Programming Assignment 2 Report

CS 773: Computer Architecture for Performance and Security, Spring 2025

Indian Institute of Technology, Bombay

Team Members:

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Git Repository

[Repository Link: **PA2**]

Traces

[Drive link: **Download**]

Experiment Details

Explanation of Table Columns:

- **Policy**: Cache partition policy used i.e. Base(No partition), Way, Static, Dynamic.
- **trace**: Workload i.e. mcf-mcf, mcf-perl, perl-perl.
- **ipc_core0**: Instructions executed per cycle by core 0.
- **ipc_core1**: Instructions executed per cycle by core 1.
- **ipc_total**: `ipc_core0 + ipc_core1`.
- **normalized_ipc**: `new_ipc_total / base_ipc_total`
- **mpki_core0**: LLC Cache misses per 1000 instructions for core 0.
- **mpki_core1**: LLC Cache misses per 1000 instructions for core 1.
- **mpki_avg**: `(mpki_core0 + mpki_core1) / 2`.
- **evictions_core0**: LLC Self eviction by core 0.
- **evictions_core1**: LLC Self eviction by core 1.
- **evictions_total**: `evictions_core0 + evictions_core1`.
- **total_instruction_executed**: `50M` (core0) + `50M` (core1) = `100M`
- **EPKI (Evictions per kilo instructions)**: `(evictions_total / total_instruction_executed) * 1000`

Base Data

Policy	Trace	IPC			MPKI			Evictions			
		Core 0	Core 1	Sum	Core 0	Core 1	Avg	Core 0	Core 1	Sum	EPKI
Base	mcf-mcf	0.1	0.11	0.21	127.06	125.63	126.34	3231212	3208433	6439645	64.4
Base	mcf-perl	0.32	0.43	0.75	4.94	1.7	3.32	178621	28589	207210	2.07
Base	perl-perl	0.44	0.44	0.88	1.2	1.2	1.2	43062	16478	59540	0.6

Task 1A: Implementing Way Partitioning in Champsim

Branch Name: `Way-Partitioning`

Files Changed:

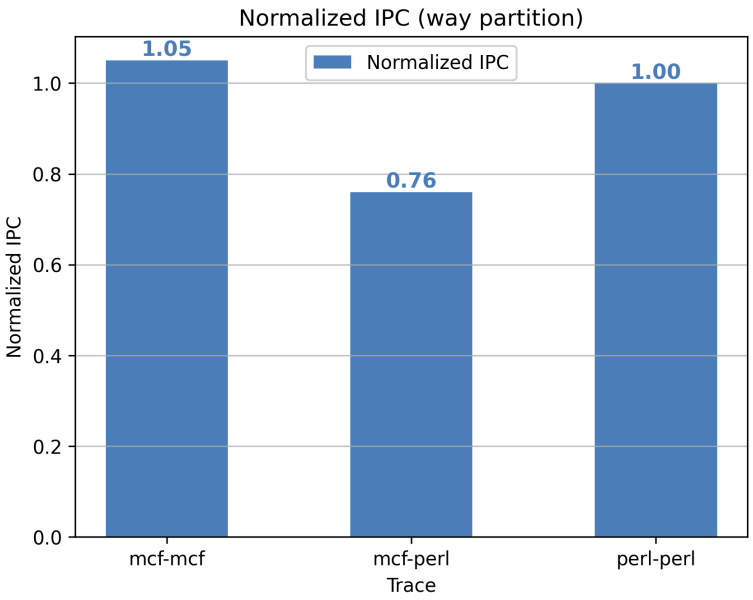
- inc/cache.h
- replacement/lru.llc_repl
- src/cache.cc

Results:

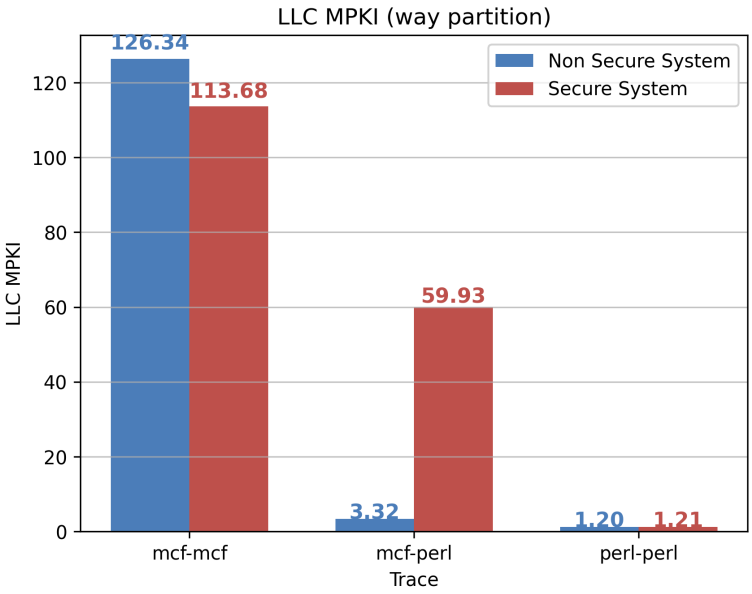
Data

Policy	Trace	IPC			MPKI			Evictions			
		Core 0	Core 1	Sum	Core 0	Core 1	Avg	Core 0	Core 1	Sum	EPKI
Way	mcf-mcf	0.11	0.11	0.22	113.53	113.83	113.68	5702496	5691456	11393952	113.94
Way	mcf-perl	0.14	0.43	0.57	118.56	1.3	59.93	5927845	183427	6111272	61.11
Way	perl-perl	0.44	0.44	0.88	1.21	1.21	1.21	34068	34016	68084	0.68

Normalized IPC



LLC MPKI Comparison



Self-Evictions per Kilo Instructions

Task 2A: Static Set Partitioning (Rang-De-Basanti)

Branch Name: `Static-Set-partitioning`

Files Changed:

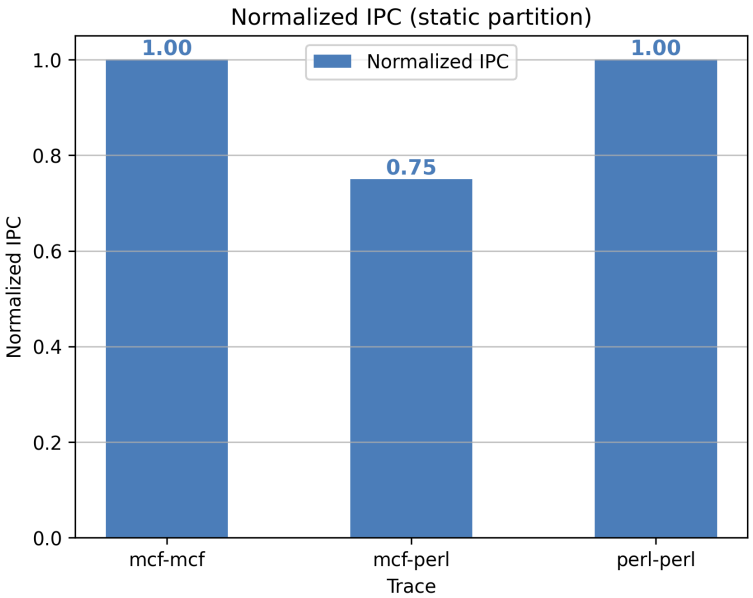
- inc/cache.h
- src/cache.cc
- src/page_table_walker.cc
- src/main.cc

Results:

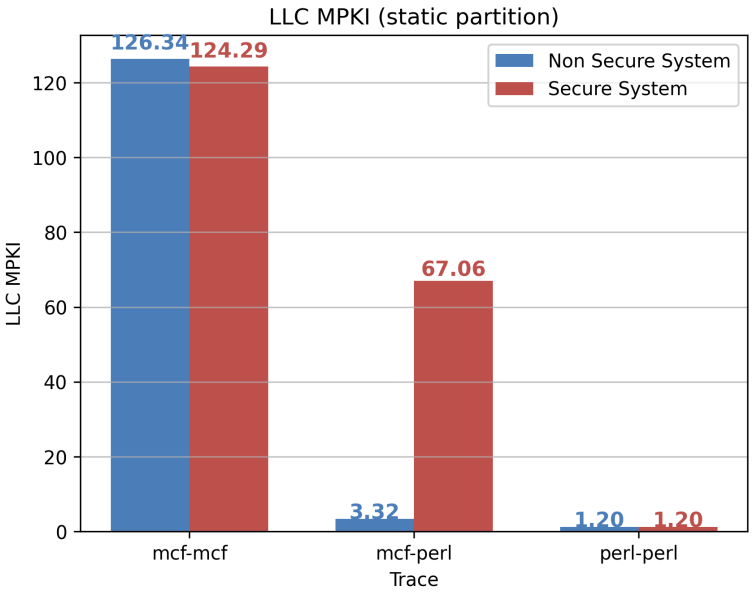
Data

Policy	Trace	IPC			MPKI			Evictions			
		Core 0	Core 1	Sum	Core 0	Core 1	Avg	Core 0	Core 1	Sum	EPKI
Static	mcf-mcf	0.11	0.1	0.21	124.11	124.46	124.29	6265117	6223081	12488198	124.88
Static	mcf-perl	0.13	0.43	0.56	132.82	1.29	67.06	6641201	186995	6828196	68.28
Static	perl-perl	0.44	0.44	0.88	1.2	1.2	1.2	60116	33436	93552	0.94

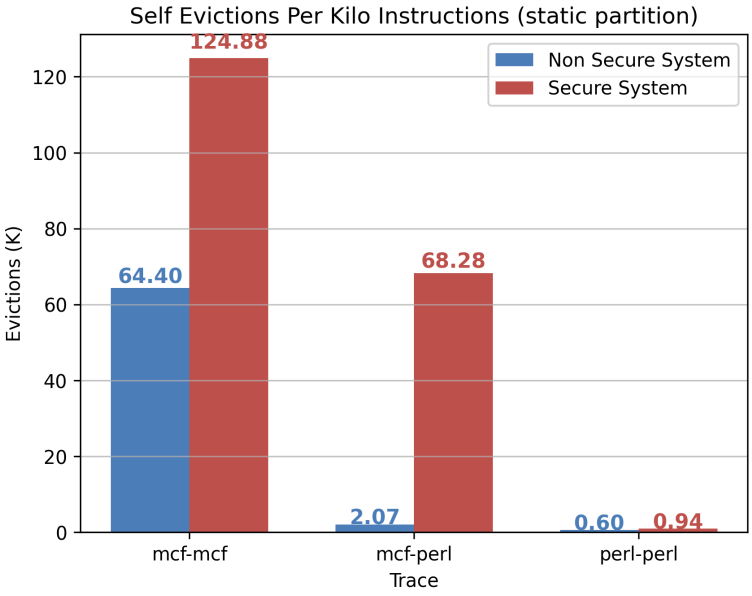
Normalized Speedup



LLC MPKI Comparison



Self-Evictions per Kilo Instructions



Task 2B: Dynamic Set Partitioning (Tumse Na Ho Payega!)

Branch Name: `Dynamic-set-partitioning`

Files Changed:

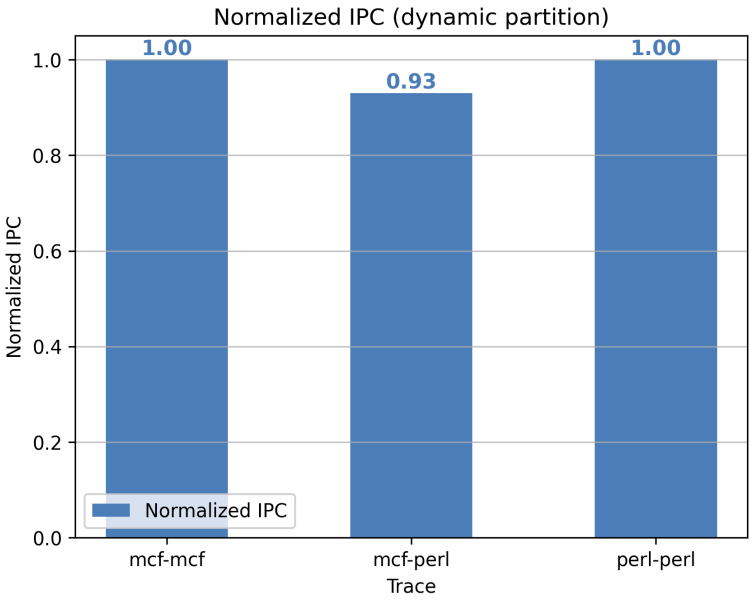
- inc/cache.h
- src/cache.cc
- src/main.cc
- src/page_table_walker.cc

Results:

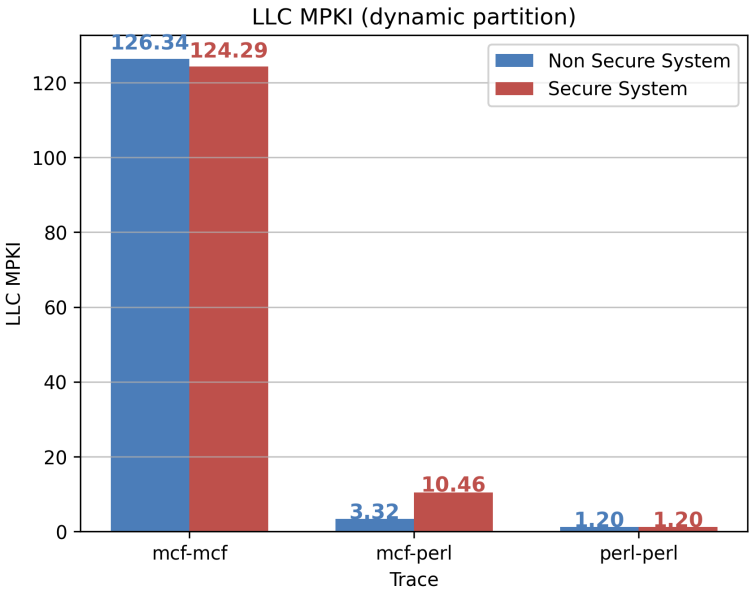
Data

Policy	Trace	IPC			MPKI			Evictions			
		Core 0	Core 1	Sum	Core 0	Core 1	Avg	Core 0	Core 1	Sum	EPKI
Dynamic	mcf-mcf	0.11	0.1	0.21	124.11	124.46	124.29	6265117	6223081	12488198	124.88
Dynamic	mcf-perl	0.27	0.43	0.7	18.89	2.02	10.46	939577	150991	1090568	10.91
Dynamic	perl-perl	0.44	0.44	0.88	1.2	1.2	1.2	60116	33436	93552	0.94

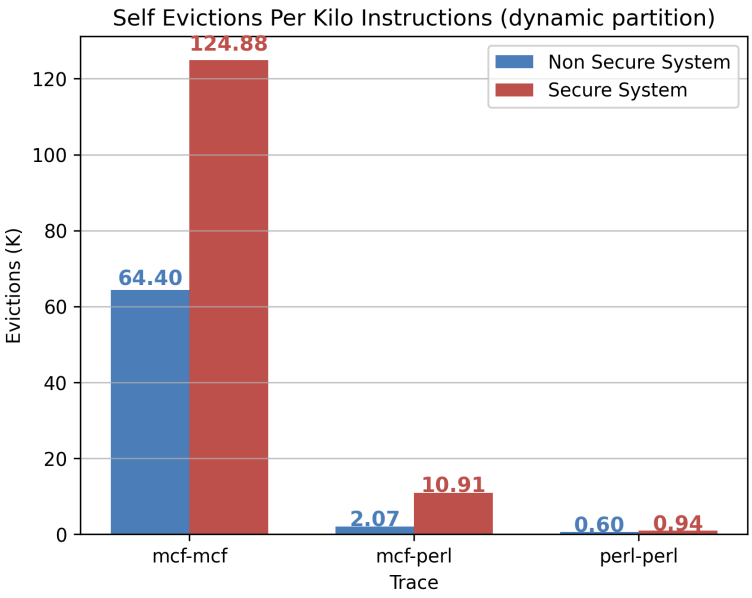
Normalized Speedup



LLC MPKI Comparison



Self-Evictions per Kilo Instructions

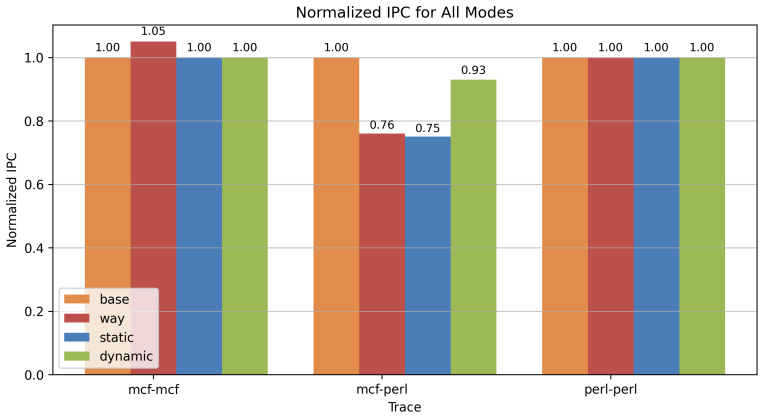


Conclusion

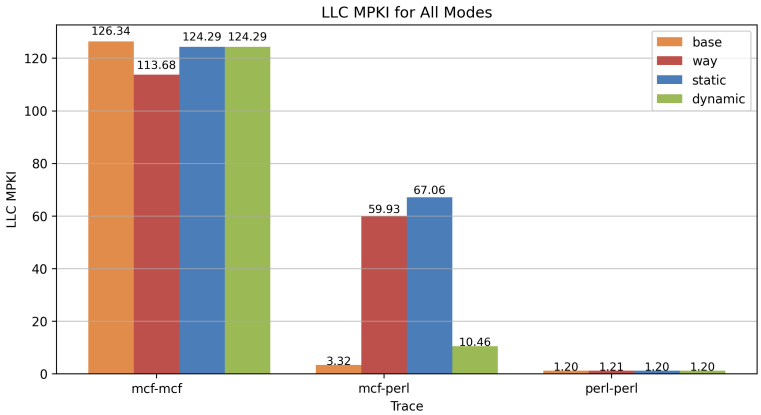
Data

Trace	Normalized IPC				LLC MPKI				Self Evictions Per Kilo Instructions			
	Base	Way	Static	Dynamic	Base	Way	Static	Dynamic	Base	Way	Static	Dynamic
mcf-mcf	1.0	1.05	1.0	1.0	126.34	113.68	124.29	124.29	64.4	113.94	124.88	124.88
mcf-perl	1.0	0.76	0.75	0.93	3.32	59.93	67.06	10.46	2.07	61.11	68.28	10.91
perl-perl	1.0	1.0	1.0	1.0	1.2	1.21	1.2	1.2	0.6	0.68	0.94	0.94

Normalized Speedup



LLC MPKI Comparison



Self-Evictions per Kilo Instructions