Parameterizing 5G New Radio

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1 Motivation

- 5G NR is designed to support an emerging diversity in services, shifting away from the smartphone-centric 4G.
- To optimize the performance of 5G NR to fit new services, understanding the impact of configuration parameters is critical.

2 Research Goals

1. Identify relevant 5G NR configuration parameters.
2. Quantify the impact of parameter changes on 5G NR performance.
3. Optimize 5G NR for industrial and critical verticals.

3 5G Campus Networks

- Physical testbeds consisting of both commercial and open-source 5G system implementations.
- We have developed a method for conducting comparable nanosecond-precision measurements across deployments.
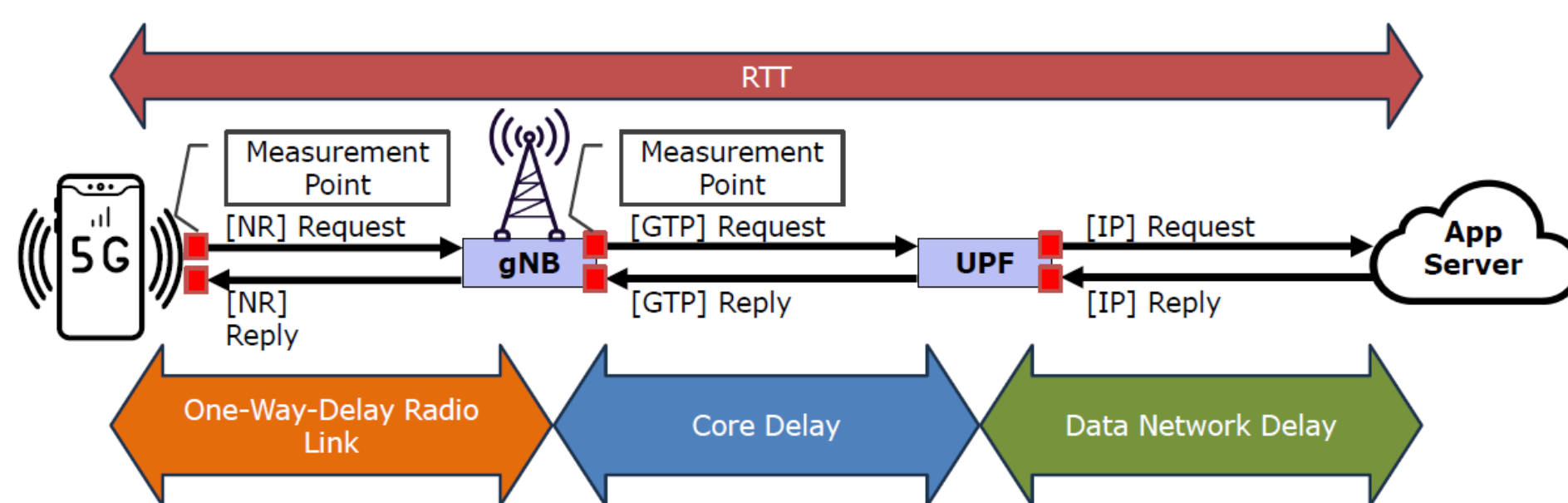

Fig. 1. Standardized performance measurement setup for comparable results across 5G deployments
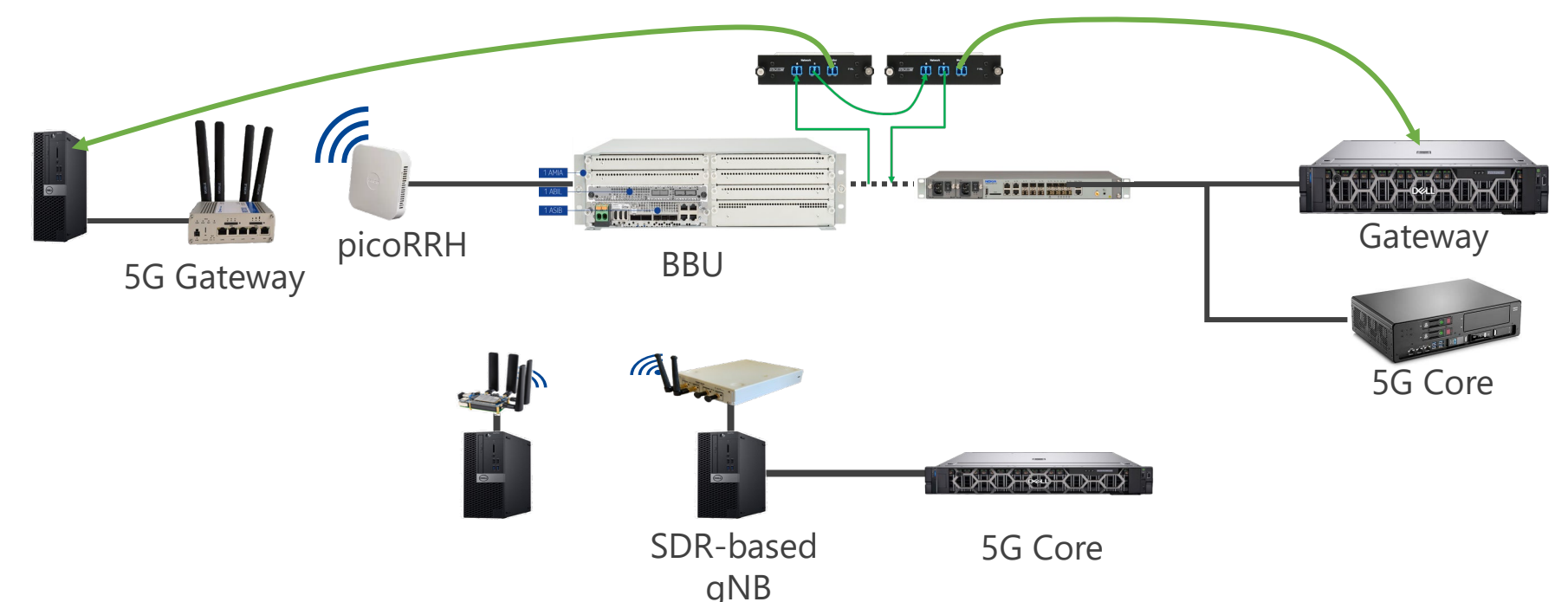

Fig. 2. Commercial Nokia 5G system and open-source 5G system available at the NTNU B5G lab

4 Comparative Measurement Study

- We conducted a detailed parameter study to investigate the impact of various configuration parameters in 5G NR.
- We successfully automated repeatable performance testing of 5G NR measurements across 5G deployments. (Fig. 3.)
- We demonstrated that performance results were not reproducible across different 5G vendor deployments. (Fig. 4., Fig. 5.)
- Our measurements show the impact of configuration parameters on 5G NR performance. (Fig. 4., Fig 5., Fig 6.)
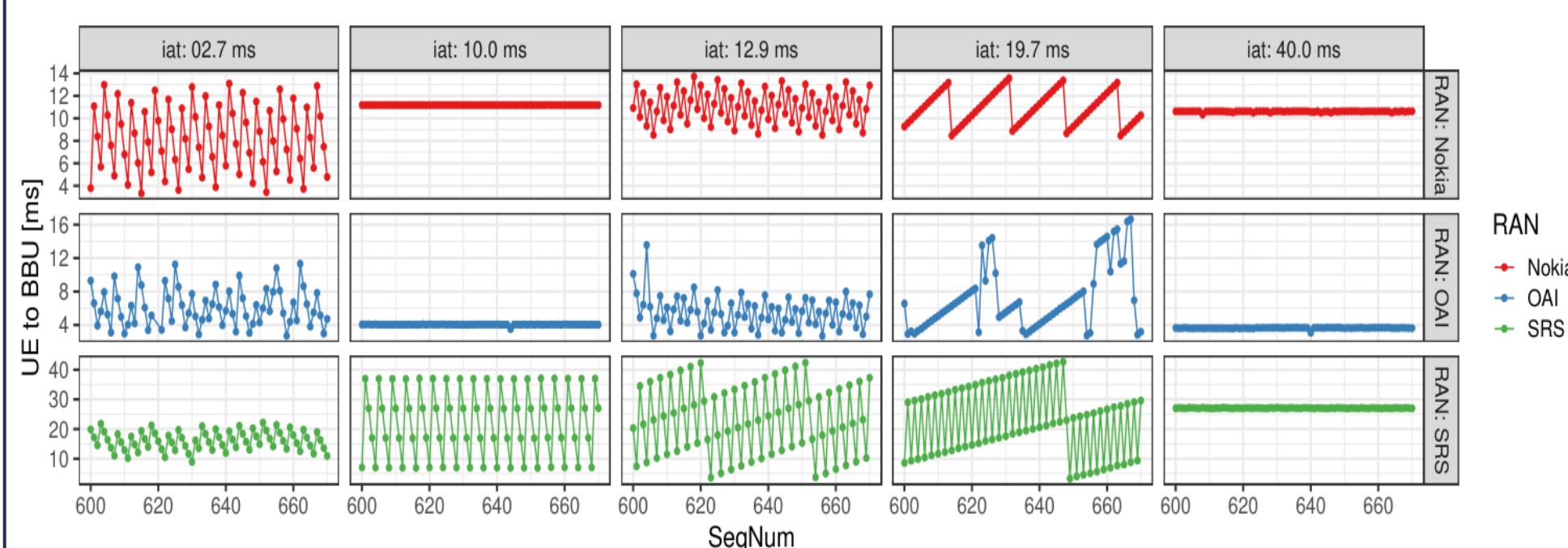

Fig. 3. Comparing uplink latency across different 5G NR gNB implementations

gNB	Ratio	DL (Mbps)			UL (Mbps)		
		NTNU	UWUE (1), (2)		NTNU	UWUE (1), (2)	
SRS	1:1	42.81±1.03	42.33±1.34	42.87±1.04	8.96±3.90	3.30±0.70	18.05±2.23
	2:1	55.64±0.43	55.77±0.52	55.54±0.40	5.04±2.72	3.25±0.42	17.21±1.61
	4:1	59.86±3.50	60.62±3.85	60.02±3.52	5.94±3.14	2.11±0.42	13.98±0.10
OAI	1:1	42.20±0.84	39.12±1.97	38.37±1.83	11.31±4.42	11.66±4.16	9.51±3.37
	2:1	55.10±4.21	49.66±3.68	49.51±4.04	8.47±1.29	7.80±1.11	7.17±1.11
	4:1	39.25±1.13	36.42±1.24	35.87±0.80	8.25±0.07	7.90±0.08	7.13±0.10

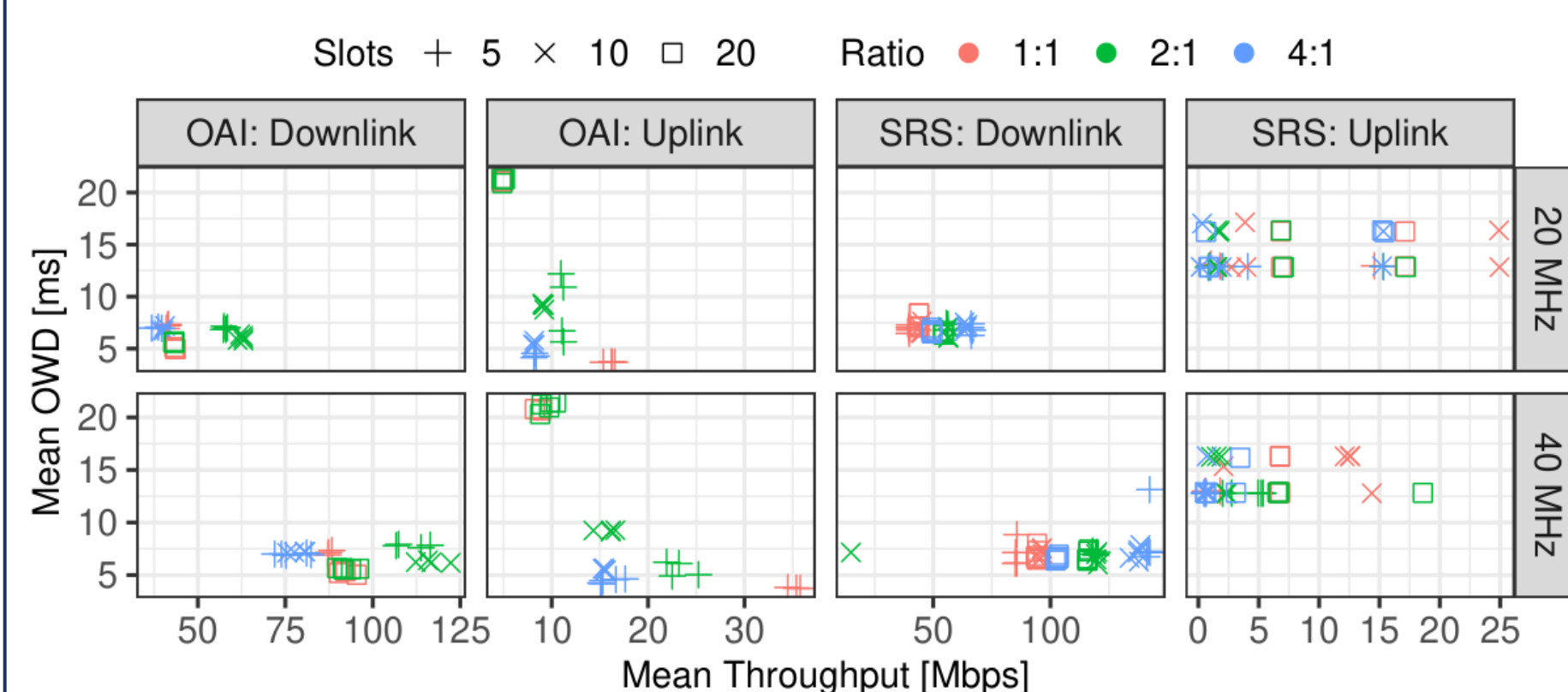Fig. 4. Comparison of mean throughput for 20 MHz bandwidth at NTNU and UWUE for SRS and OAI

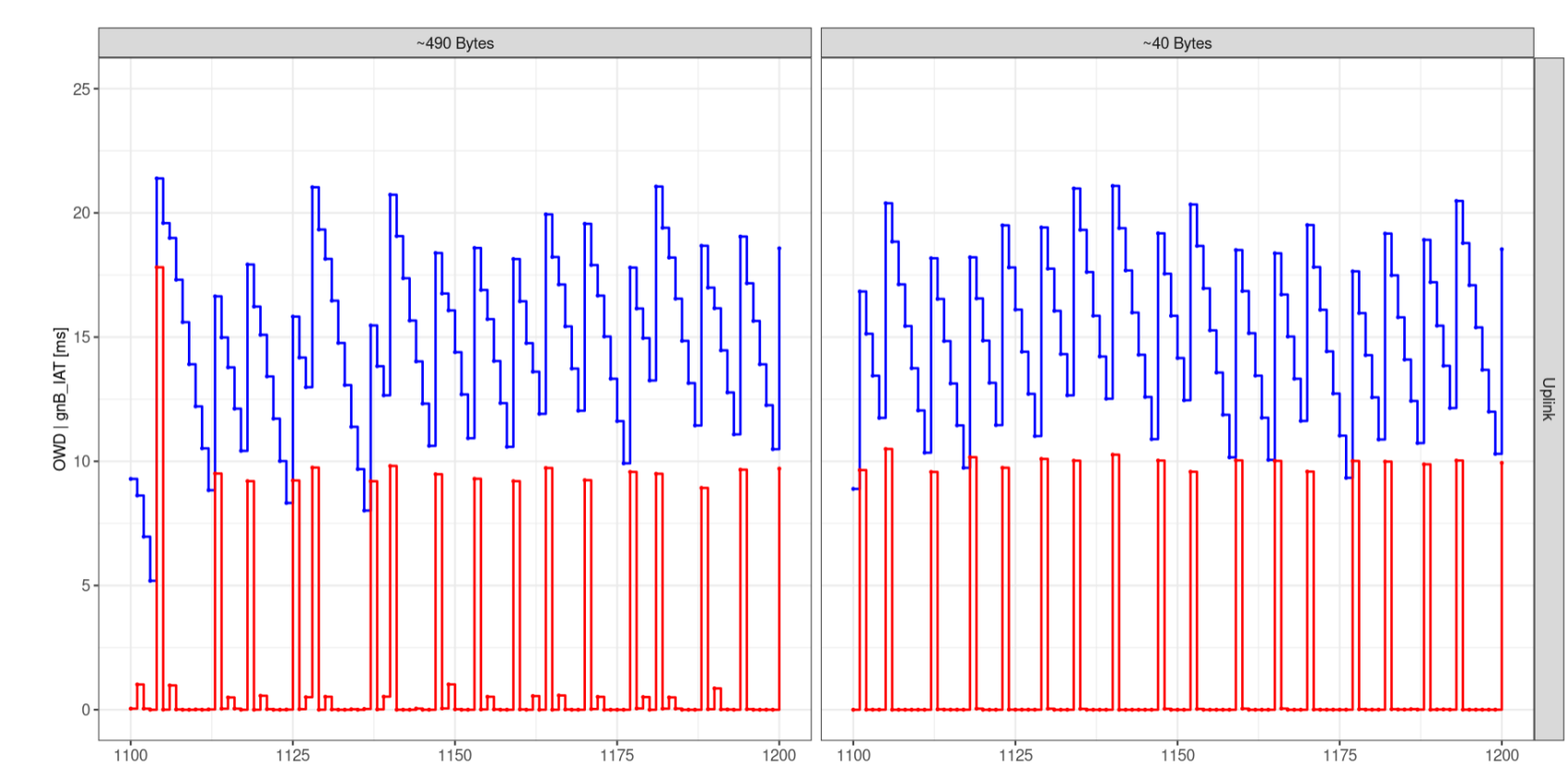Fig. 5. Performance comparison of 2 open-source 5G gNB implementations: SRS and OAI

Fig. 6. Visualizing batching in OAI across the radio interface