

# Simulation analysis

2025-08-12

# Attacks experiment @ [6eb32386](#)

- Rust simulator
- Linear Leios
- Propagation
  - txs-received
  - eb-received
  - fully-valid
- Maximum of 12 MB of txs referenced by each EB
- $L_{\text{vote}} = 7$  slots
- $L_{\text{diff}}$ 
  - 0 slots
  - 7 slots
- 33% adversarial stake
- EB attack
  - none
  - 6-second propagation delay
- Tx attack
  - none
  - 100% of adversarial EBs
- Throughput: 0.150 TxMb/s
- Tx size: 1500 B/Tx
- TPS: 100 Tx/s
- Mini-mainnet
- 4 vCPU/node
- 50 Mb/s bandwidth

# TPS

Propagation	Diffusion duration	EB delay	Tx attack	Demand [tx/s]
	<fct>	<fct>	<fct>	<dbl>
eb-received	L_diff = 0 slots	EB attack: 6.0 s/EB	Tx attack: 100%	107.4556
eb-received	L_diff = 0 slots	EB attack: 6.0 s/EB	Tx attack: none	100.0011
eb-received	L_diff = 0 slots	EB attack: none	Tx attack: 100%	110.4578
eb-received	L_diff = 0 slots	EB attack: none	Tx attack: none	100.0011
eb-received	L_diff = 7 slots	EB attack: 6.0 s/EB	Tx attack: 100%	110.4578
eb-received	L_diff = 7 slots	EB attack: 6.0 s/EB	Tx attack: none	100.0011
eb-received	L_diff = 7 slots	EB attack: none	Tx attack: 100%	113.4600
eb-received	L_diff = 7 slots	EB attack: none	Tx attack: none	100.0011
fully-valid	L_diff = 0 slots	EB attack: 6.0 s/EB	Tx attack: 100%	107.4556
fully-valid	L_diff = 0 slots	EB attack: 6.0 s/EB	Tx attack: none	100.0011
fully-valid	L_diff = 0 slots	EB attack: none	Tx attack: 100%	116.4622
fully-valid	L_diff = 0 slots	EB attack: none	Tx attack: none	100.0011
fully-valid	L_diff = 7 slots	EB attack: 6.0 s/EB	Tx attack: 100%	110.4578
fully-valid	L_diff = 7 slots	EB attack: 6.0 s/EB	Tx attack: none	100.0011
fully-valid	L_diff = 7 slots	EB attack: none	Tx attack: 100%	122.4667
fully-valid	L_diff = 7 slots	EB attack: none	Tx attack: none	100.0011
txs-received	L_diff = 0 slots	EB attack: 6.0 s/EB	Tx attack: 100%	107.4556
txs-received	L_diff = 0 slots	EB attack: 6.0 s/EB	Tx attack: none	100.0011
txs-received	L_diff = 0 slots	EB attack: none	Tx attack: 100%	119.4644
txs-received	L_diff = 0 slots	EB attack: none	Tx attack: none	100.0011
txs-received	L_diff = 7 slots	EB attack: 6.0 s/EB	Tx attack: 100%	110.4578
txs-received	L_diff = 7 slots	EB attack: 6.0 s/EB	Tx attack: none	100.0011
txs-received	L_diff = 7 slots	EB attack: none	Tx attack: 100%	119.4644
txs-received	L_diff = 7 slots	EB attack: none	Tx attack: none	100.0011

TPS varies between the cases because of noise in sortition

# Spatial efficiency

Propagation	Diffusion duration		EB delay	Tx attack	Space efficiency [%]
	<fct>	<fct>			
eb-received	L_diff = 0 slots	EB attack: 6.0 s/EB	Tx attack: 100%		88.60258
eb-received	L_diff = 0 slots	EB attack: 6.0 s/EB	Tx attack: none		93.18226
eb-received	L_diff = 0 slots	EB attack: none	Tx attack: 100%		93.54705
eb-received	L_diff = 0 slots	EB attack: none	Tx attack: none		92.87637
eb-received	L_diff = 7 slots	EB attack: 6.0 s/EB	Tx attack: 100%		88.56721
eb-received	L_diff = 7 slots	EB attack: 6.0 s/EB	Tx attack: none		92.19450
eb-received	L_diff = 7 slots	EB attack: none	Tx attack: 100%		92.43859
eb-received	L_diff = 7 slots	EB attack: none	Tx attack: none		91.94985
fully-valid	L_diff = 0 slots	EB attack: 6.0 s/EB	Tx attack: 100%		91.89644
fully-valid	L_diff = 0 slots	EB attack: 6.0 s/EB	Tx attack: none		91.36802
fully-valid	L_diff = 0 slots	EB attack: none	Tx attack: 100%		92.95009
fully-valid	L_diff = 0 slots	EB attack: none	Tx attack: none		92.73770
fully-valid	L_diff = 7 slots	EB attack: 6.0 s/EB	Tx attack: 100%		77.37280
fully-valid	L_diff = 7 slots	EB attack: 6.0 s/EB	Tx attack: none		89.71509
fully-valid	L_diff = 7 slots	EB attack: none	Tx attack: 100%		91.62396
fully-valid	L_diff = 7 slots	EB attack: none	Tx attack: none		92.16546
txs-received	L_diff = 0 slots	EB attack: 6.0 s/EB	Tx attack: 100%		93.41244
txs-received	L_diff = 0 slots	EB attack: 6.0 s/EB	Tx attack: none		93.06316
txs-received	L_diff = 0 slots	EB attack: none	Tx attack: 100%		93.32065
txs-received	L_diff = 0 slots	EB attack: none	Tx attack: none		92.58873
txs-received	L_diff = 7 slots	EB attack: 6.0 s/EB	Tx attack: 100%		93.03583
txs-received	L_diff = 7 slots	EB attack: 6.0 s/EB	Tx attack: none		92.22793
txs-received	L_diff = 7 slots	EB attack: none	Tx attack: 100%		92.16699
txs-received	L_diff = 7 slots	EB attack: none	Tx attack: none		92.19741

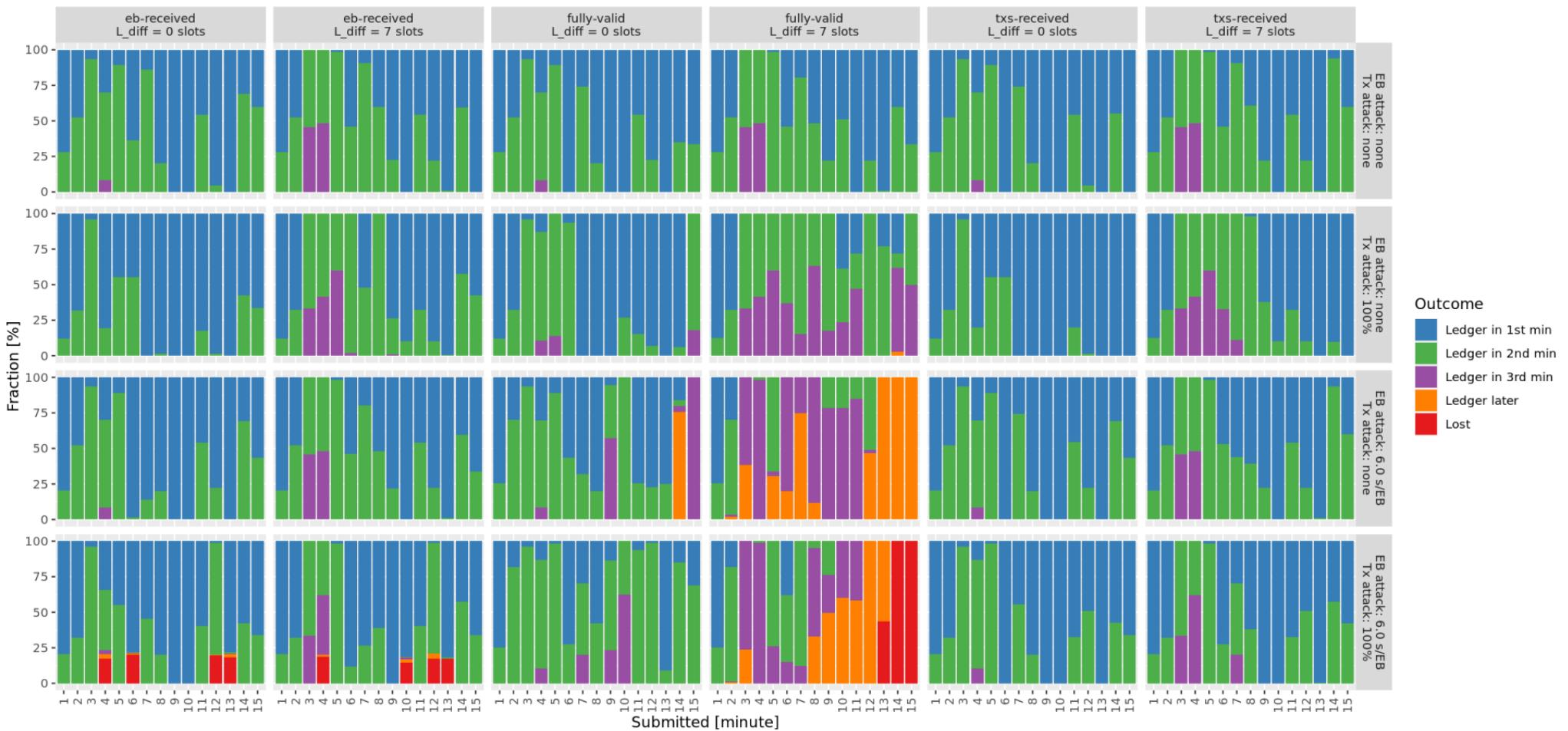
# Temporal efficiency

Propagation	Diffusion duration		<fct>	<fct>	<dbl>	<dbl>
	<fct>	<fct>				
eb-received	L_diff = 0 slots	EB attack: 6.0 s/EB	<fct>	Tx attack: 100%	15.06735	50.69842
eb-received	L_diff = 0 slots	EB attack: 6.0 s/EB	<fct>	Tx attack: none	22.65309	52.65633
eb-received	L_diff = 0 slots	EB attack: none	<fct>	Tx attack: 100%	14.09064	41.55546
eb-received	L_diff = 0 slots	EB attack: none	<fct>	Tx attack: none	24.10692	56.03596
eb-received	L_diff = 7 slots	EB attack: 6.0 s/EB	<fct>	Tx attack: 100%	15.20607	59.98167
eb-received	L_diff = 7 slots	EB attack: 6.0 s/EB	<fct>	Tx attack: none	24.38541	64.49120
eb-received	L_diff = 7 slots	EB attack: none	<fct>	Tx attack: 100%	18.51422	65.79174
eb-received	L_diff = 7 slots	EB attack: none	<fct>	Tx attack: none	24.68271	64.09703
fully-valid	L_diff = 0 slots	EB attack: 6.0 s/EB	<fct>	Tx attack: 100%	25.63898	80.16056
fully-valid	L_diff = 0 slots	EB attack: 6.0 s/EB	<fct>	Tx attack: none	30.84465	80.83244
fully-valid	L_diff = 0 slots	EB attack: none	<fct>	Tx attack: 100%	16.16756	51.48919
fully-valid	L_diff = 0 slots	EB attack: none	<fct>	Tx attack: none	22.72927	53.60776
fully-valid	L_diff = 7 slots	EB attack: 6.0 s/EB	<fct>	Tx attack: 100%	54.02914	157.94819
fully-valid	L_diff = 7 slots	EB attack: 6.0 s/EB	<fct>	Tx attack: none	90.56148	158.21992
fully-valid	L_diff = 7 slots	EB attack: none	<fct>	Tx attack: 100%	28.52943	97.70698
fully-valid	L_diff = 7 slots	EB attack: none	<fct>	Tx attack: none	24.68583	64.36274
txs-received	L_diff = 0 slots	EB attack: 6.0 s/EB	<fct>	Tx attack: 100%	15.51601	51.88756
txs-received	L_diff = 0 slots	EB attack: 6.0 s/EB	<fct>	Tx attack: none	23.47322	54.64204
txs-received	L_diff = 0 slots	EB attack: none	<fct>	Tx attack: 100%	12.79605	39.11796
txs-received	L_diff = 0 slots	EB attack: none	<fct>	Tx attack: none	22.49277	51.39454
txs-received	L_diff = 7 slots	EB attack: 6.0 s/EB	<fct>	Tx attack: 100%	17.38715	61.53882
txs-received	L_diff = 7 slots	EB attack: 6.0 s/EB	<fct>	Tx attack: none	24.99220	65.08873
txs-received	L_diff = 7 slots	EB attack: none	<fct>	Tx attack: 100%	18.97169	63.65356
txs-received	L_diff = 7 slots	EB attack: none	<fct>	Tx attack: none	25.94284	67.35180

## Key

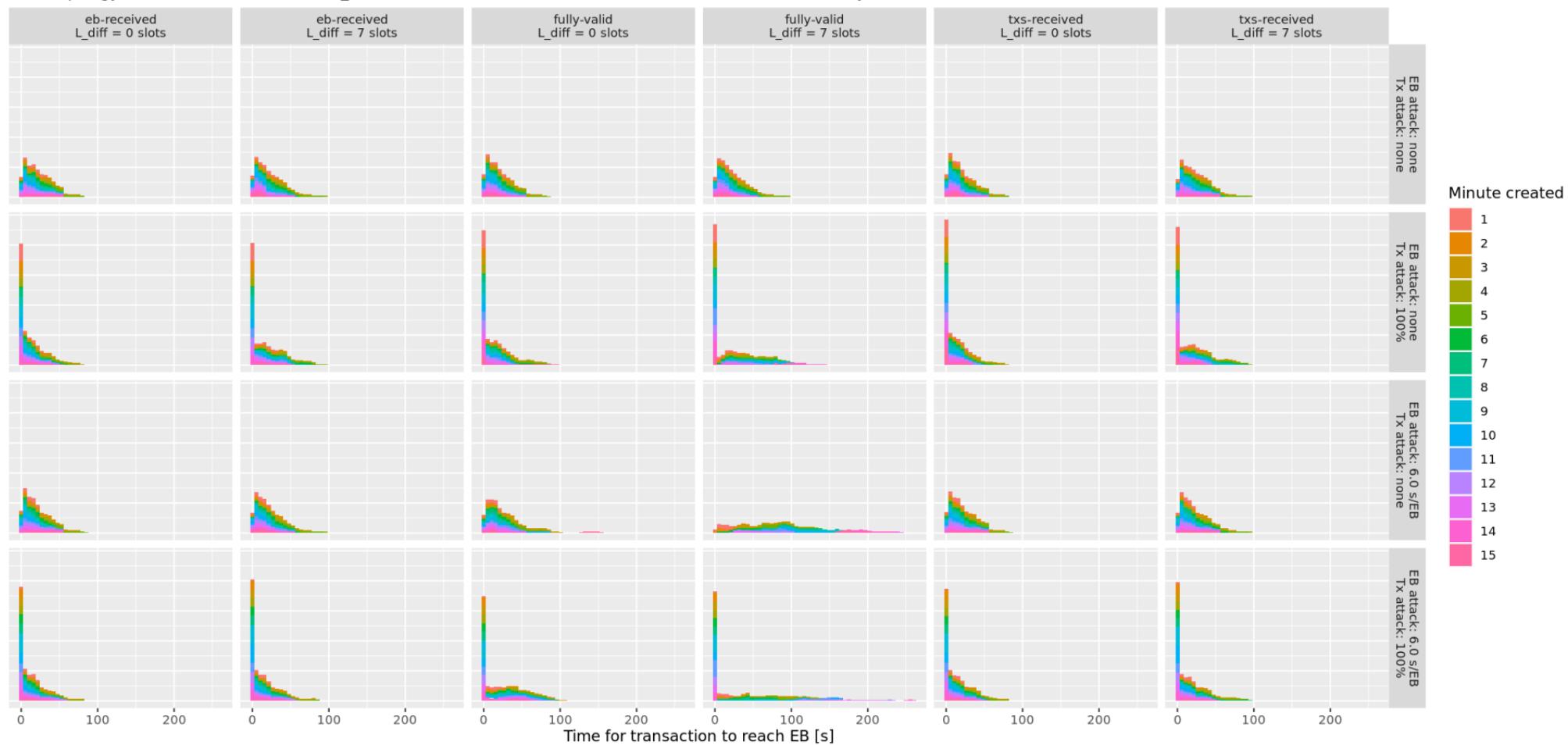
# Transactions reaching the ledger

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



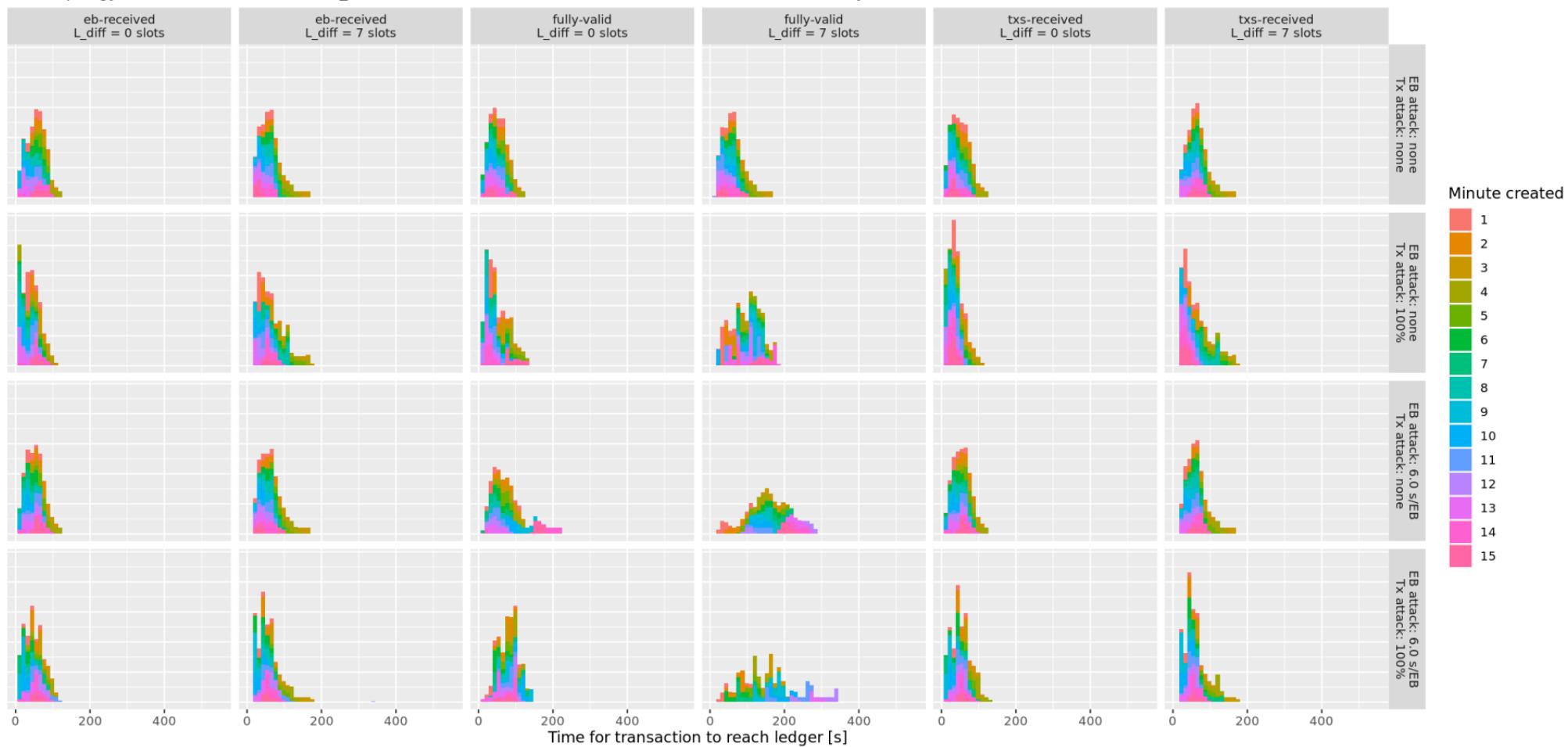
# Time for transaction to reach an EB

Rust, topology-v2, 50 Mb/s, 4 vCPU/node,  $L_{vote} = 7$  slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



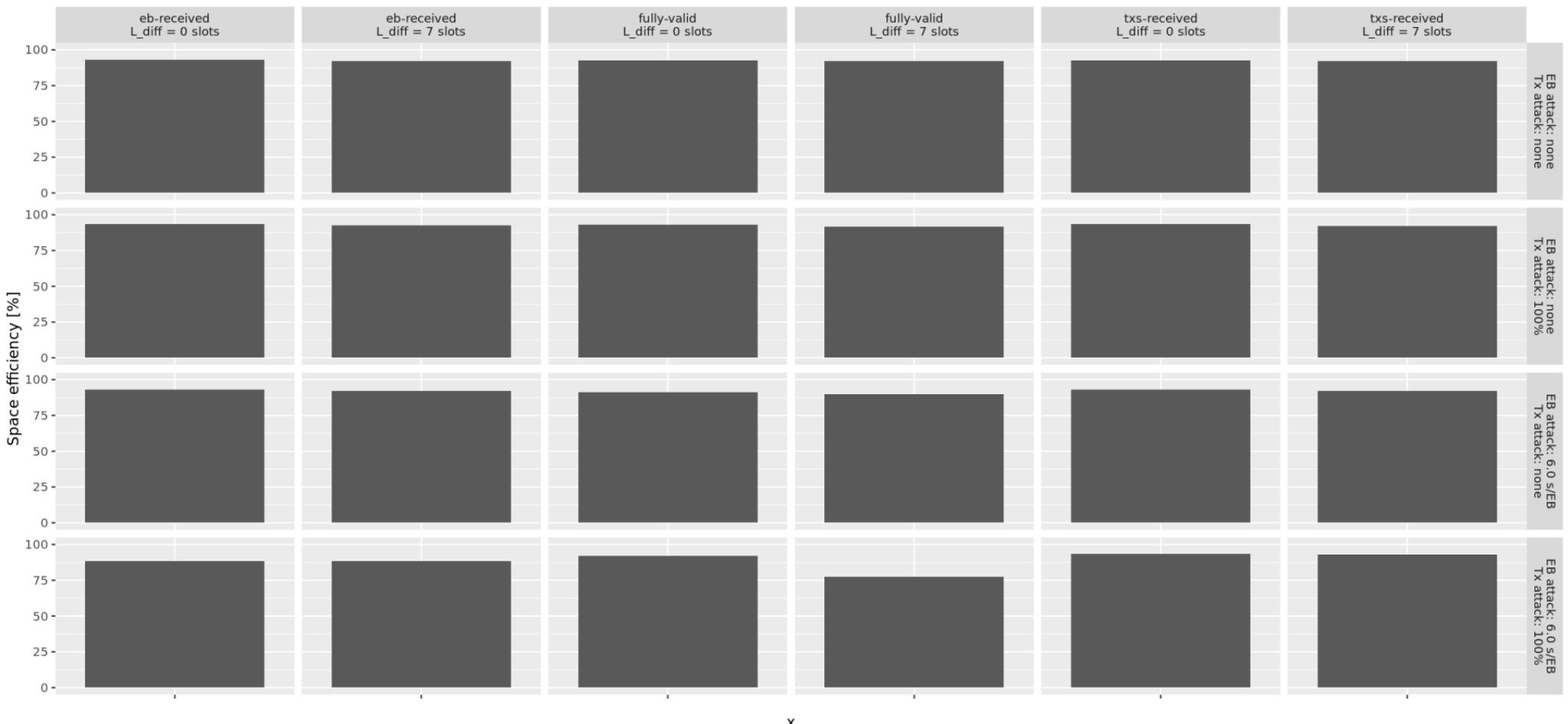
# Time for transaction to reach the ledger

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



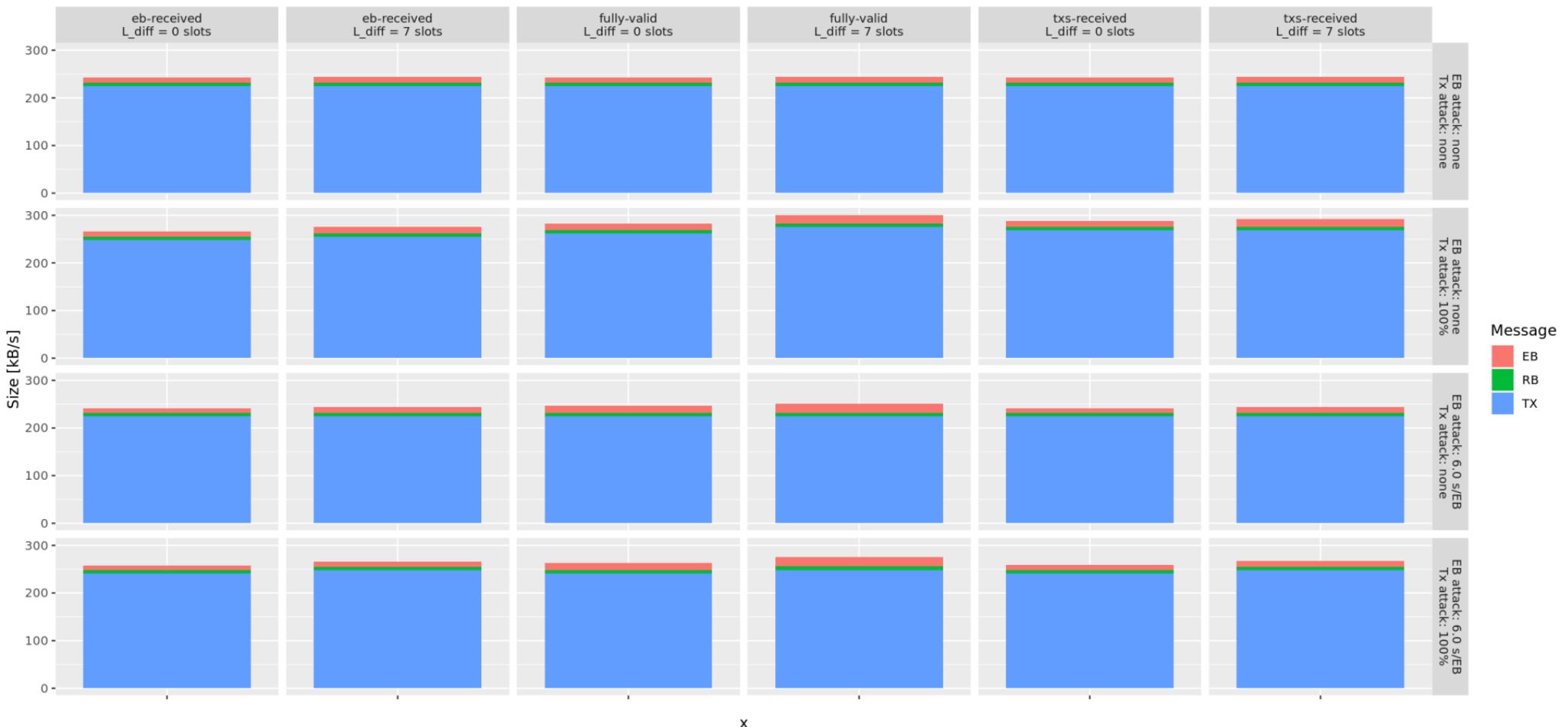
# Spatial efficiency (size of txs on ledger / size of non-tx persisted data)

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



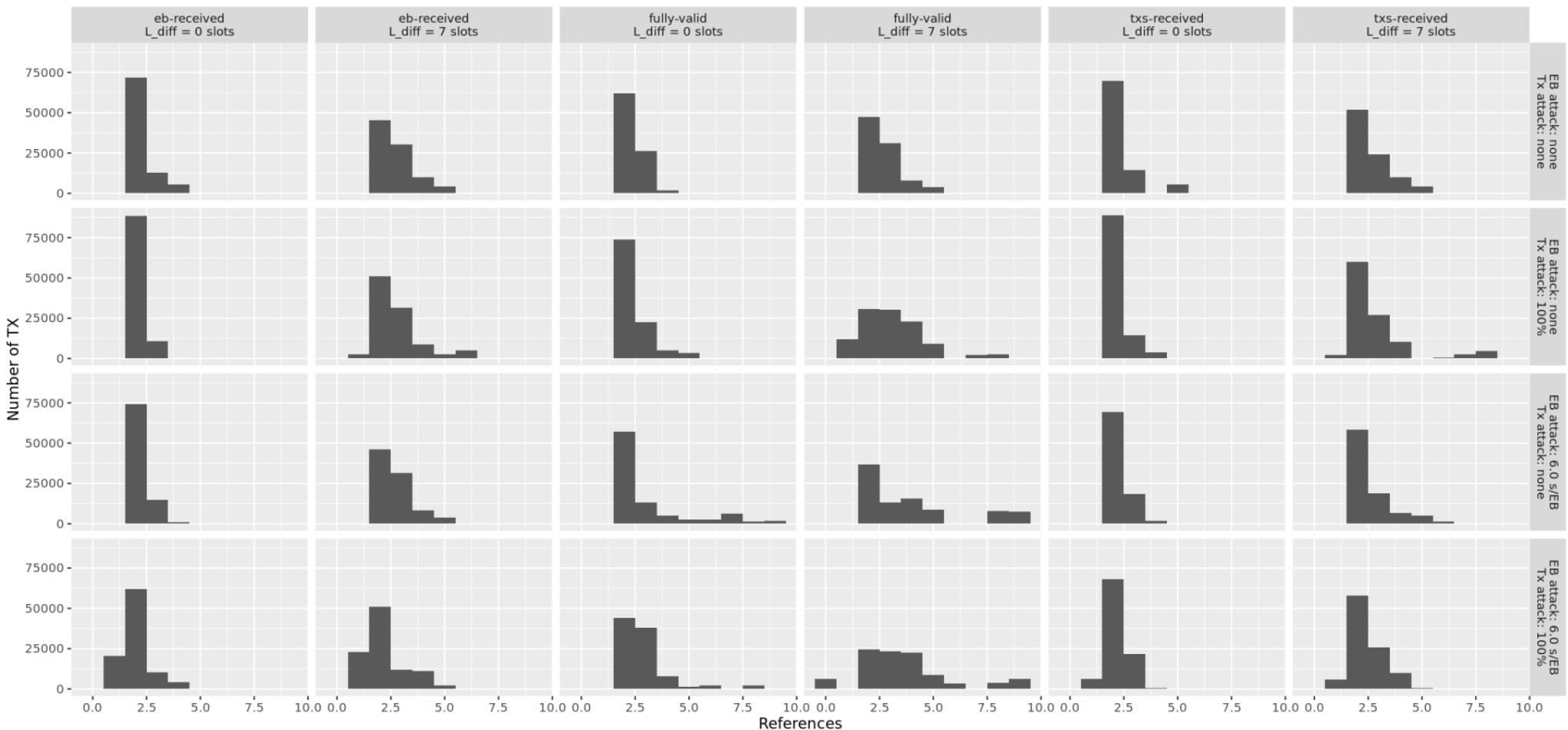
# Size of diffused data

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



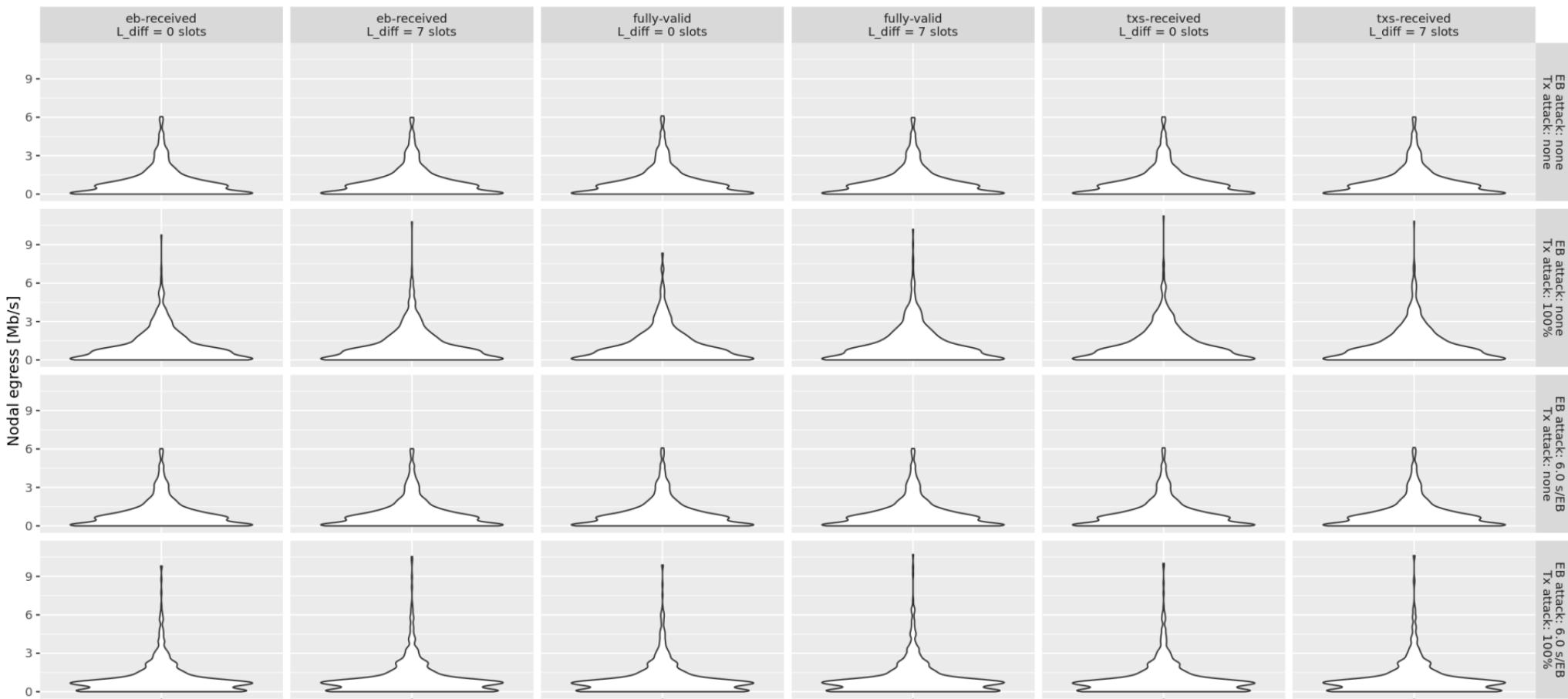
## Number of TX references (0 = not used, 2+ = duplicated)

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



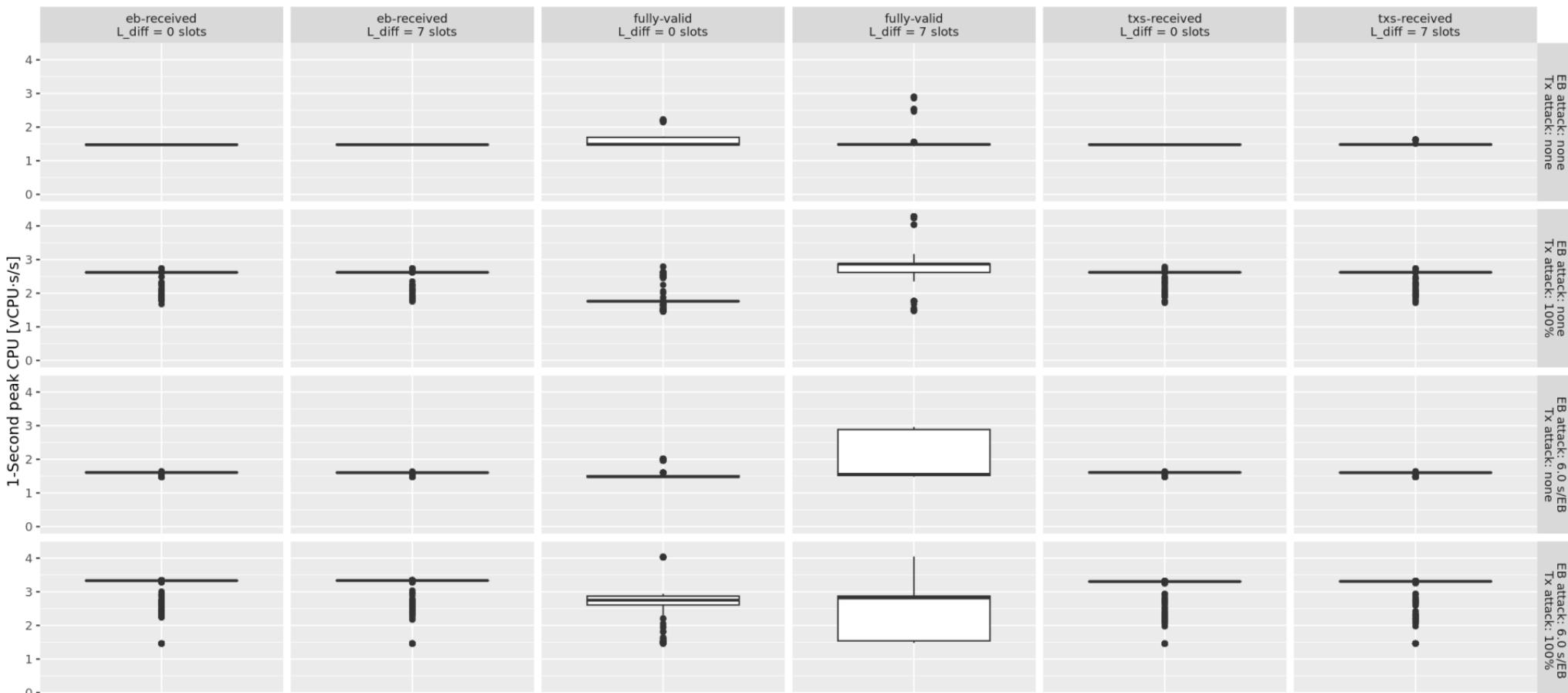
# Network

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



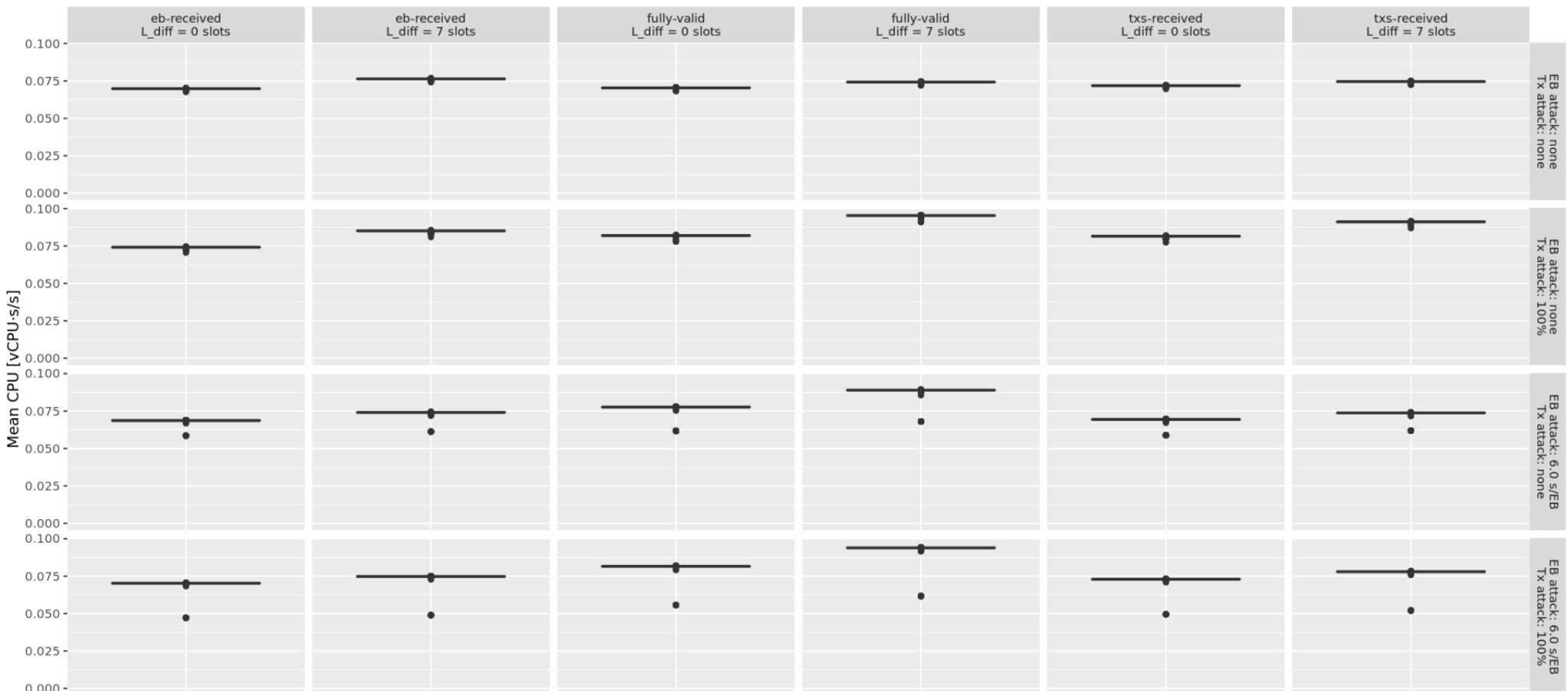
# 1-Second Peak CPU

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



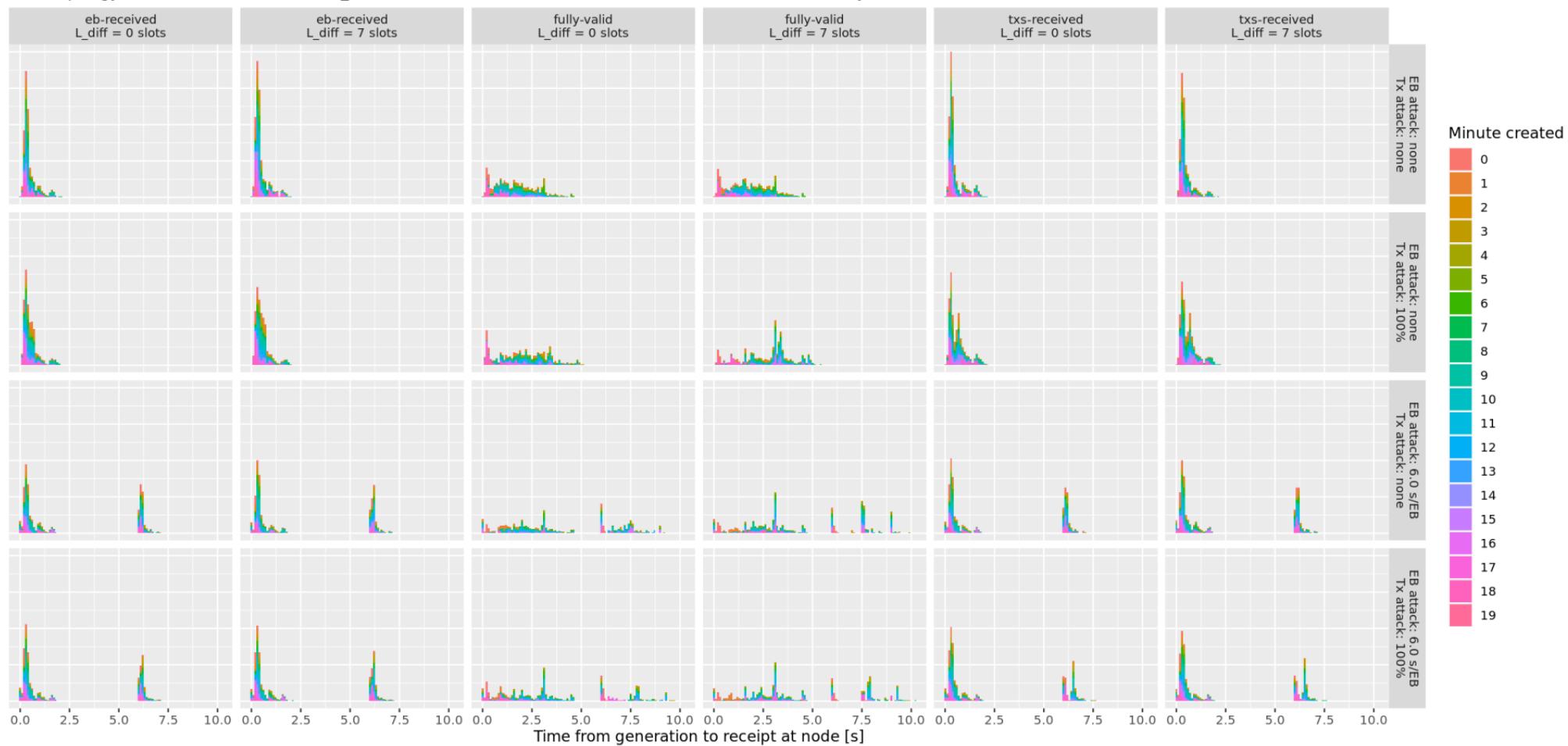
## Mean CPU

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



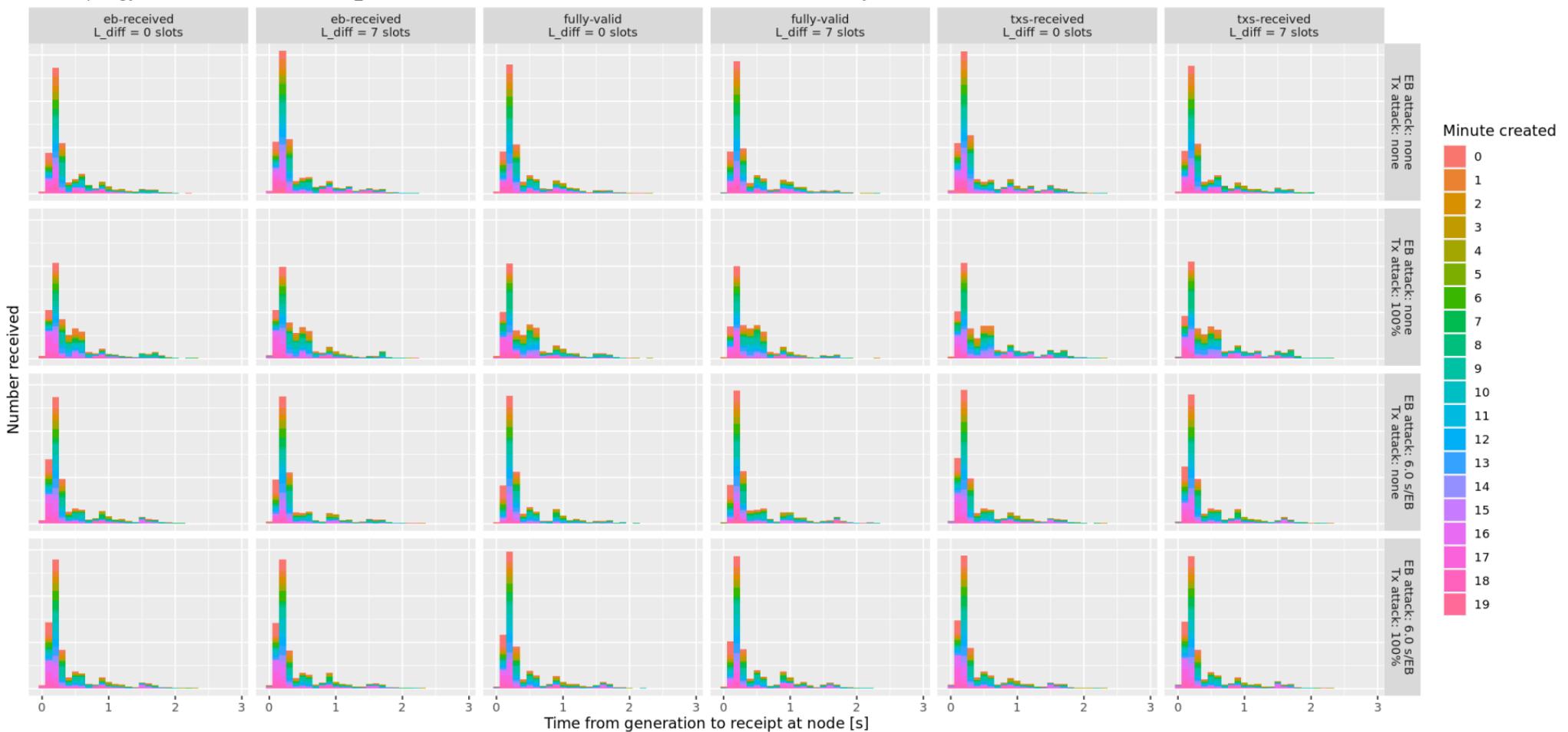
## Arrival delay for EB

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



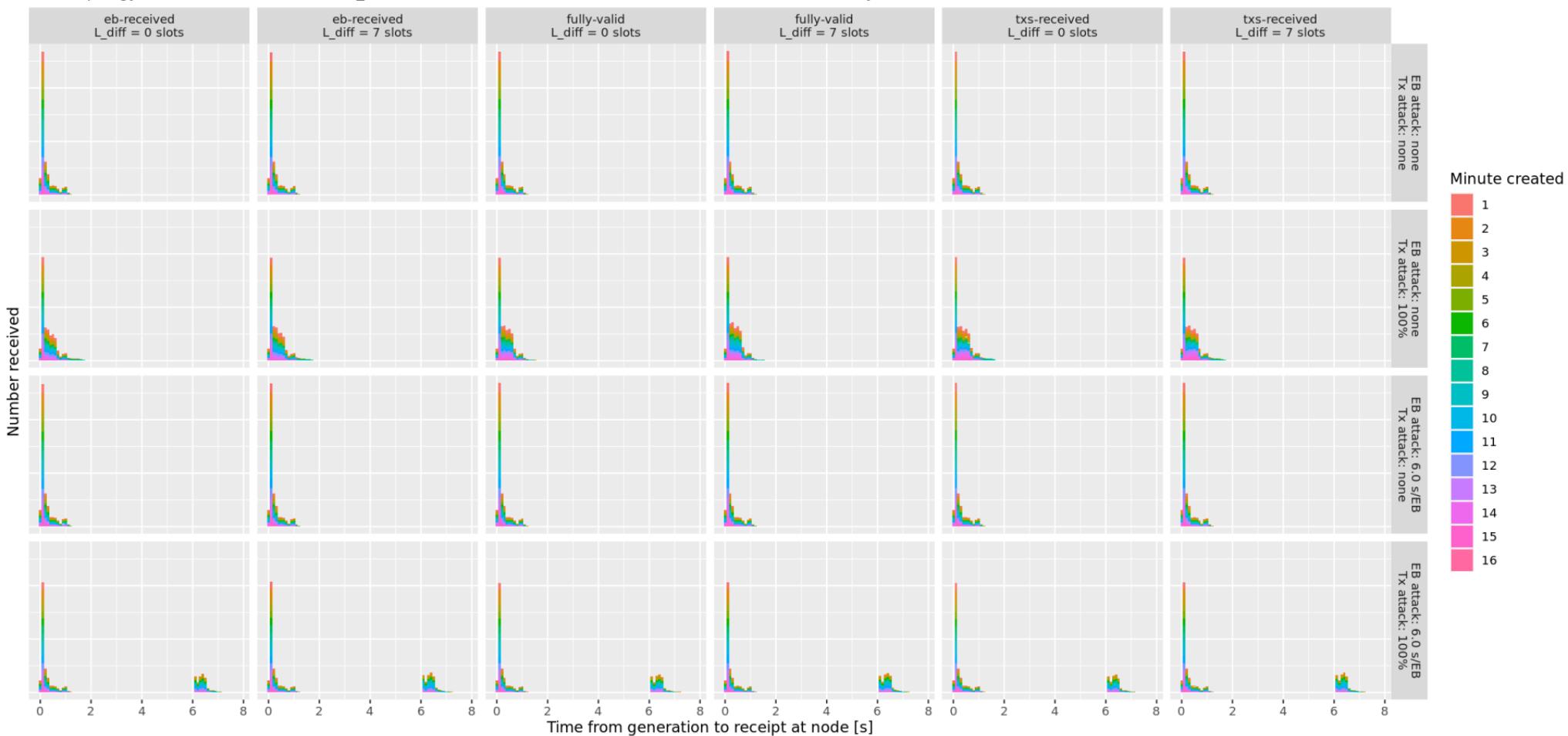
# Arrival delay for RB

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



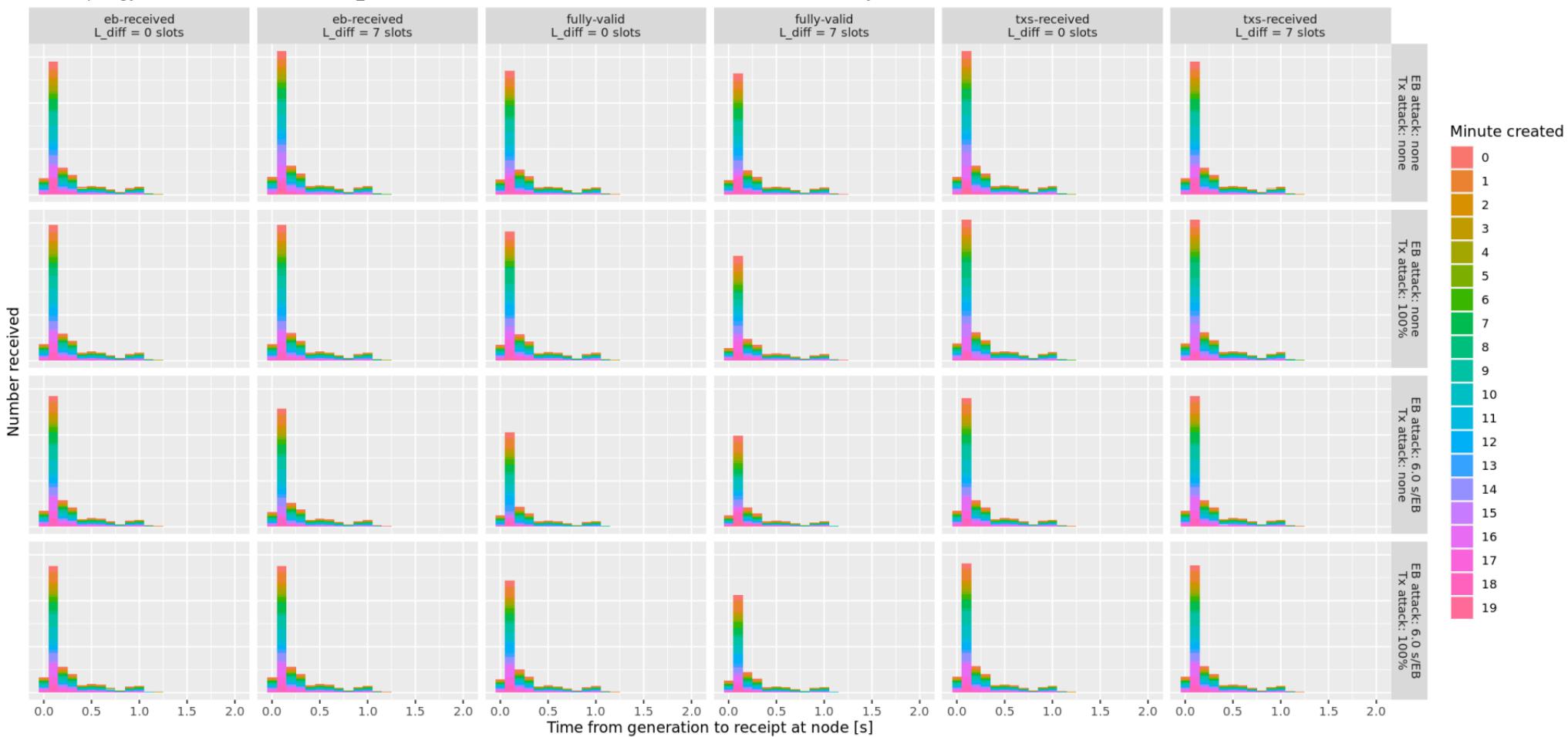
# Arrival delay for TX

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



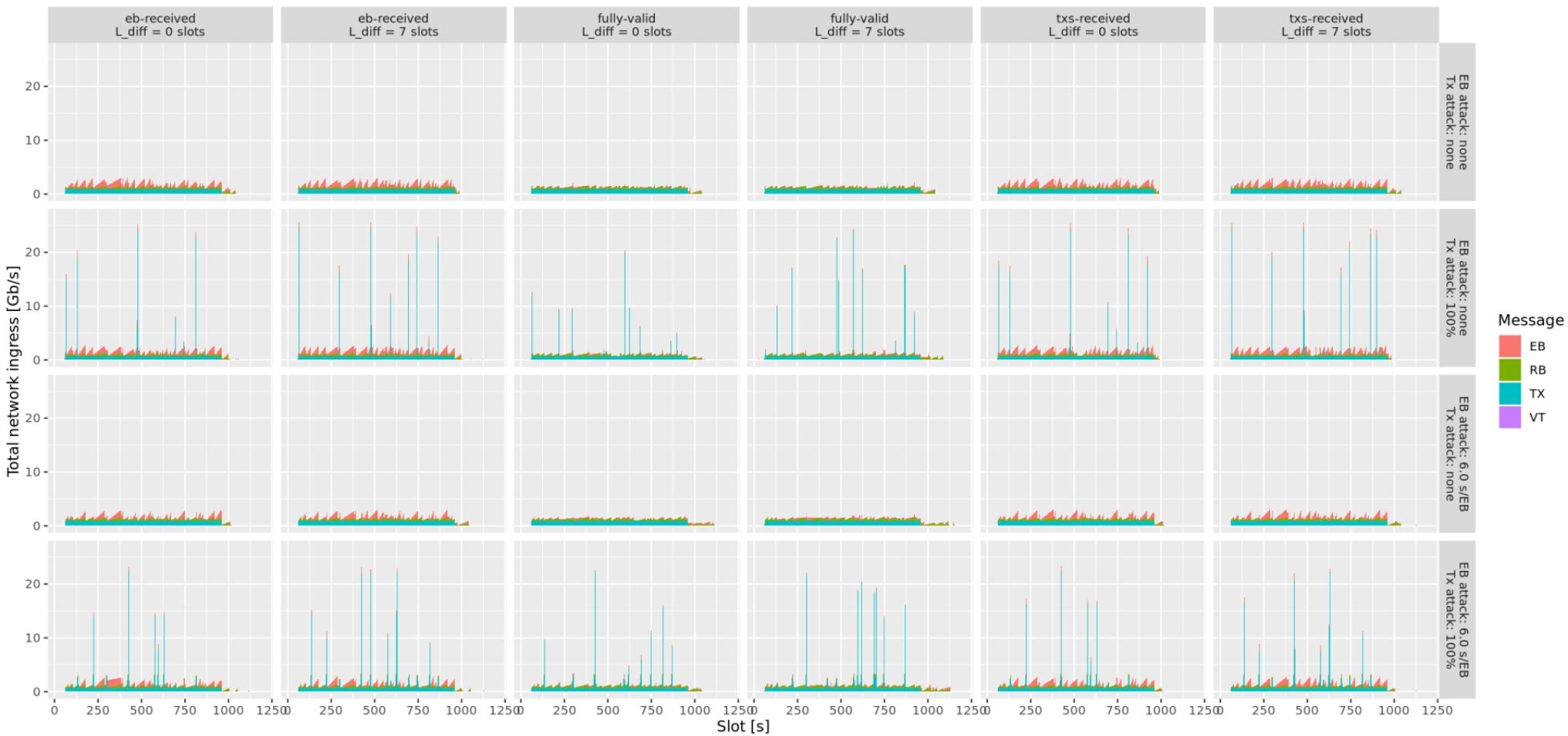
# Arrival delay for VT

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



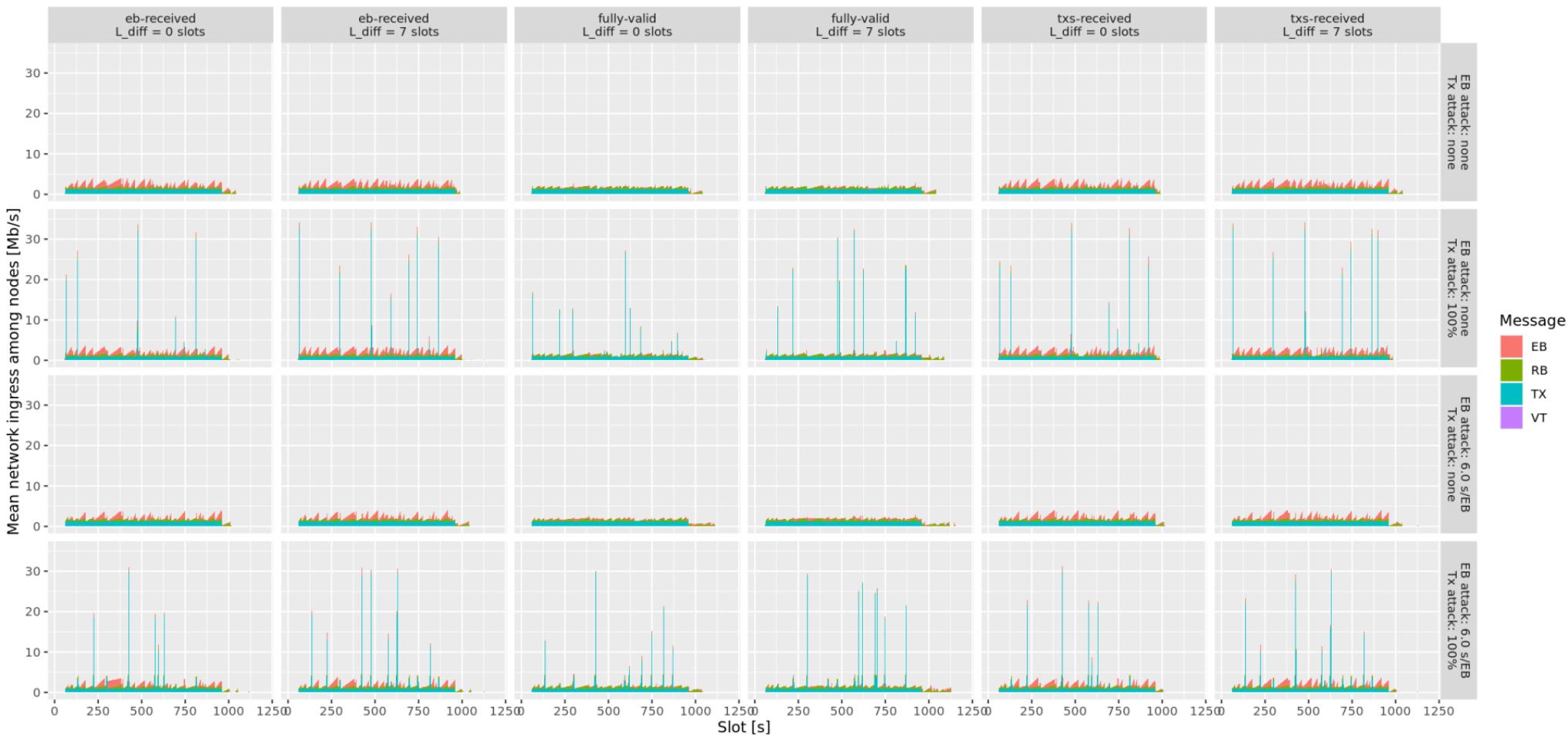
# Total bandwidth

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



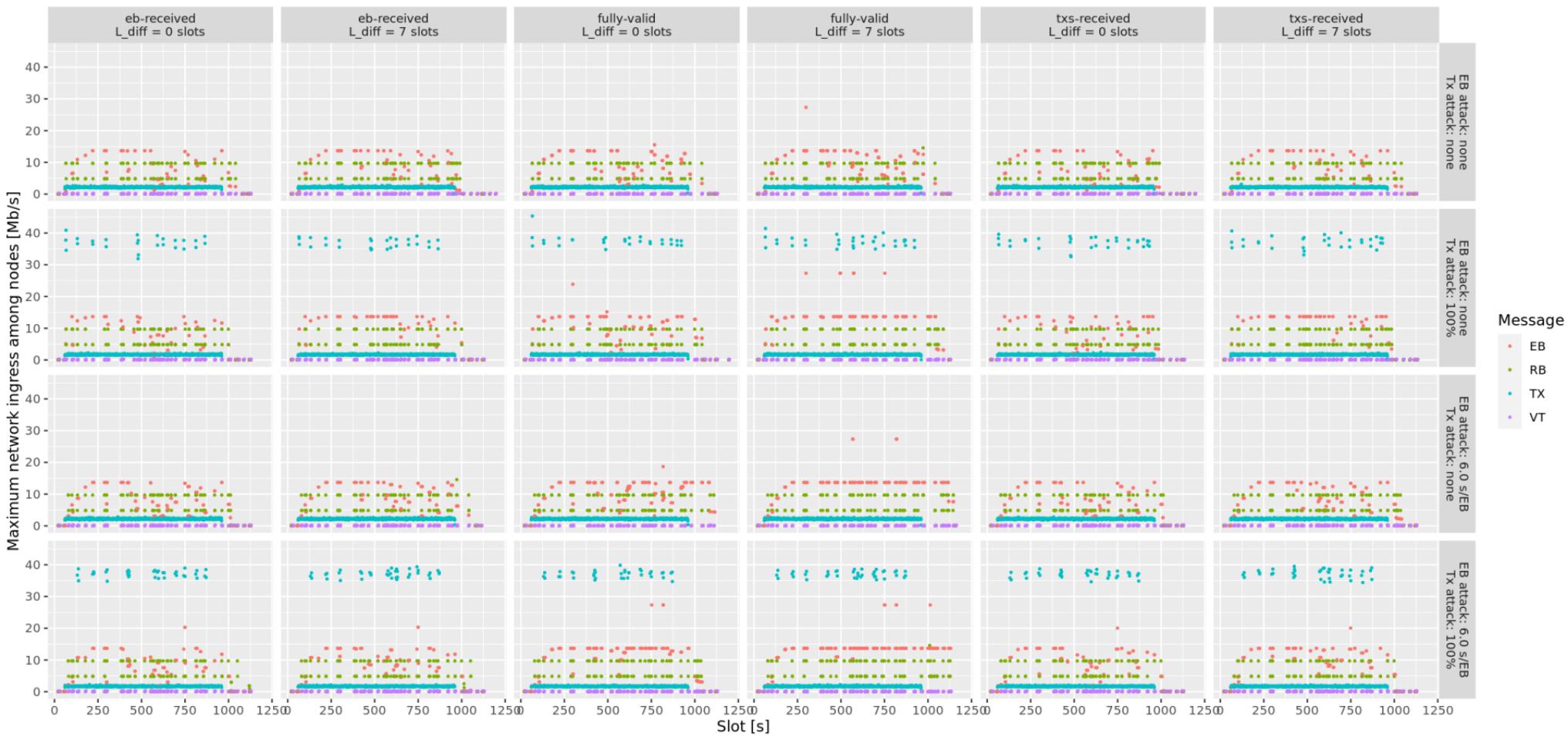
## Mean nodal ingress

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversarial



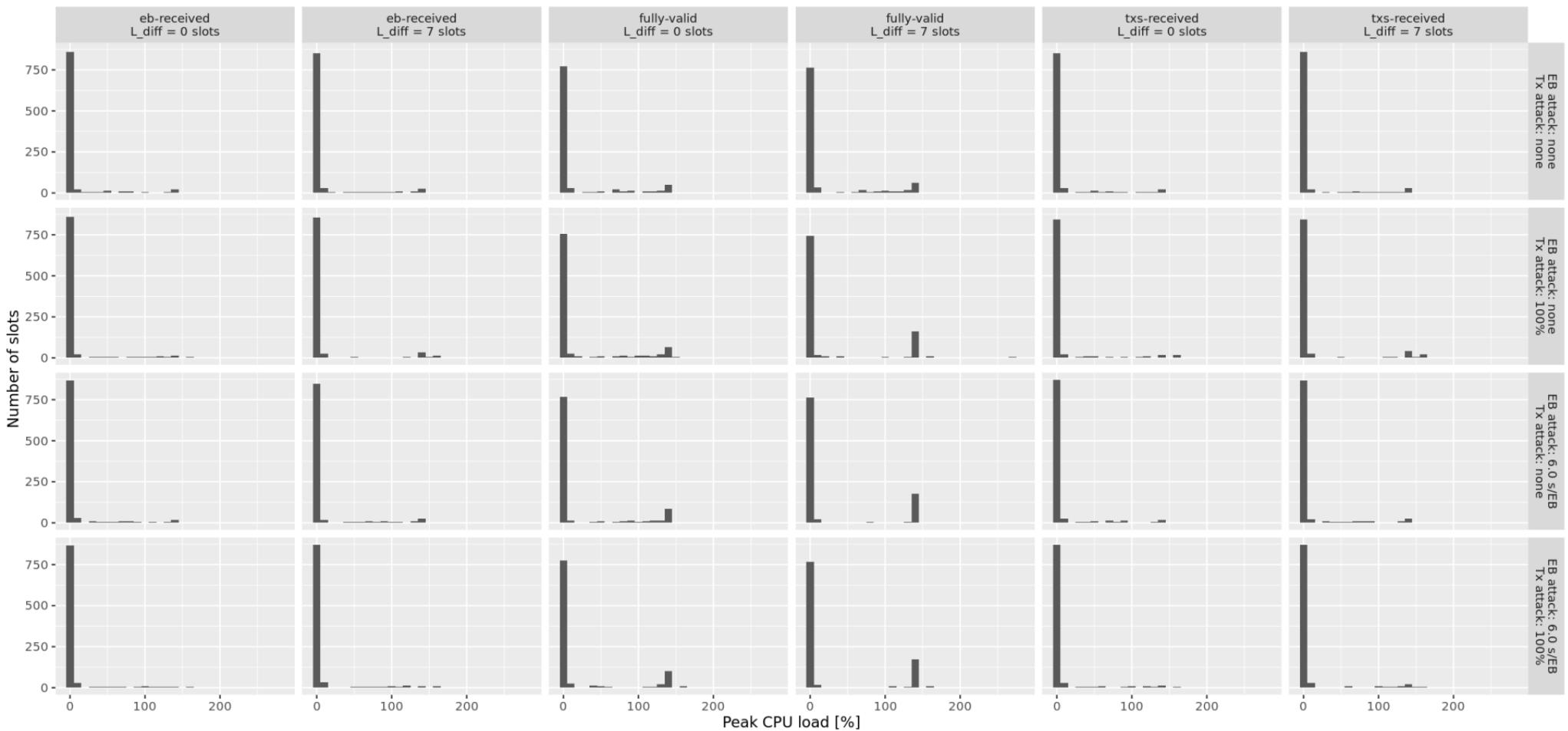
# Peak nodal ingress

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



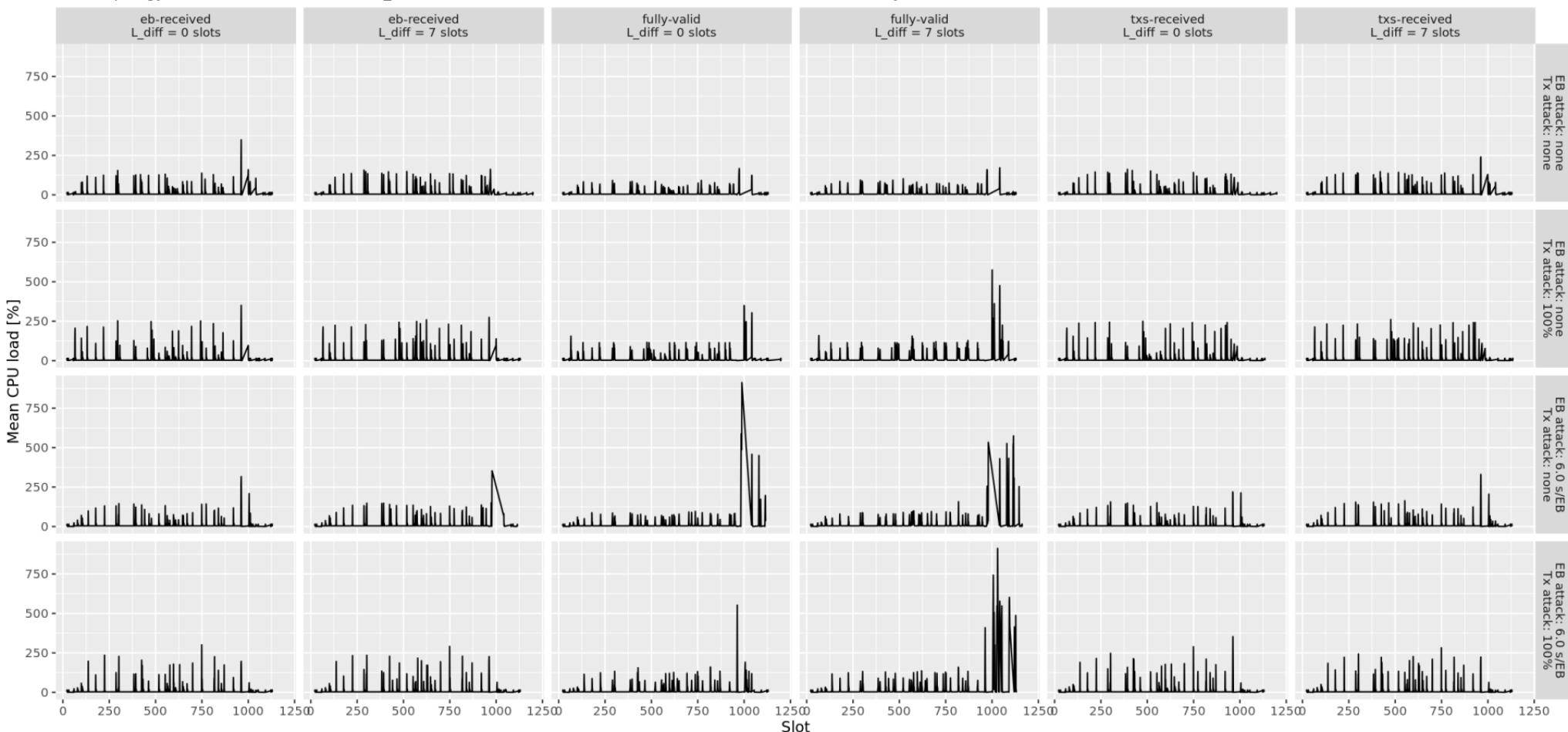
# Peak CPU load among all nodes

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



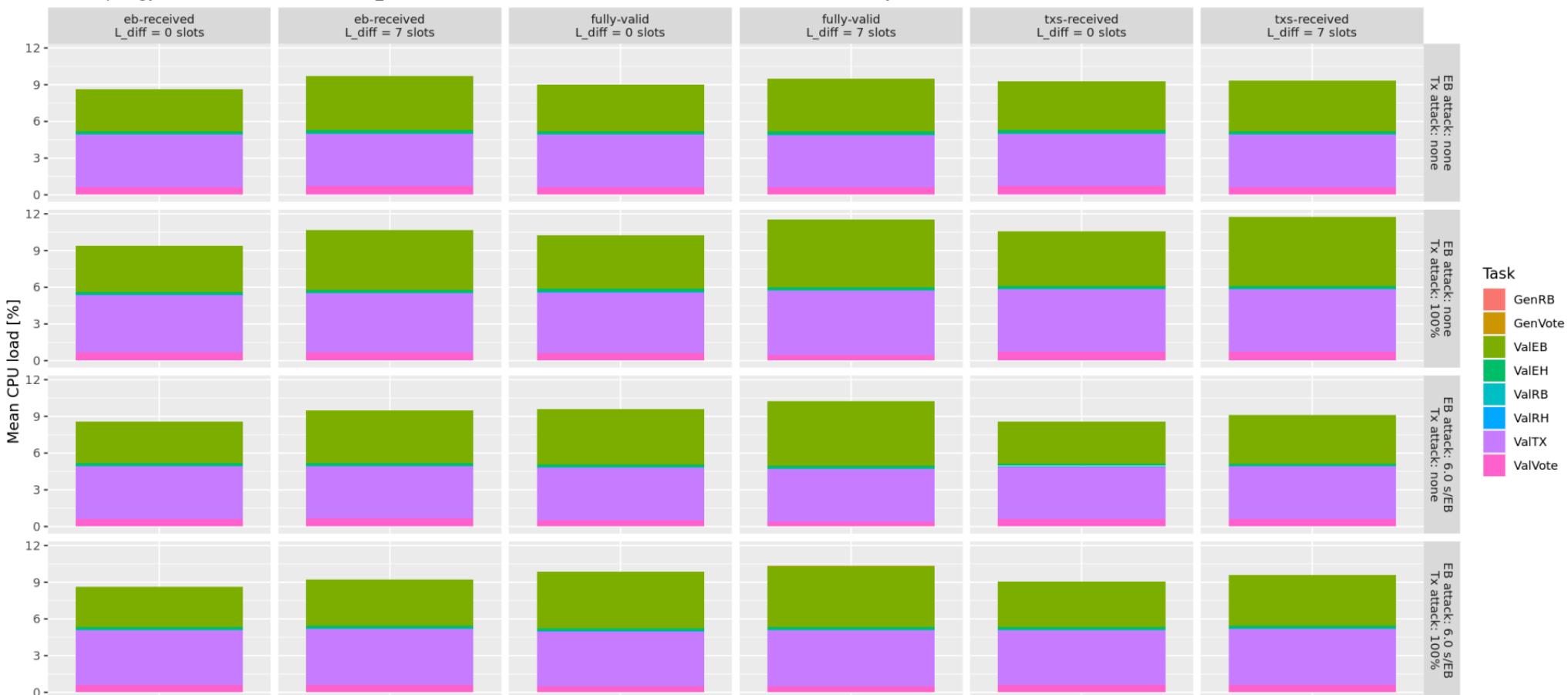
# Mean CPU load among all nodes

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



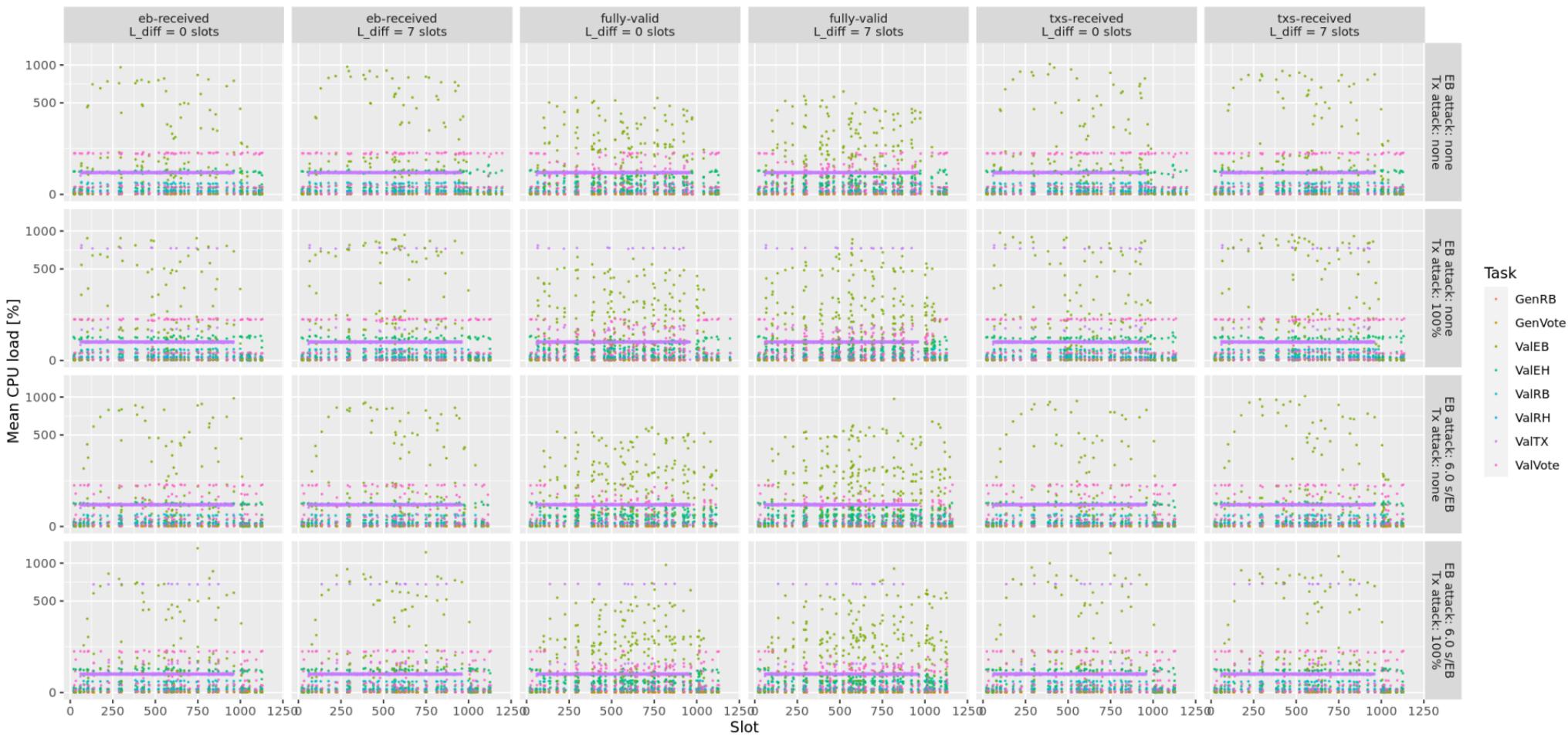
# Mean CPU load among all nodes

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



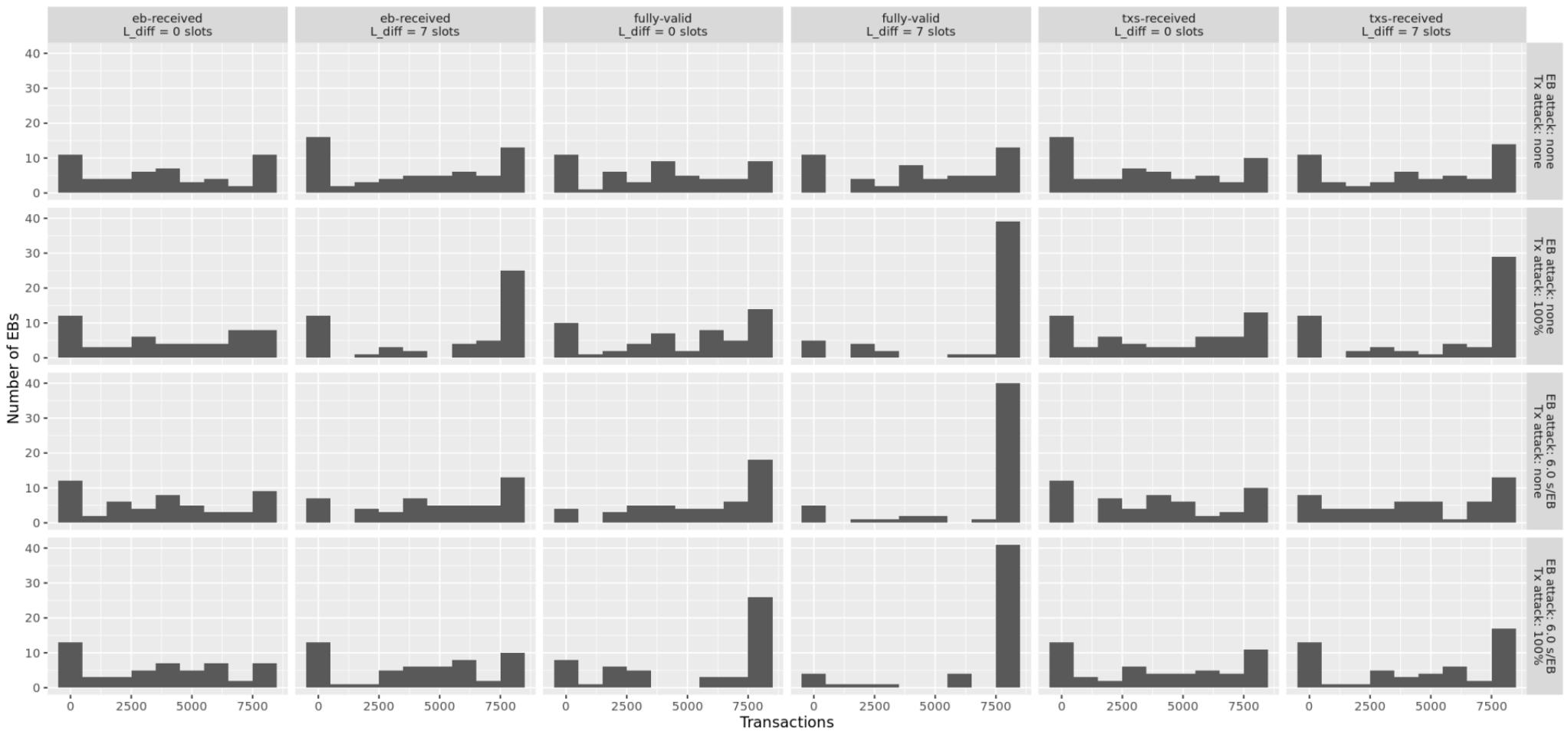
# Mean CPU load among all nodes

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



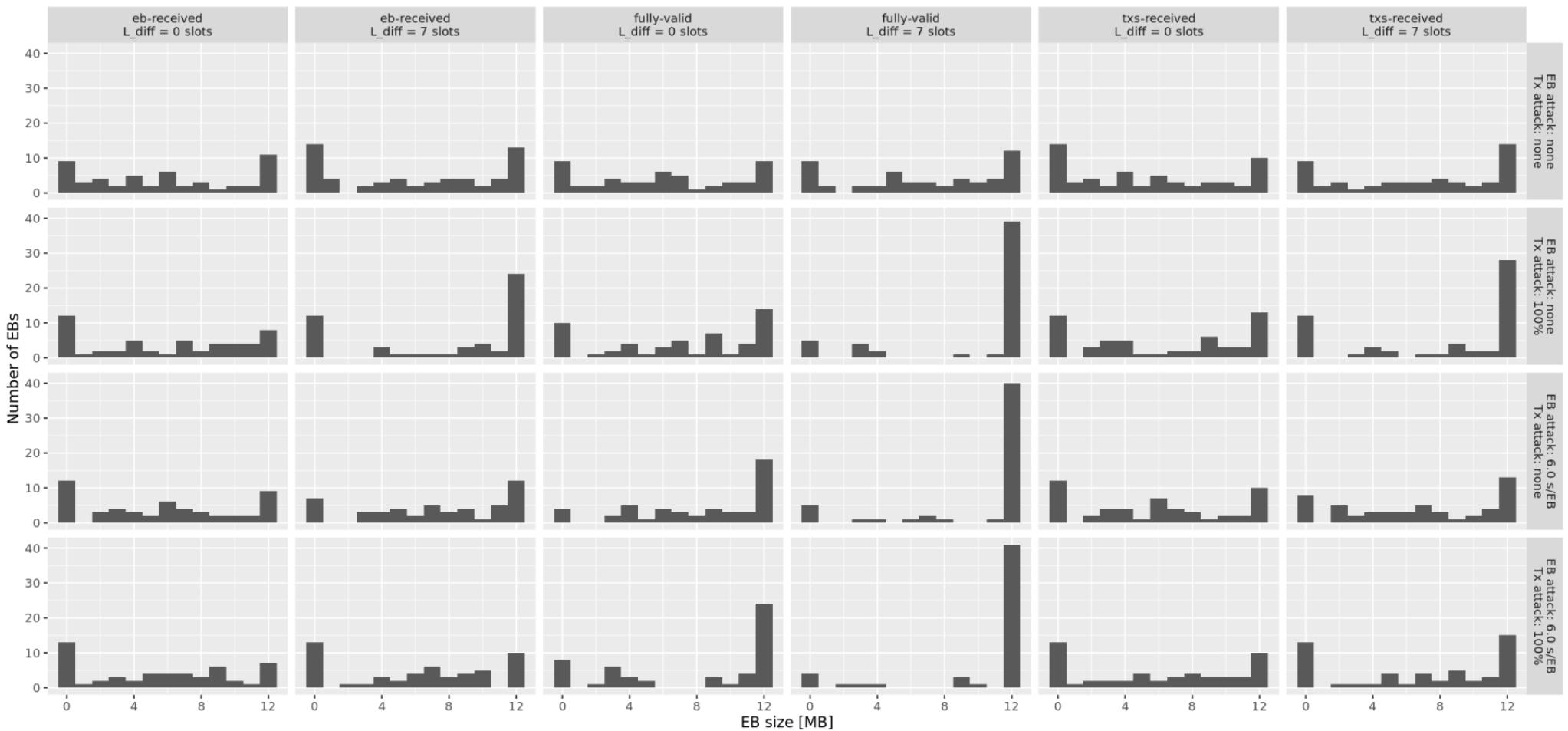
# Number of transactions in EBs

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



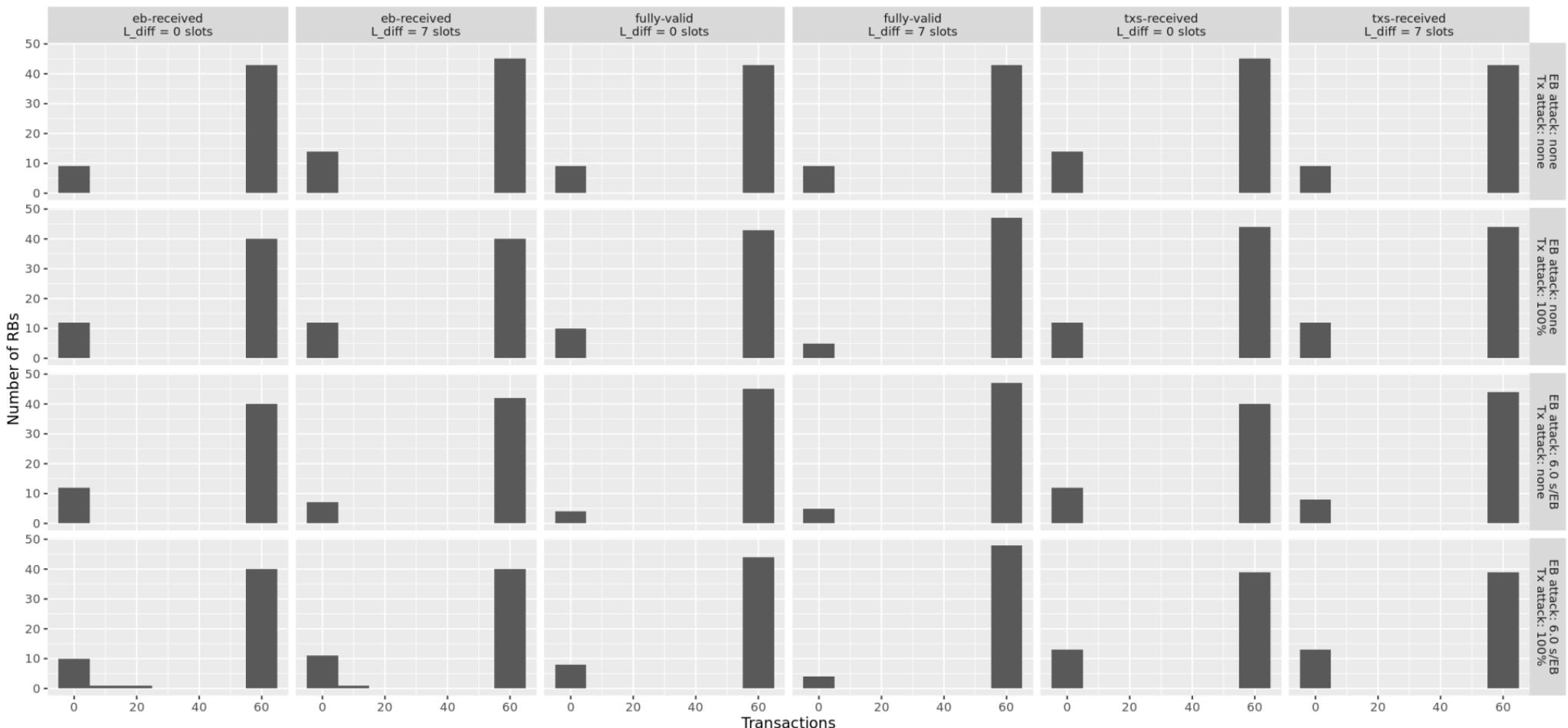
# Size of transactions in EBs

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



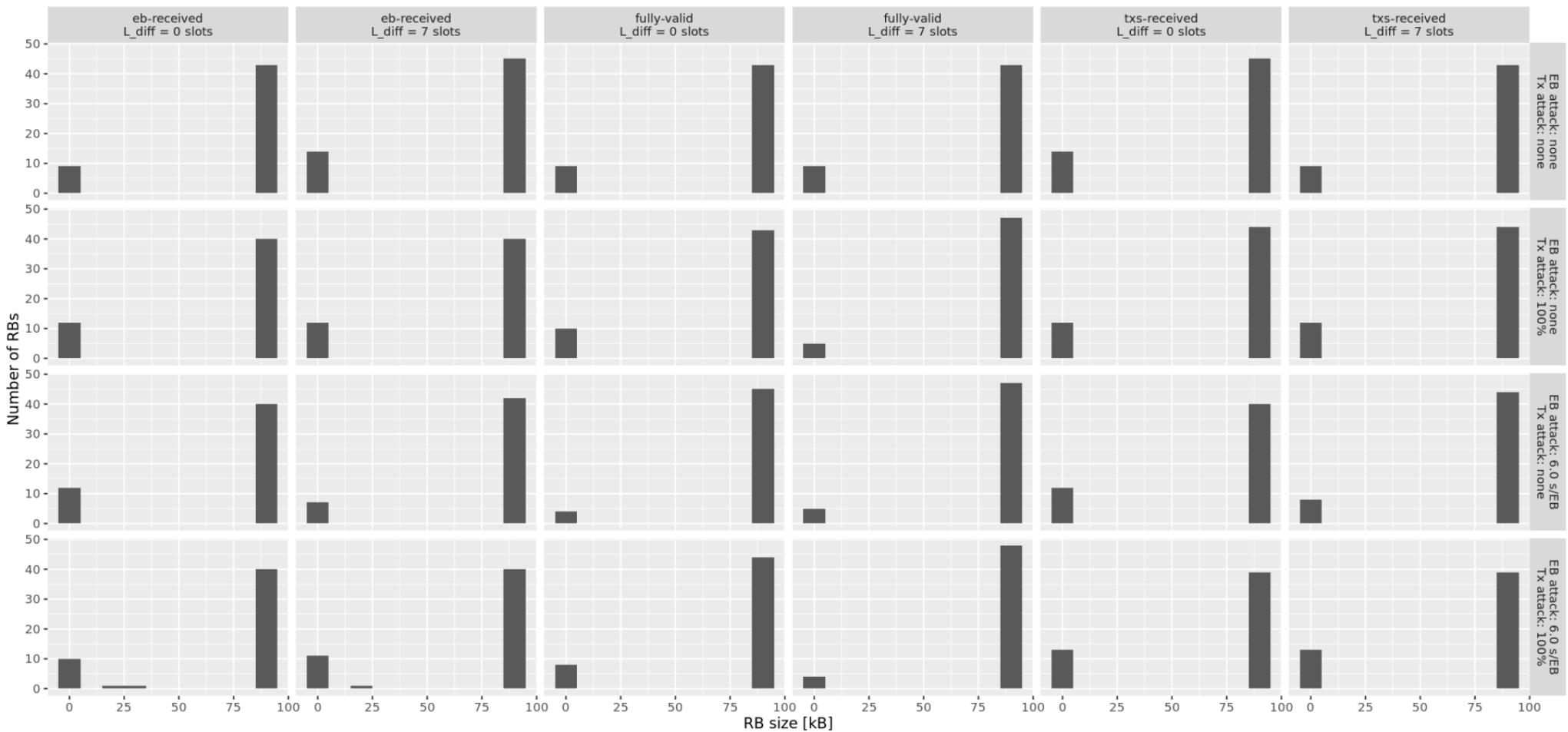
# Number of transactions in RBs

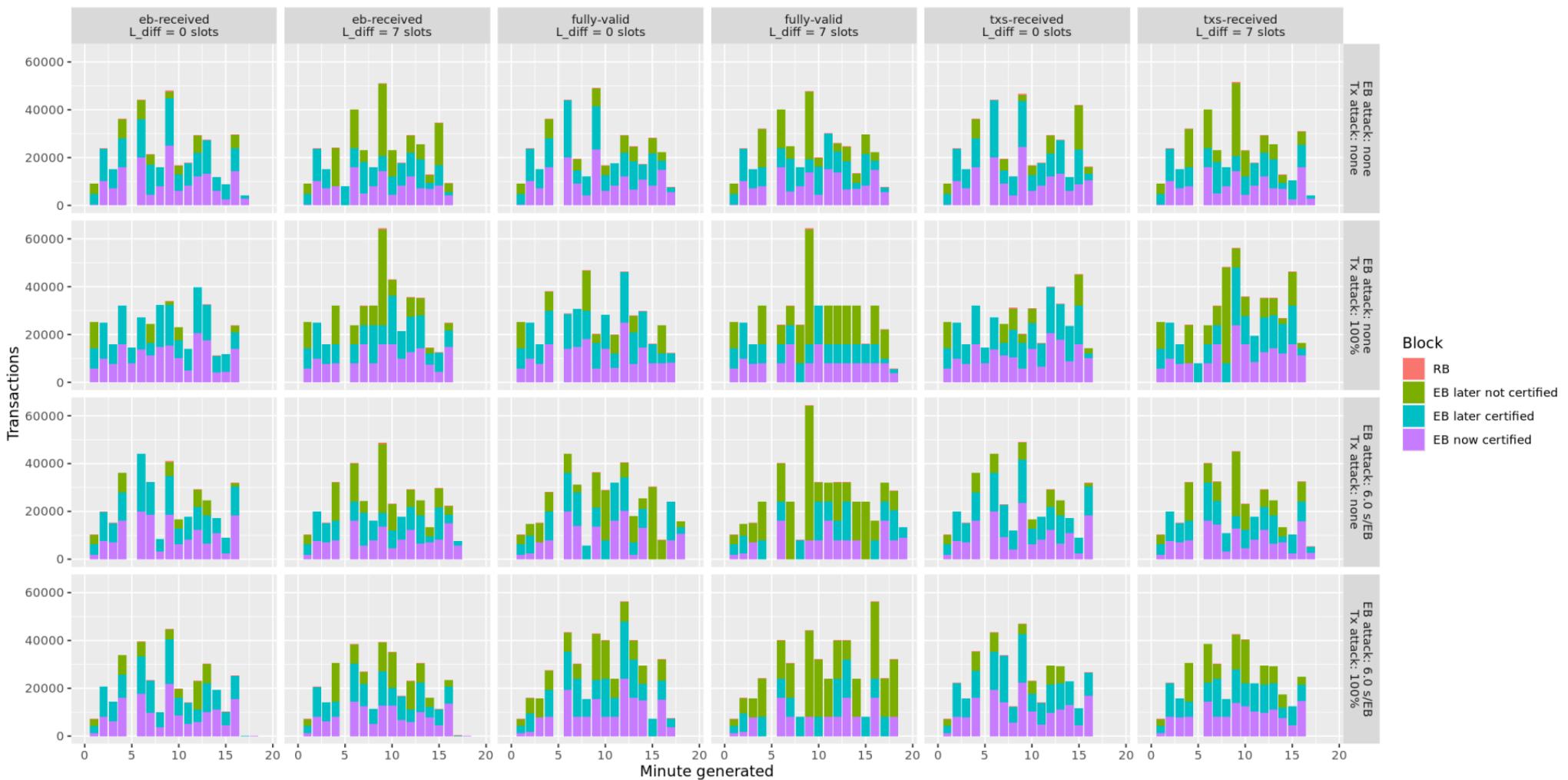
Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary

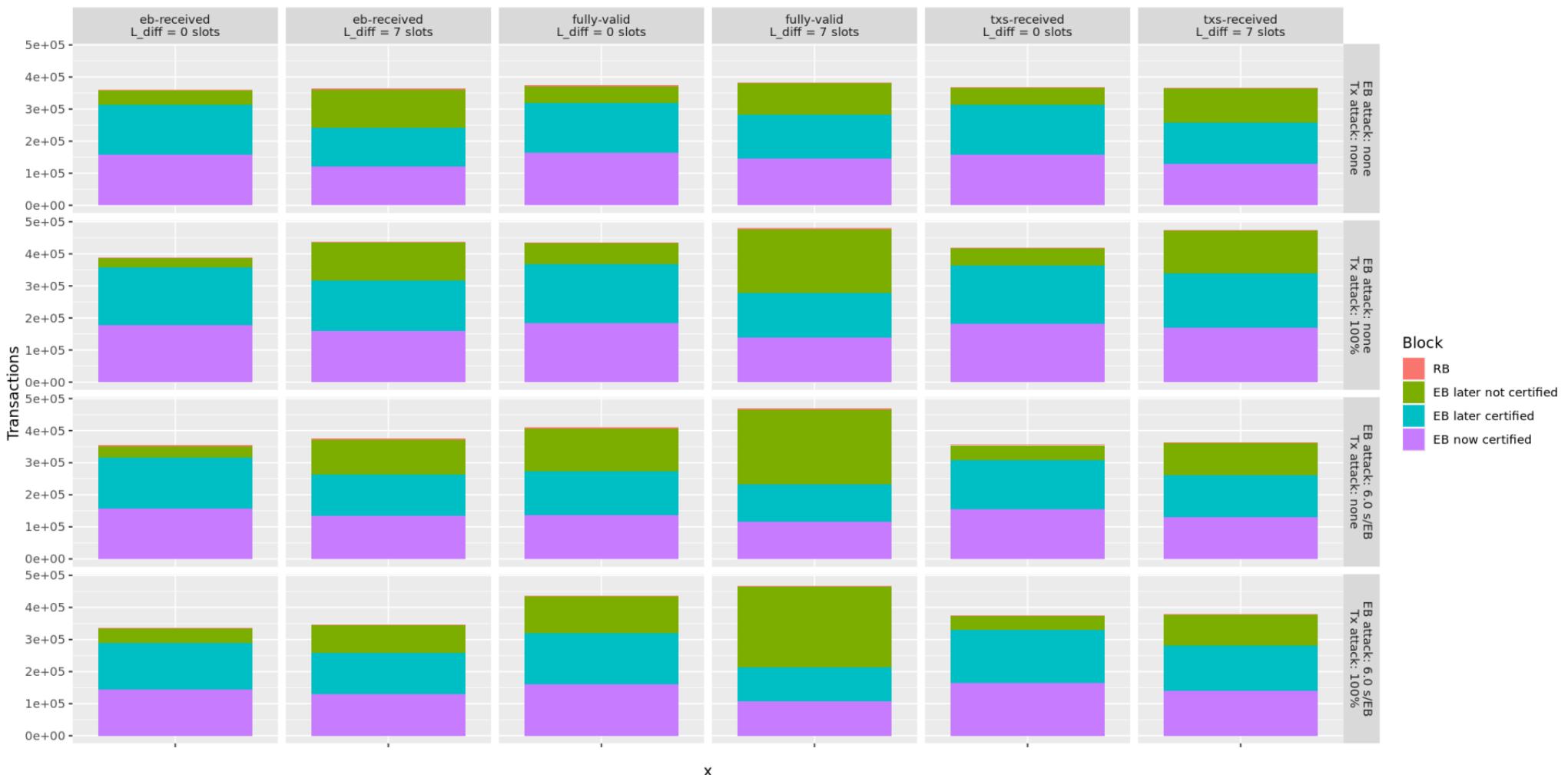


# Size of transactions in RBs

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary

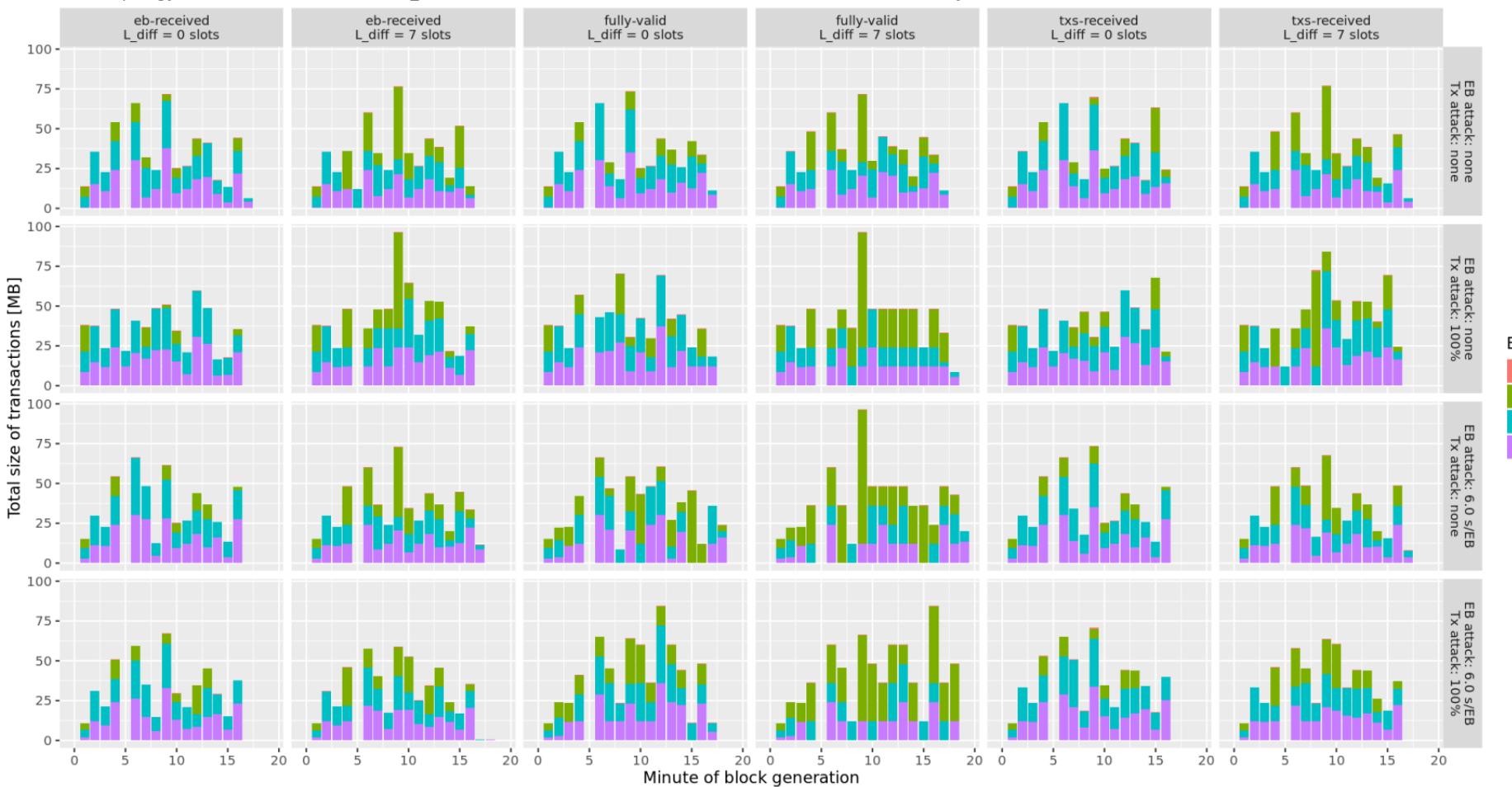






# Disposition of transactions in blocks

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary



## Disposition of transactions

Rust, topology-v2, 50 Mb/s, 4 vCPU/node, L\_vote = 7 slots, 12 MB/EB, 1500 B/Tx, 0.150 TxMB/s, 33% adversary

