Migrating from Express to Fastify

Comparative Report: Express vs Fastify

Evaluate performance of a Node.js template server on Express and Fastify under varying load on four endpoints: `/health`, `/metrics`, `/auth/register`, `/auth/login`

Metodology

Load tests were run with k6 in Docker Swarm, increasing RPS from 10 to 1500 while measuring average response time and error rate. Container limits were fixed at 0.5 CPU and 256 MB memory. Observed CPU and memory remained below 35 %, indicating bottlenecks in single-threaded execution or I/O rather than host resource exhaustion

Results

(Table and charts with results on last page of the report)

This report compares the performance of two Node.js frameworks - Express and Fastify - under different load levels on four main endpoints: /health, /metrics, /auth/register, /auth/login. All tests were run under the same conditions, with RPS ranging from 10 to 1500.

Analysis

/health

Express was slightly faster at low load (up to 1000 RPS)

Fastify performed better under high load (1100+ RPS), keeping response time under 10 ms

/metrics

Fastify had the lowest response times across all tests

Express varied from 3.7 to 16 ms; Fastify stayed around 7–9 ms

/auth/register

Express dropped in performance at 100 RPS (105 ms vs 22 ms for Fastify)

At high load (>1000 RPS), both were stable, but Fastify remained 10–20% faster

/auth/login

Below 100 RPS, both frameworks had similar results

After 200 RPS, Fastify remained stable while Express response times increased by over 50%

Key Findings

Fastify showed more stable and predictable response times at high RPS, especially for /health and /metrics

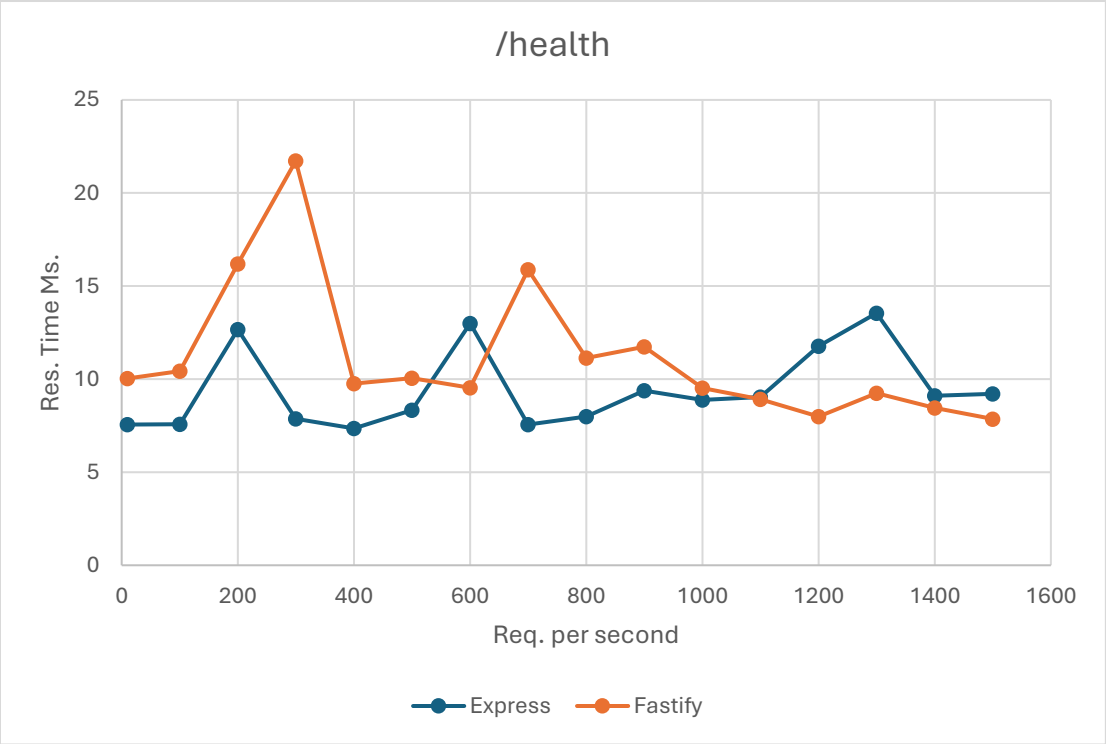
Express had noticeable performance drops on logic-heavy endpoints (/auth/register, /auth/login), especially above 100 RPS

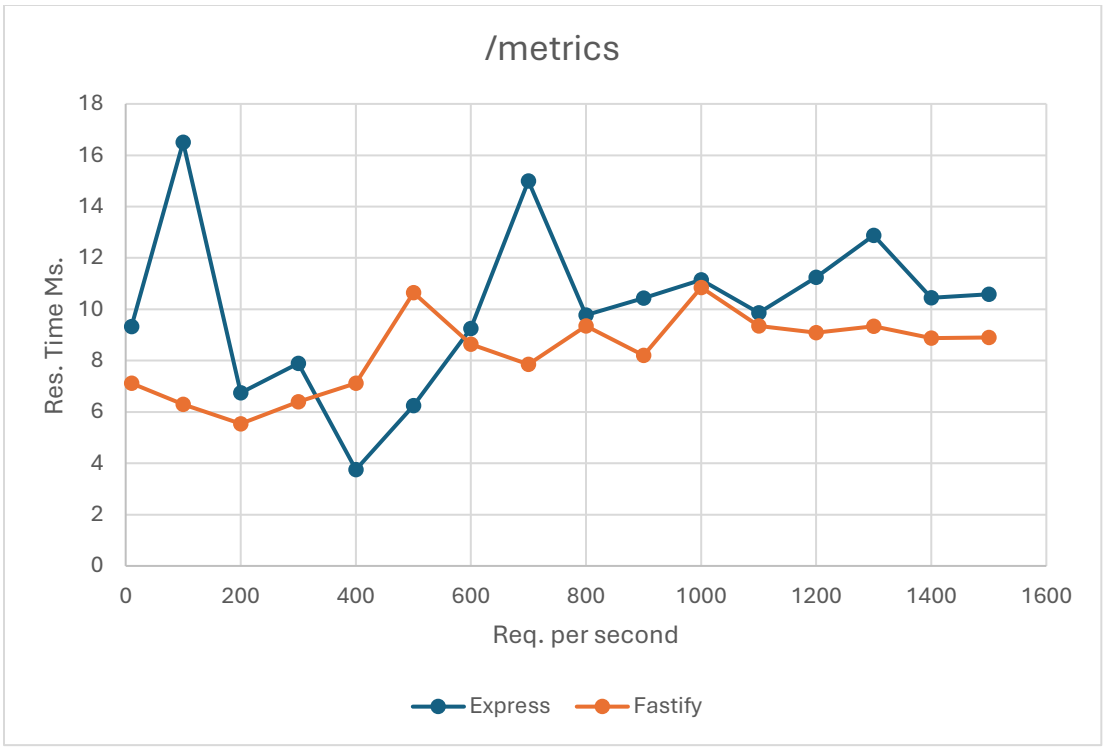
Fastify handles peak load better, especially on /metrics and /health, thanks to its async design and lightweight core

Conclusion

Fastify delivers better performance under high load, especially on CPU-intensive endpoints. Express is still a valid option for smaller projects or low-load APIs, but is not recommended for high concurrency or traffic peaks.

Charts




/metrics
Res. Time Ms.
18
16
14
12
10
8
6
4
2
0
0
200
400
600
800
1000
1200
1400
1600
Req. per second
Express
Fastify


/register
Res. Time Ms.
120
100
80
60
40
20
0
0
200
400
600
800
1000
1200
1400
1600
Req. per second
Express
Fastify

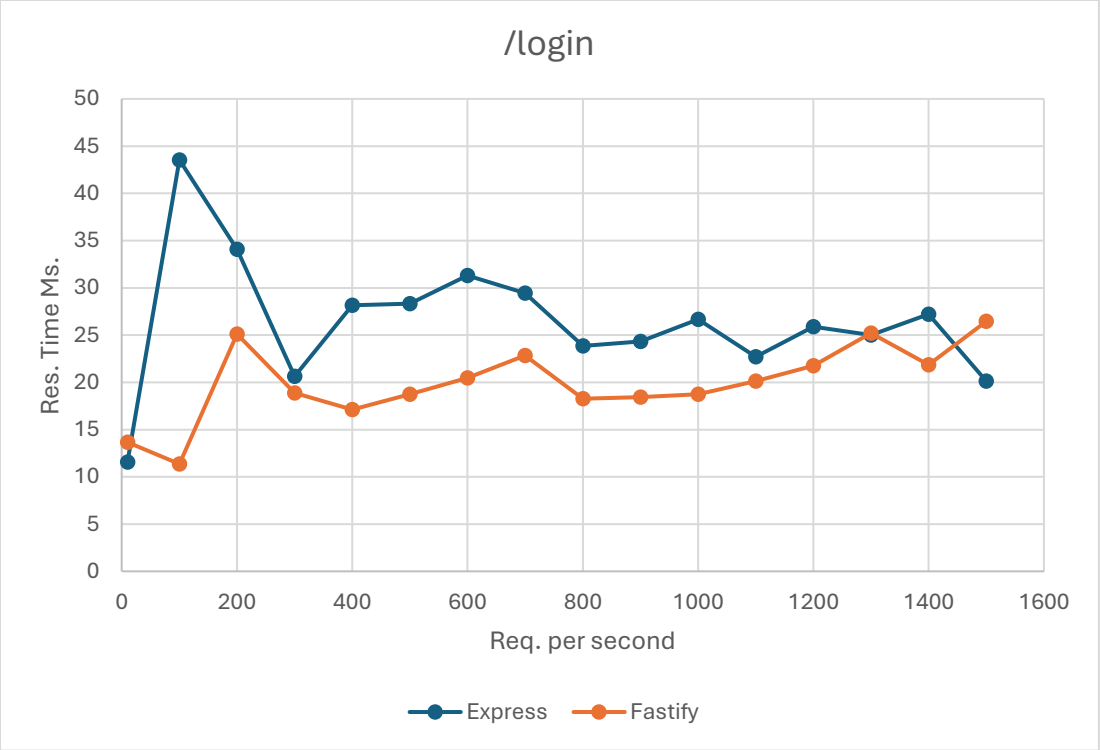


Table with load test results

Endpoint	RPS	Avg Response Time (ms)	Error %	Fastify Avg Response Time (ms)	Fastify Error %
Health					
/health	10	7.55444	0.00%	10.029583	0.00%
/health	100	7.583863	0.00%	10.437726	0.00%
/health	200	12.663609	0.00%	16.195487	0.00%
/health	300	7.874274	0.00%	21.721704	0.00%
/health	400	7.352433	0.00%	9.762872	0.00%
/health	500	8.333748	0.00%	10.060404	0.00%
/health	600	12.986474	0.00%	9.531105	0.00%
/health	700	7.568693	0.00%	15.87473	0.00%
/health	800	7.991187	0.00%	11.141696	0.00%
/health	900	9.385923	0.00%	11.732533	0.00%
/health	1000	8.883465	0.00%	9.513817	0.00%

/health	1100	9.044783	0.00%	8.924531	0.00%
/health	1200	11.773618	0.00%	7.988504	0.00%
/health	1300	13.546128	0.00%	9.23835	0.00%
/health	1400	9.110419	0.00%	8.448156	0.00%
/health	1500	9.213486	0.00%	7.860634	0.00%
Metrics					
/metrics	10	9.326637	0.00%	7.122419	0.00%
/metrics	100	16.507616	0.00%	6.300766	0.00%
/metrics	200	6.73797	0.00%	5.540001	0.00%
/metrics	300	7.890036	0.00%	6.391833	0.00%
/metrics	400	3.75171	0.00%	7.123104	0.00%
/metrics	500	6.246265	0.00%	10.645108	0.00%
/metrics	600	9.247674	0.00%	8.634211	0.00%
/metrics	700	14.99117	0.00%	7.857402	0.00%
/metrics	800	9.770219	0.00%	9.345464	0.00%
/metrics	900	10.43635	0.00%	8.199744	0.00%
/metrics	1000	11.150041	0.00%	10.849908	0.00%
/metrics	1100	9.858707	0.00%	9.343841	0.00%
/metrics	1200	11.243655	0.00%	9.093543	0.00%
/metrics	1300	12.877207	0.00%	9.336309	0.00%
/metrics	1400	10.44201	0.00%	8.87258	0.00%
/metrics	1500	10.586087	0.00%	8.903912	0.00%
/auth/register					
/auth/register	10	16.929217	0.00%	17.062929	0.00%
/auth/register	100	105.240357	0.00%	22.065578	0.00%
/auth/register	200	48.156129	0.00%	36.507651	0.00%
/auth/register	300	39.448306	0.00%	33.95396	0.00%
/auth/register	400	37.611576	0.00%	20.862219	0.00%
/auth/register	500	40.004535	0.00%	32.550261	0.00%
/auth/register	600	28.415369	0.00%	22.877674	0.00%
/auth/register	700	40.079618	0.00%	28.0662	0.00%
/auth/register	800	32.39975	0.00%	22.156158	0.00%
/auth/register	900	44.31196	0.00%	27.992662	0.00%
/auth/register	1000	45.031317	0.00%	50.582771	0.00%
/auth/register	1100	39.293691	0.00%	25.413005	0.00%

/auth/register	1200	37.526458	0.00%	32.713891	0.00%
/auth/register	1300	41.107678	0.00%	39.085437	0.00%
/auth/register	1400	38.167296	0.00%	36.20594	0.00%
/auth/register	1500	35.327588	0.00%	34.944673	0.00%
/auth/login					
/auth/login	10	11.569935	0.00%	13.663196	0.00%
/auth/login	100	43.546326	0.00%	11.360869	0.00%
/auth/login	200	34.090507	0.00%	25.120059	0.00%
/auth/login	300	20.630922	0.00%	18.874934	0.00%
/auth/login	400	28.16932	0.00%	17.118906	0.00%
/auth/login	500	28.339182	0.00%	18.74462	0.00%
/auth/login	600	31.301028	0.00%	20.463371	0.00%
/auth/login	700	29.435104	0.00%	22.854887	0.00%
/auth/login	800	23.858395	0.00%	18.269841	0.00%
/auth/login	900	24.345988	0.00%	18.428097	0.00%
/auth/login	1000	26.657457	0.00%	18.749109	0.00%
/auth/login	1100	22.71014	0.00%	20.116371	0.00%
/auth/login	1200	25.876037	0.00%	21.772846	0.00%
/auth/login	1300	25.012711	0.00%	25.197342	0.00%
/auth/login	1400	27.197199	0.00%	21.845787	0.00%
/auth/login	1500	20.148436	0.00%	26.452551	0.00%