

9.2.0 against 9.1.1

Plutus countdown loop workload

Michael Karg, Cardano Performance team

2024-09-20

Contents

1	Manifest	2
2	Analysis	4
2.1	Resource Usage	4
2.2	Anomaly control	4
2.3	Forging	5
2.4	Individual peer propagation	5
2.5	End-to-end propagation	5
I	Appendix A: charts	6
3	Cluster performance charts	7
II	Appendix B: data dictionary	25
4	Block propagation metrics	26
5	Cluster performance metrics	28

Chapter 1

Manifest

We compare 9.2.0 (Conway) relative to 9.1.1 (Conway), under Plutus countdown loop workload.

	9.1.1	9.2.0
Analysis date	2024-09-09	2024-09-20
Cluster system start date	2024-09-08	2024-09-19
Cluster system start time	17:19:41	16:14:18
Identifier	9.1.1	9.2.0
Run batch	9.1.1	9.2.0
GHC version	8.10.7	8.10.7
cardano-node version	9.1.1	9.2.0
ouroboros-consensus version	0.20.0.0	0.20.1.0
ouroboros-network version	0.16.1.1	0.17.1.1
cardano-ledger-core version	1.13.2.0	1.14.0.0
plutus-core version	1.30.0.0	1.32.1.0
cardano-crypto version	1.1.2	1.1.2
cardano-prelude version	0.2.0.0	0.2.0.0
cardano-node git	7d4d969	341ea87
ouroboros-consensus git	68a574e	3da919f
ouroboros-network git	f22edb3	5dd745f
cardano-ledger-core git	698a24c	068c7a6
plutus-core git	bc8c3a7	f2253e6
cardano-crypto git	6568a5e	6568a5e
cardano-prelude git	273167c	273167c
Era	conway	conway
Delegation map size	1000000	1000000
Starting UTxO set size	4000000	4000000
DRep count	10000	10000
Extra tx payload	100	100
Tx inputs	1	1
Tx Outputs	1	1
TPS	0.85	0.85
Transaction count	61200	61200
Plutus script	Loop	Loop
Machines	52	52
Number of filters applied	4	4
Log text lines emitted per host	845389.78846	845384.11538
Log objects emitted per host	845359.78846	845354.11538
Log objects analysed per host	546343.82692	546292.75
Host run time, s	71869.7	71849.6
Host log line rate, Hz	11.762	11.766
Total log objects analysed	28409879	28407223
Run time, s	71875	71854
Analysed run duration, s	56034	56017
Run time efficiency	0.77	0.77
Node start spread, s	7.0049280	5.6496357
Node stop spread, s	3.4195307	3.5745745
Perf analysis start spread, s	0	0
Perf analysis stop spread, s	4	3
Slots analysed	56031	56014
Blocks analysed	2700	2728
Blocks rejected	884	875

Chapter 2

Analysis

2.1 Resource Usage

	9.1.1	9.2.0	Δ	$\Delta\%$
Forge loop starts, #	0.9989	0.99888	-0.000	0
Process CPU usage, %	6.2089	6.1258	-0.083	-1
RTS GC CPU usage, %	0.61851	0.6201	0.002	0
RTS Mutator CPU usage, %	5.5802	5.4956	-0.085	-2
Major GCs, #	0.0009	0.00091	0.000	0
Minor GCs, #	1.5902	1.5943	0.004	0
Kernel RSS, MB	9034.7	9032.5	-2.200	0
RTS heap size, MB	8981.3	8978.5	-2.800	0
RTS live GC dataset, MB	3412.4	3601.5	189.100	6
RTS alloc rate, MB/s	48.81	48.915	0.105	0
Filesystem reads, KB/s	0.0	2e-05	0.000	nan
Filesystem writes, KB/s	209.63	212.35	2.720	1
CPU 85% spans, slots	11.93	11.703	-0.227	-2
Sample count	(291>)	(291>)		

2.2 Anomaly control

	9.1.1	9.2.0	Δ	$\Delta\%$
Blocks per host, blocks	70.961	71.442	0.481	1
Filtered to chained block ratio, /	0.75246	0.75691	0.004	1
Chained to forged block ratio, /	0.97136	0.96986	-0.002	0
Height & slot battles, blocks	0.00074	0.00036	-0.000	0
Block size, B	2996.0	2996.0	0.000	0
Sample count	(52)	(52)		

2.3 Forging

	9.1.1	9.2.0	Δ	$\Delta\%$
Started forge loop iteration, s	0.0015	0.00083	-0.001	-67
Acquired block context, s	0.02339	0.02284	-0.001	-4
Acquired ledger state, s	6e-05	6e-05	0.000	0
Acquired ledger view, s	2e-05	2e-05	0.000	0
Leadership check duration, s	0.0004	0.00041	0.000	0
Ledger ticking, s	0.02465	0.0259	0.001	4
Mempool snapshotting, s	0.07001	0.07192	0.002	3
Leadership to forged, s	0.00046	0.00046	0.000	0
Forged to announced, s	0.00057	0.00058	0.000	0
Forged to sending, s	0.0055	0.00554	0.000	0
Forged to self-adopted, s	0.0602	0.06061	0.000	0
Slot start to announced, s	0.1211	0.12305	0.002	2
Sample count	(2700)	(2728)		

2.4 Individual peer propagation

	9.1.1	9.2.0	Δ	$\Delta\%$
First peer notice, s	0.12295	0.12527	0.002	2
First peer fetch, s	0.1286	0.13196	0.003	2
Notice to fetch request, s	0.00122	0.00121	-0.000	0
Fetch duration, s	0.1244	0.12345	-0.001	-1
Fetches to announced, s	1e-05	2e-05	0.000	0
Fetches to sending, s	0.04292	0.04255	-0.000	0
Fetches to adopted, s	0.05838	0.06008	0.002	3
Sample count	(2700)	(2728)		

2.5 End-to-end propagation

	9.1.1	9.2.0	Δ	$\Delta\%$
0.50 adoption, s	0.39728	0.40009	0.003	1
0.80 adoption, s	0.55639	0.55943	0.003	1
0.90 adoption, s	0.5677	0.57228	0.005	1
0.92 adoption, s	0.57022	0.5763	0.006	1
0.94 adoption, s	0.57281	0.57955	0.007	1
0.96 adoption, s	0.57641	0.58373	0.007	1
0.98 adoption, s	0.58352	0.58885	0.005	1
1.00 adoption, s	0.6122	0.61958	0.007	1
Sample count	(2700)	(2728)		

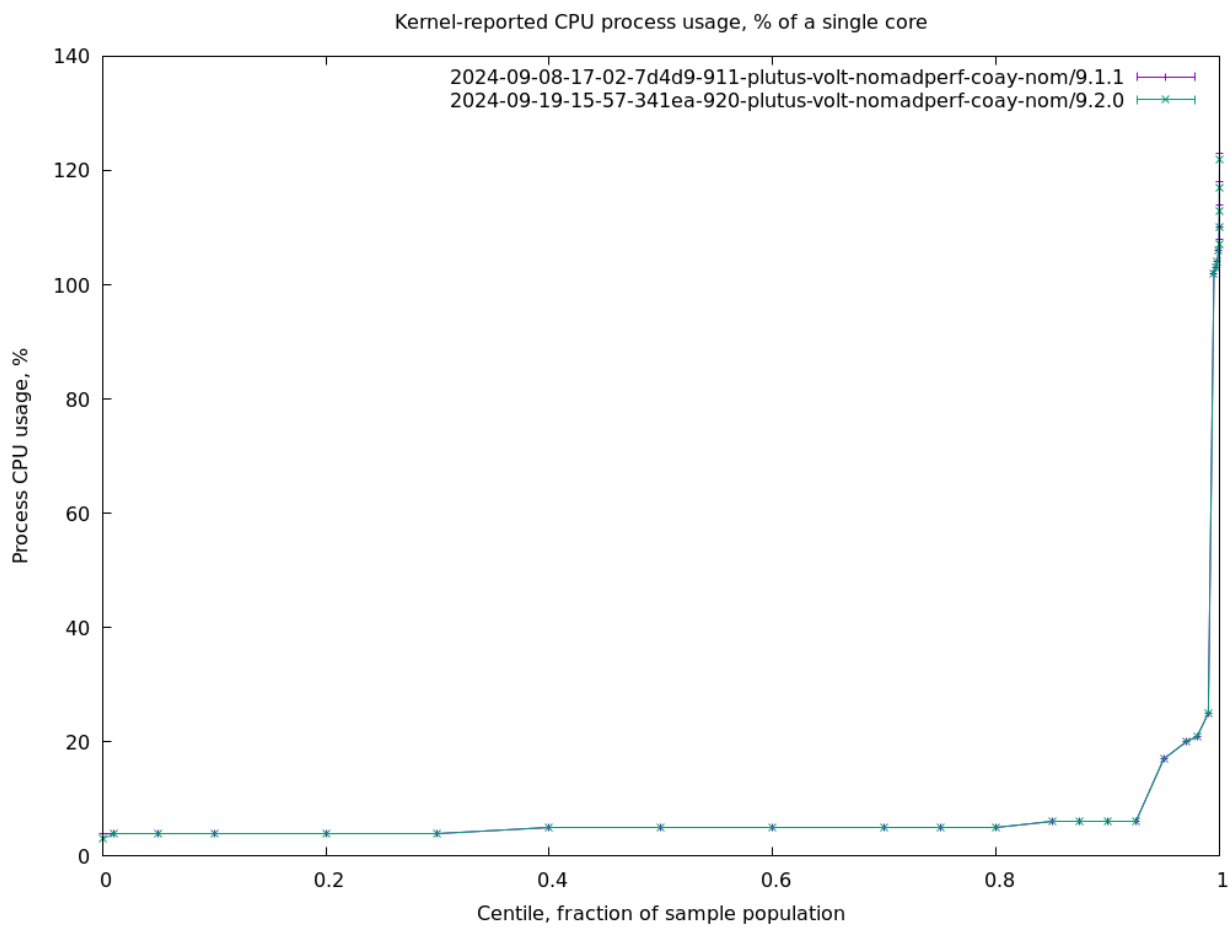
Part I

Appendix A: charts

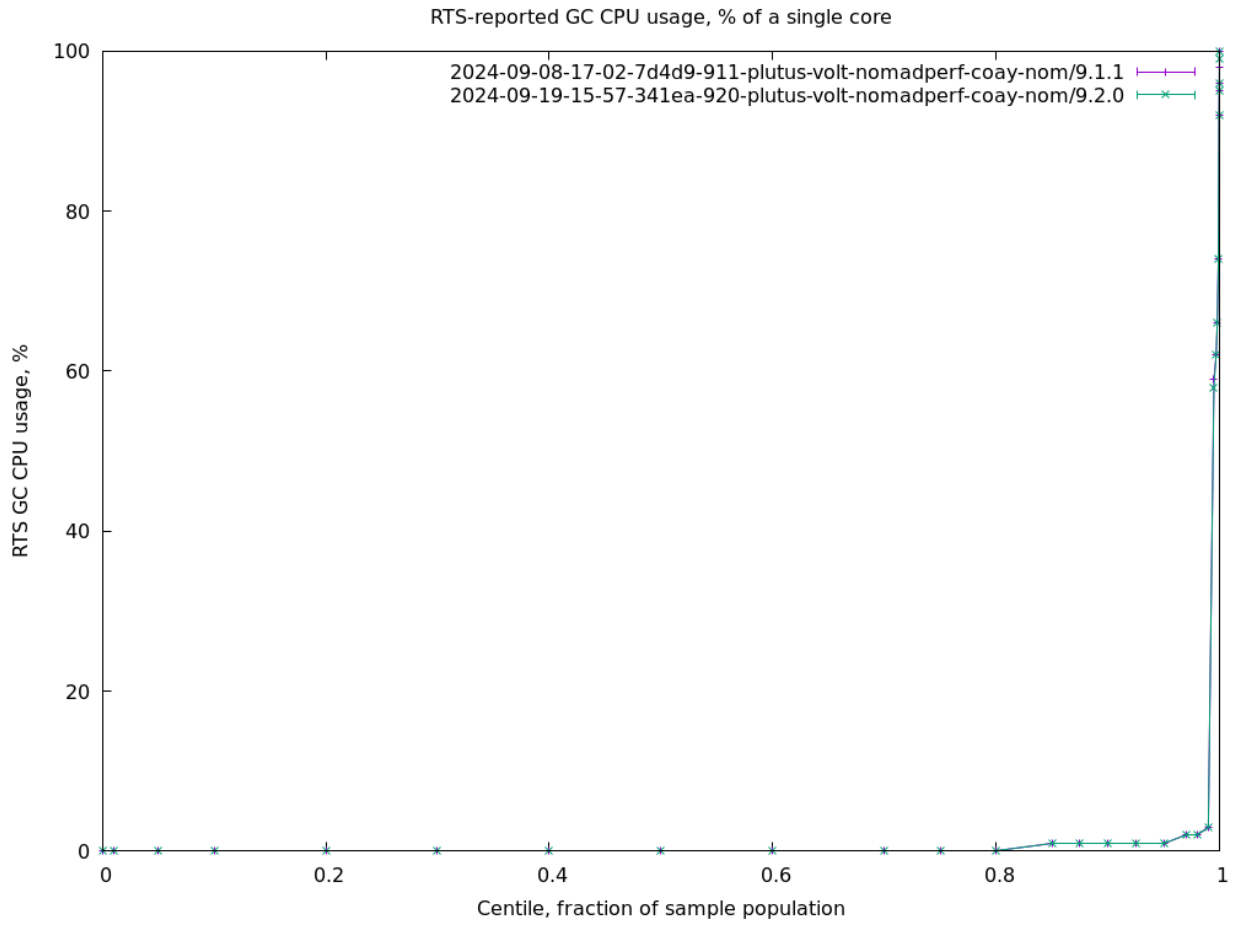
Chapter 3

Cluster performance charts

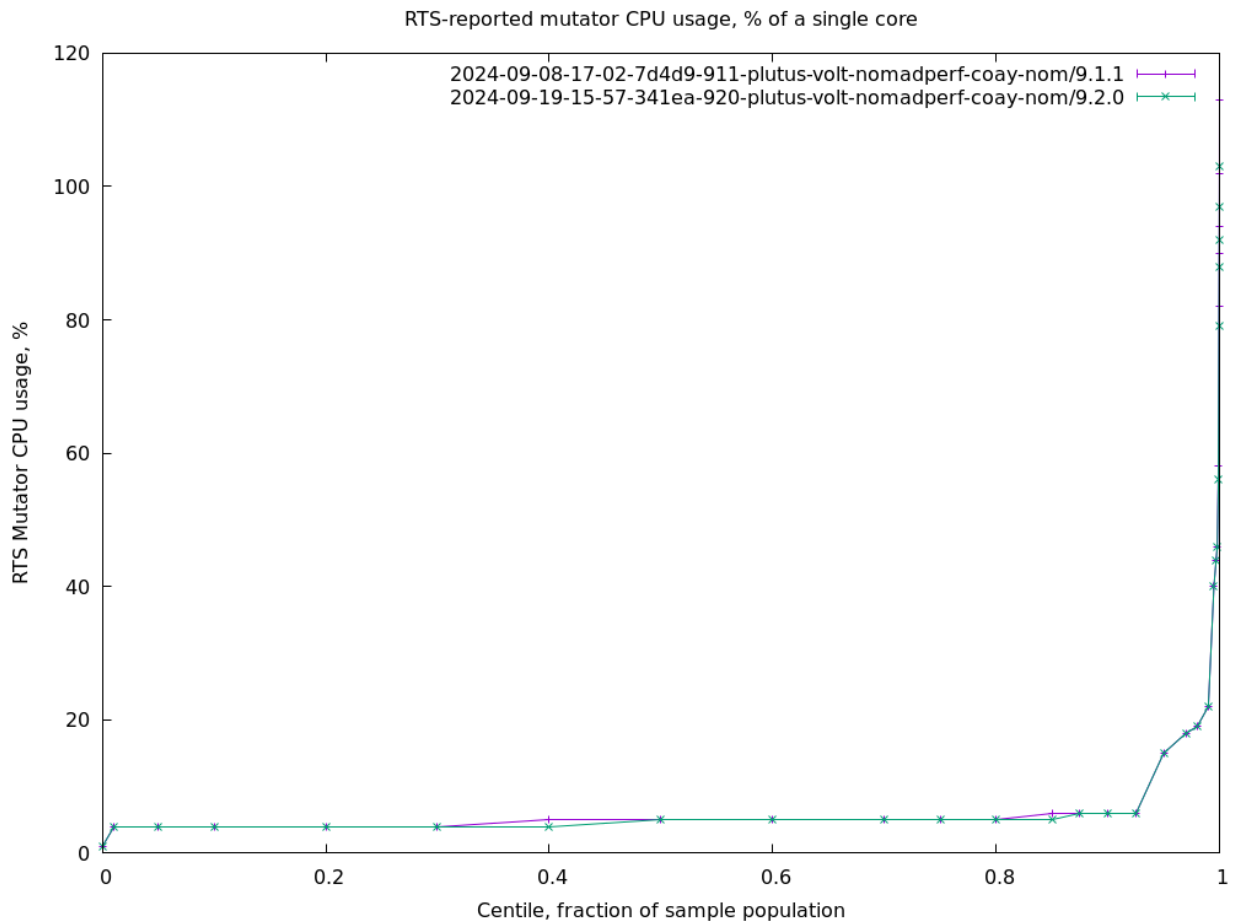
Process CPU usage (CentiCpu) Kernel-reported CPU process usage, % of a single core



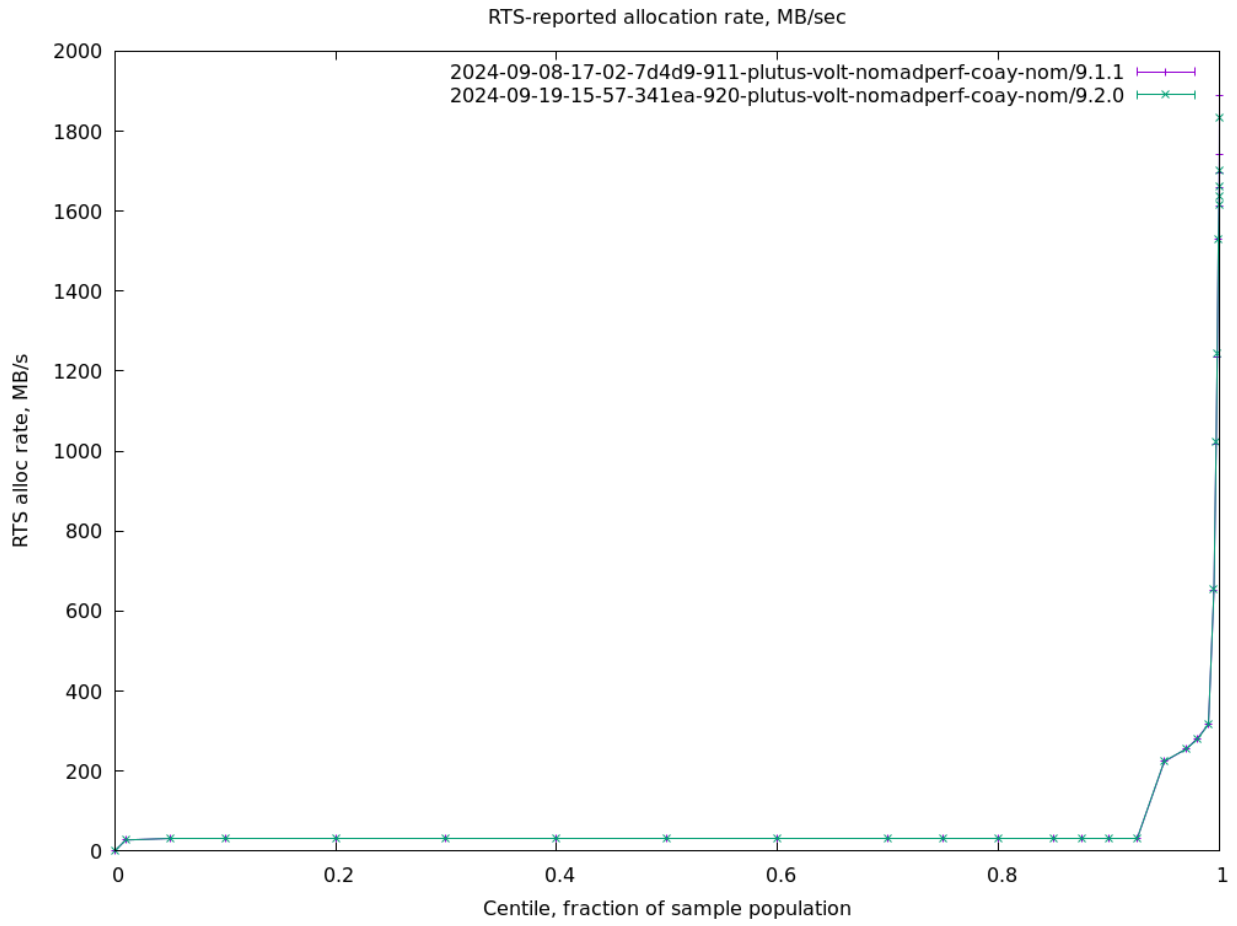
RTS GC CPU usage (CentiGC) RTS-reported GC CPU usage, % of a single core



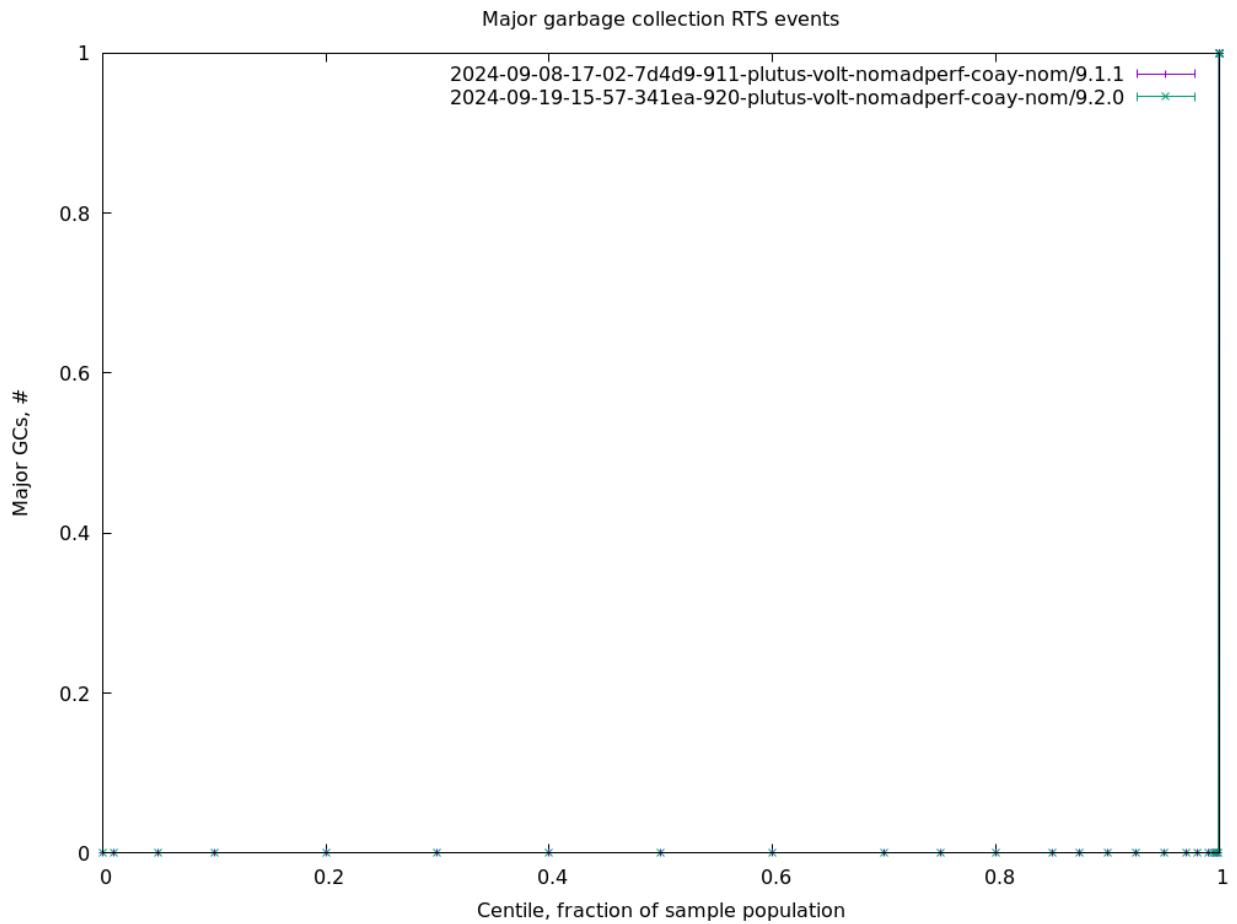
RTS Mutator CPU usage (CentiMut) RTS-reported mutator CPU usage, % of a single core



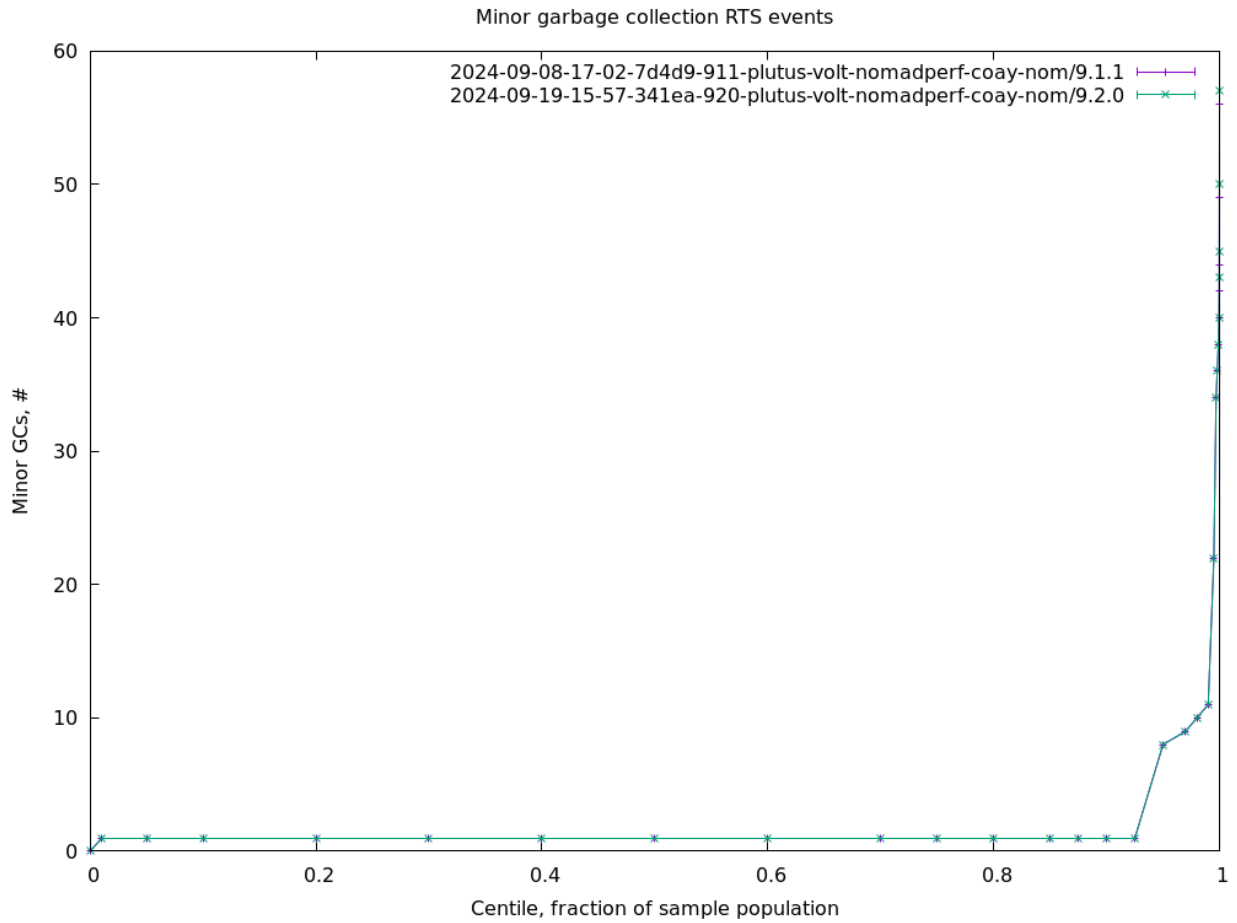
RTS alloc rate (Alloc) RTS-reported allocation rate, MB/sec



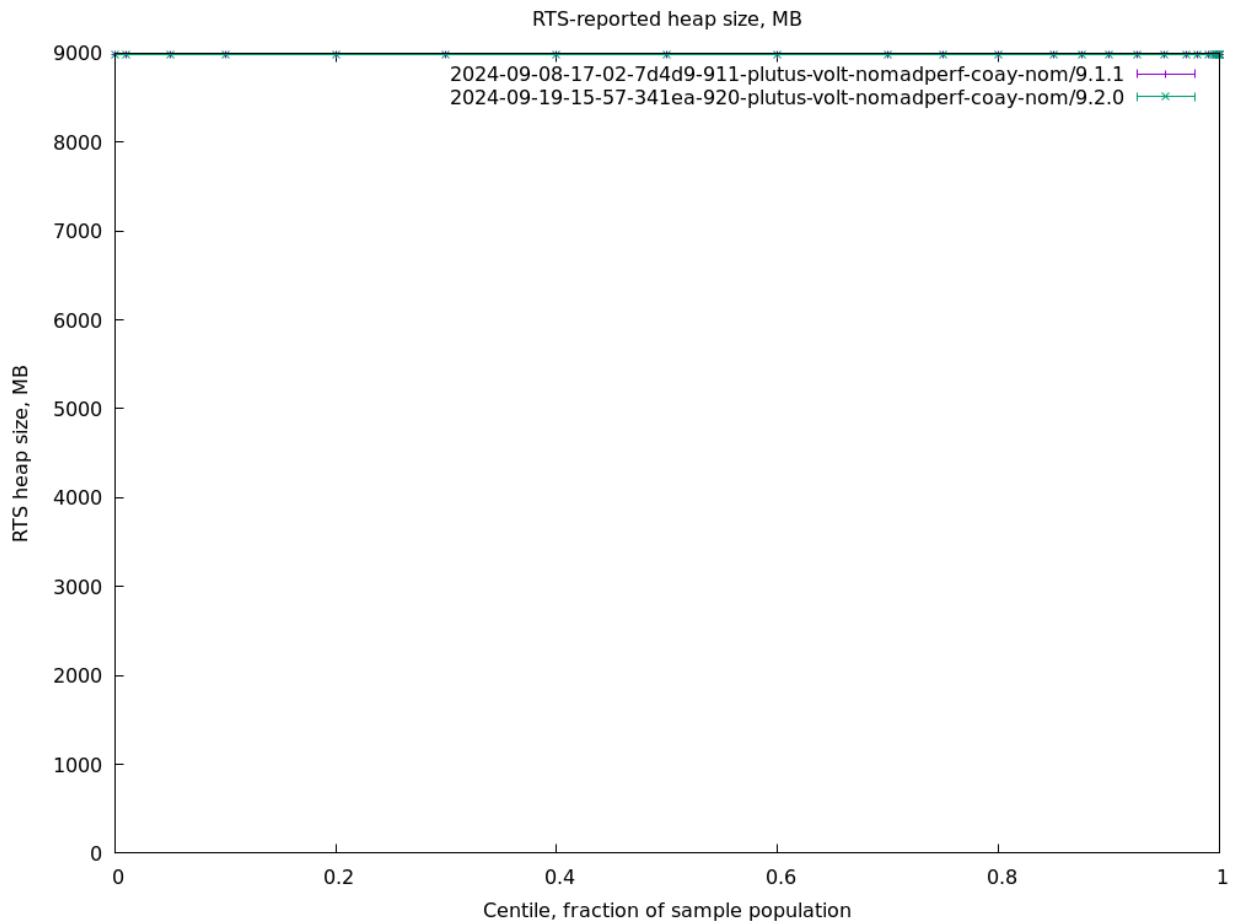
Major GCs (GcsMajor) Major garbage collection RTS events



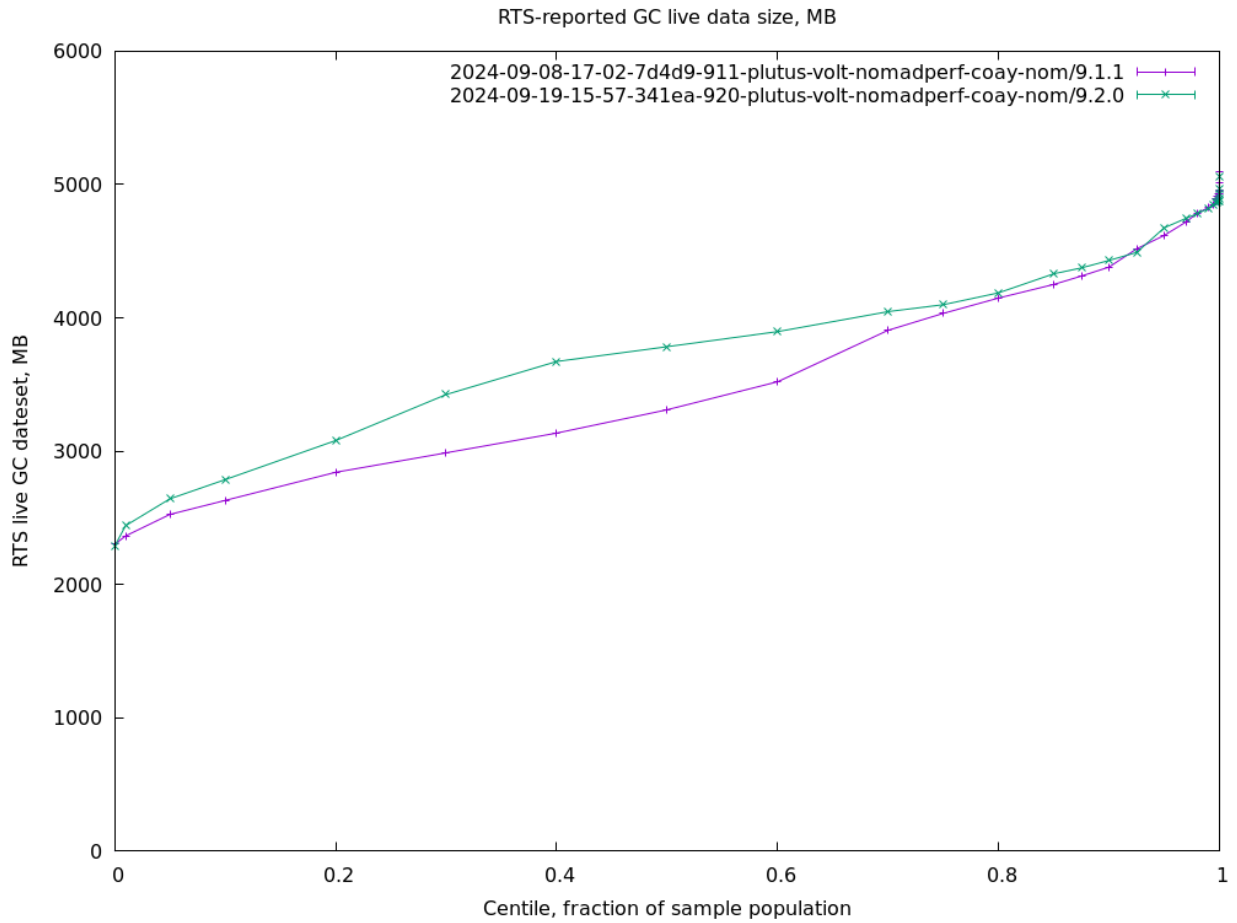
Minor GCs (GcsMinor) Minor garbage collection RTS events



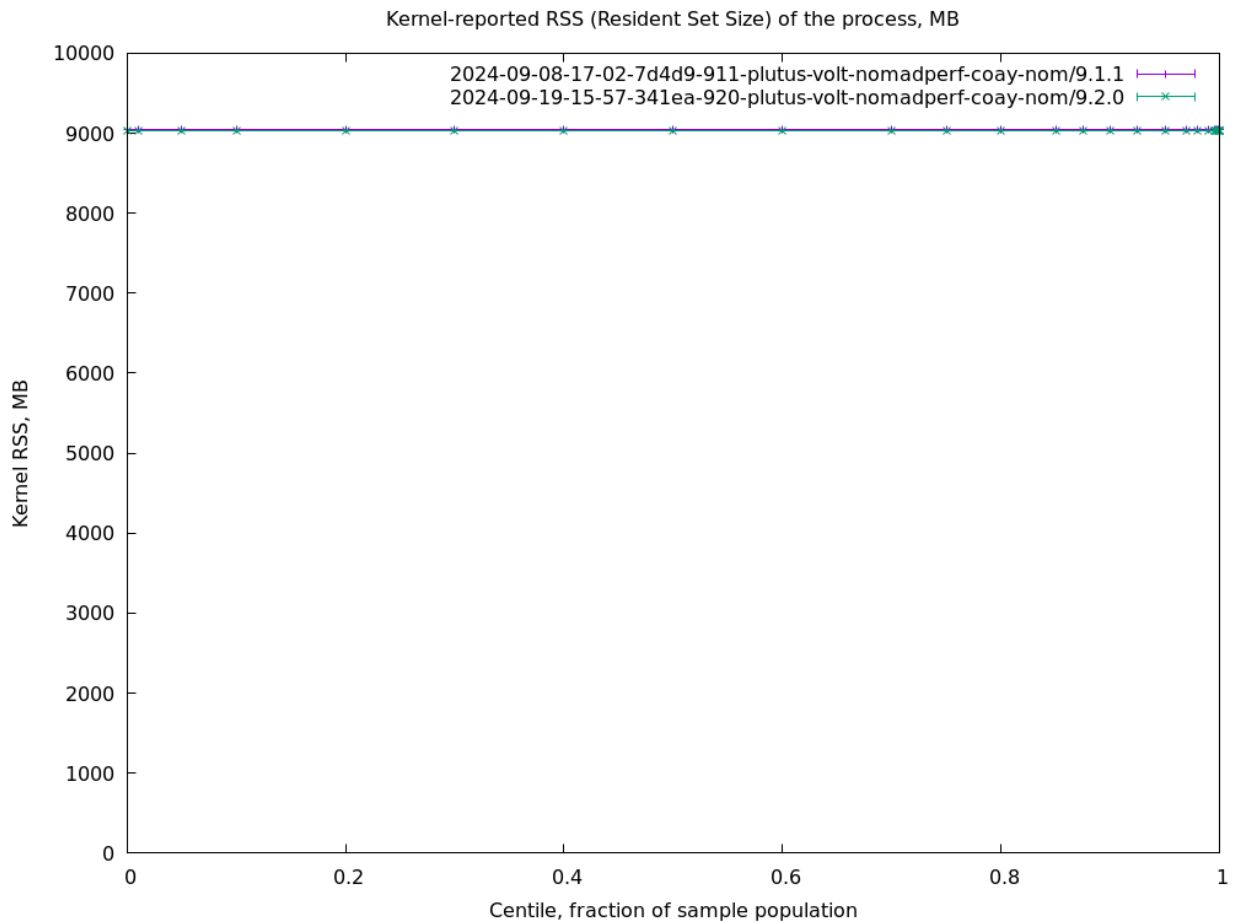
RTS heap size (Heap) RTS-reported heap size, MB



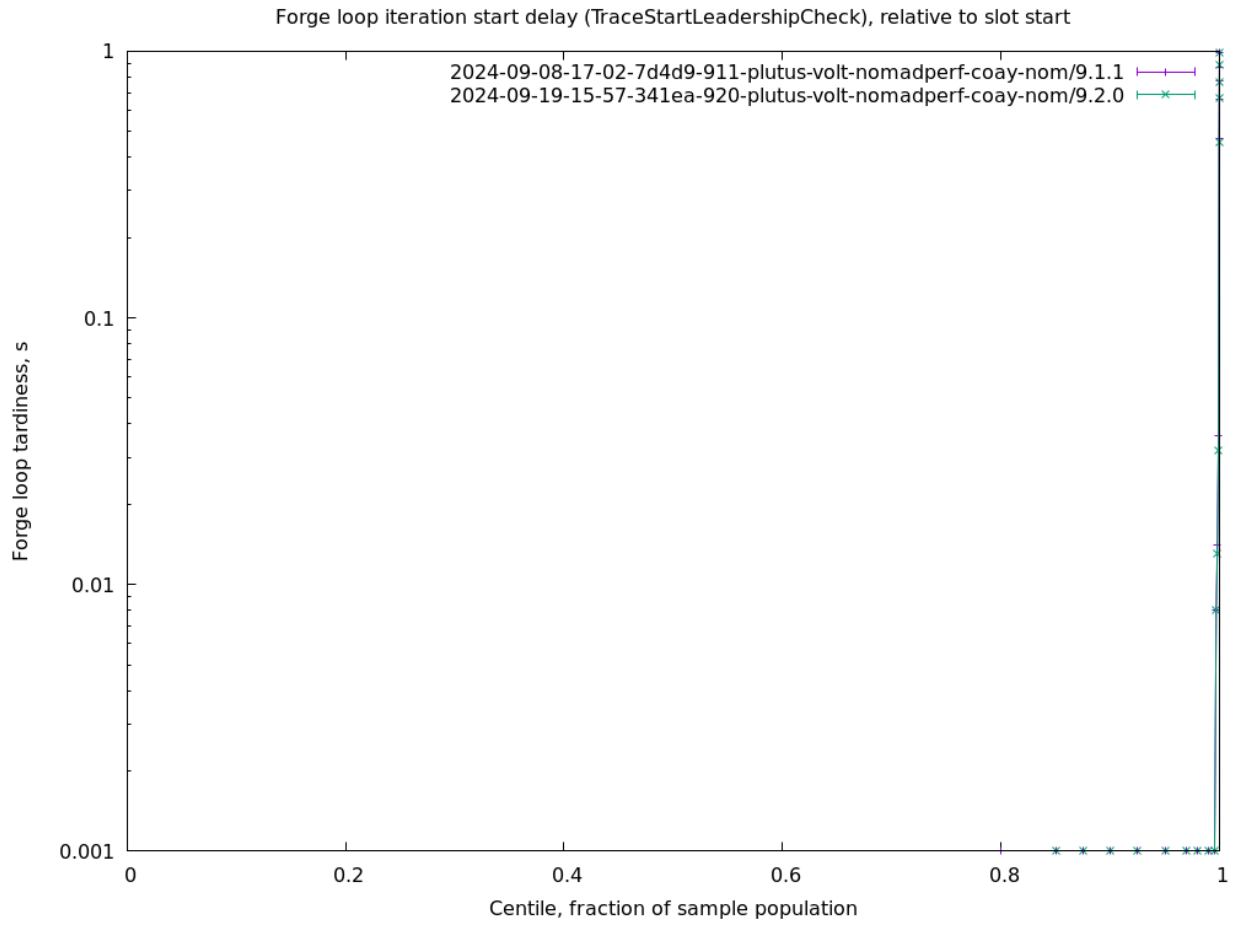
RTS live GC dataset (Live) RTS-reported GC live data size, MB



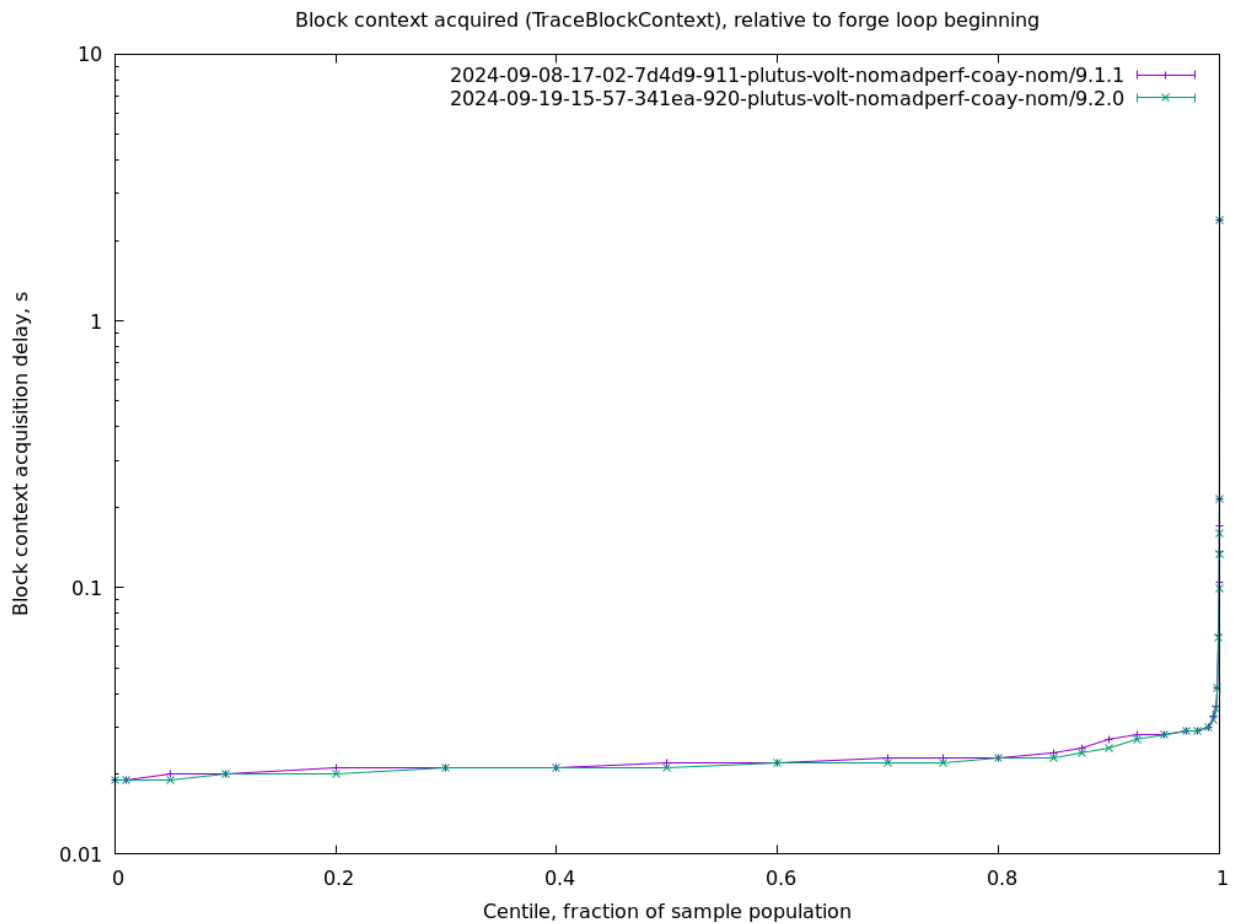
Kernel RSS (RSS) Kernel-reported RSS (Resident Set Size) of the process, MB



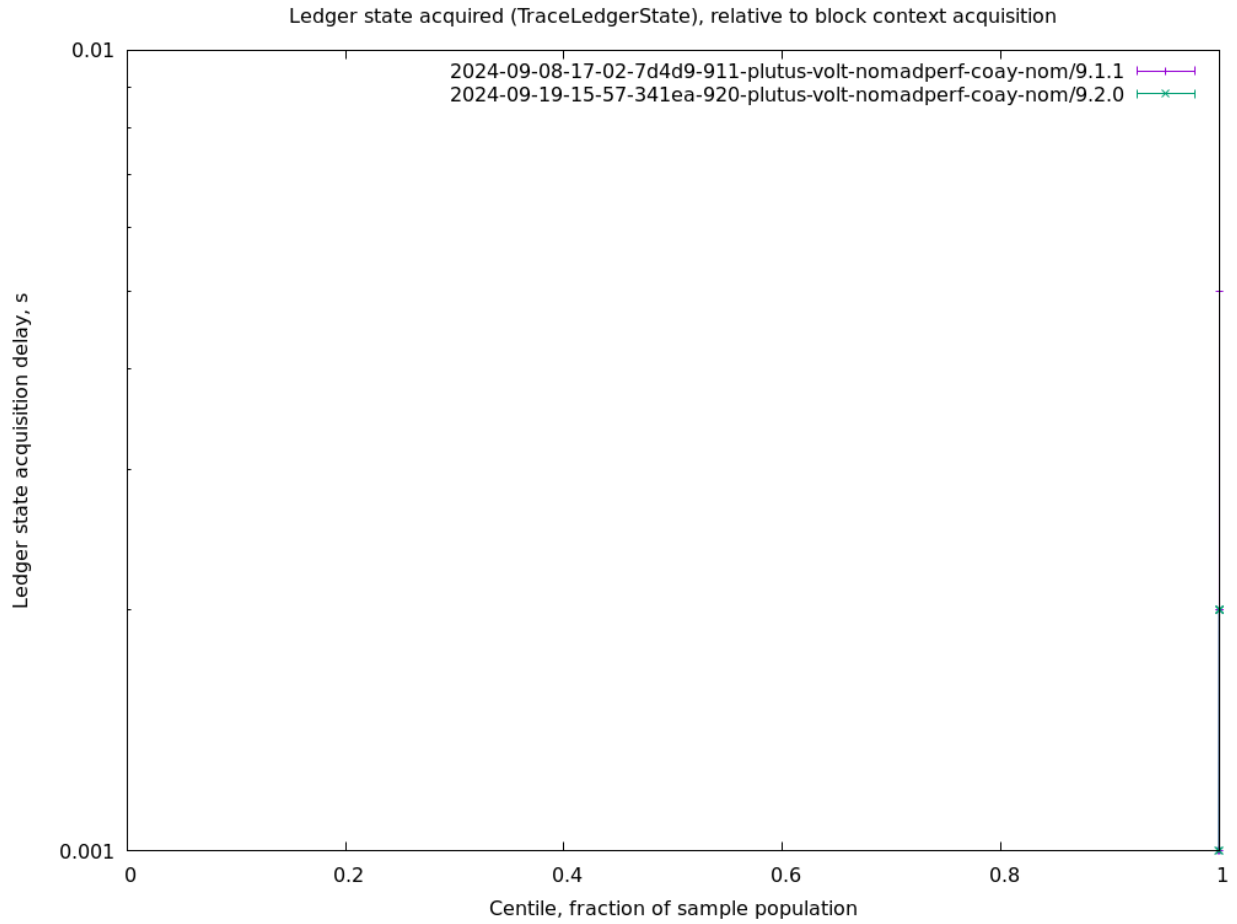
Forge loop tardiness (cdfStarted) Forge loop iteration start delay (TraceStartLeadershipCheck), relative to slot start



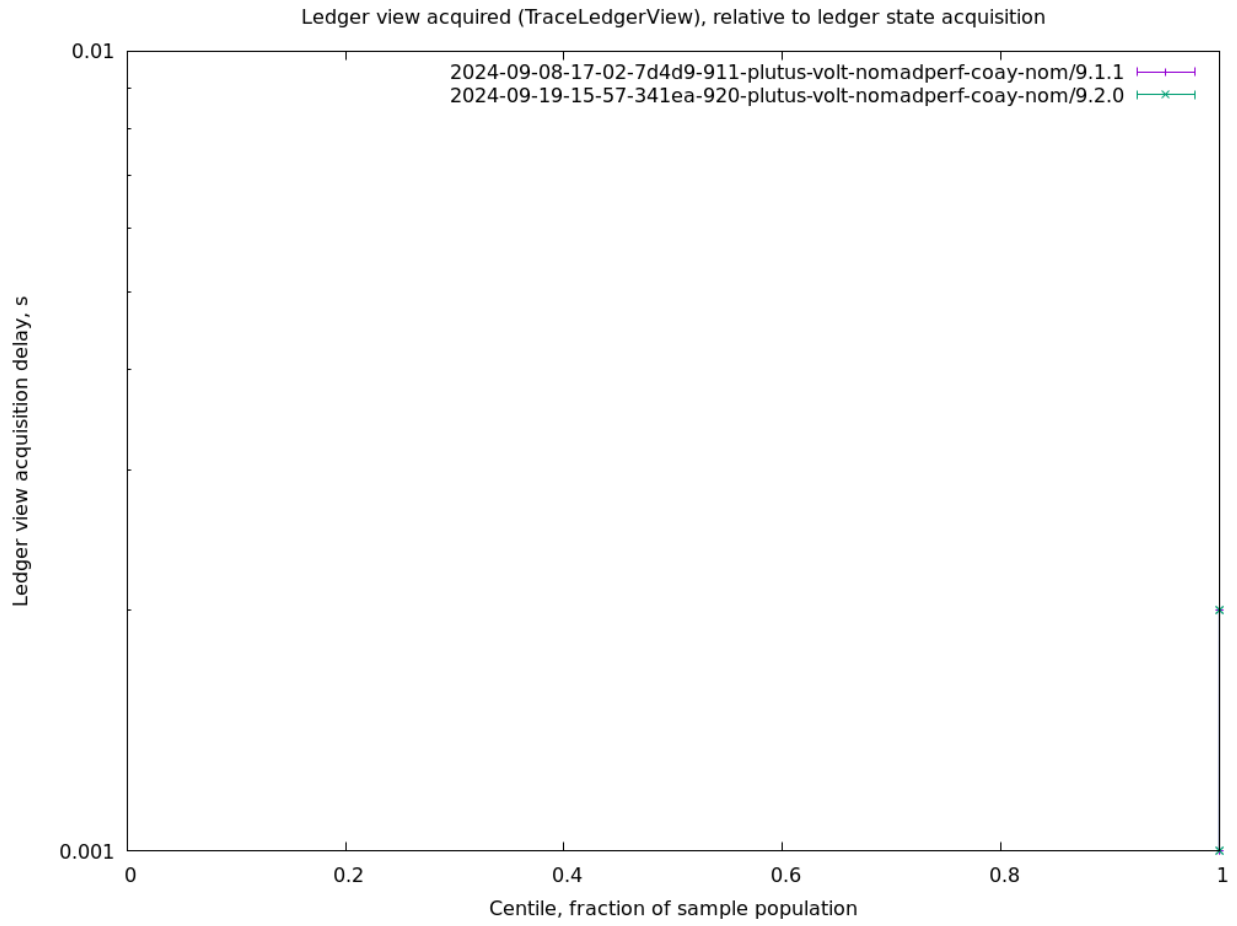
Block context acquisition delay (cdfBlkCtx) Block context acquired (TraceBlockContext), relative to forge loop beginning



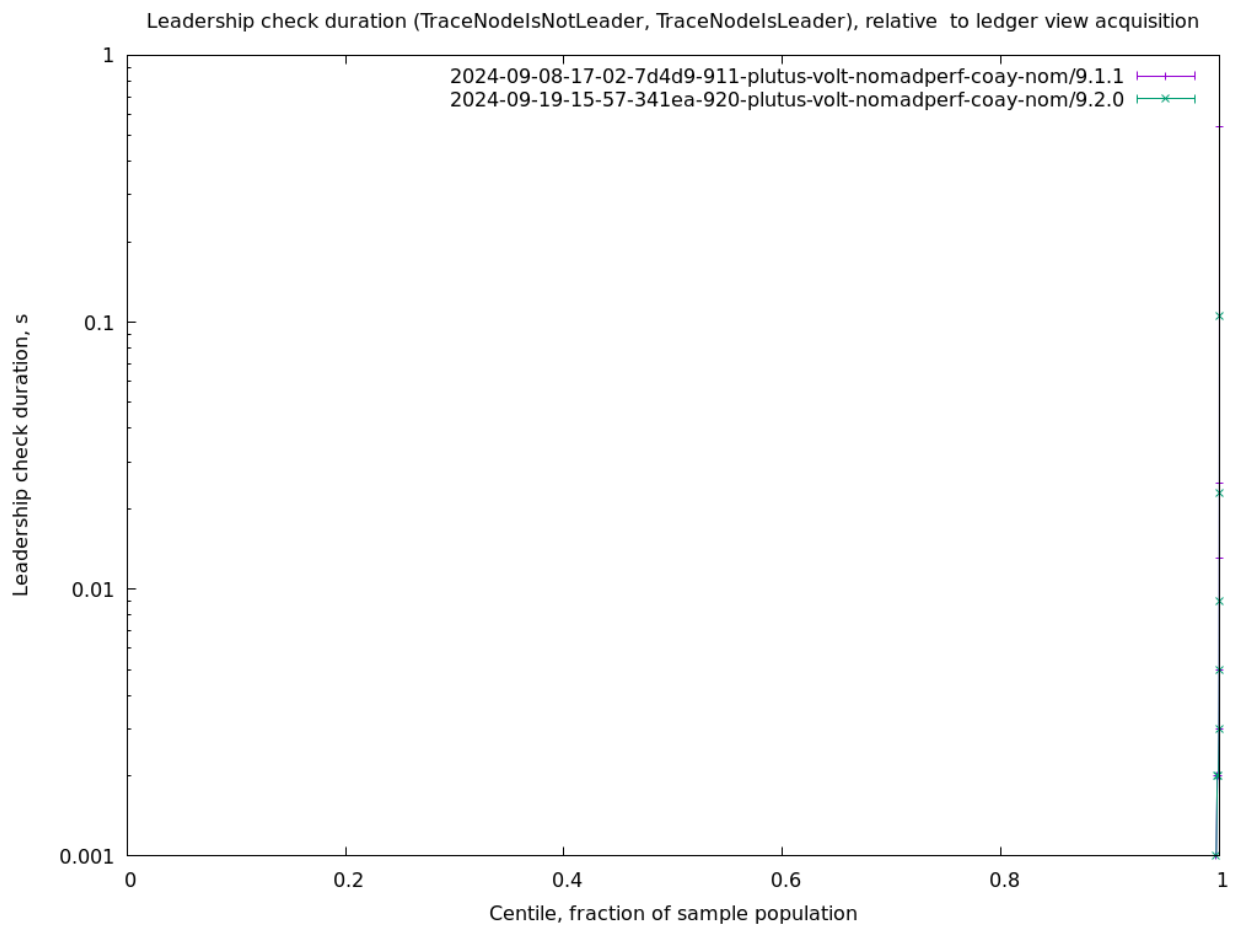
Ledger state acquisition delay (cdfLgrState) Ledger state acquired (TraceLedgerState), relative to block context acquisition



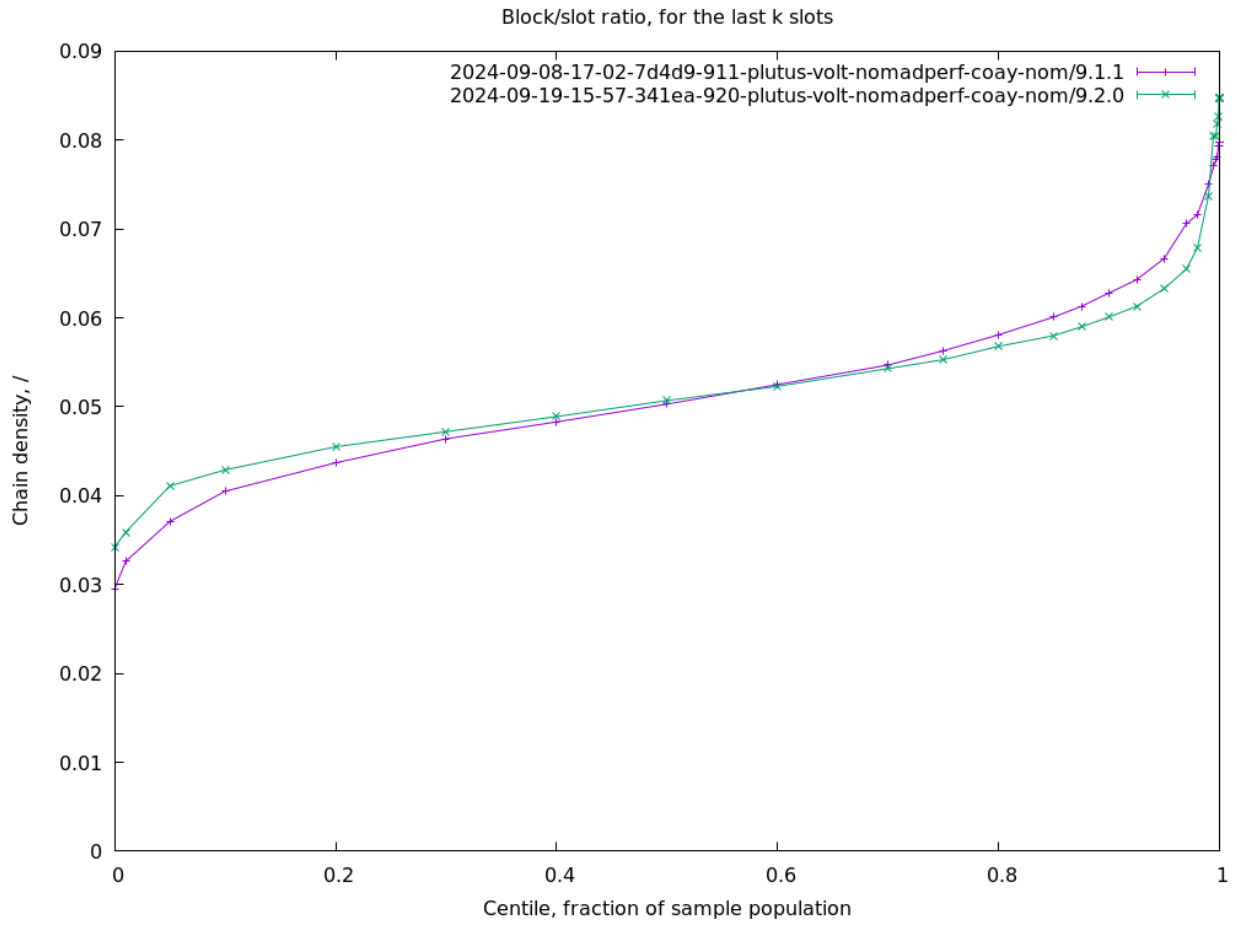
Ledger view acquisition delay (cdfLgrView) Ledger view acquired (TraceLedgerView), relative to ledger state acquisition



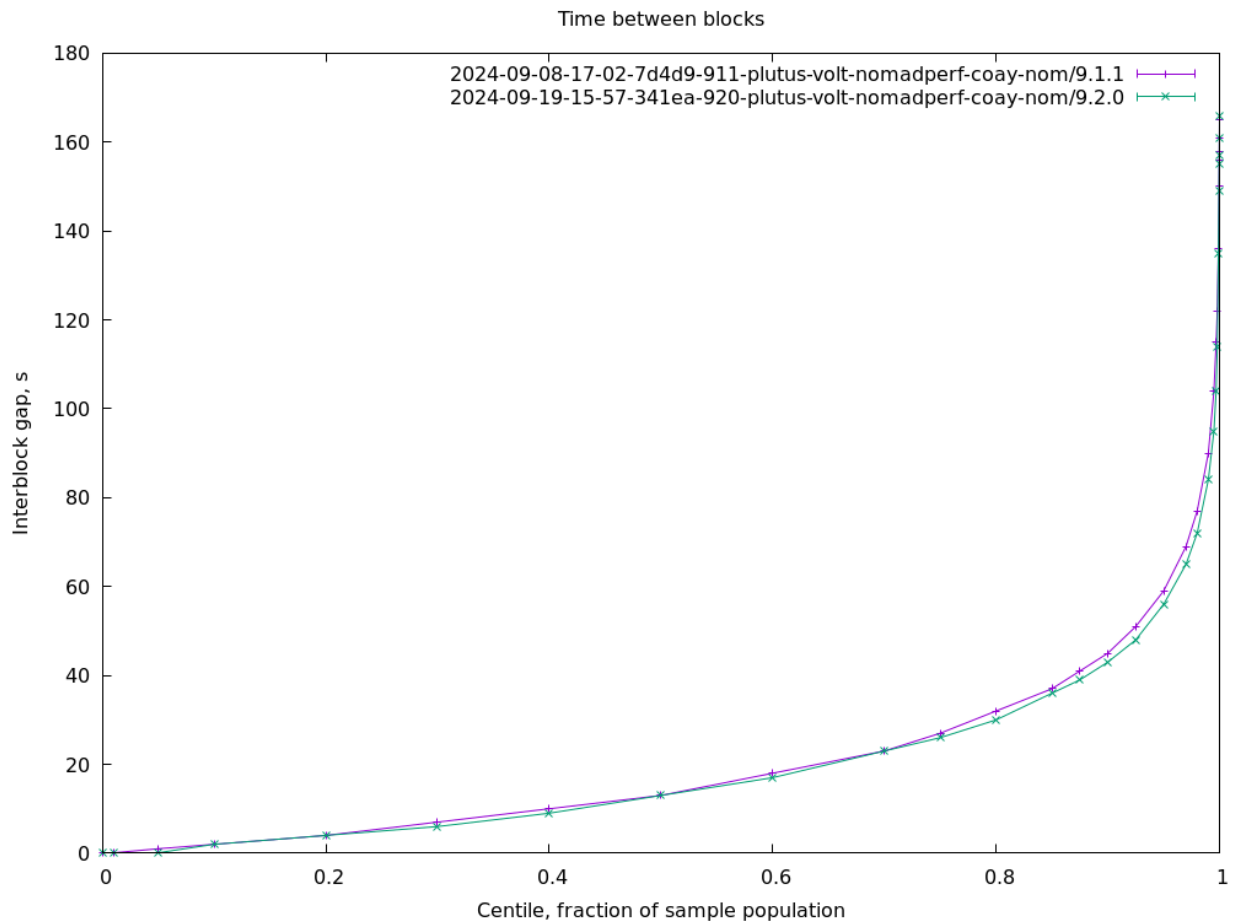
Leadership check duration (cdfLeading) Leadership check duration (TraceNodeIsNotLeader, TraceNodeIsLeader), relative to ledger view acquisition



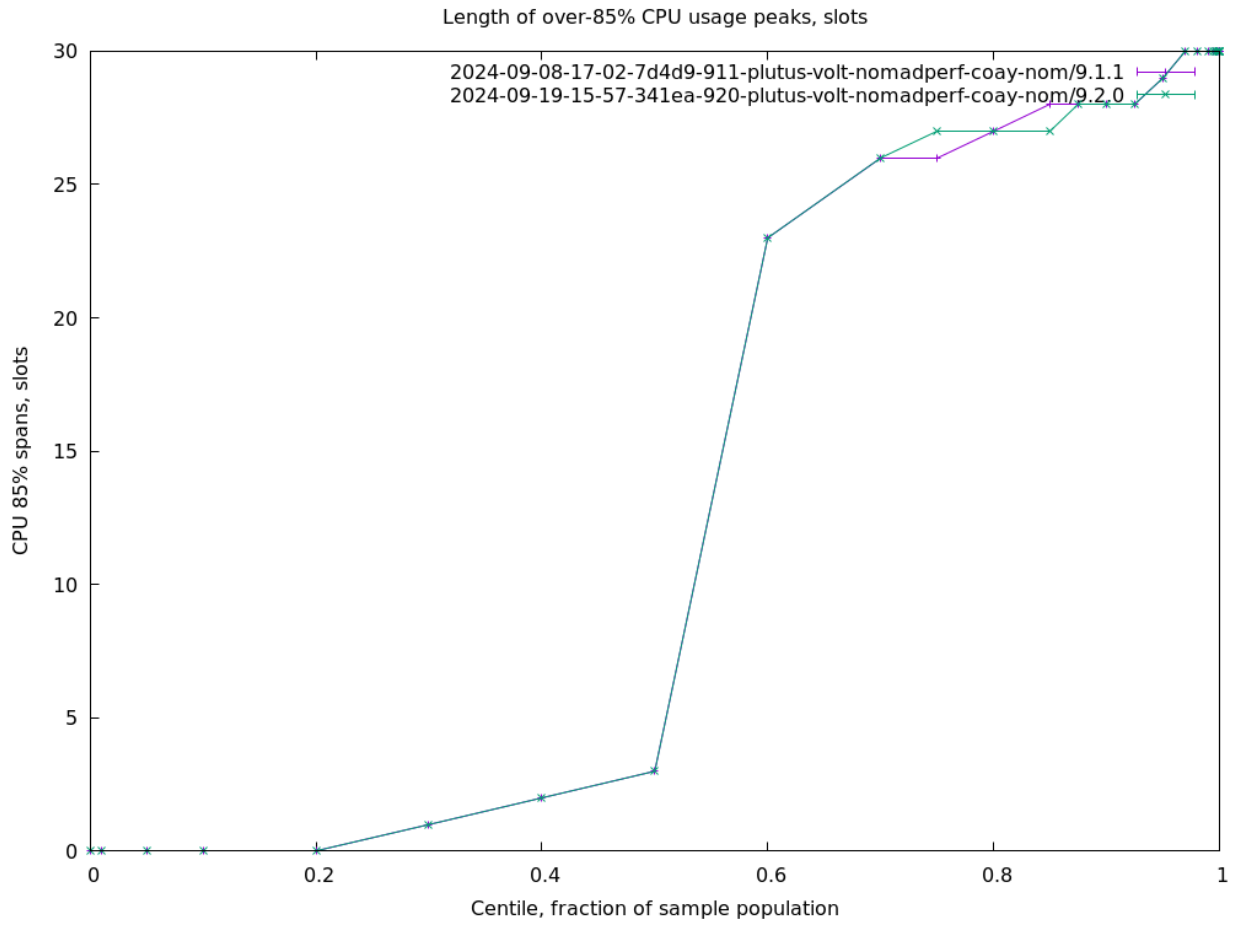
Chain density (cdfDensity) Block/slot ratio, for the last 'k' slots



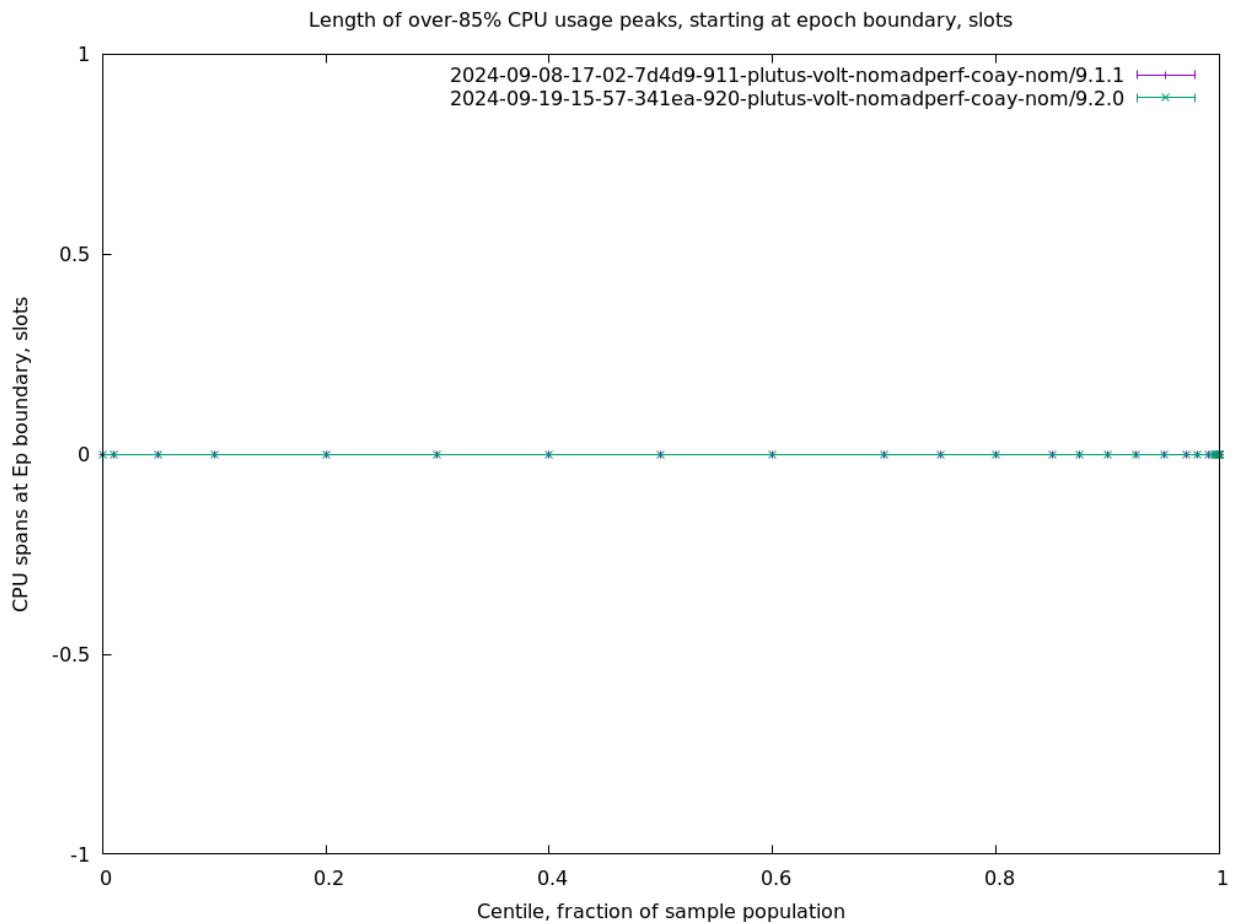
Interblock gap (cdfBlockGap) Time between blocks



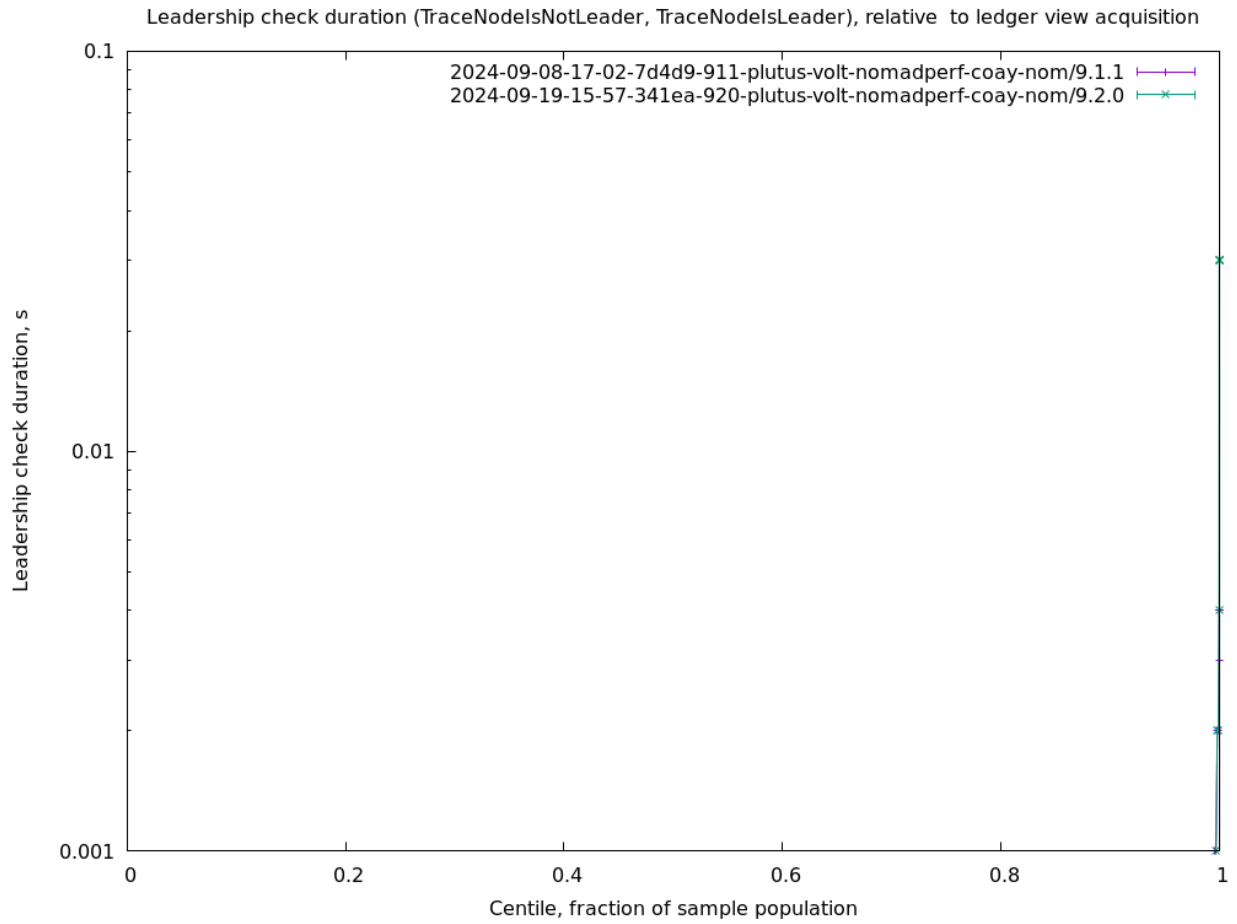
CPU 85% spans (cdfSpanLensCpu) Length of over-85% CPU usage peaks, slots



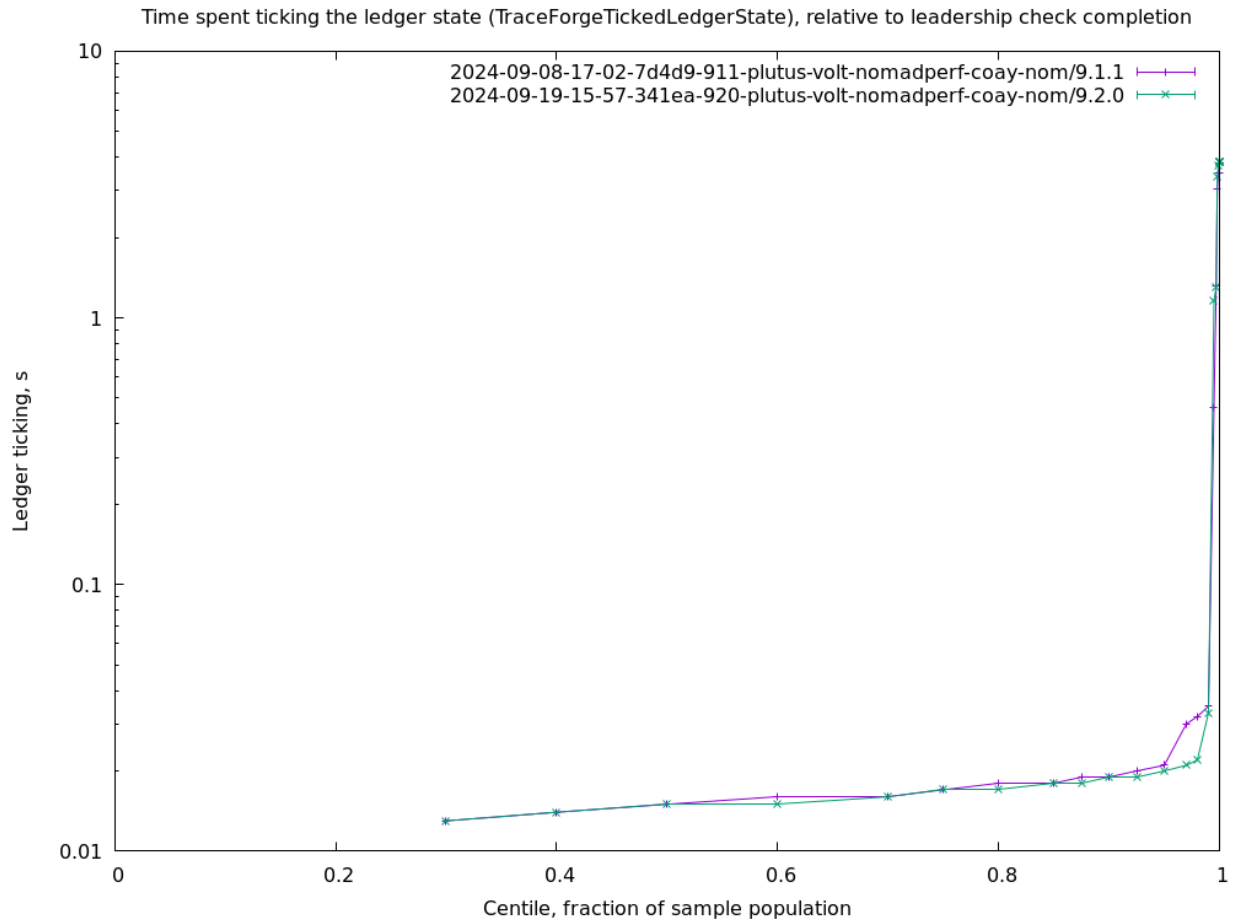
CPU spans at Ep boundary (cdfSpanLensCpuEpoch) Length of over-85% CPU usage peaks, starting at epoch boundary, slots



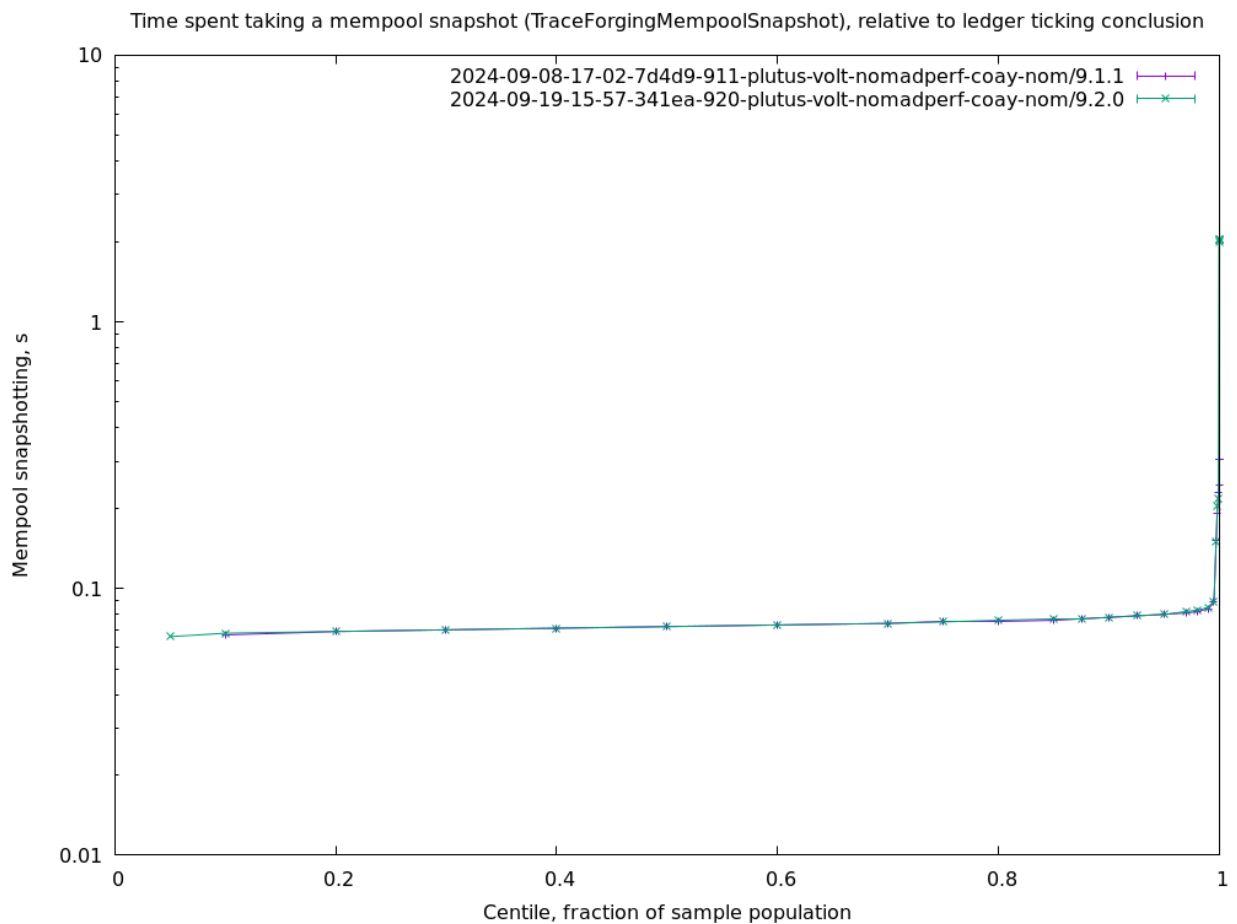
Leadership check duration (cdfForgerLead) Leadership check duration (TraceNodeIsNotLeader, TraceNodeIsLeader), relative to ledger view acquisition



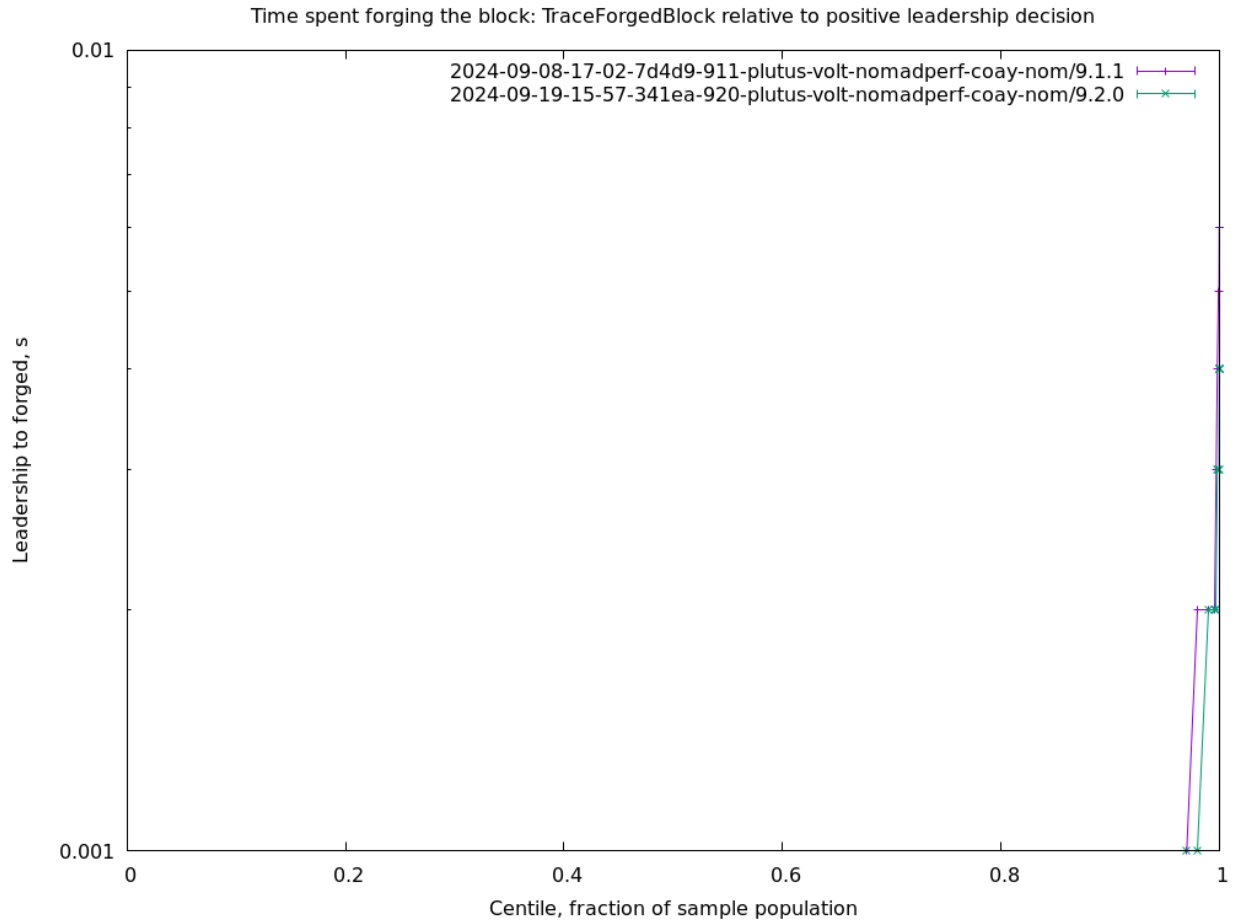
Ledger ticking (cdfForgerTicked) Time spent ticking the ledger state (TraceForgeTickedLedgerState), relative to leadership check completion



Mempool snapshotting (cdfForgerMemSnap) Time spent taking a mempool snapshot (TraceForgingMempoolSnapshot), relative to ledger ticking conclusion

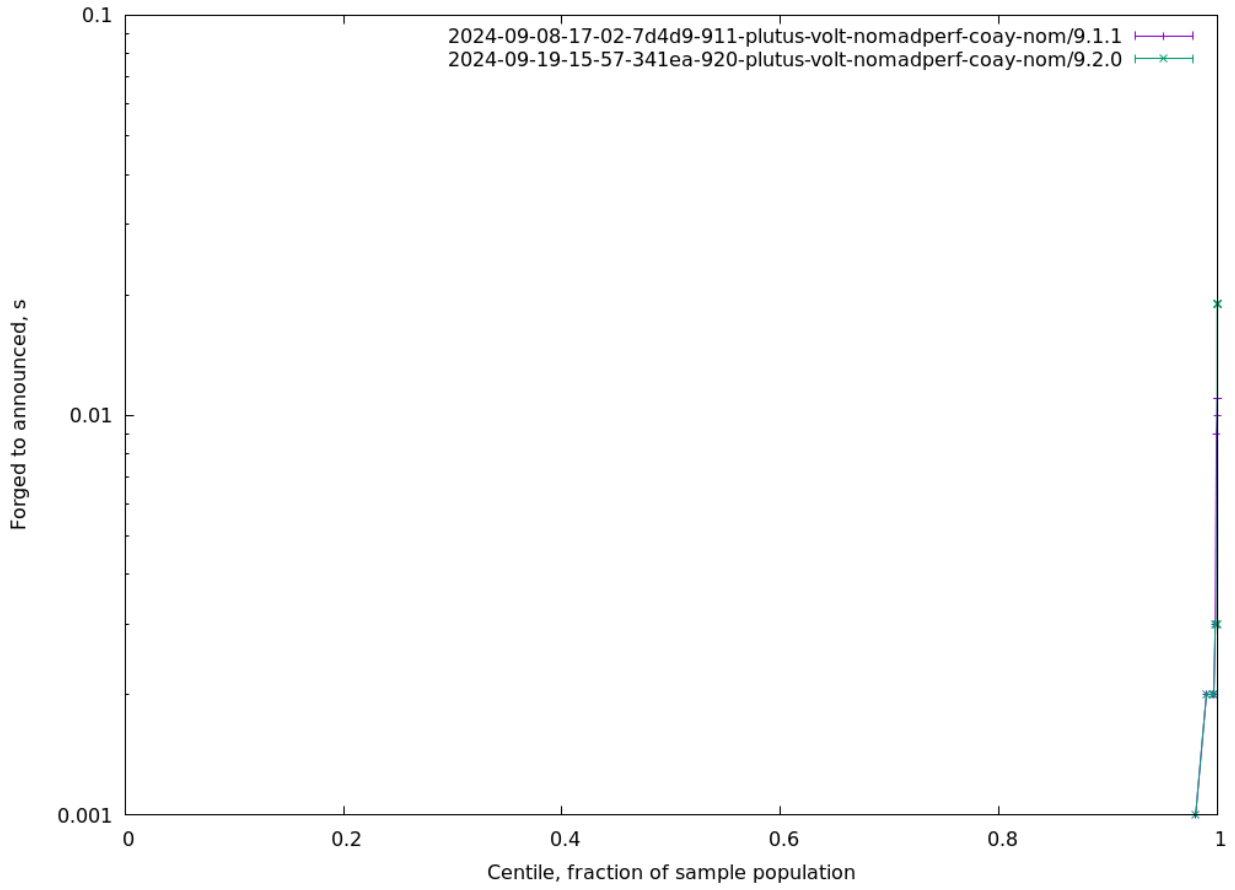


Leadership to forged (cdfForgerForge) Time spent forging the block: TraceForgedBlock relative to positive leadership decision



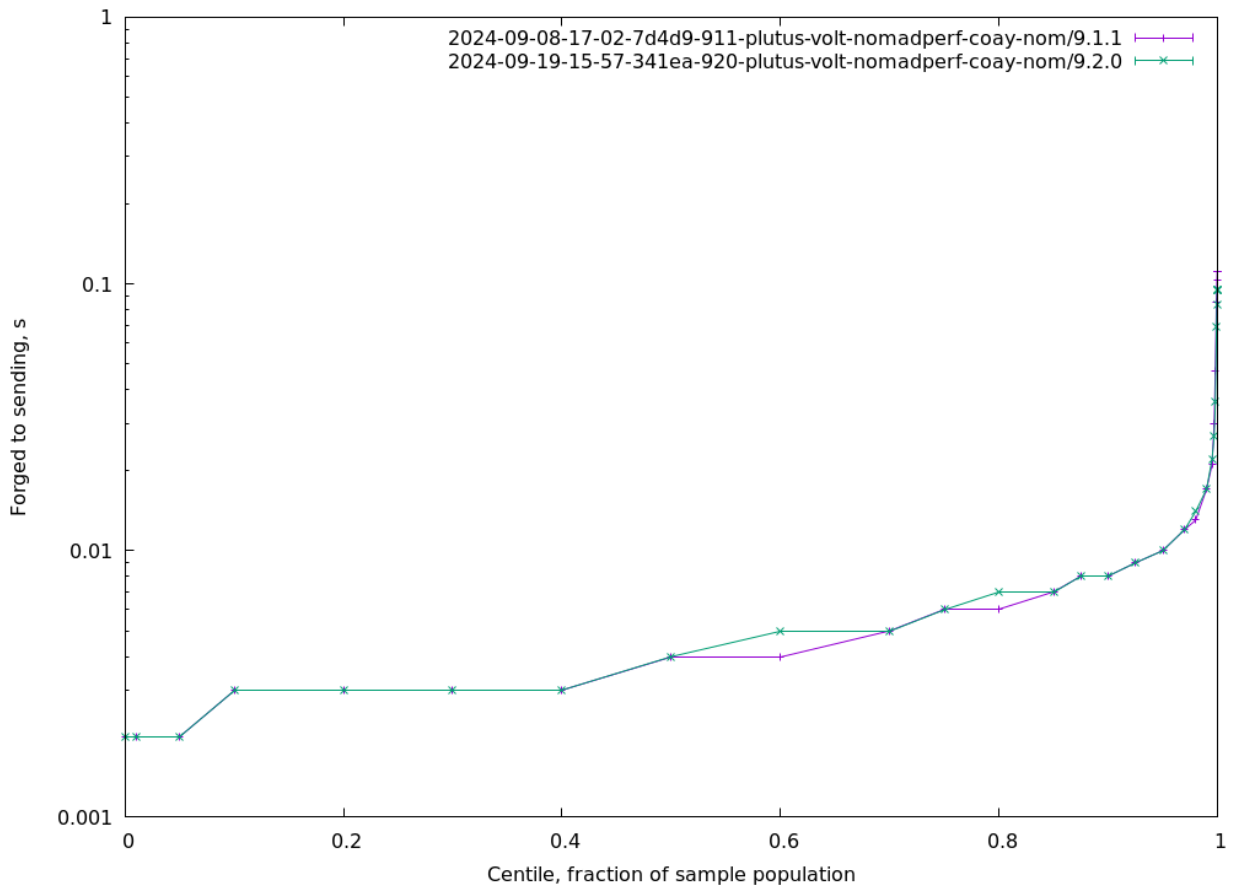
Forged to announced (cdfForgerAnnounce) Time between block forging completion and header announcement (ChainSyncServerEvent.TraceChainSyncServerRead.AddBlock)

Time between block forging completion and header announcement (ChainSyncServerEvent.TraceChainSyncServerRead.Add)

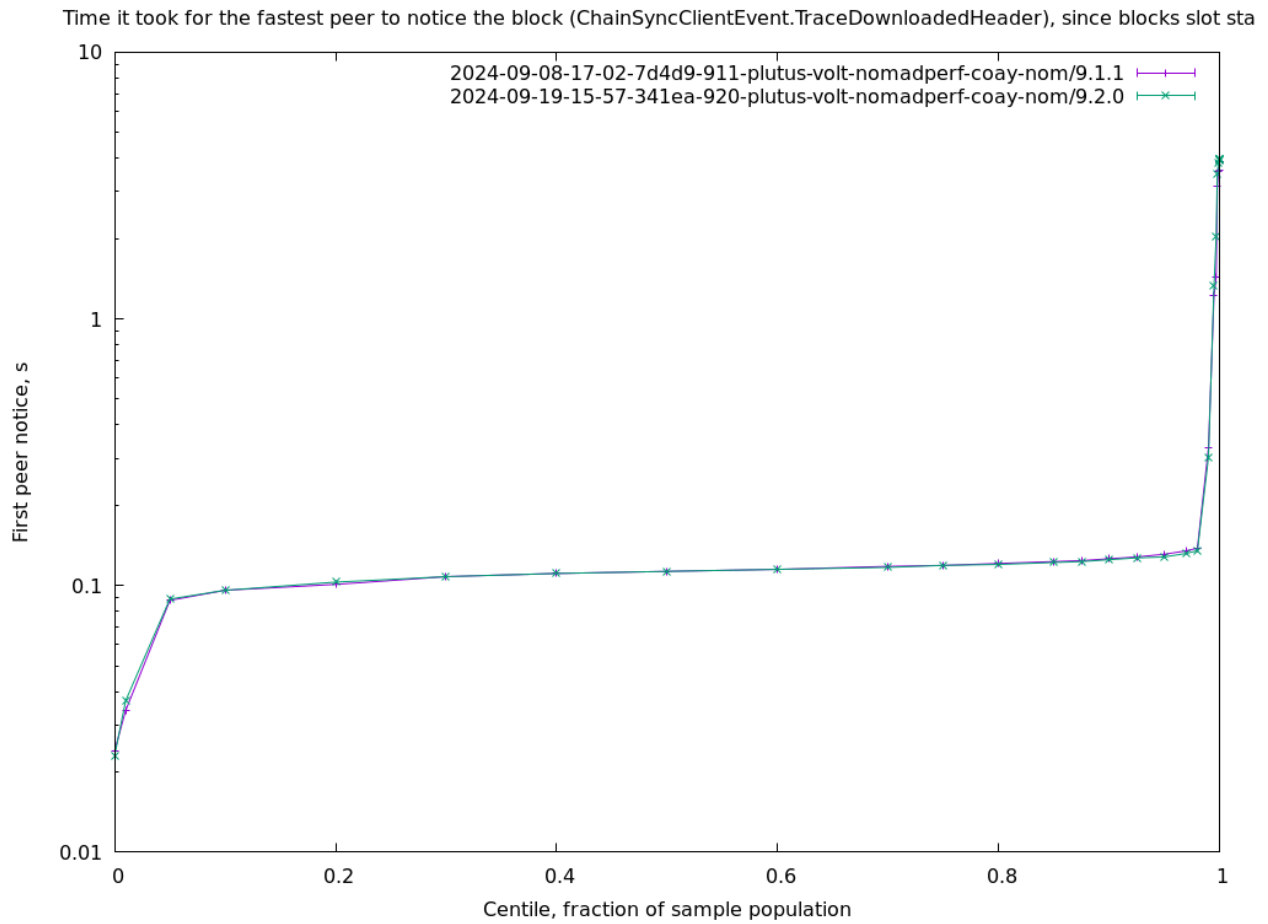


Forged to sending (cdfForgerSend) Time between block forging completion and begin-of-sending (TraceBlockFetchServerSendBlock)

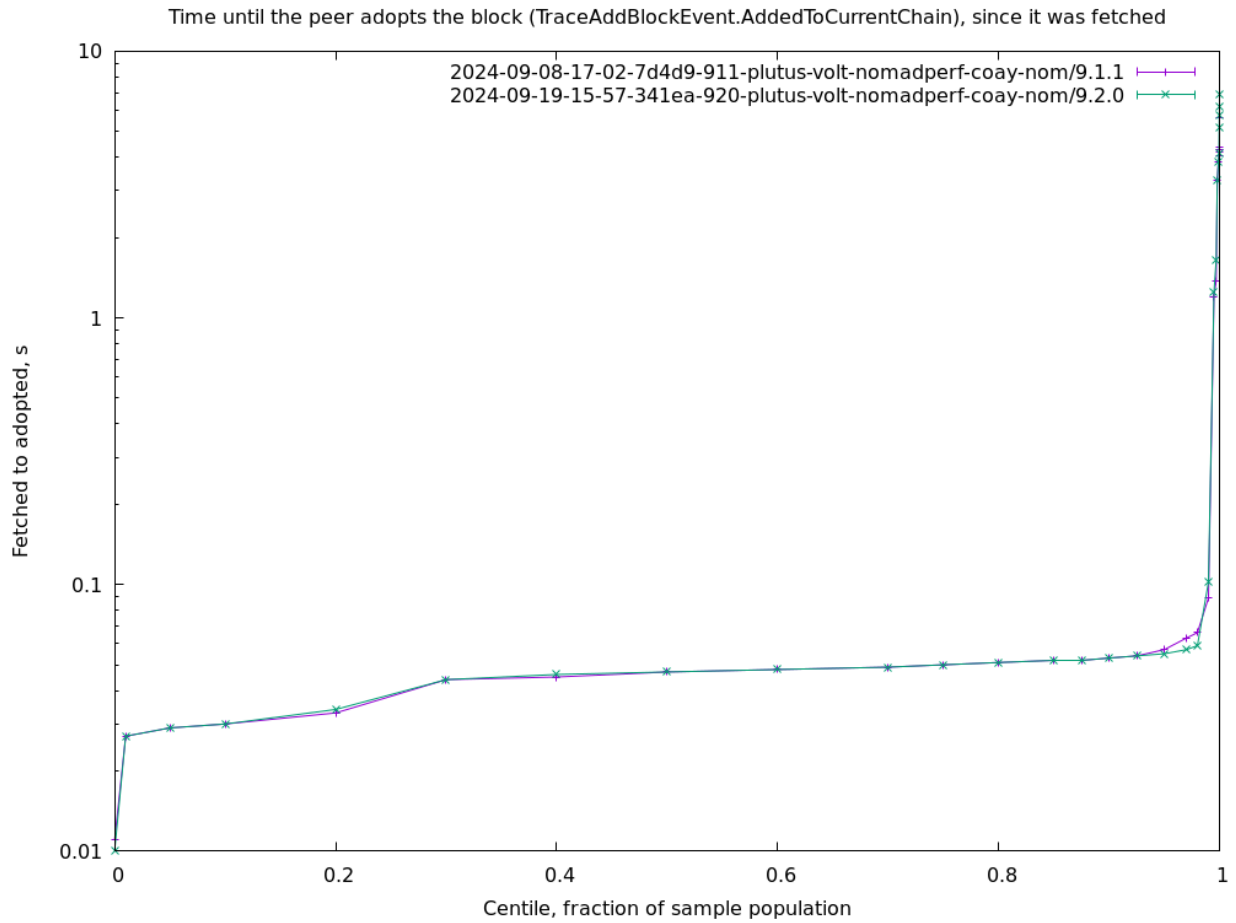
Time between block forging completion and begin-of-sending (TraceBlockFetchServerSendBlock)



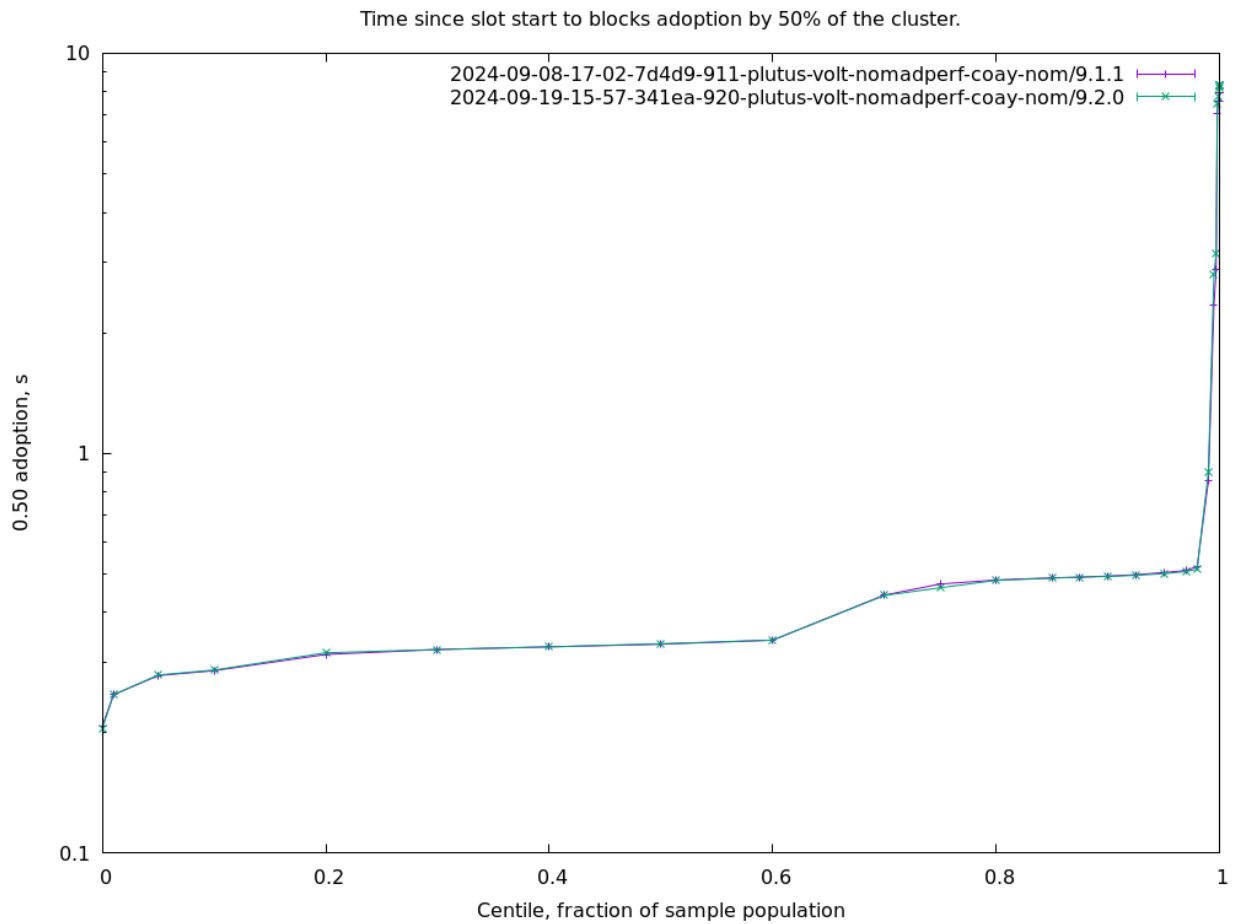
First peer notice (cdfPeerNoticeFirst) Time it took for the fastest peer to notice the block (ChainSyncClientEvent.TraceDownloadedHeader), since block's slot start



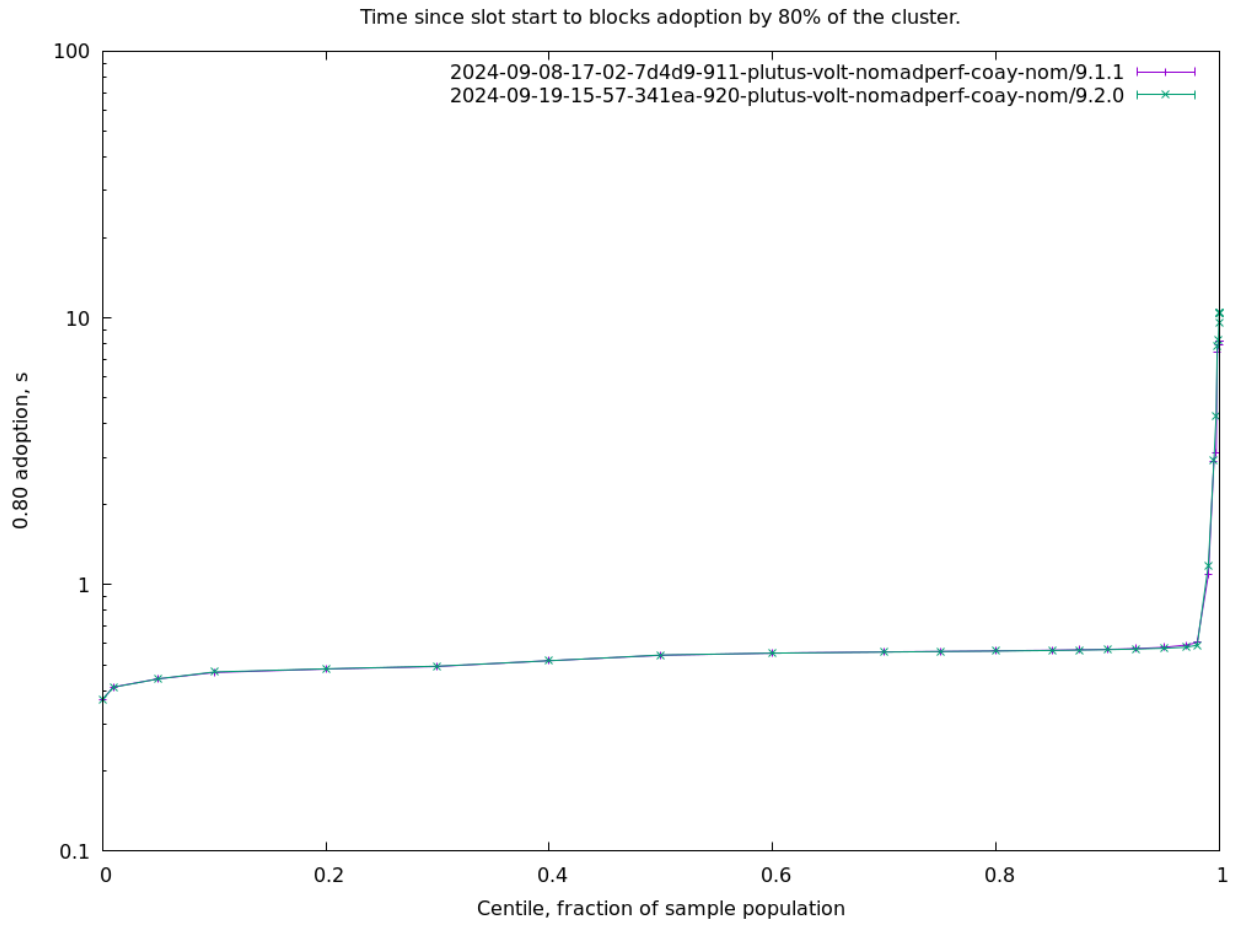
Fetches to adopted (cdfPeerAdoption) Time until the peer adopts the block (TraceAddBlockEvent.AddedToCurrentChain), since it was fetched



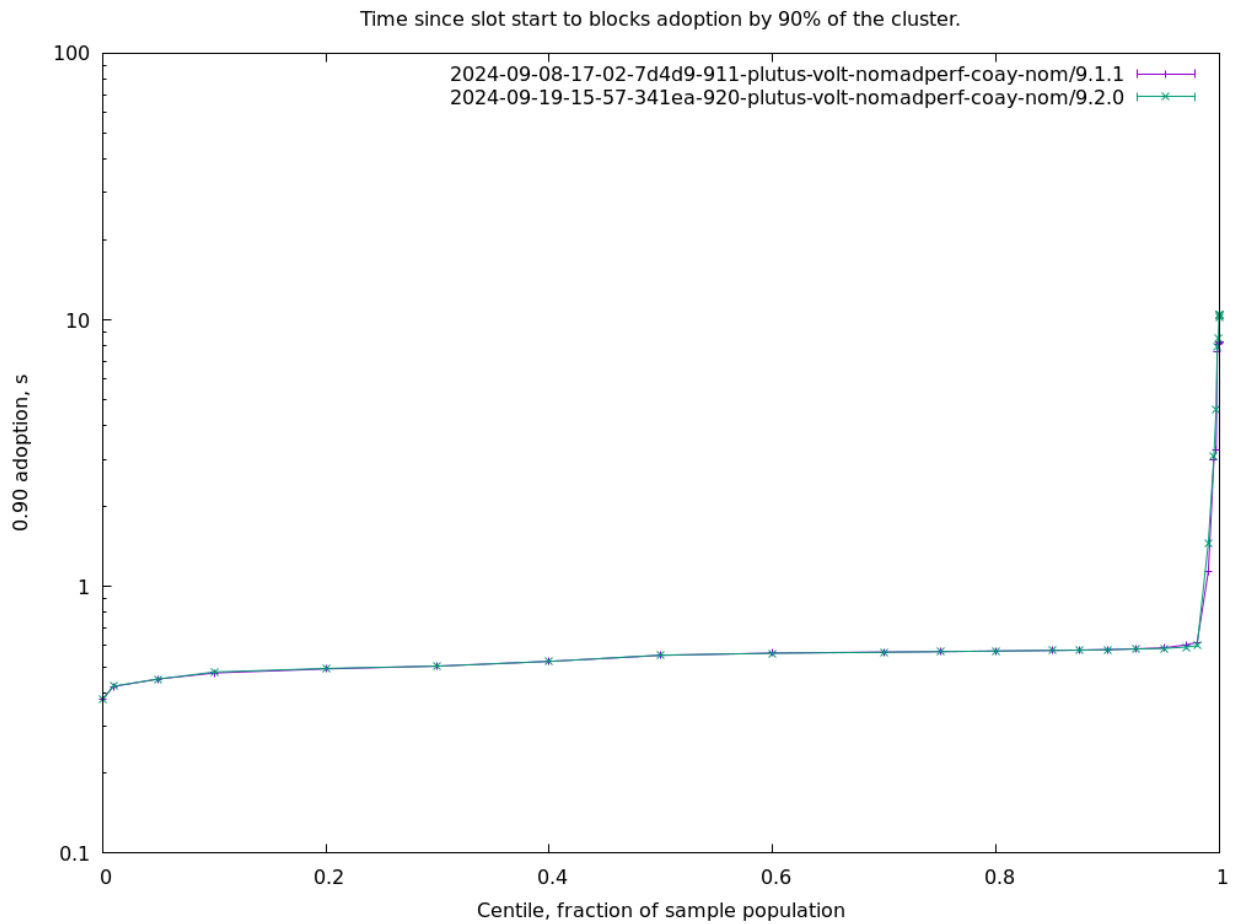
0.50 adoption (cdf0.50) Time since slot start to block's adoption by 50% of the cluster.



0.80 adoption (cdf0.80) Time since slot start to block's adoption by 80% of the cluster.

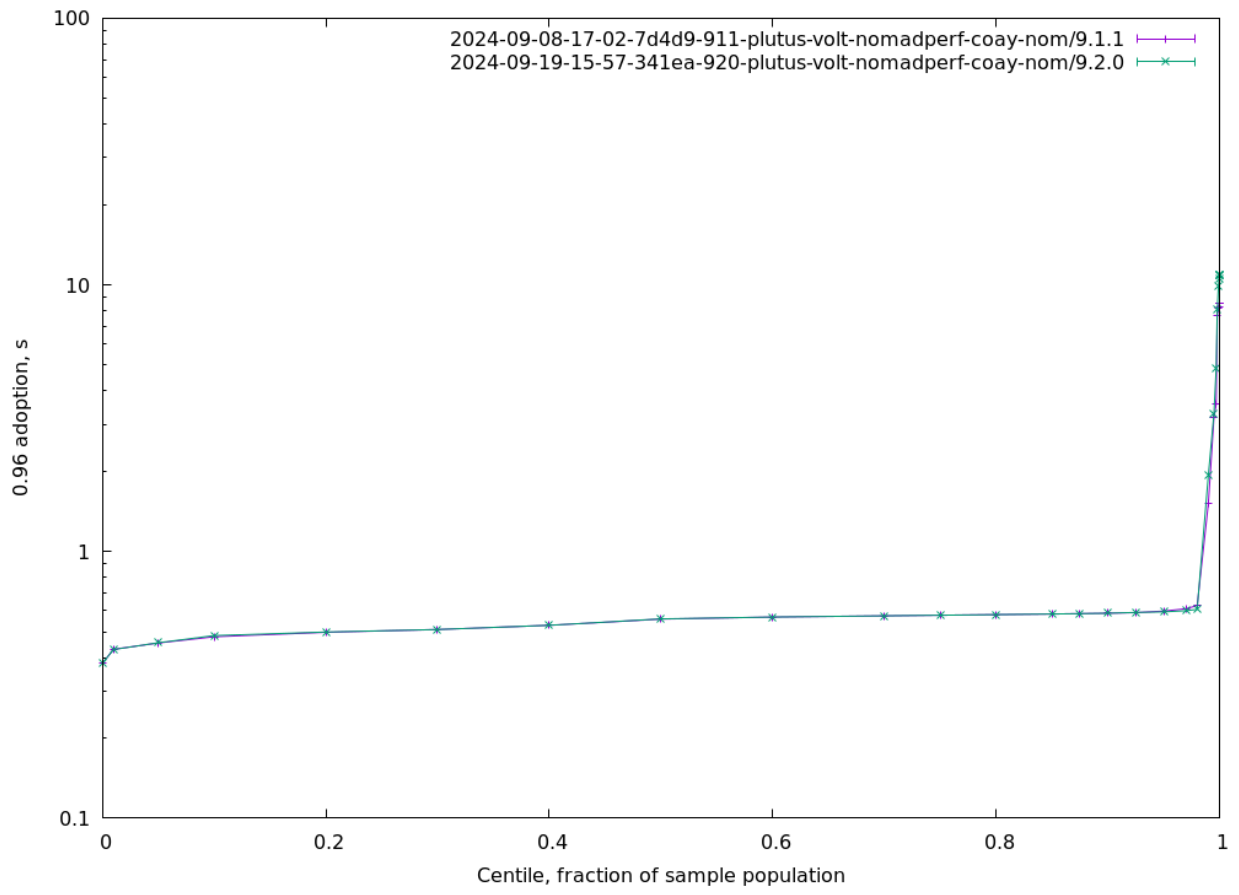


0.90 adoption (cdf0.90) Time since slot start to block's adoption by 90% of the cluster.



0.96 adoption (cdf0.96) Time since slot start to block's adoption by 96% of the cluster.

Time since slot start to blocks adoption by 96% of the cluster.



Part II

Appendix B: data dictionary

Chapter 4

Block propagation metrics

0.50 adoption (cdf0.50) Time since slot start to block's adoption by 50% of the cluster.

0.80 adoption (cdf0.80) Time since slot start to block's adoption by 80% of the cluster.

0.90 adoption (cdf0.90) Time since slot start to block's adoption by 90% of the cluster.

0.92 adoption (cdf0.92) Time since slot start to block's adoption by 92% of the cluster.

0.94 adoption (cdf0.94) Time since slot start to block's adoption by 94% of the cluster.

0.96 adoption (cdf0.96) Time since slot start to block's adoption by 96% of the cluster.

0.98 adoption (cdf0.98) Time since slot start to block's adoption by 98% of the cluster.

1.00 adoption (cdf1.00) Time since slot start to block's adoption by 100% of the cluster.

Height & slot battles (cdfBlockBattle) For a given block, number of all abandoned blocks at its block height. Sum of height and slot battles

Block size (cdfBlockSize) Block size, in bytes

Chained to forged block ratio (cdfBlocksChainedRatio) For each host, ratio of blocks that made into chain / all forged

Filtered to chained block ratio (cdfBlocksFilteredRatio) For each host, ratio of blocks that passed filtering / all on chain

Blocks per host (cdfBlocksPerHost) For each host, number of blocks made during the entire observation period

Forged to self-adopted (cdfForgerAdoption) Time between block forging completion and adoption (TraceAdoptedBlock)

Forged to announced (cdfForgerAnnounce) Time between block forging completion and header announcement (ChainSyncServerEvent.TraceChainSyncServerRead.AddBlock)

Slot start to announced (cdfForgerAnnounceCum) Time since slot start until header announcement (ChainSyncServerEvent.TraceChainSyncServerRead.AddBlock)

Acquired block context (cdfForgerBlkCtx) Block context acquired (TraceBlockContext), relative to forge loop beginning

Leadership to forged (cdfForgerForge) Time spent forging the block: TraceForgedBlock relative to positive leadership decision

Leadership check duration (cdfForgerLead) Leadership check duration (TraceNodeIsNotLeader, TraceNodeIsLeader), relative to ledger view acquisition

Acquired ledger state (cdfForgerLgrState) Ledger state acquired (TraceLedgerState), relative to block context acquisition

Acquired ledger view (cdfForgerLgrView) Ledger view acquired (TraceLedgerView), relative to ledger state acquisition

Mempool snapshotting (cdfForgerMemSnap) Time spent taking a mempool snapshot (TraceForgingMempoolSnapshot), relative to ledger ticking conclusion

Forged to sending (cdfForgerSend) Time between block forging completion and begin-of-sending (TraceBlockFetchServerSendBlock)

Started forge loop iteration (cdfForgerStart) Forge loop iteration delay (TraceStartLeadershipCheck), relative to slot start

Ledger ticking (cdfForgerTicked) Time spent ticking the ledger state (TraceForgeTickedLedgerState), relative to leadership check completion

Fetches to adopted (cdfPeerAdoption) Time until the peer adopts the block (TraceAddBlockEvent.AddedToCurrentChain), since it was fetched

Fetches to announced (cdfPeerAnnounce) Time it took a peer to announce the block (ChainSyncServerEvent.TraceChainSync), since it was fetched

Fetch duration (cdfPeerFetch) Time it took the peer to complete fetching the block (BlockFetchClient.CompletedBlockFetch), after having requested it

First peer fetch (cdfPeerFetchFirst) Time it took for the fastest peer to fetch the block (BlockFetchClient.CompletedBlockFetch), since block's slot start

First peer notice (cdfPeerNoticeFirst) Time it took for the fastest peer to notice the block (ChainSyncClientEvent.TraceDownloadedHeader), since block's slot start

Notice to fetch request (cdfPeerRequest) Time it took the peer to request the block body (BlockFetchClient.SendFetchRequest), after it have seen its header

Fetches to sending (cdfPeerSend) Time until the peer started sending the block (BlockFetchServer.SendBlock), since it was fetched

Chapter 5

Cluster performance metrics

RTS alloc rate (Alloc) RTS-reported allocation rate, MB/sec

Process CPU usage (CentiCpu) Kernel-reported CPU process usage, % of a single core

RTS GC CPU usage (CentiGC) RTS-reported GC CPU usage, % of a single core

RTS Mutator CPU usage (CentiMut) RTS-reported mutator CPU usage, % of a single core

Filesystem reads (FsRd) Number of bytes which this process really did cause to be fetched from the storage layer, per second

Filesystem writes (FsWr) Number of bytes which this process caused to be sent to the storage layer, modulo truncate(), per second

Major GCs (GcsMajor) Major garbage collection RTS events

Minor GCs (GcsMinor) Minor garbage collection RTS events

RTS heap size (Heap) RTS-reported heap size, MB

RTS live GC dataset (Live) RTS-reported GC live data size, MB

Network reads (NetRd) Network reads, kB/sec

Network writes (NetWr) Network writes, kB/sec

Kernel RSS (RSS) Kernel-reported RSS (Resident Set Size) of the process, MB

Block context acquisition delay (cdfBlkCtx) Block context acquired (TraceBlockContext), relative to forge loop beginning

Interblock gap (cdfBlockGap) Time between blocks

Chain density (cdfDensity) Block/slot ratio, for the last 'k' slots

Leadership check duration (cdfLeading) Leadership check duration (TraceNodeIsNotLeader, TraceNodeIsLeader), relative to ledger view acquisition

Ledger state acquisition delay (cdfLgrState) Ledger state acquired (TraceLedgerState), relative to block context acquisition

Ledger view acquisition delay (cdfLgrView) Ledger view acquired (TraceLedgerView), relative to ledger state acquisition

CPU 85% spans (cdfSpanLensCpu) Length of over-85% CPU usage peaks, slots

CPU spans at Ep boundary (cdfSpanLensCpuEpoch) Length of over-85% CPU usage peaks, starting at epoch boundary, slots

Forge loop tardiness (cdfStarted) Forge loop iteration start delay (TraceStartLeadershipCheck), relative to slot start

Forge loop starts (cdfStarts) For any given slot, how many forging loop starts were registered