Liferay®

Liferay PaaS Performance

Benchmark Study of Liferay
DXP 7.4 on Liferay PaaS

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Executive Summary

Liferay PaaS is Liferay's Platform-as-a-Service solution that allows customers to deploy, manage, and scale Liferay Digital Experience Platform (DXP) with cloud-native capabilities. Liferay PaaS includes a CI/CD pipeline, backups & restore, and immutable deployments via containers, alongside a feature-complete PaaS platform.

In order to demonstrate the performance limits of Liferay PaaS, the Liferay Engineering team performed intensive testing. These tests utilized virtualized hardware resources of a typical Liferay PaaS project, e.g. High Availability configuration with Sizing S (detailed below) and advanced performance testing methodology.

The goals of this benchmark study were to:

- Determine the optimal number of concurrent virtual users supported by the High Availability configuration, with two Liferay DXP instances, across defined test cases.
- Provide measurements to help Liferay PaaS customers, Liferay Global Services, and Liferay Service Partners during capacity planning.

Key Findings

The key findings of this preliminary study are:

- In the Isolated Login Transaction scenario, the configuration supports 18,000 virtual users with a maximum throughput of 508+ logins per second. Sustained login mean times are under 164 milliseconds (ms).
- In the Web Content scenario, the platform can support 18,500 virtual users with average page view time under 150 ms.
- The Asset Publisher scenario supports 10,000 virtual users with average page view time under 77ms.
- In the Document Library scenario, the platform supports over 12,500 virtual users while accessing 100,000 documents in the document repository.

Test Scenarios

The document utilizes the following conventions when describing test cases and results:

- Virtual Users – the number of simulated users concurrently transacting on the Liferay DXP system.
- Total Users – The total number of users stored in the database.
- Meantime (μ) - The average time in milliseconds it took for a test to be completed at a specific number of concurrent users.
- Standard Deviation (σ) - The amount of variation (or dispersion) in the transaction times at a specific number of concurrent users.
- Two Sigma (2σ) - In a normal distribution, two sigma represents the confidence interval where 95% of all test results are under the given value. For example, a Two Sigma value of 1000 ms would mean that 95% of all users would complete the test in under 1 second at that load

Liferay determined the scenarios that best-modeled product use cases across a broad spectrum of industries.

Transaction-centric Scenarios

- Applies to solutions across a variety of industries where a large number of users will login and perform transactions like online banking, online insurance applications, airline, and hotel booking.
- Authenticated user accesses with longer user session times.

Web Content Management Scenarios

- Applies to corporate intranet or public web sites looking to display content.
- 1:1 ratio between authenticated and non-authenticated access.

Document Management Scenarios

- Applies to corporate intranets, self-service portals, and other solutions where users manage and share documents.
- Mostly authenticated access, roughly 9:1 ratio between read and write transactions.

Benchmark Configuration and Methodology

Liferay PaaS Configurations

The configuration of Liferay PaaS includes 2 Liferay DXP instances. Additionally, High Availability includes two instances of the Web Server and three instances of Liferay Enterprise Search. High Availability serves mission-critical systems that require continual uptime and serve a larger number of users concurrently.

Components of a Liferay PaaS Environment includes:

- Liferay DXP
- Liferay Enterprise Search
- Database
- Web Server
- Backup & Restore
- Monitoring Capabilities
- Content Delivery Network (CDN)
- VPN Service

The following table details the configuration of each PaaS stack and the software included.

Configuration (per instance):

Service	CPU	Memory	Storage
Web Server	2 Cores	512 MB	N/A
Liferay DXP	12 Cores	16 GB	NFS 100 GB
MySQL Database	4 Cores	15 GB	SSD 100 GB
Search	8 Cores	8 GB	SSD 100 GB

Methodology

The Liferay PaaS performance testing was improved this year, including new processes and testing thresholds. For this whitepaper, the team has evolved testing methodology to replicate scenarios closer to the end-user experience. As a result, the team has removed the tests for Blogging and Message Boards and replaced them with Asset Publisher and Web Content.

Benchmark Results

Transaction Centric Scenarios

Isolated Login

Isolated Login is a transaction-centric test that focuses on the login process of Liferay DXP. The login is a very resource-intensive process that triggers the portal's auth pipeline, which includes retrieving and building the user's permission bag, assembling the user's session, rendering the landing page, and others.

In Liferay DXP 7.4, we use more modern features like Content Pages, Fragments, and more. When compared to former widget pages with traditional portlets on earlier versions of Liferay DXP, these new features will require more computing capacity. The preliminary tests were conducted considering these more modern features.

Virtual Users	Login μ(ms)	Login σ(ms) Mean Time Standard Deviation	Login 2σ (ms)	Login Throughput (TPS)	CPU
15000	61.8	94	249.8	427	68.5%
16000	115	293	701	453	69.6%
16500	115	206	527	467	88.6%
17000	111	281	673	480	76.3
17500	122	280	682	494	77.30%
18000	164	240	644	508	83.1%
18500	379	418	1215	514	81.2%
19000	422	437	1296	527	85.3%
20000	949	649	2247	536	92.3%
21000	1330	733	2796	550	93.9%

Figure 1: Isolated Login

Figure 1 illustrates the performance observed during this test. The mean time for login remains at less than 200 as we approach the performance inflection point. At 18,000 virtual users, we have a mean time (μ) of 164 ms and the logins (2σ) around 644ms. This indicates that the performance inflection point, where login times increase at an exponential rate for the first time, is somewhere between 18000 and 18500 users.

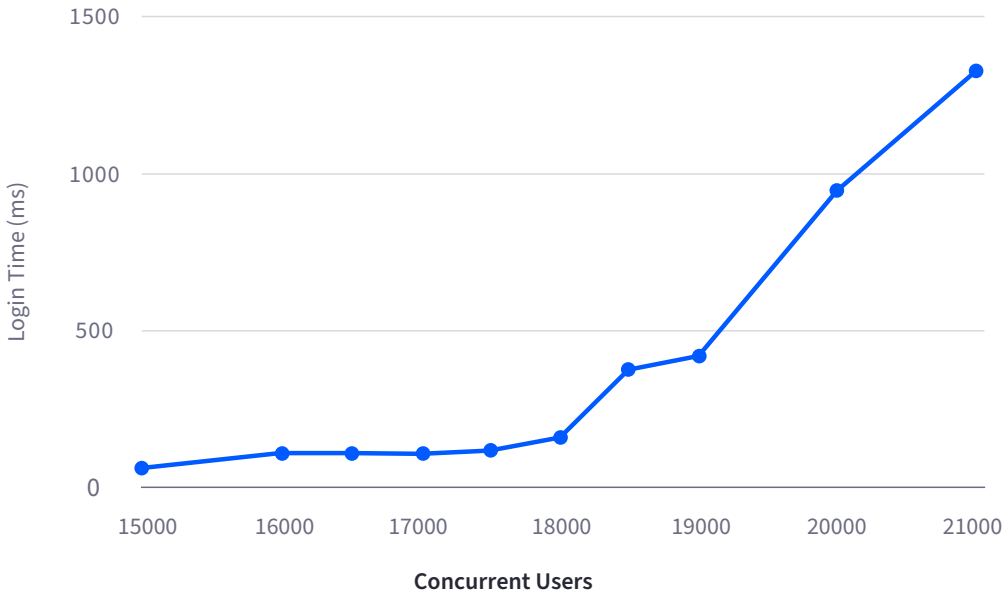


Figure 2: Isolated Login

Web Content Management Scenarios

Web Content

Web Content represents one of the foundational elements around content management. The web content test case demonstrates the content display capability in Web Content with a page view-focused approach. In Figure 3, we can see the summary for the page browsing (viewing) transactions.

Virtual Users	Browse Page μ(ms)	Browse Page σ(ms)	Total 2σ(ms)	Browse Page Throughput (TPS)	CPU
15000	39.1	112	263.1	729	57.9%
16000	48.2	197	442.2	777	55.8%
17000	59.2	276	611.2	826	57.4%
17500	92.4	202	496.4	849	63.3%
18000	75.2	187	449.2	873	65%
18500	143	260	663	894	64.2%
19000	126	492	1110	918	71.30%
19500	178	443	1064	936	70.2%
20000	395	534	1463	947	68%
21000	657	566	1789	986	73.7%
22000	753	894	2541	1020	82.90%

Figure 3 – Web Content

Figure 4 shows us the optimal performance point at 18,500 virtual users for two JVMs.

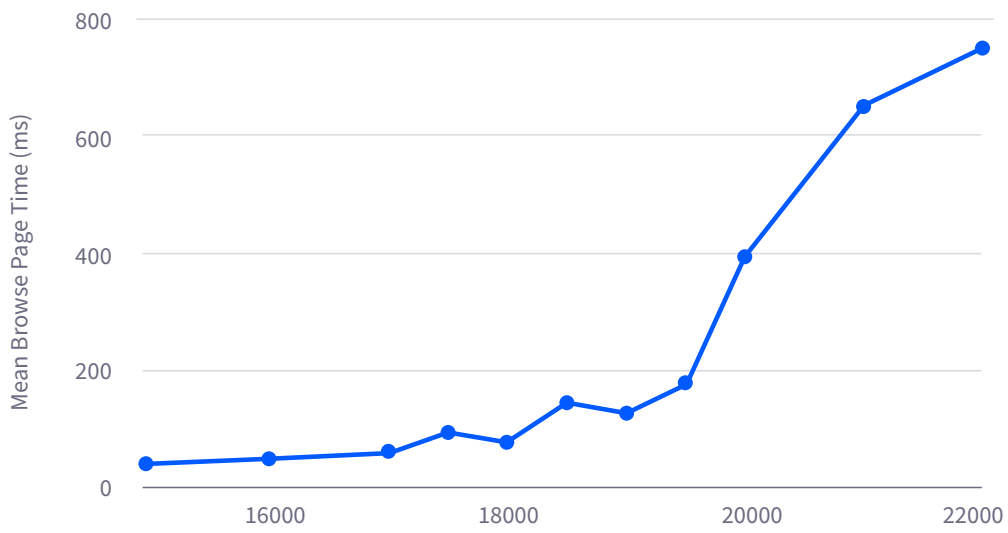


Figure 4 - Web Content

Asset Publisher

Asset Publisher is an important component for display content. In Liferay, there are various types of content including Blogs, Documents and Media, Web Content, and more. The Asset Publisher can be configured to display assets selected by Collections or Filters. We attempt to simulate real end-user behavior by browsing content and browsing pages with a filter.

As shown in Figure 5, the performance inflection point was at about 10,000 virtual users. At this load, we observed the total mean time to be around 147.6 ms with 95% of all page views consuming roughly 813.6ms.

Virtual Users	Browse Page Without Filterμ (ms)	Browse Page Without Filter σ (ms)	Browse Page Without Filter Through-put (TPS)	Browse Page Without Filter μ (ms)	Browse Page Without Filter σ (ms)	Browse Page Without Filter Through-put (TPS)	Total μ (ms)	Total σ (ms)	Total 2σ (ms)	CPU
6000	53.5	47.4	46.1	47.2	48.4	231	100.7	95.8	292.3	51.80%
7000	54.9	32.2	54.4	48	30.8	271	102.9	63	228.9	54.60%
8000	54.2	50.2	62	46.9	46	310	101.1	96.2	293.5	66.50%
9000	60.5	60.5	69	54.7	67.7	346	115.2	128.2	371.6	78.10%
9500	11	61.3	73.8	38	53.7	368	49	115	279	67.7%%
10000	77	166	77.3	70.6	167	387	147.6	333	813.6	74.30%
10500	110	290	80.8	98.7	259	405	208.7	549	1306.7	81.10%
11000	110	300	84.8	108	317	424	218	617	1452	74.40%
12000	679	708	88.9	653	674	445	1332	1382	4096	84.90%
13000	1470	1020	91.3	1440	1020	455	2910	2040	6990	93.60%

Figure 5 – Asset Publisher

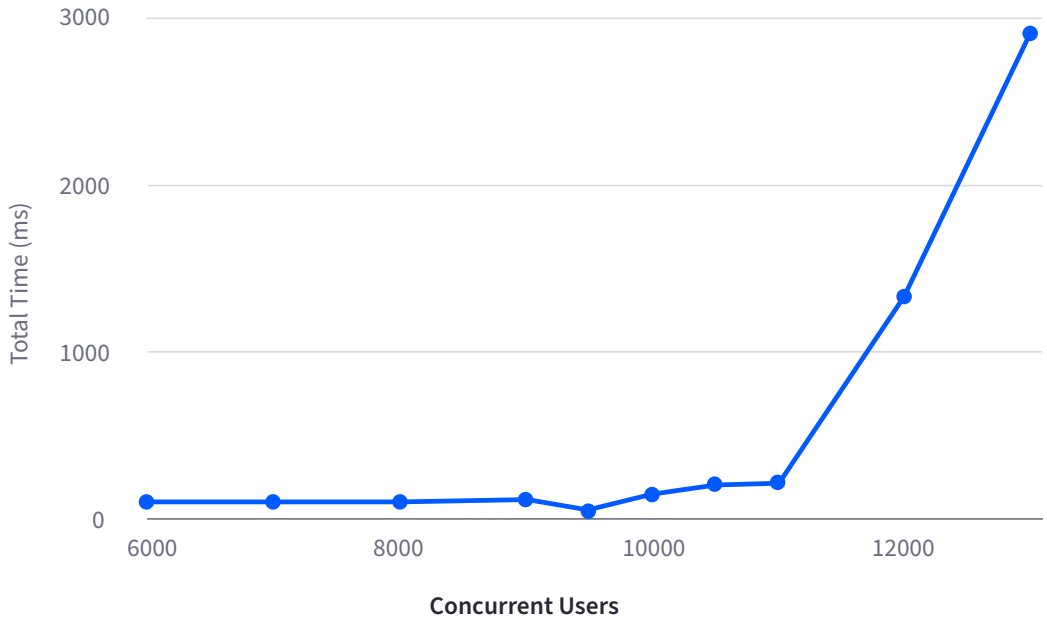


Figure 6 - Asset Publisher

Document Management Scenarios

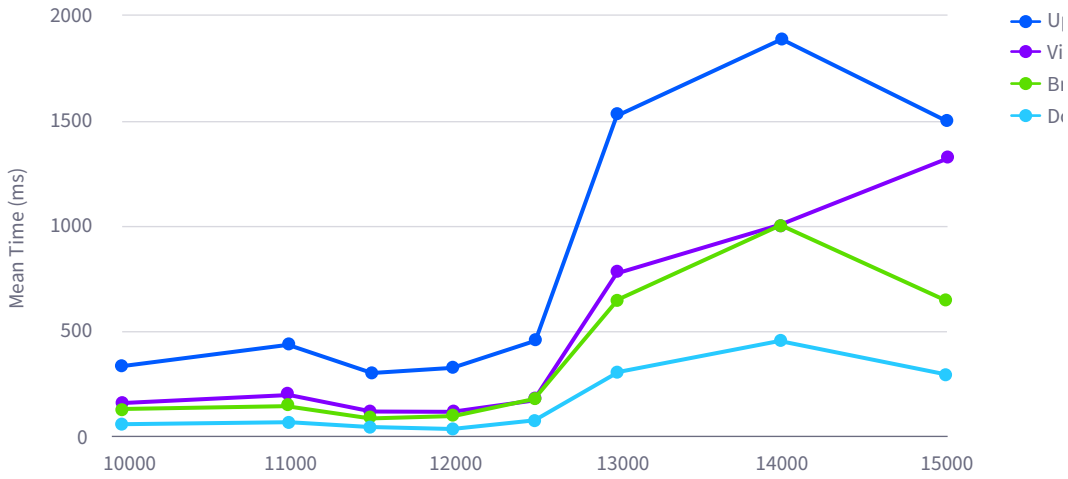
Liferay DXP provides rich capabilities for both Web Content Management and Document Management. The Documents and Media features are backed by a full-featured content repository that supports multi-level workflow approvals, custom document metadata definitions, and social collaboration features (e.g, ratings, comments). The performance test scenario demonstrates the typical usages and includes these tests: Browse File, Download File, and Upload File.

At 12,500 virtual users, we see a total mean time of 889.6 ms and total standard deviation of 2430 ms.

Virtual Users	Browse Folder µ	Browse Folder σ	Browse Folder Through-put (TPS)	View File Details µ	View File Details σ (ms)	View File Details Through-put (TPS)
10000	153	519	73.1	125	427	65.1
11000	201	686	85.6	148	509	77.6
11500	111	377	90.5	89.7	318	81.2
12000	120	144	92.1	97.4	160	83.5
12500	179	573	97.9	182	550	87.8
13000	786	1080	98	647	975	88.7
14000	1000	1000	105	1010	975	94.2
15000	643	728	109	1320	1370	98.3

Virtual Users	Download File µ	Download File σ(ms)	Download File Through-put (TPS)	Upload File µ	Upload File σ (ms)	Total µ (ms)	Total σ (ms)
10000	56	312	64.6	334	797	668	2055
11000	69	348	77.9	437	1130	855	2673
11500	40.5	255	81.6	305	580	546.2	1530
12000	31.7	66.1	83.6	329	208	578.1	578.1
12500	71.6	378	88.3	457	929	889.6	2430
13000	303	558	88.6	1530	1730	3266	4343
14000	450	565	94.1	1890	1580	4350	4120
15000	293	495	98.2	1500	1280	3756	3873

Figure 7 - Document Management



Summary

This benchmark study demonstrates the performance of Liferay PaaS in a typical High Availability configuration (Sizing S) and to provide statistics for future capacity planning.

Based on the results of this study, Liferay determined that Liferay PaaS provides a high-performance environment for building solutions for any combination of transaction, web content management, and document management scenarios. Additionally, with Liferay DXP 7.4's added feature-rich capabilities, Liferay PaaS continued to deliver robust functionality and performance.

Liferay PaaS also offers the Auto Scaling feature which allows customers to handle unexpected peak traffic volumes, leading to a more seamless experience when these scenarios occur. Using Auto Scaling, Liferay PaaS adds capacity when workloads exceed user-defined thresholds, providing a balance between cost and scalability.

With improved performance and out-of-the-box features, we believe that Liferay PaaS is uniquely positioned to help enterprises successfully achieve digital transformation.

Moving Forward

Contact Us

For more information about Liferay PaaS, contact us at sales@liferay.com.

Liferay helps organizations build for the future by enabling them to create, manage, and scale powerful solutions on the world's most flexible Digital Experience Platform (DXP). Trusted globally by over a thousand companies spanning multiple industries, Liferay's open-source DXP facilitates the development of marketing and commerce websites, customer portals, intranets, and more. Learn how we can use technology to change the world together at liferay.com.