Multi-Application Linux Kernel Profile

PRESENTER:

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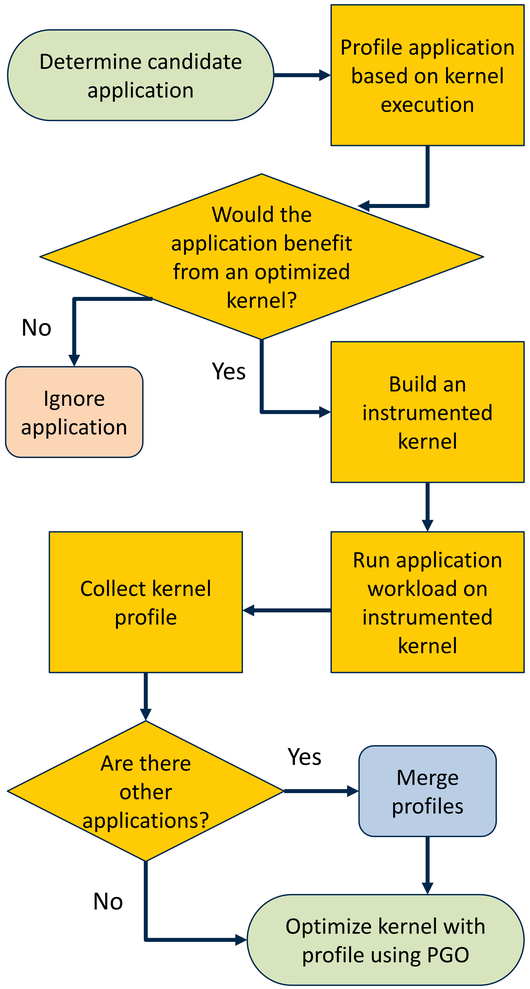
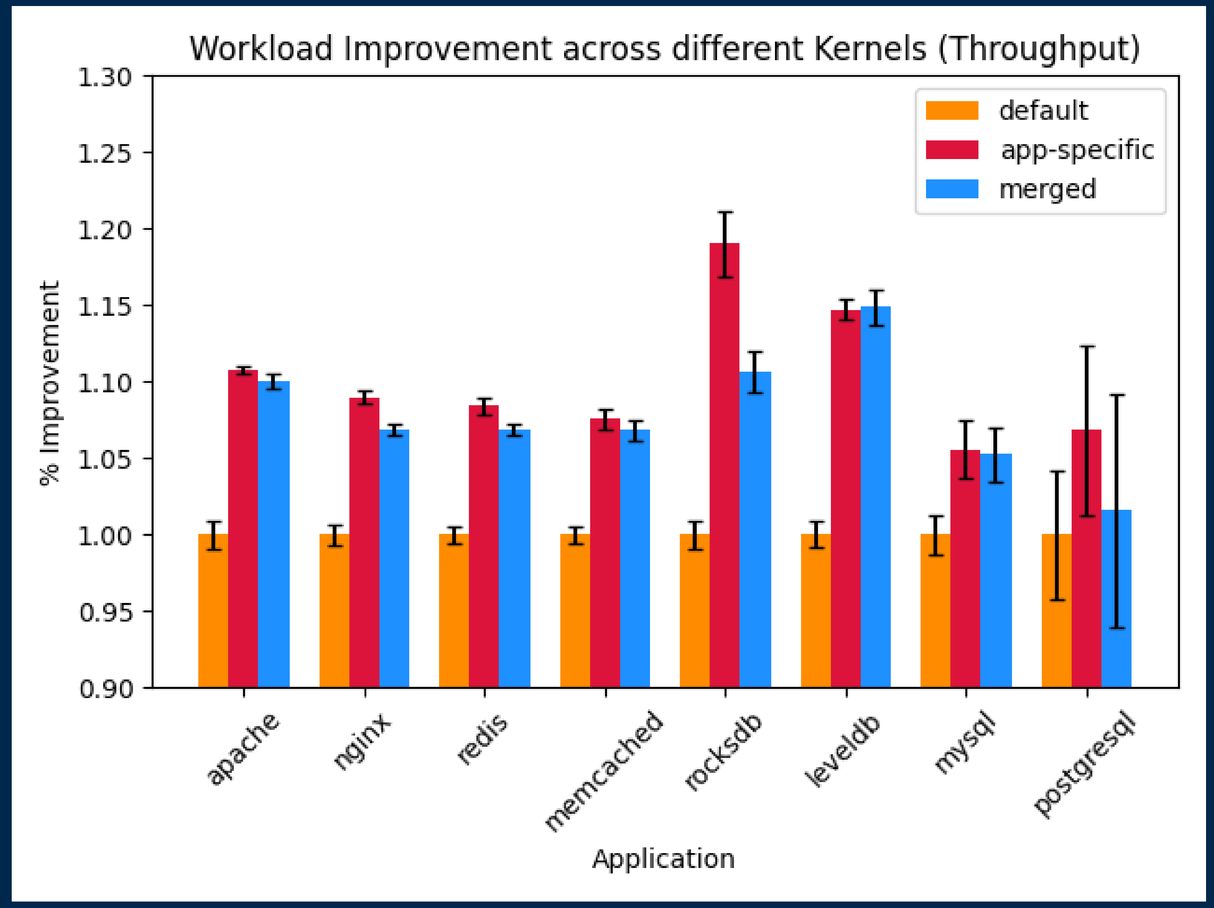
- Profile-guided optimizations (PGO) can be done on the Linux kernel using the compiler.
- PGO has been used to create application-specific kernels, which overfit for one application and tend to degrade the performance of other applications [1].
- We merge kernel profiles of different applications and apply kernel PGO to improve the performance of all applications without hurting any specific application.

METHODOLOGY

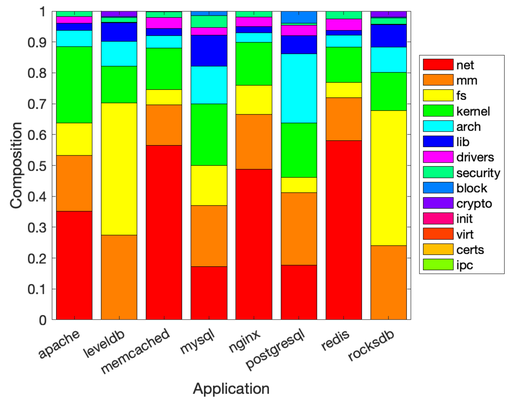


Profile-guided optimizations on the Linux kernel can be done to benefit a set of **different** applications without hurting any **one** application.



Application	% Kernel cycle	% Kernel instruction	% Kernel iCache Miss	% Kernel TLB Miss
apache	62.88%	64.55%	60.37%	63.11%
nginx	74.02%	74.86%	68.3%	80.45%
redis	69.84%	56.96%	78.88%	85.55%
memcached	69.07%	55.04%	74.31%	51.62%
mysql	63.26%	59.21%	64.86%	10.38%
postgresql	60.00%	73.22%	43.85%	24.40%
rocksdb	46.34%	41.79%	42.97%	18.19%
leveldb	43.05%	30.27%	56.67%	31.7%

- Kernel execution for 8 applications that we chose for kernel PGO.
- These applications span databases, web servers, and key-value stores.



- Composition of line execution frequency by Linux kernel sub-directory for each application.
- This showcases the "diversity" of each application relative to the others.

[1] Pengfei Yuan, Yao Guo, Lu Zhang, Xiangqun Chen, and Hong Mei. 2018. Building application-specific operating systems: a profile-guided approach. Science China Information Sciences 61, 9 (13 Aug 2018), 092102.

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