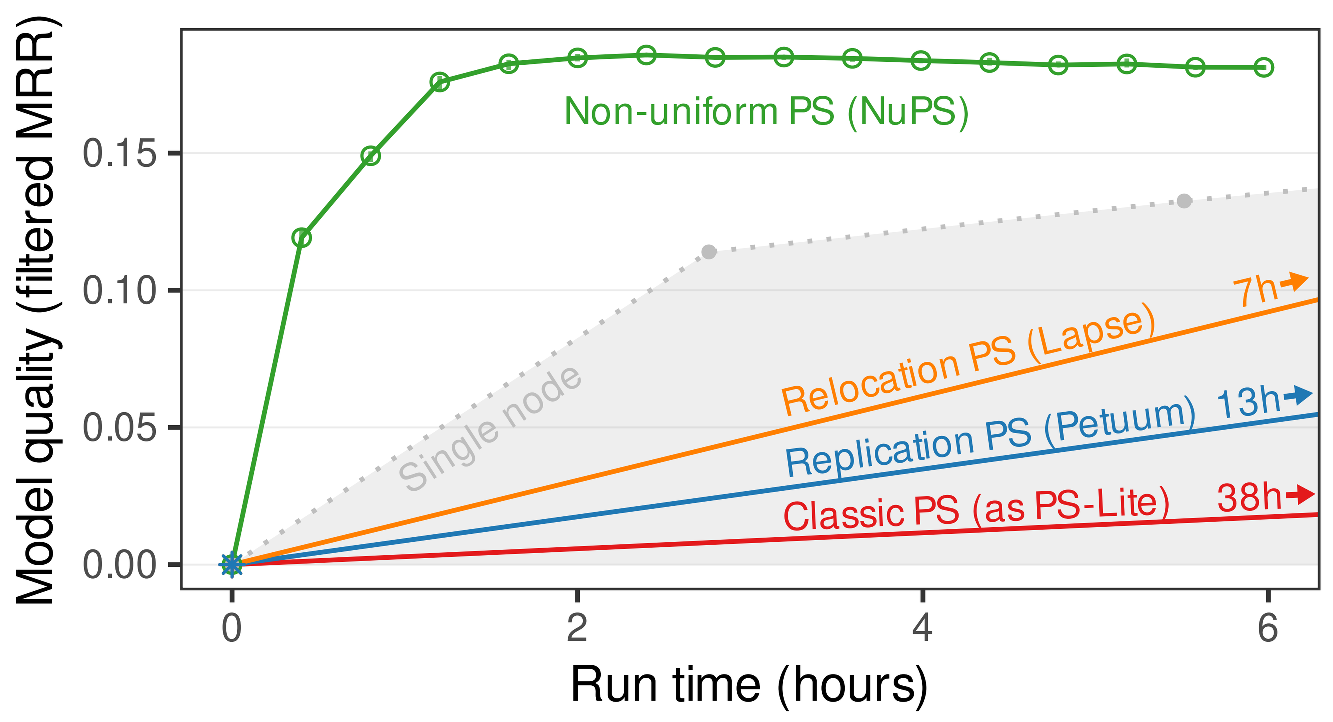
- Parameter Servers (PSs) facilitate distributed machine learning
- But existing PSs are inefficient for non-uniform access:
  - Skew: PSs inefficient because they manage all parameters identically
  - Sampling: PSs inefficient because sampling entails randomized access

NuPS

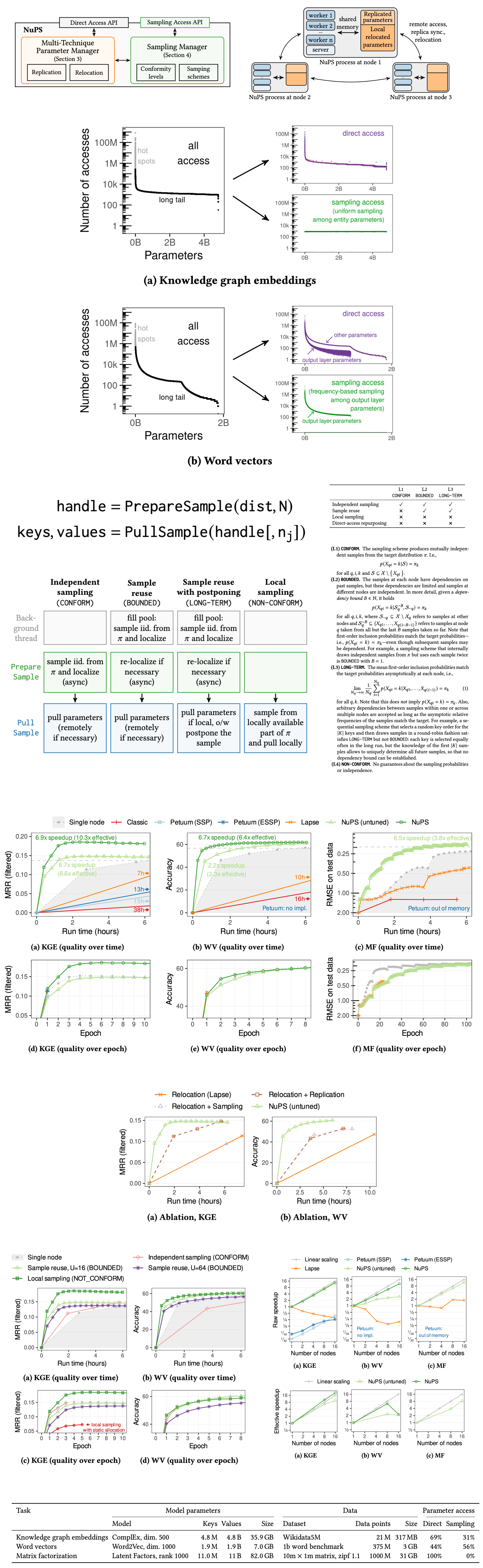
1. Supports multiple management techniques and picks a suitable one for each parameter:
   - Replication is efficient for hot spot parameters
   - Relocation is efficient for long tail parameters
2. Supports sampling directly via suitable primitives and sampling schemes that allow for a controlled quality—efficiency trade-off

Results

1. NuPS outperformed existing PSs by up to one order of magnitude across multiple ML tasks
2. NuPS provided up to linear scalability
3. Most efficient was to replicate a small set of hotspot parameters and relocate all others



Parameter server performance for training large knowledge graph embeddings on an 8-node cluster.



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