Game Server Monitoring & Management

Great Technology For Great Games

DK Moon
dkmoon@ifunfactory.com

Server Monitoring

✓ Q) 데이터 센터에서 가장 큰 장애 요인은?

✓ 목적: 자동화된 방식으로 게임 서버의 상태 확인 및 잠재적인 문제점 발견

✓ 범위

- 물리적 요소 모니터링: CPU, DISK I/O, RAM, Network, DB I/O
- 논리적 요소 모니터링: 게임 내 유저수, 게임 내 경제 흐름 (virtual economy)

물리 요소 모니터링 - CPU

- ✓ 적정 CPU utilization: 50~70%
- ✓ 낮은 CPU 수치: 서버의 비효율적인 운용 가능성. lock 에 의한 직렬화 가능성, I/O 에 의한 blocking 가능성
- ✓ 높은 CPU 수치: 불필요한 loop 이나 busy waiting 의심
- ✓ CPU profiling: sampling 에 기반해 코드 별 코드 사용 빈도 확인
- ✓ Tools: top, w, mpstat, pidstat, iostat

물리 요소 모니터링 - RAM

- ✓ VSZ (Virtual Memory Size): 프로세스의 메모리 맵 사이즈
- ✓ RSS (Resident Set Size): 실제 메모리에 올라가 있는 사이즈
- ✓ Q) VSZ 가 빠른 속도로 계속해서 증가한다면 어떤 의미일까?
- ✓ Q) RSS 가 물리 메모리 사이즈에 근접해 있다면 어떤 의미일까?
- ✓ tools: vmstat

물리 요소 모니터링 - DISK

✓ 디스크 용량

- Coredump, log 파일 생성에 의해 순간적으로 disk 사용량이 증가할 수 있음
- 이들을 위한 별도의 disk 확보 바람직

✓ 디스크 I/O Bandwidth

- 빈번한 I/O 유발은 CPU 사용량을 떨어뜨리며, disk 를 병목으로 만들게 됨
- disk 장비의 물리적인 I/O bandwidth 를 고려하여 그 이상의 I/O 가 발생되지 않도록 유의
- 디스크는 “용량 vs. BW” 간의 trade-off 가 존재함
- Lesson) Log 생성은 공짜가 아님
  Q) Log 메시지를 파일이 아닌 화면에 출력하면 더 느릴까?

물리 요소 모니터링 Tool - Ganglia

Main | Search | Views | Aggregate Graphs | Compare Hosts | Automatic Rotation | Live Dashboard | Mobile

Wikimedia Grid Report at Tue, 18 Apr 2017 05:13:13 +0000

Last hour | 2hr | 4hr | day | week | month | year | job or from to Go Clear

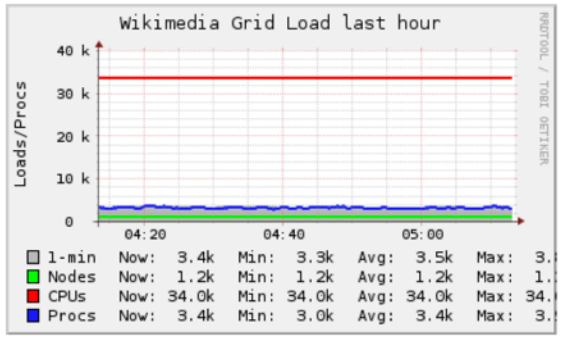
Sorted ascending | descending | by name | by hosts up | by hosts down

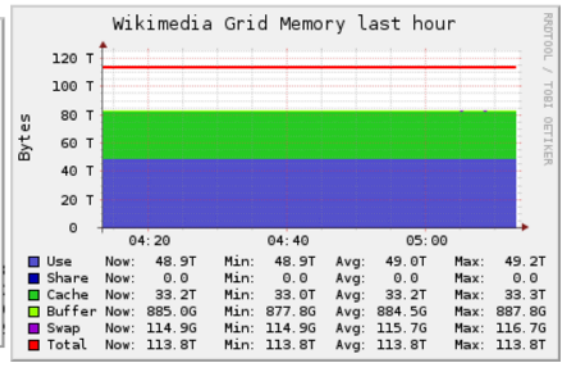
Wikimedia Grid > --Choose a Source

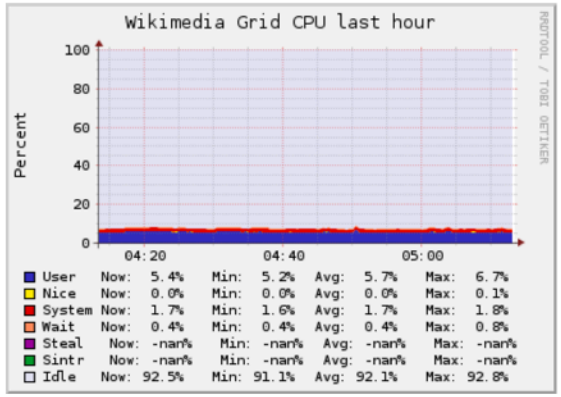
Wikimedia Grid (79 sources) (tree view)

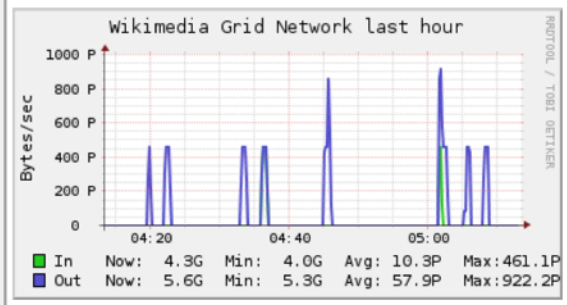
CPUs Total: **33979**
Hosts up: **1207**
Hosts down: **0**

Current Load Avg (15, 5, 1m):
10%, 10%, 10%
Avg Utilization (last hour):
10%
Localtime:
2017-04-18 05:13









물리 요소 모니터링 Tool - Nagios

Nagios®

General
- Home
- Documentation

Current Status
- Tactical Overview
- Map
- Hosts
- Services
- Host Groups
  - Summary
  - Grid
- Service Groups
  - Summary
  - Grid
- Problems
  - Services (Unhandled)
  - Hosts (Unhandled)
  - Network Outages

Quick Search:

Reports
- Availability
- Trends
- Alerts
  - History
  - Summary
  - Histogram
- Notifications
- Event Log

System
- Comments
- Downtime
- Process Info
- Performance Info
- Scheduling Queue
- Configuration

Current Network Status
Last Updated: Tue Jun 7 11:46:01 CDT 2016
Updated every 90 seconds
Nagios® Core™ 4.0.8 - www.nagios.org
Logged in as *nagiosadmin*

View History For This Host
View Notifications For This Host
View Service Status Detail For All Hosts

Host Status Totals

Up	Down	Unreachable	Pending
1	0	0	0

All Problems	All Types
0	1

Service Status Totals

Ok	Warning	Unknown	Critical	Pending
12	0	1	0	0

All Problems	All Types
1	13

Service Status Details For Host 'localhost'

Limit Results: 100

Host	Service	Status	Last Check	Duration	Attempt	Status Information
localhost	HTTP	OK	06-07-2016 11:43:47	0d 0h 7m 14s	1/4	HTTP OK: HTTP/1.1 200 OK - 3220 bytes in 0.001 second response time
	PING	OK	06-07-2016 11:44:19	0d 0h 6m 36s	1/4	PING OK - Packet loss = 0%, RTA = 0.04 ms
	Root Partition	OK	06-07-2016 11:45:01	0d 0h 6m 0s	1/4	DISK OK - free space: / 9022 MB (54% inode=84%):
	SSH	OK	06-07-2016 11:45:42	0d 0h 5m 19s	1/4	SSH OK - OpenSSH_5.3 (protocol 2.0)
	Service Status - crond	OK	06-07-2016 11:41:19	0d 0h 4m 42s	1/4	crond (pid 2420) is running...
	Service Status - httpd	OK	06-07-2016 11:42:00	0d 0h 4m 1s	1/4	httpd (pid 41424) is running...
	Service Status - mysqld	OK	06-07-2016 11:42:37	0d 0h 3m 24s	1/4	mysqld (pid 15755) is running...
	Service Status - ndo2db	OK	06-07-2016 11:42:11	0d 0h 3m 50s	1/4	ndo2db (pid 15862) is running...
	Service Status - npcd	OK	06-07-2016 11:43:50	0d 0h 7m 11s	1/4	NPCD running (pid 3546).
	Service Status - ntpd	OK	06-07-2016 11:44:24	0d 0h 6m 33s	1/4	ntpd (pid 2125) is running...
	Swap Usage	OK	06-07-2016 11:45:06	0d 0h 5m 55s	1/4	SWAP OK - 100% free (2047 MB out of 2047 MB)
	Total Processes	OK	06-07-2016 11:41:21	0d 0h 4m 40s	1/4	PROCS OK: 177 processes with STATE = RSZDT

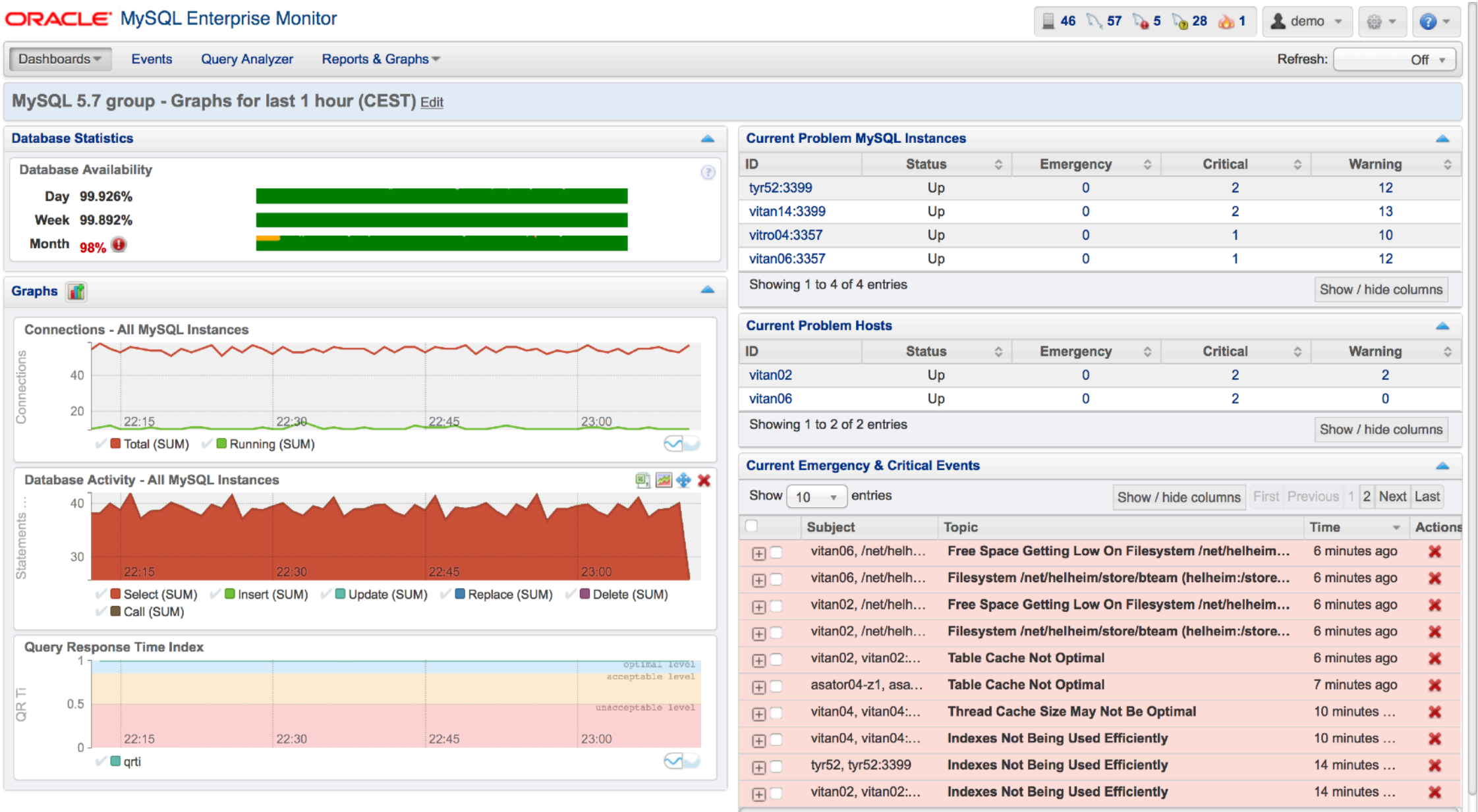
Results 1 - 13 of 13 Matching Services

DB Monitoring

- ✓ Query Throughput
- ✓ Query 실행 성능
- ✓ Buffer pool 사용량

- ✓ MySQL 수준에서의 지원
  - ✓ Global Status Variables (“show global status”)
  - ✓ “performance_schema” database
  - ✓ “sys” database

MySQL Enterprise Monitor



MySQL Enterprise Monitor

ORACLE MySQL Enterprise Monitor

46 57 5 28 1 demo

Dashboards Events Query Analyzer Reports & Graphs Refresh: Off

- All
- A
- asdda
- B
- Merlin
- MySQL 5.7
  - asator04-z1:3357
  - tyr52:3399
  - tyr72:3357
  - vitan02:3357
  - vitan04:3357
  - vitan06:3357
  - vitan14:3399
  - vitro04:3357
- Scalability Trunk Farms
- Scalability Trunk Repo
- vale4x
- | OS - FreeBSD
- | OS - Oracle Linux
- | OS - Oracle Solaris
- | OS - Windows
- Replication 1
- Replication 2

Database File IO

By File | By Wait Type | By Thread

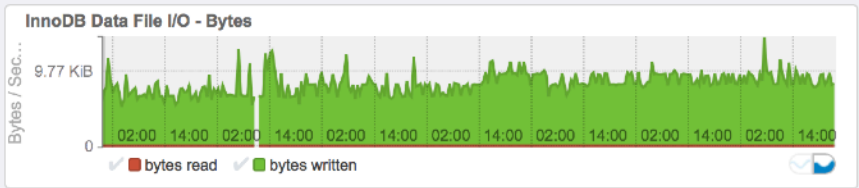
Refreshed: 14.10.2015 00:00:28 Reload

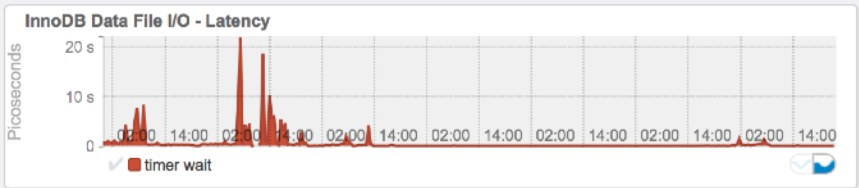
Show 10 entries Search: Show / hide columns First Previous 1 2 Next Last

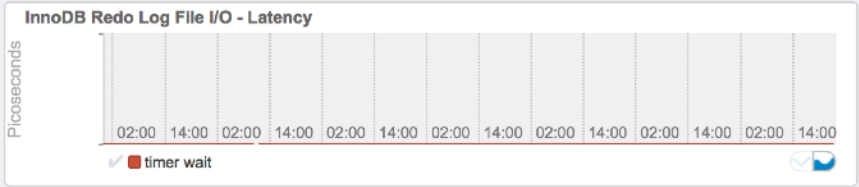
IO Type	Total IOs	Total IO Latency	Avg IO Latency	Max IO Latency	Read IOs	Read IO Latency	Total Read	Avg Read	Write IOs	Write IO Latency	Total Written	Avg Written	Misc IO Latency
innodb/innodb_da...	299.59 K	26.21 m	5.25 ms	33.98 s	277	672.06 ms	6.34 MiB	23.45 KiB	299.22 K	26.19 m	4.58 GiB	16.04 KiB	372.01 ms
myisam/dfile	139.21 K	9.72 m	4.19 ms	1.15 s	56.51 K	9.7 m	4.63 GiB	85.92 KiB	2	2.96 ms	1.76 KiB	899 b	1.37 s
sql/FRM	480.12 K	31.5 s	65.6 us	267.14 ms	764	461.15 ms	264.51 KiB	354 b	0	0 ps	0 b	0 b	31.03 s
innodb/innodb_lo...	23	255.69 ms	11.12 ms	74.04 ms	7	9.73 ms	68.5 KiB	9.79 KiB	6	3.8 ms	3 KiB	512 b	242.17 ms
myisam/kfile	40	81.98 ms	2.05 ms	34.89 ms	18	45.7 ms	4.63 KiB	263 b	3	35.1 ms	331 b	110 b	1.17 ms
mysys/charset	3	61.08 ms	20.36 ms	60.88 ms	1	60.88 ms	17.69 KiB	17.69 KiB	0	0 ps	0 b	0 b	199.76 us
mysys/cnf	5	49.78 ms	9.96 ms	49.56 ms	3	49.58 ms	56 b	18 b	0	0 ps	0 b	0 b	193.71 us
sql/ERRMSG	5	29.22 ms	5.84 ms	28.41 ms	3	28.57 ms	72.23 KiB	24.08 KiB	0	0 ps	0 b	0 b	649.36 us
sql/dbopt	20	1.79 ms	89.66 us	370.67 us	0	0 ps	0 b	0 b	0	0 ps	0 b	0 b	1.79 ms
sql/casetest	10	1.45 ms	145.49 us	484.93 us	0	0 ps	0 b	0 b	0	0 ps	0 b	0 b	1.45 ms

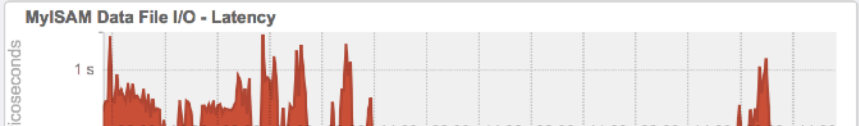
Showing 1 to 10 of 13 entries First Previous 1 2 Next Last

Graph Time Range: 1 hour | 2 hours | 6 hours | 12 hours | 1 day | 2 days | 1 week









Scheduled Maintenance

✓ 목적

- 물리 장비 추가/교체
- 논리 서버 추가/삭제/리부팅

✓ 부작용

- 정기 점검 후 유저 리텐션 감소

✓ 점검에 대한 관행

- “유저가 적은 시간에 짧게”
- 무중단 점검: 동일한 서버를 두 세트 유지. 점검동안 다른 서버로 접속시킴
  - Loadbalancer 를 이용하는 방식
  - DNS entry 를 이용하는 방식
  - Q) 무중단 점검이 불가능한 경우는 언제일까?

물리 장비의 MTBF

✓ Mean Time Between Failures

- 물리 장비의 안정성 지표
- 그러나 “보장” 이 아닌 “기대값”의 의미임
- 예) HDD 의 MTBF 는 약 300,000 시간 이상 이지만, 그 보다 훨씬 짧은 시간에 장애가 발생하기도 함

장애에 대한 대응

✓ 장애 가능 요소
- 서버: 파워, 디스크, CPU, DISK
- 네트워크 스위치
- DB 서버

✓ 장애 대응방식1 - 이중화
- 서버: 듀얼 파워, RAID 디스크
- 네트워크 스위치: 듀얼 스위치
- DB 서버: master-slave replication, RAID

✓ 장애 대응방식2 - fault tolerant design
- Stateless design
- Byzantine fault tolerance

Project Proposal

기술 창업 경험담

THANKS!

Great Technology For Great Games, iFunFactory

DK Moon
dkmoon@ifunfactory.com
www.ifunfactory.com