

Informix Benchmarks on Cloud Systems Updated!

By Lester Knutsen

Date: Thursday, December 9, 2021, 2:00pm EST

Informix Tech Talks by the IIUG

We have launched a new channel on YouTube for Informix Users! Please subscribe to our channel on YouTube to stay informed.

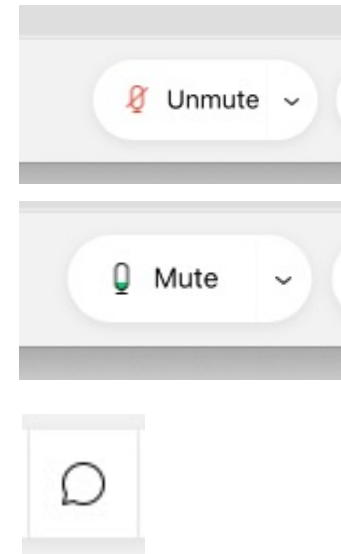
International Informix User Group

We speak Informix



Webcast Guidelines

- **The Webcast is pre-recorded.**
The replay and slides will be available on the IIUG Website
- **Please Mute your line.**
Background sounds will distract everyone
- **Use the Chat Button** to ask questions



Lester Knutsen



Lester Knutsen has been developing database applications with IBM Informix databases since 1983. He is founder of Advanced DataTools, an IBM Informix Consulting and Training Partner. Lester is semi-retired and continues to provide Informix Training and Informix Performance Tuneup services on a limited part-time basis. Lester was the founder of the Washington D.C. Area Informix Users Group and was one of the five founding members of the International Informix Users Group. Lester Knutsen was honored to receive the IBM Champion Lifetime Achievement Award from IBM in 2020.

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Agenda

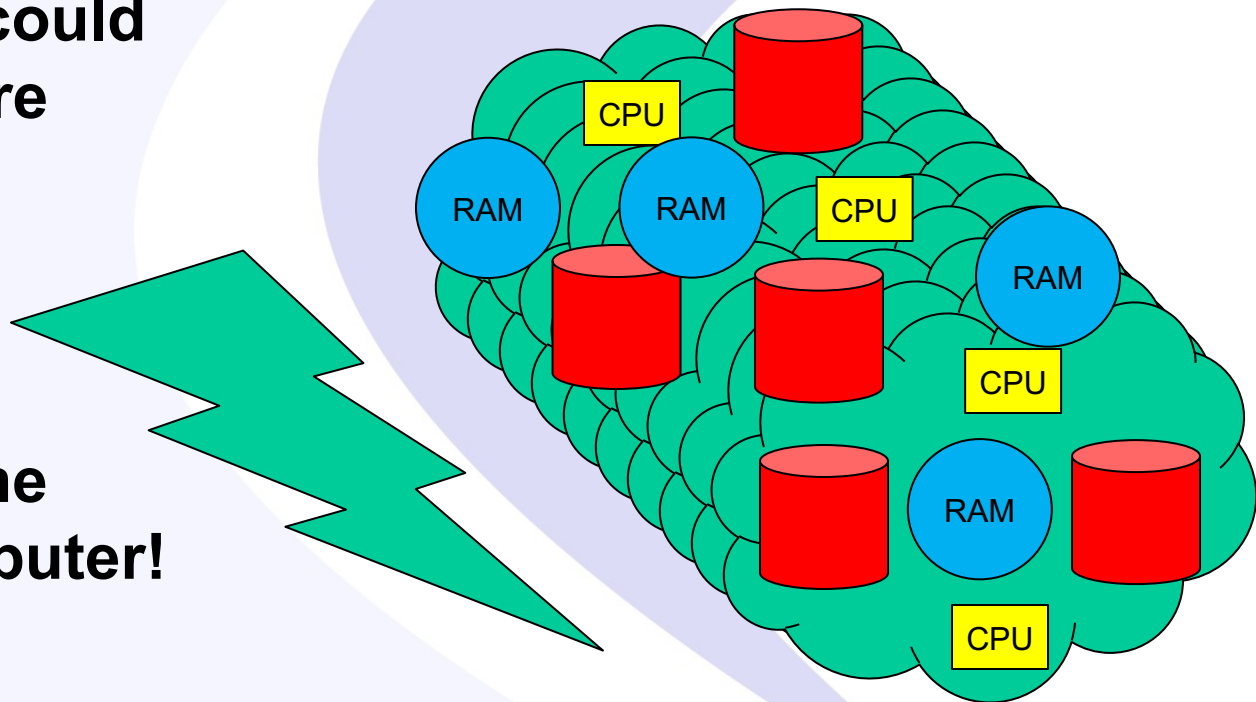
- What is the Cloud?
- Benchmarks and Tools
- Requirement: Move our Advanced Informix Performance Tuning Course Servers to the Cloud for Training Class Benchmark Labs
- Share Case Studies – Supporting Informix customers on the Cloud
- Updated - Observations About Informix in the Cloud
- Updated - Benchmark Results
- Updated - Cost Benefit Review and Learnings
- Updated - Performance Tuning Recommendations

What is Cloud Computing?

**Your stuff could
be anywhere**

- CPU
- RAM
- Disk
- Network

**On someone
else's computer!**



The Connection Becomes the Bottleneck

Background – Benchmark Tools

- Webcast - Cloud and Databases 101 by Tom Rieger
- Fastest Informix DBA Contest
- OpenSource Benchmark Tools – BenchmarkSQL
- Linux FIO – Flexible I/O Tester

Webinar: Cloud and Databases 101: Value, Sizing, and Best Practices – Tom Rieger April 2021

<https://youtu.be/9rZ-faQMeyA>

YouTube

Search

PowerPoint Slide Show - [cloud and database 101 - APRIL WEBINAR - v6]

EDB™

History of database benchmarking and sizing

- General workloads
 - Transactional
 - Analytical
- Vendor-specific workloads
 - Database-specific
 - Vendor-specific – SAP SD
- More fit-for-purpose
 - Load testing
 - Performance testing
 - IO performance
- Historically benchmarks were focused on **performance NOT economics**

TPC®

The 1990s



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8:37 / 54:25

#cloud #databases #webinar

Webinar: Cloud and Databases 101: Value, Sizing, and Best Practices – Tom Rieger April 2021

<https://youtu.be/9rZ-faQMeyA>



Cloud platform vendors make 'databases' confusing and 'lock in'

The screenshot displays three overlapping web pages from major cloud providers, each showing their database services. The AWS page on the left lists database types and use cases in a table. The Google Cloud page on the right highlights database modernization and open source options. The Microsoft Azure page in the center features a 'Find the database product you need' section with a list of services and their descriptions.

Database type	Use cases
Relational	Traditional applications, ERP, CRM, e-commerce
Key-value	High-traffic web apps, e-commerce systems, gaming applications
In-memory	Caching, session management, gaming leaderboards, real-time analytics
Document	Content management, catalogs, user profiles
Wide column	High scale industrial apps for equipment maintenance, management, and route optimization
Graph	Fraud detection, social networking, recommendation engines
Time series	IoT applications, DevOps, industrial telemetry
Ledger	Systems of record, supply chain, registrations, banking

Find the database product you need

IF YOU WANT TO	USE THIS
Build modern cloud applications with an always up-to-date relational database service that includes serverless compute, hyperscale storage, and AI-powered and automated features to optimize performance and durability	Azure SQL Database
Migrate your SQL workloads to Azure while maintaining complete SQL Server compatibility, with all the benefits of a fully managed and evergreen platform as a service	Azure SQL Managed Instance
Migrate your SQL workloads to Azure while maintaining complete SQL Server compatibility and operating system-level access	SQL Server on Virtual Machines
Build scalable, secure, and fully managed enterprise-ready apps on open-source PostgreSQL, scale out single-node PostgreSQL with high performance, or migrate PostgreSQL and Oracle workloads to the cloud	Azure Database for PostgreSQL
Deliver high availability and elastic scaling to open-source mobile and web apps with a managed community MySQL database service, or migrate MySQL workloads to the cloud	Azure Database for MySQL
Deliver high availability and elastic scaling to open-source mobile and web apps with a managed community MariaDB database service	Azure Database for MariaDB
Build applications with guaranteed low latency and high availability anywhere, at any scale, or migrate Cassandra, MongoDB, and other NoSQL workloads to the cloud	Azure Cosmos DB
Power fast, scalable applications with an open-source-compatible in-memory data store	Azure Cache for Redis
Accelerate your transition to the cloud using a simple, self-guided migration process	Azure Database Migration Service

Database Modernization
Upgrades to modernize your operational database infrastructure.

Open Source Databases
Fully managed open source databases with enterprise-grade support.

Google Cloud Databases
Database services to migrate, manage, and modernize data.

SQL Server on Google Cloud
Options for running SQL Server virtual machines on Google Cloud.

Fastest Informix DBA Contest

<https://advanceddatatools.com/tech-info/fastest-dba/>

[Google](#) [DuckDuckGo](#) [CORVID-19](#) [Advanced DataTools](#) [New - To Review](#) [Lester Bookmarks](#) [News](#) [Top Links](#) [Popular](#) [RUG Board](#) [Grammarly](#) [Time Zone Co..e Calculator](#)

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Fastest Informix DBA Contests

Advanced DataTools periodically sponsors a contest either online or at the International Informix Users Conference to find and honor the fastest Informix DBAs. The challenge involves tuning a basic Informix database server and a SQL script to see who can get it to run the fastest.




2013
Fastest Informix DBA Contest VI


2012
Fastest Informix DBA Contest V


2011
Fastest Informix DBA Contest IV

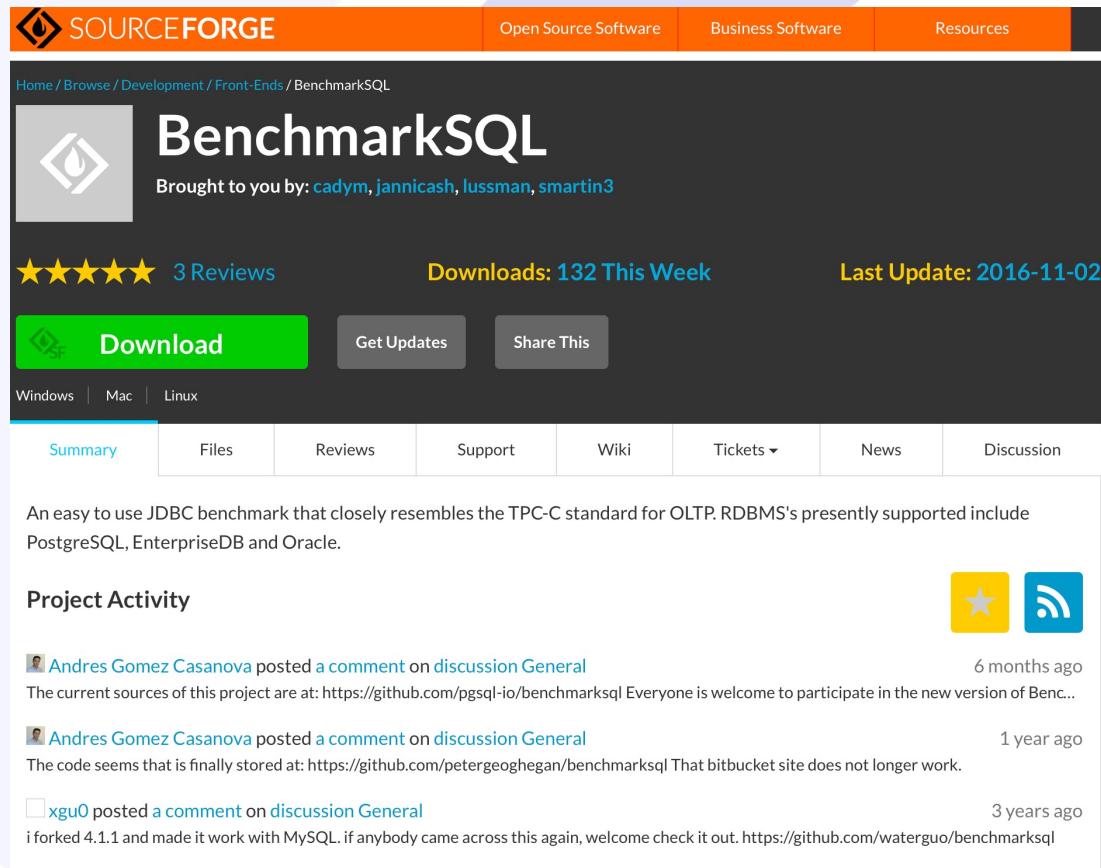

2010
Fastest Informix DBA Contest III


2009
Fastest Informix DBA Contest II


2009
Fastest Informix DBA Contest I

BenchmarkSQL

<https://sourceforge.net/projects/benchmarksql/>



The screenshot shows the SourceForge project page for BenchmarkSQL. The page has a dark theme with an orange header bar. The header bar contains the SourceForge logo and navigation links: "Open Source Software", "Business Software", and "Resources". Below the header, the breadcrumb trail reads "Home / Browse / Development / Front-Ends / BenchmarkSQL". The main section features the BenchmarkSQL logo, the text "Brought to you by: [cadym](#), [jannicash](#), [lussman](#), [smartin3](#)", and a star rating of 5 stars with "3 Reviews". It also displays "Downloads: 132 This Week" and "Last Update: 2016-11-02". There are three buttons: a green "Download" button, a grey "Get Updates" button, and a grey "Share This" button. Below these buttons are links for "Windows", "Mac", and "Linux". A navigation bar contains links: "Summary" (active), "Files", "Reviews", "Support", "Wiki", "Tickets", "News", and "Discussion". The "Summary" section describes BenchmarkSQL as "An easy to use JDBC benchmark that closely resembles the TPC-C standard for OLTP. RDBMS's presently supported include PostgreSQL, EnterpriseDB and Oracle." The "Project Activity" section lists three comments: 1. Andres Gomez Casanova posted a comment on discussion General 6 months ago. 2. Andres Gomez Casanova posted a comment on discussion General 1 year ago. 3. xgu0 posted a comment on discussion General 3 years ago. The comments provide links to GitHub repositories and discuss the project's history and availability.

SOURCEFORGE Open Source Software Business Software Resources

Home / Browse / Development / Front-Ends / BenchmarkSQL

 **BenchmarkSQL**
Brought to you by: [cadym](#), [jannicash](#), [lussman](#), [smartin3](#)

★★★★★ 3 Reviews Downloads: 132 This Week Last Update: 2016-11-02

 **Download** [Get Updates](#) [Share This](#)

[Windows](#) | [Mac](#) | [Linux](#)

[Summary](#) | [Files](#) | [Reviews](#) | [Support](#) | [Wiki](#) | [Tickets](#) | [News](#) | [Discussion](#)

An easy to use JDBC benchmark that closely resembles the TPC-C standard for OLTP. RDBMS's presently supported include PostgreSQL, EnterpriseDB and Oracle.

Project Activity

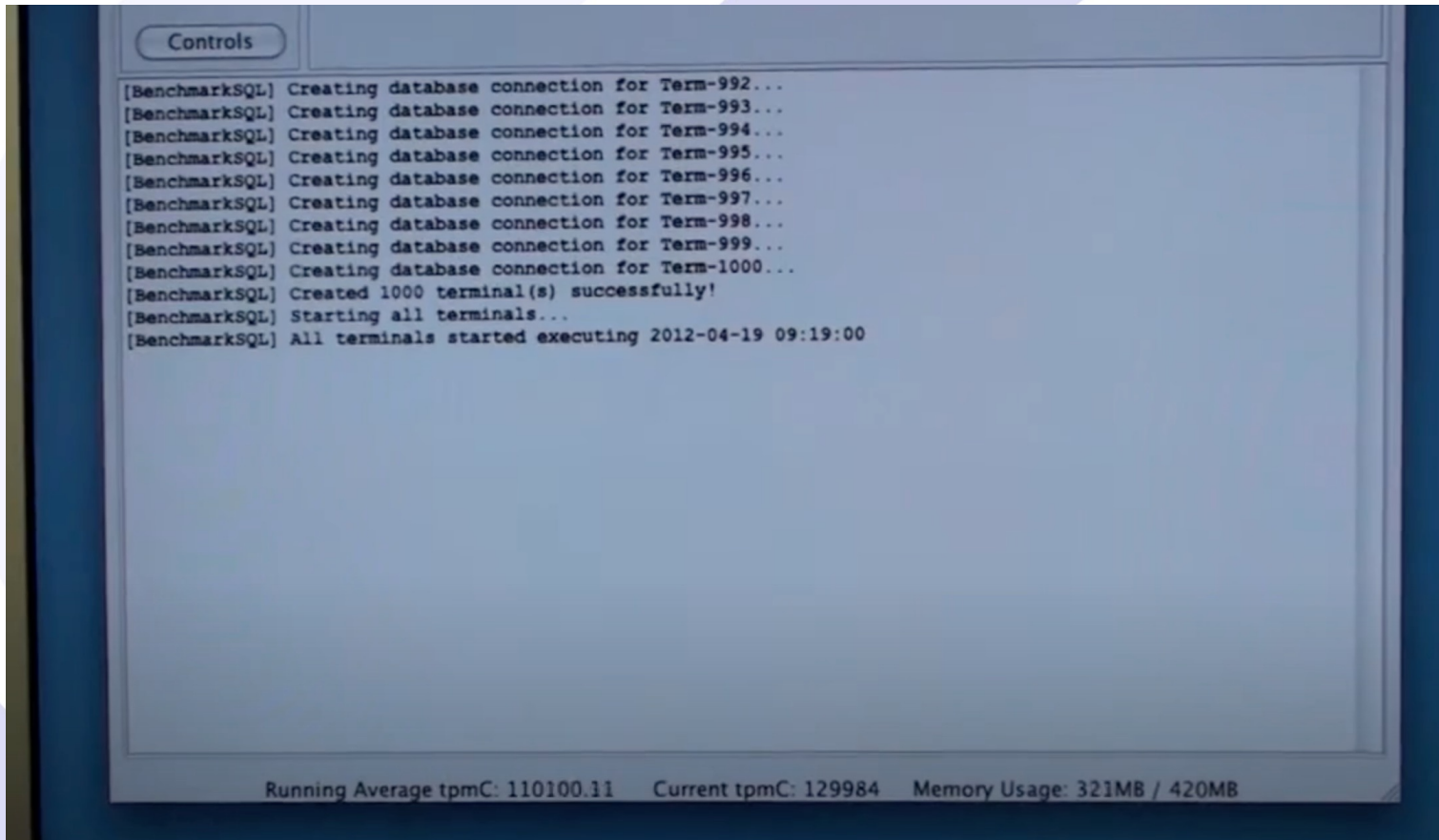
 [Andres Gomez Casanova](#) posted a comment on [discussion General](#) 6 months ago
The current sources of this project are at: <https://github.com/pgsql-io/benchmarksql> Everyone is welcome to participate in the new version of Benc...

 [Andres Gomez Casanova](#) posted a comment on [discussion General](#) 1 year ago
The code seems that is finally stored at: <https://github.com/petergeoghegan/benchmarksql> That bitbucket site does not longer work.

 [xgu0](#) posted a comment on [discussion General](#) 3 years ago
i forked 4.1.1 and made it work with MySQL. if anybody came across this again, welcome check it out. <https://github.com/waterguo/benchmarksql>

BenchmarkSQL

<https://sourceforge.net/projects/benchmarksql/>



The screenshot displays the BenchmarkSQL monitoring window. It features a 'Controls' tab at the top left. The main area shows a log of database connections being created for terms 992 through 1000. Below this, it states 'Created 1000 terminal(s) successfully!' and 'Starting all terminals...'. The final line indicates 'All terminals started executing 2012-04-19 09:19:00'. At the bottom, a status bar provides performance metrics: 'Running Average tpmC: 110100.11', 'Current tpmC: 129984', and 'Memory Usage: 321MB / 420MB'.

```
[BenchmarkSQL] Creating database connection for Term-992...  
[BenchmarkSQL] Creating database connection for Term-993...  
[BenchmarkSQL] Creating database connection for Term-994...  
[BenchmarkSQL] Creating database connection for Term-995...  
[BenchmarkSQL] Creating database connection for Term-996...  
[BenchmarkSQL] Creating database connection for Term-997...  
[BenchmarkSQL] Creating database connection for Term-998...  
[BenchmarkSQL] Creating database connection for Term-999...  
[BenchmarkSQL] Creating database connection for Term-1000...  
[BenchmarkSQL] Created 1000 terminal(s) successfully!  
[BenchmarkSQL] Starting all terminals...  
[BenchmarkSQL] All terminals started executing 2012-04-19 09:19:00
```

Running Average tpmC: 110100.11 Current tpmC: 129984 Memory Usage: 321MB / 420MB

Linux - Flexible I/O tester

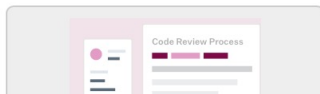
Available on Most Linux Distributions

fio

Navigation

- [1. fio - Flexible I/O tester rev. 3.27](#)
- [2. Examples](#)
- [3. TODO](#)
- [4. Moral License](#)
- [5. License](#)

Quick search



Welcome to FIO's documentation!

Version: 3.27

Contents:

- [1. fio - Flexible I/O tester rev. 3.27](#)
 - [1.1. Overview and history](#)
 - [1.2. Source](#)
 - [1.3. Mailing list](#)
 - [1.4. Author](#)
 - [1.5. Binary packages](#)
 - [1.6. Building](#)
 - [1.6.1. Windows](#)
 - [1.6.2. Documentation](#)
 - [1.7. Platforms](#)
 - [1.8. Running fio](#)
 - [1.9. How fio works](#)

Linux - Flexible I/O tester

Available on Most Linux Distributions – yum install fio

```
#####
## Module: @(#)fio-test.sh      2.0      Date: 06/01/2020
## Author: Lester Knutsen   Email: lester@advancedatools.com
##          Advanced DataTools Corporation
#####
## fio options:
## --name=description of job
## --ioengine=posixaio
## --rw=write --rw=randwrite --rw=randrw
## --bs=2k
## --size=4g
## --numjobs=1
## --runtime=60
## --time_based
## --direct=1
## --end_fsync=1

## Sequential Write Test
fio --name=seqwrite --ioengine=posixaio --rw=write --bs=2k --size=4g --numjobs=1 --runtime=60 --time_based
--direct=1 --end_fsync=1

## Random Write Test
fio --name=random-write --ioengine=posixaio --rw=randwrite --bs=2k --size=4g --numjobs=1 --runtime=60 --time_based
--direct=1 --end_fsync=1

## Random Read/Write Test
fio --name=random-rw --ioengine=posixaio --rw=randrw --bs=2k --size=4g --numjobs=1 --runtime=60 --time_based
--direct=1 --end_fsync=1

informix@tiger6:~/InformixAdvclass/lab03-benchmark2 train1 > |
```

Goal – Move my Advanced Informix Performance Tuning Course servers to the Cloud



Goal – Move 8
Servers to the
Cloud

Advanced Informix Performance Tuning Course

Completed October 25-28, 2021

Are you ready to take your DBA skills to the next level?

Attend our Advanced Informix Performance Tuning taught by Lester Knutsen and Art Kagel, Informix IBM Champions.



- Attend Online via Webex
- SSH for hands-on labs on our AWS Informix server
- Participate in Q&A and collaborative class discussions
- Four days of Informix Database Performance Tuning and benchmarks

More Information on at:
<https://advanceddatatools.com/training/advanced-course>

Advanced DataTools

Requirements

- Measurable Performance
- Repeatable, Consistent Results
- Cost Effective

Anticipated Problems

- Disk IO Bottleneck
- Performance Variance
- Unknown Real Costs
- Problems and experience supporting Informix customers on the Cloud
- Noisy Neighbor –Instances activity that is out of my control
- What happens when the Network is down?

Benchmark Results

- Focus on Amazon AWS
- Twelve AWS Instances with varying configurations
- Taught Two class – Informix for DBAs with eight servers on AWS
- OS – used both Red Hat and Amazon Linux

AWS Servers

 Services ▾

Search for services, features, marketplace products

 New EC2 Experience
Tell us what you think

EC2 Dashboard

EC2 Global View

Events

Tags

Limits

▼ Instances

Instances

New

Instance Types

Launch Templates

Spot Requests

Savings Plans

Instances (8) Info

Filter instances

☐	Name ▾	Instance ID	Instance state ▾	Instance type ▾	
☐	tiger1	i-0eb58de335d4aa2ea	✓ Running 🔍	t2.2xlarge	(
☐	tiger2	i-08e2b64f9d593111d	✓ Running 🔍	t3.xlarge	(
☐	tiger4	i-0f10030215e4eb2a3	✓ Running 🔍	i3.2xlarge	(
☐	tiger8	i-0991da67df143308e	✓ Running 🔍	t2.xlarge	(
☐	tiger9	i-02a2d742aa520ba4e	✓ Running 🔍	t2.xlarge	(
☐	tiger5	i-09e0154294dcc4c06	✓ Running 🔍	t2.xlarge	(
☐	tiger7	i-00d68c7ee9cafab21	✓ Running 🔍	t2.xlarge	(
☐	tiger10	i-0a3ef4e19ecfb0351	✓ Running 🔍	t3.2xlarge	(

Overwhelming Choice of CPU Types: 8 CPU filter

EC2 > Instance types

Instance types (49)

Filter instance types

vCPUs: =8 X Clear filters

Actions

< 1 > ⚙

☐	Instance type ▾	vCPUs ▾	Architecture ▾	Memory (GiB) ▾	Storage (GB) ▾	Storage type ▾	Network performance ▾	On-Demand Linux pricing ▾	On-Demand Windows pricing ▾
☐	t2.xlarge	8	x86_64	32	-	-	Moderate	0.3712 USD per Hour	0.4332 USD per Hour
☐	t3.xlarge	8	x86_64	32	-	-	Up to 5 Gigabit	0.3328 USD per Hour	0.48 USD per Hour
☐	a1.xlarge	8	arm64	16	-	-	Up to 10 Gigabit	0.204 USD per Hour	0.572 USD per Hour
☐	c4.xlarge	8	x86_64	15	-	-	High	0.398 USD per Hour	0.766 USD per Hour
☐	c5.xlarge	8	x86_64	16	-	-	Up to 10 Gigabit	0.34 USD per Hour	0.708 USD per Hour
☐	c5a.xlarge	8	x86_64	16	-	-	Up to 10 Gigabit	0.308 USD per Hour	0.676 USD per Hour
☐	c5ad.xlarge	8	x86_64	16	300	ssd	Up to 10 Gigabit	0.344 USD per Hour	0.712 USD per Hour
☐	c5d.xlarge	8	x86_64	16	200	ssd	Up to 10 Gigabit	0.384 USD per Hour	0.752 USD per Hour
☐	c5n.xlarge	8	x86_64	21	-	-	Up to 25 Gigabit	0.432 USD per Hour	0.8 USD per Hour
☐	c6g.xlarge	8	arm64	16	-	-	Up to 10 Gigabit	0.272 USD per Hour	-
☐	c6gd.xlarge	8	arm64	16	474	ssd	Up to 10 Gigabit	0.3072 USD per Hour	-
☐	c6gn.xlarge	8	arm64	16	-	-	Up to 25 Gigabit	0.3456 USD per Hour	-
☐	d2.xlarge	8	x86_64	61	12288	hdd	High	1.38 USD per Hour	1.601 USD per Hour
☐	d3.xlarge	8	x86_64	64	11880	hdd	Up to 15 Gigabit	0.999 USD per Hour	1.367 USD per Hour
☐	g4ad.xlarge	8	x86_64	32	300	ssd	Up to 10 Gigabit	0.54117 USD per Hour	0.90917 USD per Hour
☐	g4dn.xlarge	8	x86_64	32	225	ssd	Up to 25 Gigabit	0.752 USD per Hour	1.12 USD per Hour
☐	h1.xlarge	8	x86_64	32	2000	hdd	Up to 10 Gigabit	0.468 USD per Hour	0.836 USD per Hour
☐	i2.xlarge	8	x86_64	61	1600	ssd	High	1.705 USD per Hour	1.946 USD per Hour

Select an instance type above

AWS Instance Types for Databases

- **General Purpose (t2 & t3)** - Provide a balance of compute, memory and networking resources, and can be used for a variety of diverse workloads.
- **General Purpose (m5) Balanced Workload** - Latest generation of General Purpose Instances powered by Intel Xeon® Platinum 8175M processors.
- **Storage Optimized (i3)** - Provide high, sequential read and write access to very large data sets on local storage. Provides fast NVMe SSD.
- **Memory Optimized (r6)** - Designed to deliver fast performance for workloads that process large data sets in memory.

Overwhelming Choice of SSD Disks Types

Solid state drives (SSD)

The SSD-backed volumes provided by Amazon EBS fall into these categories:

- General Purpose SSD — Provides a balance of price and performance. We recommend these volumes for most workloads.
- Provisioned IOPS SSD — Provides high performance for mission-critical, low-latency, or high-throughput workloads.

The following is a summary of the use cases and characteristics of SSD-backed volumes. For information about the maximum IOPS and throughput per instance, see [Amazon EBS-optimized instances](#).

	General Purpose SSD		Provisioned IOPS SSD		
Volume type	gp3	gp2	io2 Block Express ‡	io2	io1
Durability	99.8% - 99.9% durability (0.1% - 0.2% annual failure rate)	99.8% - 99.9% durability (0.1% - 0.2% annual failure rate)	99.999% durability (0.001% annual failure rate)	99.999% durability (0.001% annual failure rate)	99.8% - 99.9% durability (0.1% - 0.2% annual failure rate)
Use cases	• Low-latency interactive apps • Development and test environments		Workloads that require: • Sub-millisecond latency • Sustained IOPS performance • More than 64,000 IOPS or 1,000 MiB/s of throughput	• Workloads that require sustained IOPS performance or more than 16,000 IOPS • I/O-intensive database workloads	
Volume size	1 GiB - 16 TiB		4 GiB - 64 TiB	4 GiB - 16 TiB	
Max IOPS per volume (16 KiB I/O)	16,000		256,000	64,000 †	
Max throughput per volume	1,000 MiB/s	250 MiB/s *	4,000 MiB/s	1,000 MiB/s †	
Amazon EBS Multi-attach	Not supported		Supported		
Boot volume	Supported				

AWS SSD Disk Types

- **General Purpose SSD**
 - gp2 – max throughput 128-250 MiB/s
 - gp3 – max throughput 1,000 MiB/s
- **Provisioned IOPS SSD**
 - io1 – max throughput 1,000 MiB/s
 - (99.8% - 99.9% durability)
 - io2 – max throughput 1,000 MiB/s
 - (99.999% durability)

Costs are Important

AWS Cost Summary per Month						
EC2 Instance Costs	Baseline Training System	AWS General Purpose	AWS Balanced Workloads	AWS General Purpose	AWS Storage Optimized	AWS Storage Optimized
Type	Lenova TS150	t2.2xlarge	m5.2xlarge	t3.2xlarge	i3.2xlarge	i3en.2xlarge
OS	Centos OS	Red Hat 8	Red Hat 8	Amazon Linux	Red Hat 8	Red Hat 8
CPU	8	8	8	8	8	8
Memory	16	32	32	32	61	64
Network	Unlimited	Moderate	Up to 10 GB	Up to 5 GB	Up to 10 GB	Up to 25 GB
EC2 per Hour		0.3712	0.384	0.3328	0.624	0.904
Month (730 hr)	233.00	270.976	280.32	242.944	455.52	659.92
Status	Tested	Tested	Tested	Tested	Tested	Not Tested

Disk Costs NOT Included in AWS Instances

SSD Disk Costs

EBS Storage Costs										
Type	gp2	gp3	gp3	gp3	io1	io1	io1	io2	io2	io2
IOPS	360	3000	6000	12000	3000	6000	12000	3000	6000	12000
Size	120 GB	120 GB	120 GB	120 GB	120 GB	120 GB	120 GB	120 GB	120 GB	120 GB
Month Costs / Disk	12.00	9.60	24.60	54.60	210.00	405.00	795.00	210.00	405.00	795.00
Month Costs 2 Disk	24.00	19.20	49.20	109.20	420.00	810.00	1,590.00	420.00	810.00	1,590.00

The disks are the bottleneck!

Real Cloud Cost Advantage

- **Turn off the Instance when not needed and SAVE costs**
- Easy to change Configuration
 - Upgrade Disks and CPU
 - Downgrade Disks and CPU
- **Monitor disk costs – they do not stop when the Instance stops**

Demo

AWS Server Monitoring Tools - Instance

Subnet ID

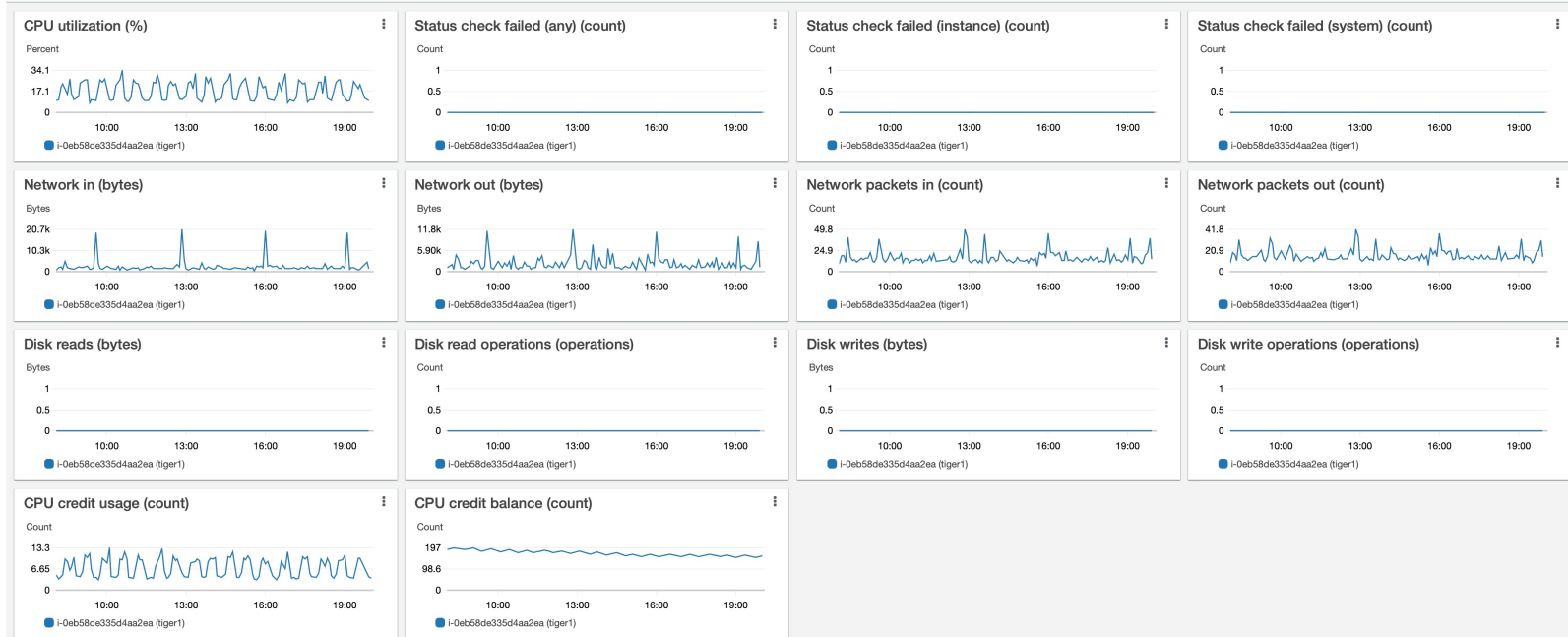
subnet-ee2ec093

Details Security Networking Storage Status checks **Monitoring** Tags

Manage detailed monitoring

1h 3h **12h** 1d 3d 1w Custom

Add to dashboard

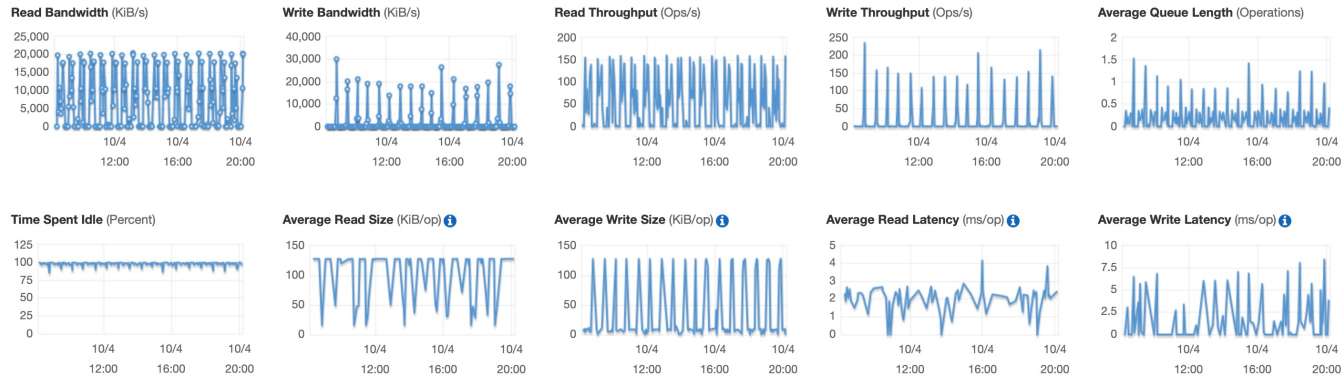


AWS Server Monitoring Disk

CloudWatch metrics:

Showing data for: Last 12 Hours

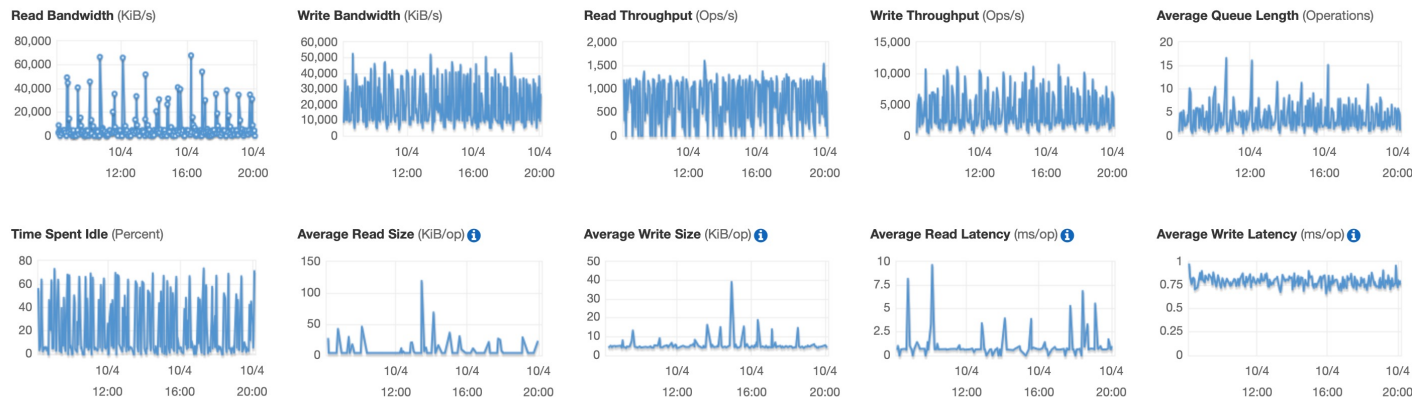
Below are your CloudWatch metrics for the selected resources (a maximum of 10). Click on a graph to see an expanded view. All times shown are in UTC. [View all CloudWatch metrics](#)



CloudWatch metrics:

Showing data for: Last 12 Hours

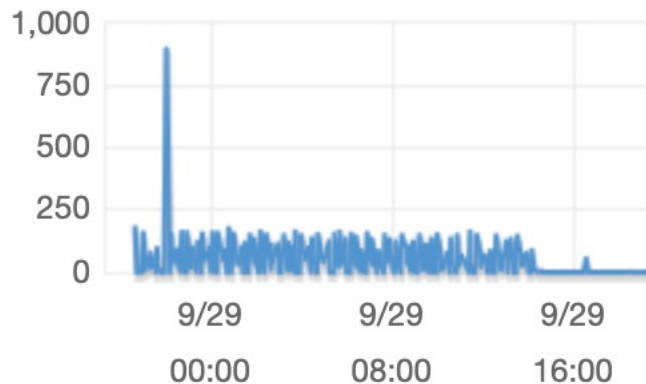
Below are your CloudWatch metrics for the selected resources (a maximum of 10). Click on a graph to see an expanded view. All times shown are in UTC. [View all CloudWatch metrics](#)



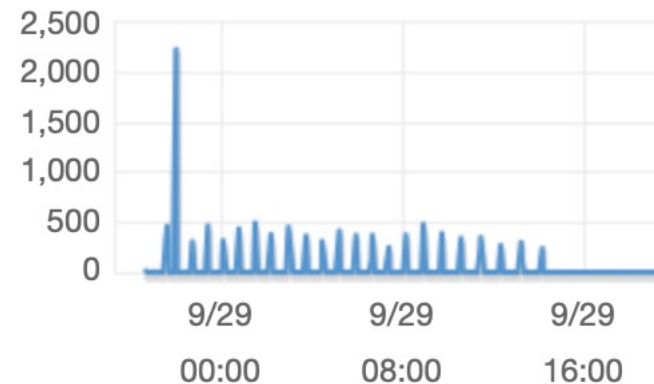
Same Workload

Disk IOPS CAP 360

Read Throughput (Ops/s)



Write Throughput (Ops/s)



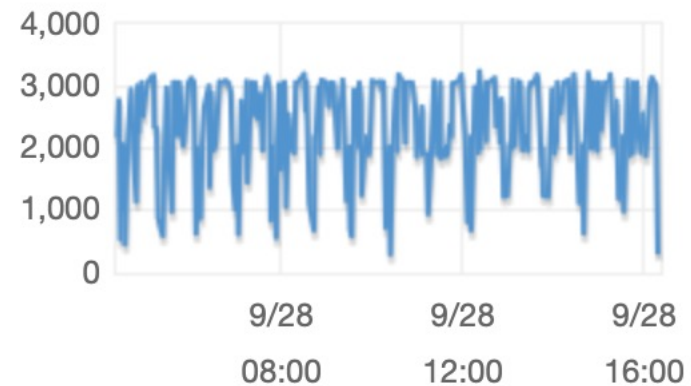
Same Workload

Disk IOPS CAP 3,000

Read Throughput (Ops/s)



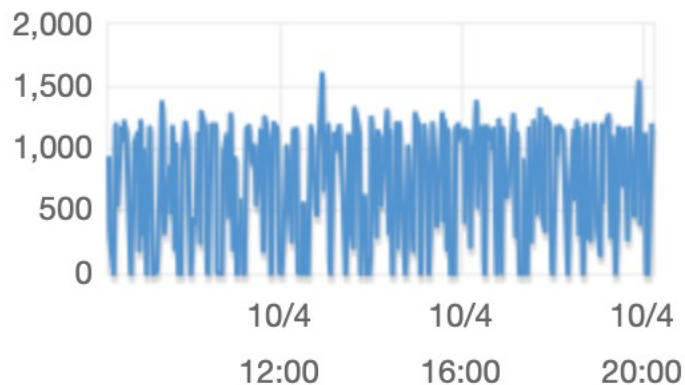
Write Throughput (Ops/s)



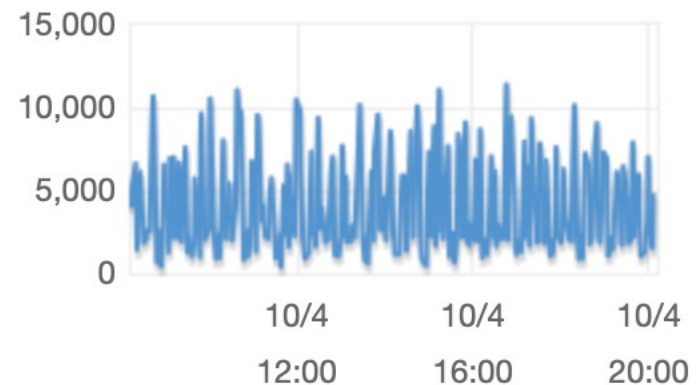
Same Workload

Disk IOPS Cap – 12,000

Read Throughput (Ops/s)



Write Throughput (Ops/s)



Same Workload

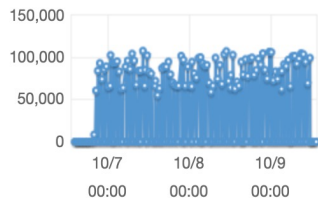
Disk IOPS CAP 16000

CloudWatch metrics:

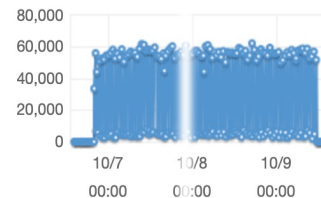
Showing data for

Below are your CloudWatch metrics for the selected resources (a maximum of 10). Click on a graph to see an expanded view. All times shown are in UTC. [View all CloudWatch metrics](#)

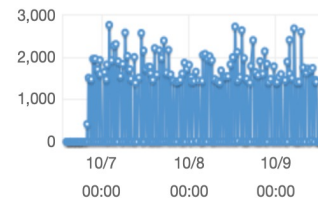
Read Bandwidth (KiB/s)



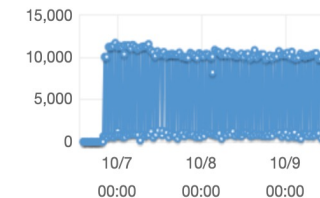
Write Bandwidth (KiB/s)



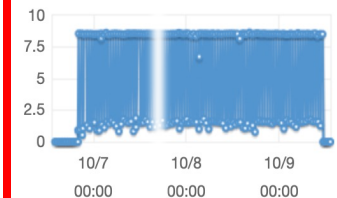
Read Throughput (Ops/s)



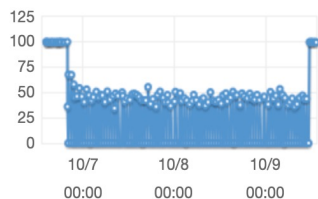
Write Throughput (Ops/s)



Average Queue Length (Operations)



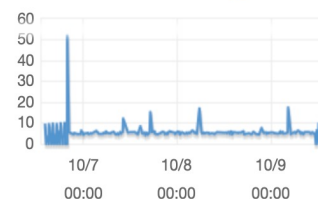
Time Spent Idle (Percent)



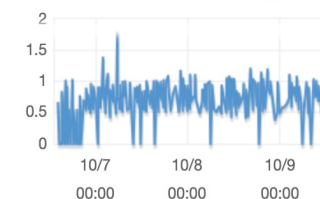
Average Read Size (KiB/op) ⓘ



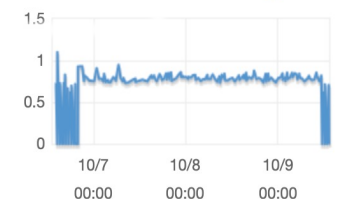
Average Write Size (KiB/op) ⓘ



Average Read Latency (ms/op) ⓘ



Average Write Latency (ms/op) ⓘ



AWS IOPS Definition

- IOPS are a unit of measure representing input/output operations per second.
- The operations are measured in KiB, and the underlying drive technology determines the maximum amount of data that a volume type counts as a single I/O. I/O size is capped at 256 KiB for SSD volumes

IOPS

IOPS are a unit of measure representing input/output operations per second. The operations are measured in KiB, and the underlying drive technology determines the maximum amount of data that a volume type counts as a single I/O. I/O size is capped at 256 KiB for SSD volumes and 1,024 KiB for HDD volumes because SSD volumes handle small or random I/O much more efficiently than HDD volumes.

When small I/O operations are physically sequential, Amazon EBS attempts to merge them into a single I/O operation up to the maximum I/O size. Similarly, when I/O operations are larger than the maximum I/O size, Amazon EBS attempts to split them into smaller I/O operations. The following table shows some examples.

Volume type	Maximum I/O size	I/O operations from your application	Number of IOPS	Notes
SSD	256 KiB	1 x 1024 KiB I/O operation	4 ($1,024 \div 256 = 4$)	Amazon EBS splits the 1,024 I/O operation into four smaller 256 KiB operations.
		8 x sequential 32 KiB I/O operations	1 ($8 \times 32 = 256$)	Amazon EBS merges the eight sequential 32 KiB I/O operations into a single 256 KiB operation.
		8 random 32 KiB I/O operations	8	Amazon EBS counts random I/O operations separately.

FIO Benchmark Tests

<u>FIO Test</u>	<u>Local SSD</u>	<u>AWS gp3 12000 IOPS</u>	<u>AWS io1 6000 IOPS</u>
Sequential Write Test	42.5MiB/s	2624KiB/s	2619KiB/s
Random Write Test	19.3MiB/s	2405KiB/s	2541KiB/s
Random Read/Write			
READ:	9,623 KiB/s	988KiB/s	1,312KiB/s
WRITE:	9,622 KiB/s	989KiB/s	1,310KiB/s
ios	272,232/272748	29,656/29801	39,356/39327

FIO AWS Results

	FIO Test - 10/21/2021	gp3 - 16000 IOPS	gp3 - 16000 IOPS	gp3 - 16000 IOPS	gp3 - 16000 IOPS	gp3 - 16000 IOPS	gp2 - 360 IOPS	gp2 - 360 IOPS
/informixchunks								
	Sequentially Write Test	2788	2858	2775	2823	3083	2876	2824
	Random Write Test	2828	2949	2859	2939	3221	2996	3037
	Random Read/Write Test - READ	1719	1702	1488	1736	1730	1915	1889
	Random Read/Write Test - WRITE	1713	1695	1478	1729	1723	1907	1881
	IOS - READ	51555	51041	44515	51902	51751	57378	56610
	IOS - WRITE	51409	50835	44213	51709	51544	57143	56351
/informixchunks2								
	Sequentially Write Test	2874	2841	2739	2844	2864	2057	2961
	Random Write Test	2876	2726	2731	2927	2906	2134	2910
	Random Read/Write Test - READ	1706	1566	1664	1780	1718	1497	1894
	Random Read/Write Test - WRITE	1700	1555	1655	1774	1712	1488	1886
	IOS - READ	51156	46966	49772	53228	51416	44848	56746
	IOS - WRITE	50998	46652	49502	53038	51229	44569	56521
/home								
	Sequentially Write Test		2829	2836				2603
	Random Write Test		2297	2369				2138
	Random Read/Write Test - READ		1778	1601				1698
	Random Read/Write Test - WRITE		1772	1591				1692
	IOS - READ		53338	47943				50830
	IOS - WRITE		53260	47660				50608
InformixChunks Total		223,322	213,386	205,391	228,429	224,897	220,808	245,510

FIO AWS Variance from Advanced Training Class

FIO Test - 10/21/2021								
		gp3 - 16000 IOPS	gp3 - 16000 IOPS	gp3 - 16000 IOPS	gp3 - 16000 IOPS	gp3 - 16000 IOPS	gp2 - 360 IOPS	gp2 - 360 IOPS
/informixchunks								
	Sequentially Write Test	2788	2858	2775	2823	3083	2876	2824
	Random Write Test	2828	2949	2859	2939	3221	2996	3037
	Random Read/Write Test - READ	1719	1702	1488	1736	1730	1915	1889
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InformixChunks Total		223,322	213,386	205,391	228,429	224,897	220,808	245,510

Note: Slower disk IOPS produced better results?

Benchmark Performance Results

Machine	tiger1 Run 1	tiger1 Run 2	tiger10	tiger2	tiger4	tiger10	tiger2	tiger4	tiger6
AWS Type	t2.2xlarge	t2.2xlarge	t3.2xlarge	t3.2xlarge	i3.2xlarge	t3.2xlarge	t3.2xlarge	i3.2xlarge	Local BASELINE
CPU	8	8	8	8	8	8	8	8	8
Memory	32	32	32	32	32	32	32	32	16
Disk	gp2 - 360 IOPS	gp2 - 3000 IOPS	gp2 - 3000 IOPS	io1 6000 IOPS	io1 6000 IOPS	gp2 - 3000 IOPS	io1 6000 IOPS	io1 3000 IOPS	SSD
OS	Red Hat 8	Red Hat 8	Amazon Linux 2	Red Hat 8	Red Hat 8	Amazon Linux 2	Red Hat 8	Red Hat 8	Red Hat 8
Setup Run	100m53.799s	53m0.351s	42m1.273s	44m20.539s	26m58.137s	42m1.273s	44m20.539s	26m58.137s	15m0.977s
Total Time HH:MM:SS	192:33:46	23:57:00	21:04:00	14:32:00	9:28:00	24:50:00	26:03:00	13:50:00	27:55:00
Runs	37	30	25	19	20	20	20	20	100
Average	5:12:16	0:47:54	0:50:34	0:45:54	0:28:24	1:14:30	1:18:09	0:41:30	0:16:45
Runs per Month	3,366.38	21,945.72	20,791.14	22,904.59	37,014.08	14,110.07	13,451.06	25,330.12	62,758.21

Updated Performance Costs

Machine	tiger 1 Run 1	tiger 2	tiger 4	tiger 4	tiger 1 Run 4	tiger6
AWS Type	t2.2xlarge	t3.2xlarge	i3.2xlarge	i3.2xlarge	m5.2xlarge	Local BASELINE
CPU	8	8	8	8	8	8
Memory	32	32	32	32	32	16
Disk	gp2 - 360 IOPS	io1 6000 IOPS	io1 3000 IOPS	io1 6000 IOPS	gp3 - 16000 IOPS	SSD
OS	Red Hat 8	Red Hat 8	Red Hat 8	Red Hat 8	Red Hat 8	Red Hat 8
EC2 Instance Costs	270.98	242.94	455.52	455.52	364.52	233.00
EBS Storage Costs	24.00	810.00	420.00	810.00		
Total Costs	294.98	1,052.94	875.52	1,265.52	364.52	233.00
Setup Run	100m53.799s	44m20.539s	26m58.137s	26m58.137s		15m0.977s
Start Time	9/11/21 2:47 AM	10/3/21 3:14	10/3/21 15:15	9/28/21 22:34	10/6/21 4:40	10/2/21 20:45
End Time	9/19/21 3:20 AM	10/4/21 5:17	10/4/21 5:05	9/29/21 8:02	10/6/21 12:21	10/4/21 0:40
Total Time HH:MM:SS	192:33:46	26:03:00	13:50:00	9:28:00	7:41:00	27:55:00
Runs	37	20	20	20	20	100
Average	5:12:16	1:18:09	0:41:30	0:28:24	0:23:03	0:16:45
Runs per Month	3,366.38	13,451.06	25,330.12	37,014.08	45,605.21	62,758.21
Est Costs per Month	294.98	1,052.94	875.52	1,265.52	364.52	233.00
Est Cost per Run	\$ 0.08762	\$ 0.07828	\$ 0.03456	\$ 0.03419	\$ 0.00799	\$ 0.00371

Advanced Informix Performance Tuning Class Student Lab Results

Advanced Informix Performance Tuning Lab Results - Benchmark 2 and 3

Server	tiger1	tiger2	tiger4	tiger5	tiger7
Benchmark 2- Batch Billing Before SQL Improvements	2m14.717s	3m1	2m11.892s	3m2.049s	2m28.815s
Benchmark 3 - SQL 500 TPC/C Transaction per minute	49,480	63,372		31,064	43,840

Performance was as good as in our classrooms

Performance Tuning Recommendations

- DIRECT_IO – It depends!!!!
- Informix Mirroring improves reads (requires 2 disks to double the IOPS)
- Separate disks for Logs, Temp, Data, Indexes (spread the IOPS around)
- Remember – Databases are limited by IOPS

How to Estimate Your IOPS

Determine your IOPS and throughput requirements

[PDF](#) | [RSS](#)

Use Windows Performance Monitor to get information about IOPS and throughput.

To open Windows Performance Monitor, run **perfmon** at the command prompt. IOPS and throughput data is provided by the following performance counters:

- Disk reads/sec + disk writes/sec = IOPS
- Disk read bytes/sec + disk write bytes/sec = throughput

We recommend that you get the IOPS and throughput data for peak usage time and also over a typical workload cycle, to get a good estimate of your requirements. Make sure that the instance type you choose for SQL Server supports these I/O requirements.

It is important to get this estimate right. Otherwise, you might over-provision your resources, which might result in underutilized resources, or under-provision your resources, which might result in severe performance issues.

**Remember – This only gives you an average!
You need to add 20% or more for peak periods
or you are LIMITED by your average!**

Example Using Onstat -p

```
IBM Informix Dynamic Server Version 14.10.FC6 -- On-Line -- Up 5 days 03:57:05 -- 3695968 Kbytes
2021-10-04 18:33:13
```

Profile

dskreads	pagreads	bufreads	%cached	dskwrits	pagwrits	bufwrits	%cached	
87753069	5288258282	20584326666	99.62	1120634556	1296709600	13825899561	91.89	
isamtot	open	start	read	write	rewrite	delete	commit	rollbk
23091628276	1479340	1170446	769433343	10318351034	153268201	190943	510929	1959
gp_read	gp_write	gp_rewrt	gp_del	gp_alloc	gp_free	gp_curs		
0	0	0	0	0	0	0		
ovlock	ovuserthread	ovbuff	usercpu	syscpu	numckpts	flushes		
0	0	0	129083.35	28095.51	1478	1882		
bufwaits	lokwaits	lockreqs	deadlks	dltouts	ckpwaits	compress	seqscans	
25312	772828	2181863060	231	0	779	3442120	41525	
ixda-RA	idx-RA	da-RA	logrec-RA	RA-pgsused	lchwaits			
17809120	206636	33725963	0	25942104	9050932			

IOPS Calculation Worksheet

Advanced DataTools Corporation

Key Ratio's from Onstat -p

Server Up Time:	5 days 03:57:05	(From onstat -p or the last time onstat -z was run - replace with your data)				
Hours Up	123.95	Please enter hours since the statistic where cleared				
Minutes Up	7,437.00	Please enter monites since the statistics where cleared				
Buffers	1,500,000	Enter number of buffers from your onconfig file				
Page Size KB	2	Enter the default page size for Informix on your Server (2 for Linux, Solaris, 4 for AIX, Windows)				
Disk IO						
	dskreads	pagreads	bufreads	dskwrits	pagwrits	bufwrits
Pages: (from onstat -p)	87,753,069	5,288,258,282	20,584,326,666	1,120,634,556	1,296,709,600	13,825,899,561 (re
Kbytes	175,506,138	10,576,516,564	41,168,653,332	2,241,269,112	2,593,419,200	27,651,799,122
KB Per Hour	1,415,943	85,328,895	332,139,196	18,082,042	20,923,108	223,088,335
KB Per Minute	23,599	1,422,148	5,535,653	301,367	348,718	3,718,139
Disk R/W per Second	dskreads+dskwrite*pagesize/60		5,416			
KB R/W per Second	pagreads+pagwrite*pagesize/60		29,514			

Informix Average IOPS Calculation

```
-----  
-- Module: @(#)AWSIOPS.sql      version: 2.5      Date: 10/1/2021  
-- Author: Lester Knutsen      Contact: lester@advanceddatatools.com  
-- Copyright: Advanced DataTools Corporation - 2021  
-- Description:  
-----  
  
{ ==  
AWS IOPS Calculations  
Disk reads/sec + disk writes/sec = IOPS  
Disk read bytes/sec + disk write bytes/sec = throughput  
}  
  
database sysmaster;  
select  
    "Statics Uptime in Seconds: " metric,  
    (ROUND (( sh_curtime - sh_pfclrtype))) value -- hours_since_stats_reset  
from sysshmvals  
union all  
select  "Average Disk IOPS - Page RW per Second" metric,  
        (( select sum ( value ) from sysprofile where name in ( "dskreads", "dskwrites" )  
          / ( select (ROUND (( sh_curtime - sh_pfclrtype))) from sysshmvals )) value  
  
from sysdual  
union all  
select  "Average Disk Throughput - Bytes per Second" metric,  
        ((( select sum ( value ) from sysprofile where name in ( "dskreads", "dskwrites" )  
          * ( select sh_pagesize from sysshmvals ) )  
          / ( select (ROUND (( sh_curtime - sh_pfclrtype))) from sysshmvals )) value  
  
from sysdual;
```


Informix IOPS Calculation running Benchmark2 on Local SSD

```
SQL:  New  Run  Modify  Use-editor  Output  Choose  Save  Info
Run the current SQL statements.

----- sysmaster@train1 ----- Press CTRL-W f

metric                                     value

Statics Uptime in Seconds:                 140.000000000000
Average Disk IOPS – Page RW per Second     20063.6357142857
Average Disk Throughput – Bytes per Second 41090325.9428571
```

This is the Average IOPS
More IOPS will be required to manage Peak Workloads!!

Questions?



Send follow-up questions to
Lester@advanceddatatools.com

Advanced DataTools

Thank You

Advanced DataTools Corporation



For more information:

Lester@advancedatools.com

<https://www.advancedatools.com>

Advanced DataTools

Thank You

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