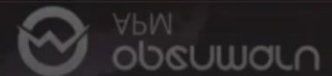


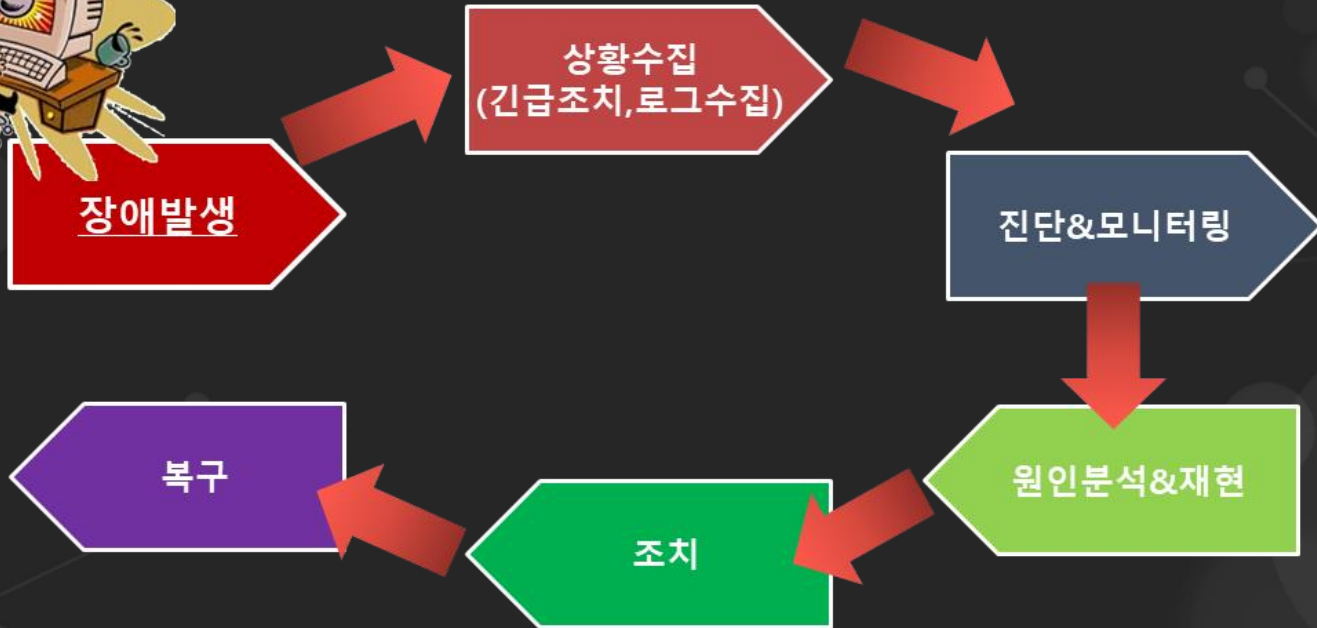
# WAS에서 발생하는 주요 문제에 대한 트러블슈팅 방법

# Application Performance Management

## 트러블 슈팅



# Troubleshooting 공통 프로세스



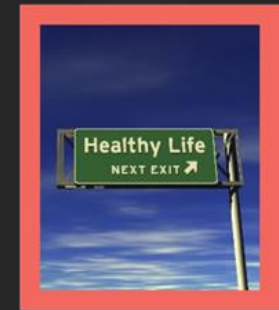
증상과 원인



진단 및 모니터링



조치



방지대책

# 트러블 슈팅의 기본

- 로그 등 관련 자료는 충분히 확보해야
  - 로그는 첫 번째 문제부터 살펴봐야
- 설부른 추측은 금물
  - 전해들은 말을 100% 믿지 말라
  - 증거에 의존하여 분석
  - 문서를 100% 믿지 말라
- 문제분석
  - 문제를 분리하는 방법(Divide & Conquer)
  - 코드 샘플링을 통한 분리 / 재현
  - 재현 & 테스트 & 재현 & 테스트



# Server Hang이란?

- 서버가 전혀 Response를 주지 못함 → 서버 Hang
- 느리더라도 Response를 준다 → 서버 Slowdown
- 서버 Hang의 증상
  - Request가 처리되지 않는다
  - 새로운 Request를 받지 못하고 기존 Request가 Timeout되거나 응답이 없는 상황
  - 서버가 아무 작업도 하지 않는 것 같다
  - 서버의 증상:
    - Hang이 오래 지속되면 JVM Crash될 수도 있다(항상은 아님)
    - 그냥 두면 Hang이 풀리는 경우도 있다(리소스 경합이 발생하여 Hang이 발생한 경우에는 Resource가 풀리면 Hang이 풀린다)
    - 대부분 Hang이 발생된 후에는 관리자의 조치가 없으면 Hang 상태로 두 한이 남아있게 된다



증상과 원인

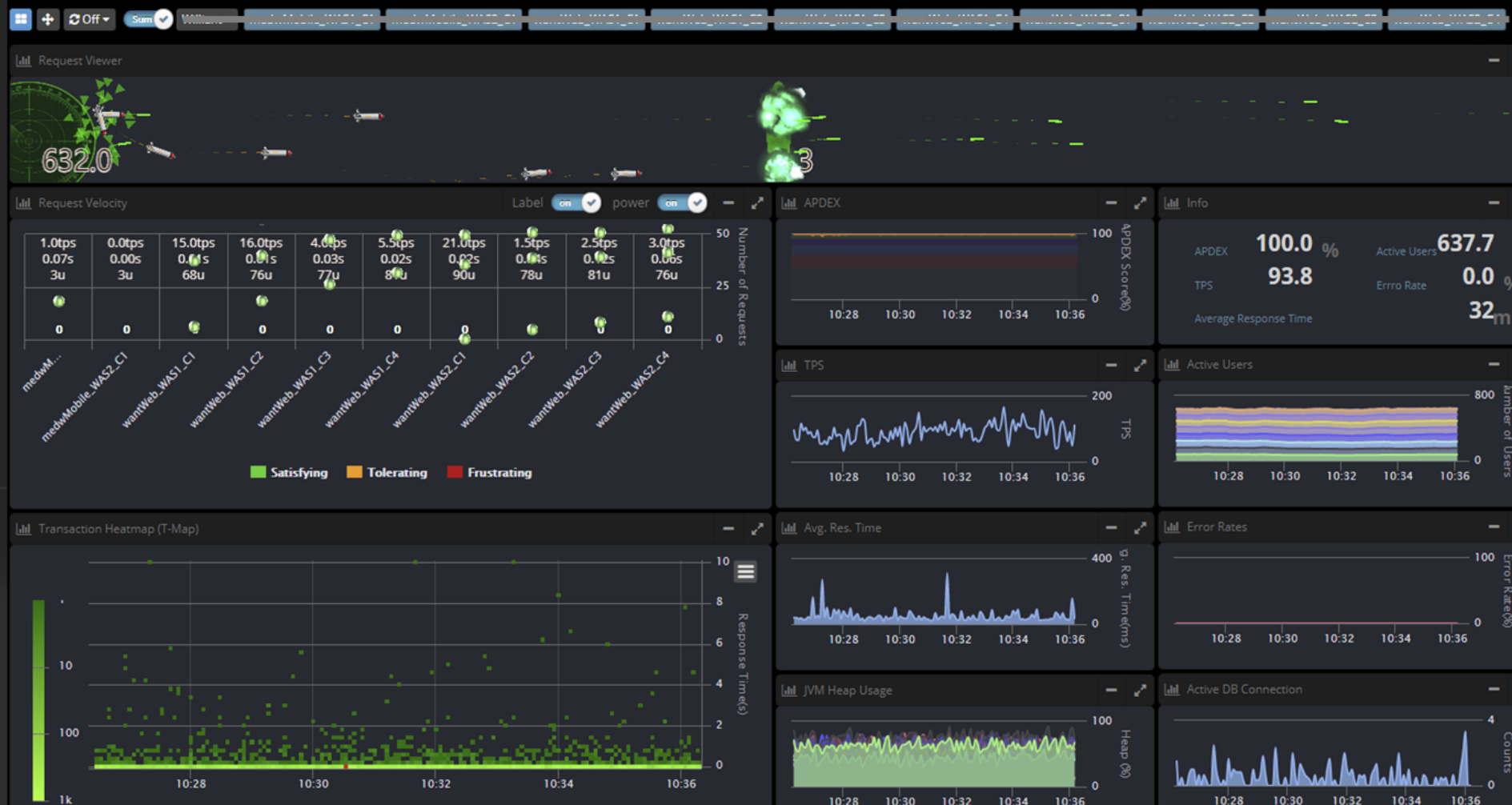
# APM = Application Performance Management

3티어구조에서 성능문제 발생시 신속한 진단과 조치를 위한 성능관리 도구!



- OPENMARU APM 은 실시간으로 어플리케이션 성능을 모니터링 하여 안정적인 시스템 운영을 지원하는 어플리케이션 성능 관리(Application Performance Management, APM) 솔루션
- 웹 어플리케이션의 내부를 실시간으로 모니터링 하면서 사용자들에게 쾌적하게 서비스가 제공되고 있는지를 "가용성"과 "성능"의 관점에서 분석
- 애플리케이션 서버에 에이전트를 배포 페이지 요청의 응답 시간과 쿼리에 대한 데이터베이스 응답 시간을 모니터링하여 "서비스 장애 감지", "장애 원인 특정 시간 단축, 서비스 부하의 원인을 파악"

# 정상적인 상황에서의 APM 대시보드



# 장애 상황에서의 APM 대시보드

대시보드에 Pending Request가 쌓임

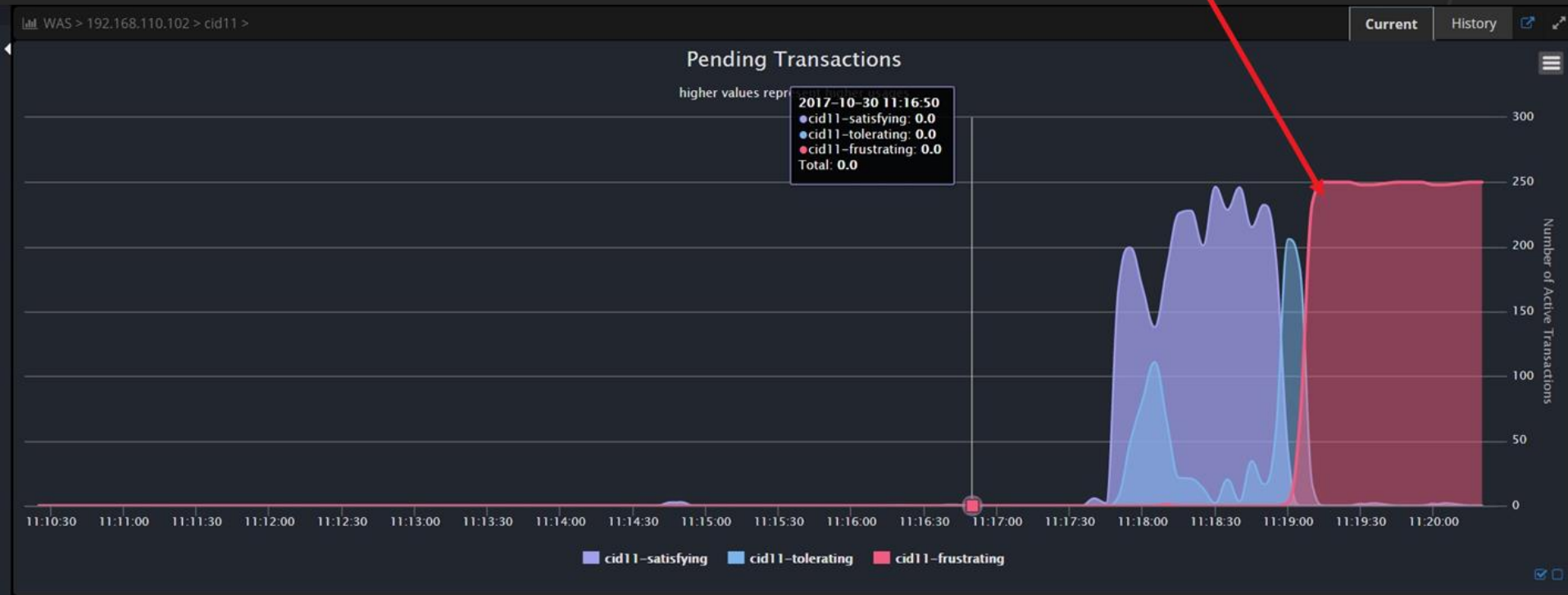




# 대시보드에서 Pending 상황을 나중에 확인방법

- WAS → Instance → [호스트명] → [인스턴스 이름] → 애플리케이션 → 지연 트랜잭션
- 애플리케이션 그룹 → [그룹명] → 지연 트랜잭션

Pending Request가 250개 급격히 쌓임



Application Performance Management

# Java 스레드 덤프 분석방법

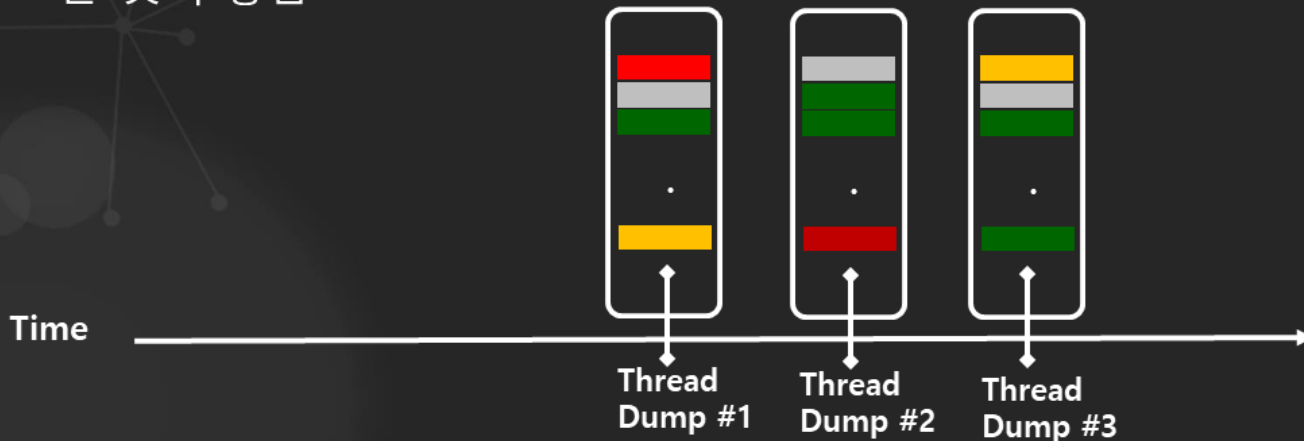


- 스레드 덤프란?

- JVM 내부에서 현재 수행중인 스레드의 SnapShot을 텍스트로 출력
- 서버 Hang, 서버 Slowdown 등 서버에서 발생하는 문제를 해결하는 가장 유용한 도구
- 약 3~5초간격으로 3~5회 연속해서 스레드 덤프를 받아야 분석이 가능하다

- 언제 받아야 하나?

- 운영 중인 서버에서도 수행가능(많은 시간이 걸리지 않는 작업임)
- 서버 Hang, Slowdown시, 서버가 Crash되거나 OutOfMemory가 발생한 직후에 받는 것이 좋음



**B** Back  
**2** To  
**B** Basics

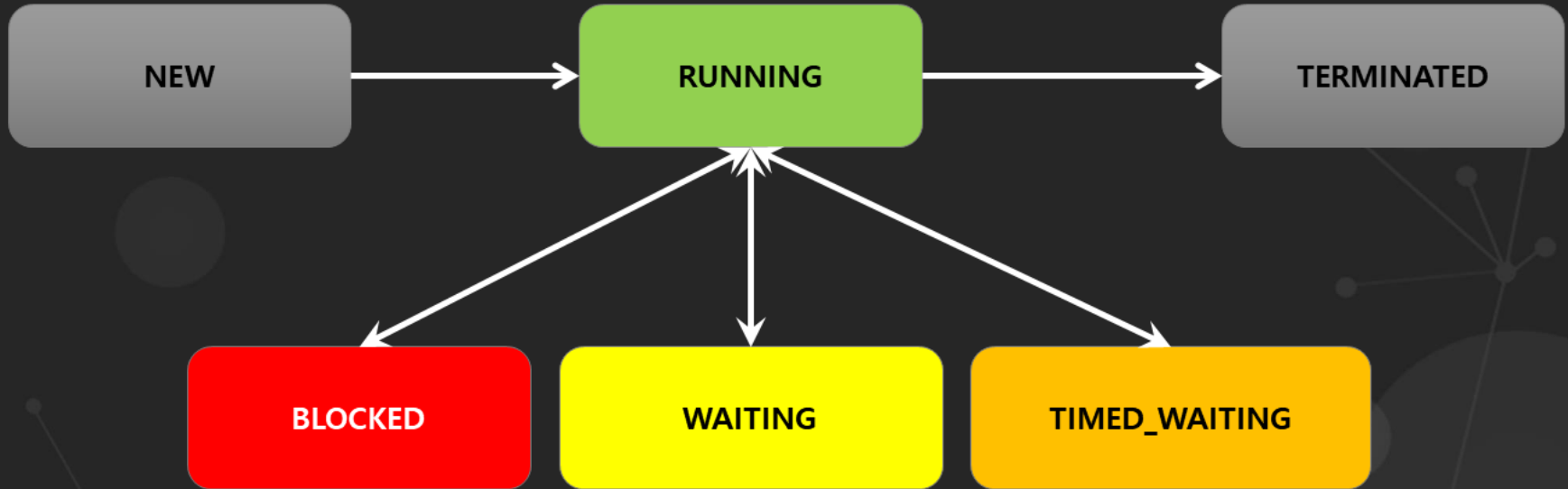
개념과 배경지식

# Thread 상태

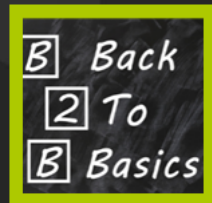


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- `java.lang.Thread.State`

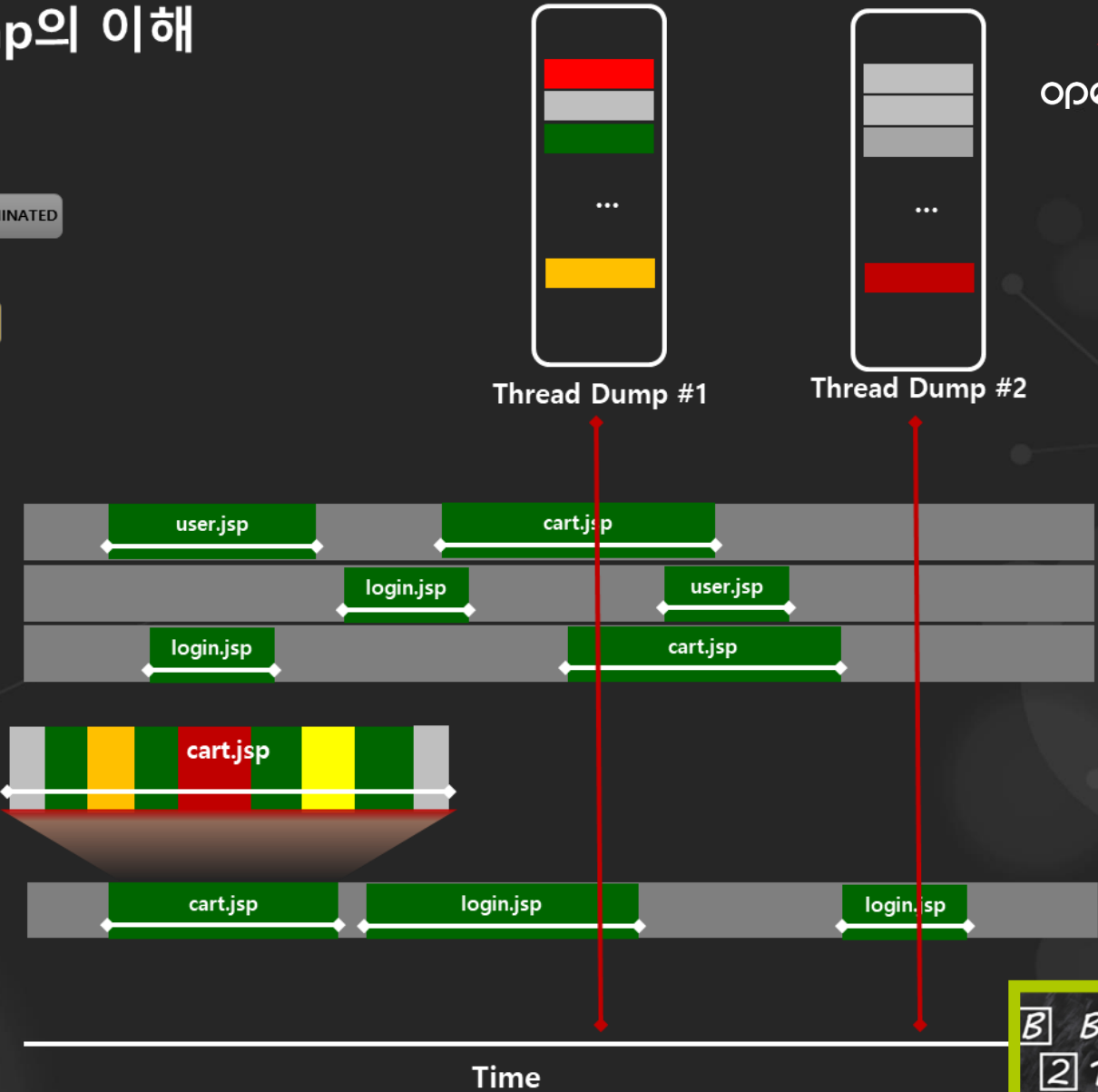
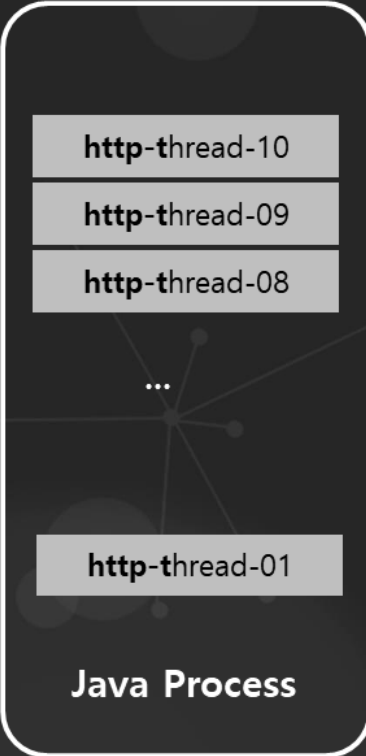


- **NEW** – 생성되어있지만 실행되지 않은 상태
- **RUNNING** – 작업 수행 중
- **BLOCKED** – 다른 스레드의 Lock 해제를 기다리는 중
- **WAITING** – `wait()`, `join()`, `park()` 메소드로 대기 중
- **TIMED\_WAITING** – **WAITING**과 같지만, 정해진 시간만 대기
- **TERMINATED** – 종료됨



개념과 배경지식

# Java Thread Dump의 이해



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개념과 배경지식



# 스레드 덤프 받는 방법은?

- Linux / UNIX 시스템에서 스레드 덤프
  - kill -3 <PID>
  - 일반적으 nohup 명령을 이용하여 시작하기 때문에 nohup.out파일에 stdout 로그가 남게 됨
  - 윈도우에서는 Ctrl + Break
  - OPENMARU Installer 설치 WAS : s1 → ./dump.sh
  - OPENMARU APM 화면에서 버튼 클릭(장애시 자동 생성)**



진단 및 모니터링

## Docker와 Openshift 같은 환경

### 스레드 덤프를 어떻게 받나?

- docker exec -it c4343003c1 /bin/bash  
~# kill -3 <PID>

### 내용을 어떻게 복사? nohup 로그는 남기나?

- docker cp c4343003c1:/file/path/nohup.out /host/path/target

OPENMARU APM은 Openshift, Docker를 지원 → 버튼 클릭 & 분석 UI 제공



in...	Type	Name	State	URL	Duration(ms)	CPU
323	Active Thread	http-thread-pool-threads - 250	WAITING	/popup/sample/ce...	408,302	
456	Active Thread	http-thread-pool-threads - 248	WAITING	/popup/sample/ce...	406,944	
589	Active Thread	http-thread-pool-threads - 248	WAITING	/popup/sample/ce...	410,976	
722	Active Thread	http-thread-pool-threads - 247	WAITING	/popup/sample/ce...	431,456	
855	Active Thread	http-thread-pool-threads - 246	WAITING	/popup/sample/ce...	411,474	
988	Active Thread	http-thread-pool-threads - 245	WAITING	/popup/sample/ce...	406,328	
1,121	Active Thread	http-thread-pool-threads - 244	WAITING	/popup/sample/ce...	405,695	
1,254	Active Thread	http-thread-pool-threads - 243	WAITING	/popup/sample/ce...	410,276	
1,387	Active Thread	http-thread-pool-threads - 242	WAITING	/popup/sample/ce...	406,761	
1,520	Active Thread	http-thread-pool-threads - 241	WAITING	/popup/sample/ce...	406,228	

# 스레드 덤프의 정보 구성



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- 스레드 덤프의 각 스레드의 정보 구성



스레드 이름      우선순위      스레드ID      OS 스레드ID      스레드 상태

```
"http-thread-pool-threads - 250" prio=1( tid=0x00007fab9c192800 nid=0xdbc9 waiting on condition |0x00007faa6ce2c000]
java.lang.Thread.State: WAITING (parking)
```

```
at sun.misc.Unsafe.park(Native Method)
- parking to wait for <0x000000078b428170> (a java.util.concurrent.locks.AbstractQueuedSynchronizer$ConditionObject)
at java.util.concurrent.locks.LockSupport.park(LockSupport.java:186)
at java.util.concurrent.locks.AbstractQueuedSynchronizer$ConditionObject.await(AbstractQueuedSynchronizer.java:2043)
at java.util.concurrent.LinkedBlockingQueue.take(LinkedBlockingQueue.java:442)
at java.util.concurrent.ThreadPoolExecutor.getTask(ThreadPoolExecutor.java:1068)
at java.util.concurrent.ThreadPoolExecutor.runWorker(ThreadPoolExecutor.java:1130)
at java.util.concurrent.ThreadPoolExecutor$Worker.run(ThreadPoolExecutor.java:615)
at java.lang.Thread.run(Thread.java:744)
at org.jboss.threads.JBossThread.run(JBossThread.java:122)
```

스레드 호출 Stack

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개념과 배경지식

# OPENMARU APM에서 스레드 덤프 생성 방법



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- 대시보드 → Request Velocity의 빨간색 클릭 → '요청' 버튼 클릭
- WAS → Instance → [호스트명] → [인스턴스 이름] → 스레드 덤프 분석 → '요청' 버튼 클릭
- <자동생성 조건> 이벤트 → 경고정책 → Pending Transaction이 Critical 조건이 되면 자동생성



한국어

홈 / WAS / 대시보드

cid11

Request Velocity



Thread Dump List

#	Created	Host	Instance	Level	
1	2017-10-30 11:25:45	192.168.110.1...	cid11	INFO	CBS5F3F56-6AF3
2	2017-10-30 11:25:44	192.168.110.1...	cid11	INFO	ED1EAE7-1D57
3	2017-10-30 11:24:45	192.168.110.1...	cid11	INFO	CC93D779-63B5
4	2017-10-30 11:24:44	192.168.110.1...	cid11	INFO	313CA30C-FAC6
5	2017-10-30 11:23:27	192.168.110.1...	cid11	INFO	6B39CEFF-3315

Record ID: 20

Thread Dump Analyzer > 2017-10-30 11:25:45 (CBS5F3F56-6AF3-4973-8E43-48FEF2019B60)

#	Lin...	Type	Name	State	URL	Duration(ms)	CPU
1	323	Active Thread	http-thread-pool-threads - 250	WAITING	/popup/simple/cer...	408,302	
2	456	Active Thread	http-thread-pool-threads - 250	WAITING	/popup/simple/cer...	406,944	
3	589	Active Thread	http-thread-pool-threads - 248	WAITING	/popup/simple/cer...	410,976	
4	722	Active Thread	http-thread-pool-threads - 247	WAITING	/popup/simple/cer...	411,456	
5	855	Active Thread	http-thread-pool-threads - 246	WAITING	/popup/simple/cer...	411,474	
6	988	Active Thread	http-thread-pool-threads - 245	WAITING	/popup/simple/cer...	406,328	
7	1,121	Active Thread	http-thread-pool-threads - 244	WAITING	/popup/simple/cer...	405,695	
8	1,254	Active Thread	http-thread-pool-threads - 243	WAITING	/popup/simple/cer...	410,276	
9	1,387	Active Thread	http-thread-pool-threads - 242	WAITING	/popup/simple/cer...	406,761	
10	1,520	Active Thread	http-thread-pool-threads - 241	WAITING	/popup/simple/cer...	406,228	

Thread Dump Text > 2017-10-30 11:25:45 (CBS5F3F56-6AF3-4973-8E43-48FEF2019B60)

```
33442 - <0x0000000789e645d8> (a java.util.concurrent.ThreadPoolExecutor$Worker)
33443
33444 "http-thread-pool-threads - 1" prio=10 tid=0x00007f26f40b7000 nid=0x4bfc wait
33445 java.lang.Thread.State: WAITING (parking)
33446 at sun.misc.Unsafe.park(Native Method)
33447 - parking to wait for <0x0000000788bf5578> (a java.util.concurrent.locks
33448 at java.util.concurrent.locks.LockSupport.park(LockSupport.java:186)
33449 at java.util.concurrent.locks.AbstractQueuedSynchronizer$ConditionObject
33450 at org.apache.http.pool.AbstractConnPool.getPoolEntryBlocking(AbstractCon
33451 at org.apache.http.pool.AbstractConnPool.access$200(AbstractConnPool.java
33452 at org.apache.http.pool.AbstractConnPool$2.get(AbstractConnPool.java:243)
33453 - locked <0x00000007935133e8> (a org.apache.http.pool.AbstractConnPool$2)
33454 at org.apache.http.pool.AbstractConnPool$2.get(AbstractConnPool.java:191)
33455 at org.apache.http.impl.conn.PoolingHttpClientConnectionManager.leaseConn
33456 at org.apache.http.impl.conn.PoolingHttpClientConnectionManager$1.get(Poo
33457 at org.apache.http.impl.execchain.MainClientExec.execute(MainClientExec.j
33458 at org.apache.http.impl.execchain.ProtocolExec.execute(ProtocolExec.java:
33459 at org.apache.http.impl.execchain.RetryExec.execute(RetryExec.java:89)
33460 at org.apache.http.impl.execchain.RedirectExec.execute(RedirectExec.java:
33461 at org.apache.http.impl.client.InternalHttpClient.doExecute(InternalHttpC
33462 at org.apache.http.impl.client.CloseableHttpClient.execute(CloseableHttpC
```



# OPENMARU APM에서 스레드 덤프 간단 분석 방법



① 리스트 중에서 분석할 스레드 덤프를 선택

② '분석' 버튼을 클릭

③ Type을 클릭하여 소팅  
(Active Thread는 OPENMARU가 busyfyng, Tolerating, Frustrating APM이 모니터링 중인 스레드)

④ 스레드를 클릭하여 수행상태 확인

⑤ 스레드가 수행중인 URL, 수행시간, CPU 사용시간 확인

⑥ 수행 중인 스레드 Stack 확인

#	Created	Host	Instance	Level	URL
1	2017-10-30 11:25:45	192.168.110.1...	cid11	INFO	CB5F3F56-6AF3
2	2017-10-30 11:25:44	192.168.110.1...	cid11	INFO	ED1EEAE7-103F
3	2017-10-30 11:24:45	192.168.110.1...	cid11	INFO	CC93D779-63B5
4	2017-10-30 11:24:44	192.168.110.1...	cid11	INFO	313CA30C-FAC6
5	2017-10-30 11:23:27	192.168.110.1...	cid11	INFO	6B39CEFF-3315

#	Lin..	Type	Name	State	URL	Duration(ms)	CPU
1	323	Active Thread	http-thread-pool-threads - 250	WAITING	/popup/simple/cer...	408,302	
2	456	Active Thread	http-thread-pool-threads - 250	WAITING	/popup/simple/cer...	406,944	
3	589	Active Thread	http-thread-pool-threads - 248	WAITING	/popup/simple/cer...	410,976	
4	722	Active Thread	http-thread-pool-threads - 247	WAITING	/popup/simple/cer...	411,456	
5	855	Active Thread	http-thread-pool-threads - 246	WAITING	/popup/simple/cer...	411,474	
6	988	Active Thread	http-thread-pool-threads - 245	WAITING	/popup/simple/cer...	406,328	
7	1,121	Active Thread	http-thread-pool-threads - 244	WAITING	/popup/simple/cer...	405,695	
8	1,254	Active Thread	http-thread-pool-threads - 243	WAITING	/popup/simple/cer...	410,276	
9	1,387	Active Thread	http-thread-pool-threads - 242	WAITING	/popup/simple/cer...	406,761	
10	1,520	Active Thread	http-thread-pool-threads - 241	WAITING	/popup/simple/cer...	406,228	

```

Thread Dump Text > 2017-10-30 11:25:45 (CB5F3F56-6AF3-4973-8E43-48FEF2019B60)
33442 - <0x0000000789e645d8> (a java.util.concurrent.ThreadPoolExecutor$Worker)
33443
33444 "http-thread-pool-threads - 1" prio=10 tid=0x00007f26f40b7000 nid=0x4bfc wait
33445 java.lang.Thread.State: WAITING (parking)
33446 at sun.misc.Unsafe.park(Native Method)
33447 - parking to wait for <0x0000000788bf5578> (a java.util.concurrent.locks
33448 at java.util.concurrent.locks.LockSupport.park(LockSupport.java:186)
33449 at java.util.concurrent.locks.AbstractQueuedSynchronizer$ConditionObject
33450 at org.apache.http.pool.AbstractConnPool.getPoolEntryBlocking(AbstractCon
33451 at org.apache.http.pool.AbstractConnPool.access$200(AbstractConnPool.java
33452 at org.apache.http.pool.AbstractConnPool$2.get(AbstractConnPool.java:243)
33453 - locked <0x00000007935133e8> (a org.apache.http.pool.AbstractConnPool$2)
33454 at org.apache.http.pool.AbstractConnPool$2.get(AbstractConnPool.java:191)
33455 at org.apache.http.impl.conn.PoolingHttpClientConnectionManager.leaseConn
33456 at org.apache.http.impl.conn.PoolingHttpClientConnectionManager$1.get(Poo
33457 at org.apache.http.impl.execchain.MainClientExec.execute(MainClientExec.j
33458 at org.apache.http.impl.execchain.ProtocolExec.execute(ProtocolExec.java:
33459 at org.apache.http.impl.execchain.RetryExec.execute(RetryExec.java:89)
33460 at org.apache.http.impl.execchain.RedirectExec.execute(RedirectExec.java:
33461 at org.apache.http.impl.client.InternalHttpClient.doExecute(InternalHttpC
33462 at org.apache.http.impl.client.CloseableHttpClient.execute(CloseableHttpC
    
```

# Application Performance Management

## 스레드 덤프 분석 패턴



# 스레드 덤프 분석 주요 패턴



DB 쿼리가 느릴 때



HTTP 호출이 느릴 때



Logging 처리가 느릴 때



파일 I/O가 느릴 때



Lock이 걸릴 때

# 스레드 덤프 분석 주요 패턴



## DB 쿼리가 느릴 때

```
650 "default task-246" #656 prio=5 os_prio=0 tid=0x00007fe94012d800 nid=0x2a4d runnable [0x00007fe82a440000]
651 java.lang.Thread.State: RUNNABLE
652   at java.net.SocketInputStream.socketRead0(Native Method)
653   at java.net.SocketInputStream.socketRead(SocketInputStream.java:116)
654   at java.net.SocketInputStream.read(SocketInputStream.java:170)
655   at java.net.SocketInputStream.read(SocketInputStream.java:141)
656   at oracle.net.ns.Packet.receive(Packet.java:311)
657   at oracle.net.ns.DataPacket.receive(DataPacket.java:105)
658   at oracle.net.ns.NetInputStream.getNextPacket(NetInputStream.java:305)
659   at oracle.net.ns.NetInputStream.read(NetInputStream.java:249)
660   at oracle.net.ns.NetInputStream.read(NetInputStream.java:171)
661   at oracle.net.ns.NetInputStream.read(NetInputStream.java:89)
662   at oracle.jdbc.driver.T4CSocketInputStreamWrapper.readNextPacket(T4CSocketInputStreamWrapper.java:123)
663   at oracle.jdbc.driver.T4CSocketInputStreamWrapper.read(T4CSocketInputStreamWrapper.java:79)
```


Thread Dump Analyzer > 2017-06-15 10:31:20 (E52CF44A-558F-43A5-8E56-3321F479E1CB)

#	Lin.	Type	Name	State	URL	Durati...	CPU Ti...	Class	At	Addr...
1	650	Active Thre	default task-246	RUNNABLE	/cnet/front/exame...	14,403	352.9	java.net.So...	0x000...	
2	924	Active Thre	default task-238	BLOCKED	/cnet/front/exame...	33,986	693.4	org.apache...	0x000...	
3	1,061	Active Thre	default task-236	BLOCKED	/cnet/front/exame...	33,058	628.9	org.apache...	0x000...	
4	1,181	Active Thre	default task-235	BLOCKED	/cnet/front/exame...	39,877	745.3	org.apache...	0x000...	
5	1,588	Active Thre	default task-215	BLOCKED	/cnet/front/exame...	38,246	745.2	org.apache...	0x000...	
6	1,737	Active Thre	default task-212	BLOCKED	/cnet/front/exame...	32,150	637.7	org.apache...	0x000...	
7	1,983	Active Thre	default task-204	BLOCKED	/cnet/front/exame...	30,869	627.5	org.apache...	0x000...	
8	2,117	Active Thre	default task-202	BLOCKED	/cnet/front/exame...	38,711	757.2	org.apache...	0x000...	
9	2,314	Active Thre	default task-196	BLOCKED	/cnet/front/exame...	30,347	608.5	org.apache...	0x000...	
10	2,498	Active Thre	default task-193	BLOCKED	/cnet/front/exame...	38,861	757.6	org.apache...	0x000...	
11	2,620	Active Thre	default task-191	BLOCKED	/cnet/front/exame...	32,901	655.2	org.apache...	0x000...	
12	2,772	Active Thre	default task-188	RUNNABLE	/cnet/front/exame...	34,560	673.6	java.securi...	0x000...	
13	3,143	Active Thre	default task-176	BLOCKED	/cnet/front/exame...	31,438	613.1	org.apache...	0x000...	
14	3,281	Active Thre	default task-174	BLOCKED	/cnet/front/exame...	25,674	559.1	org.apache...	0x000...	
15	3,419	Active Thre	default task-172	RUNNABLE	/cnet/front/exame...	40,398	766.5	java.net.So...	0x000...	
16	3,633	Active Thre	default task-168	BLOCKED	/cnet/front/exame...	26,471	502.3	org.apache...	0x000...	
17	4,007	Active Thre	default task-151	BLOCKED	/cnet/front/exame...	29,606	589.9	org.apache...	0x000...	
18	4,144	Active Thre	default task-149	BLOCKED	/cnet/front/exame...	26,854	555.2	org.apache...	0x000...	
19	4,278	Active Thre	default task-147	BLOCKED	/cnet/front/exame...	27,212	564.5	org.apache...	0x000...	
20	4,400	Active Thre	default task-146	BLOCKED	/cnet/front/memb...	1,145	11.3	org.apache...	0x000...	
21	4,577	Active Thre	default task-143	BLOCKED	/cnet/front/exame...	37,405	694.4	org.apache...	0x000...	
22	5,179	Active Thre	default task-110	BLOCKED	/cnet/front/exame...	28,692	618.0	org.apache...	0x000...	
23	5,302	Active Thre	default task-109	BLOCKED	/cnet/front/exame...	12,069	282.6	org.apache...	0x000...	
24	5,589	Active Thre	default task-98	BLOCKED	/cnet/front/exame...	31,622	630.8	org.apache...	0x000...	
25	5,738	Active Thre	default task-95	BLOCKED	/cnet/front/exame...	38,526	743.0	org.apache...	0x000...	
26	5,917	Active Thre	default task-90	BLOCKED	/cnet/front/exame...	28,350	612.5	org.apache...	0x000...	
27	6,265	Active Thre	default task-74	BLOCKED	/cnet/front/exame...	37,662	743.6	org.apache...	0x000...	

Thread Dump Text > 2017-06-15 10:31:20 (E52CF44A-558F-43A5-8E56-3321F479E1CB)

```
648 - None
649
650 "default task-246" #656 prio=5 os_prio=0 tid=0x00007fe94012d800 nid=0x2a4d runnable [0x00007fe82a440000]
651 java.lang.Thread.State: RUNNABLE
652   at java.net.SocketInputStream.socketRead0(Native Method)
653   at java.net.SocketInputStream.socketRead(SocketInputStream.java:116)
654   at java.net.SocketInputStream.read(SocketInputStream.java:170)
655   at java.net.SocketInputStream.read(SocketInputStream.java:141)
656   at oracle.net.ns.Packet.receive(Packet.java:311)
657   at oracle.net.ns.DataPacket.receive(DataPacket.java:105)
658   at oracle.net.ns.NetInputStream.getNextPacket(NetInputStream.java:305)
659   at oracle.net.ns.NetInputStream.read(NetInputStream.java:249)
660   at oracle.net.ns.NetInputStream.read(NetInputStream.java:171)
661   at oracle.net.ns.NetInputStream.read(NetInputStream.java:89)
662   at oracle.jdbc.driver.T4CSocketInputStreamWrapper.readNextPacket(T4CSocketInputStreamWrapper.java:123)
663   at oracle.jdbc.driver.T4CSocketInputStreamWrapper.read(T4CSocketInputStreamWrapper.java:79)
```

Oracle DB의 응답을 기다리는 스레드



Thread Dump

# 스레드 덤프 분석 방법 - DB 연결이 오래 걸릴 때



## DB getConnection이 느릴 경우

Connection Pool 획득 요청 이후 Pool이 부족하여 대기하고 있는 상태

```
1894 "default task-229" #720 prio=5 os_prio=0 tid=0x00000000c411000 nid=0x79bb waiting on condition [0x00007f...
1895 java.lang.Thread.sleep(0)
1896 at sun.misc.Unsafe.park(Native Method)
1897 - parking to wait for <0x00000000c2832210> (a java.util.concurrent.Semaphore$FairSync)
1898 at java.util.concurrent.locks.LockSupport.parkNanos(LockSupport.java:215)
1899 at java.util.concurrent.locks.AbstractQueuedSynchronizer.doAcquireSharedNanos(AbstractQueuedSynchronizer.java:1060)
1900 at java.util.concurrent.locks.AbstractQueuedSynchronizer.tryAcquireSharedNanos(AbstractQueuedSynchronizer.java:1325)
1901 at java.util.concurrent.Semaphore.tryAcquire(Semaphore.java:409)
1902 at org.jboss.jca.core.connectionmanager.pool.api.Semaphore.tryAcquire(Semaphore.java:68)
1903 at org.jboss.jca.core.connectionmanager.pool.mcp.SemaphoreConcurrentLinkedDequeManagedConnectionPool.getSimpleConnection(AbstractPool.java:632)
1904 at org.jboss.jca.core.connectionmanager.pool.AbstractPool.getConnection(AbstractPool.java:604)
1905 at org.jboss.jca.core.connectionmanager.AbstractConnectionManager.getManagedConnection(AbstractConnectionManager.java:138)
1906 at org.jboss.jca.core.connectionmanager.tx.TxConnectionManagerImpl.getManagedConnection(TxConnectionManagerImpl.java:392)
1907 at org.jboss.jca.core.connectionmanager.AbstractConnectionManager.allocateConnection(AbstractConnectionManager.java:111)
1908 at org.jboss.as.connector.subsystems.datasources.WildFlyDataSource.getConnection(WildFlyDataSource.java:77)
1909 at org.springframework.jdbc.datasource.DataSourceUtils.doGetConnection(DataSourceUtils.java:111)
1910 at org.springframework.jdbc.datasource.DataSourceUtils.getConnection(DataSourceUtils.java:77)
1911 at org.mybatis.spring.transaction.SpringManagedTransaction.openConnection(SpringManagedTransaction.java:32)
1912 at org.mybatis.spring.transaction.BaseExecutorImpl.prepareStatement(BaseExecutorImpl.java:107)
1913 at org.mybatis.spring.transaction.BaseExecutorImpl.prepareStatement(BaseExecutorImpl.java:107)
1914 at org.mybatis.spring.transaction.BaseExecutorImpl.prepareStatement(BaseExecutorImpl.java:107)
1915 at org.mybatis.spring.transaction.BaseExecutorImpl.prepareStatement(BaseExecutorImpl.java:107)
1916 at org.mybatis.spring.transaction.BaseExecutorImpl.prepareStatement(BaseExecutorImpl.java:107)
1917 at org.mybatis.spring.transaction.BaseExecutorImpl.prepareStatement(BaseExecutorImpl.java:107)
1918 at org.mybatis.spring.transaction.BaseExecutorImpl.prepareStatement(BaseExecutorImpl.java:107)
1919 at org.mybatis.spring.transaction.BaseExecutorImpl.prepareStatement(BaseExecutorImpl.java:107)
1920 at org.mybatis.spring.transaction.BaseExecutorImpl.prepareStatement(BaseExecutorImpl.java:107)
```

스레드 덤프 분석기 > 2019-03-11 18:03:20 (26DFF023-4EB4-4654-8C17-06C06CDFAFE3)

#	Line#	Type	Name	State	URL	Durati...	CPU
1	536	Active Thread	taskExecutor-8	TIMED_WAITING			5,747
2	963	Active Thread	default task-248	TIMED_WAITING	/bms/dt/getNotic...		3,797
3	1,204	Active Thread	default task-246	TIMED_WAITING	/blg/message/mes...		6,297
4	1,343	Active Thread	default task-244	TIMED_WAITING	/blg/message/mes...		7,399
5	1,510	Active Thread	default task-240	RUNNABLE	/blg/message/mes...		11,773
6	1,680	Active Thread	default task-236	TIMED_WAITING	/blg/message/mes...		2,496
7	1,894	Active Thread	default task-229	TIMED_WAITING	/bms/dt/editrepo...		4,287
8	2,049	Active Thread	default task-225	TIMED_WAITING	/blg/message/mes...		3,917
9	2,671	Active Thread	default task-203	WAITING	/bms/dcten/Bms...		52
10	2,804	Active Thread	default task-199	TIMED_WAITING	/blg/message/mes...		5,460
11	3,198	Active Thread	default task-180	TIMED_WAITING	/blg/message/mes...		528
12	3,397	Active Thread	default task-174	TIMED_WAITING	/bms/dt/editrepo...		4,912

Record ID: 695

스레드 덤프 텍스트 > 2019-03-11 18:03:20 (26DFF023-4EB4-4654-8C17-06C06CDFAFE3)

```
1892 - None
1893 - None
1894 "default task-229" #720 prio=5 os_prio=0 tid=0x00000000c411000 nid=0x79bb waiting on condition [0x00007f...
1895 java.lang.Thread.sleep(0)
1896 at sun.misc.Unsafe.park(Native Method)
1897 - parking to wait for <0x00000000c2832210> (a java.util.concurrent.Semaphore$FairSync)
1898 at java.util.concurrent.locks.LockSupport.parkNanos(LockSupport.java:215)
1899 at java.util.concurrent.locks.AbstractQueuedSynchronizer.doAcquireSharedNanos(AbstractQueuedSynchronizer.java:1060)
1900 at java.util.concurrent.locks.AbstractQueuedSynchronizer.tryAcquireSharedNanos(AbstractQueuedSynchronizer.java:1325)
1901 at java.util.concurrent.Semaphore.tryAcquire(Semaphore.java:409)
1902 at org.jboss.jca.core.connectionmanager.pool.api.Semaphore.tryAcquire(Semaphore.java:68)
1903 at org.jboss.jca.core.connectionmanager.pool.mcp.SemaphoreConcurrentLinkedDequeManagedConnectionPool.getSimpleConnection(AbstractPool.java:632)
1904 at org.jboss.jca.core.connectionmanager.pool.AbstractPool.getConnection(AbstractPool.java:604)
1905 at org.jboss.jca.core.connectionmanager.AbstractConnectionManager.getManagedConnection(AbstractConnectionManager.java:138)
1906 at org.jboss.jca.core.connectionmanager.tx.TxConnectionManagerImpl.getManagedConnection(TxConnectionManagerImpl.java:392)
1907 at org.jboss.jca.core.connectionmanager.AbstractConnectionManager.allocateConnection(AbstractConnectionManager.java:111)
1908 at org.jboss.as.connector.subsystems.datasources.WildFlyDataSource.getConnection(WildFlyDataSource.java:77)
1909 at org.springframework.jdbc.datasource.DataSourceUtils.doGetConnection(DataSourceUtils.java:111)
1910 at org.springframework.jdbc.datasource.DataSourceUtils.getConnection(DataSourceUtils.java:77)
1911 at org.mybatis.spring.transaction.SpringManagedTransaction.openConnection(SpringManagedTransaction.java:32)
1912 at org.mybatis.spring.transaction.BaseExecutorImpl.prepareStatement(BaseExecutorImpl.java:107)
1913 at org.mybatis.spring.transaction.BaseExecutorImpl.prepareStatement(BaseExecutorImpl.java:107)
1914 at org.mybatis.spring.transaction.BaseExecutorImpl.prepareStatement(BaseExecutorImpl.java:107)
1915 at org.mybatis.spring.transaction.BaseExecutorImpl.prepareStatement(BaseExecutorImpl.java:107)
1916 at org.mybatis.spring.transaction.BaseExecutorImpl.prepareStatement(BaseExecutorImpl.java:107)
1917 at org.mybatis.spring.transaction.BaseExecutorImpl.prepareStatement(BaseExecutorImpl.java:107)
1918 at org.mybatis.spring.transaction.BaseExecutorImpl.prepareStatement(BaseExecutorImpl.java:107)
1919 at org.mybatis.spring.transaction.BaseExecutorImpl.prepareStatement(BaseExecutorImpl.java:107)
1920 at org.mybatis.spring.transaction.BaseExecutorImpl.prepareStatement(BaseExecutorImpl.java:107)
```

# 스레드 덤프 분석 주요 패턴



## HTTP 호출이 느릴 때

```

2589 - None
2590
2591 "ajp-thread-pool-threads - 363" prio=10 tid=0x00007f977c250800 nid=0x3bbb runnable [0:
2592 java.lang.Thread.State: RUNNABLE
2593 at java.net.SocketInputStream.socketRead0(Native Method)
2594 at java.net.SocketInputStream.read(SocketInputStream.java:153)
2595 at java.net.SocketInputStream.read(SocketInputStream.java:122)
2596 at java.io.BufferedInputStream.fill(BufferedInputStream.java:235)
2597 at java.io.BufferedInputStream.read1(BufferedInputStream.java:275)
2598 at java.io.BufferedInputStream.read(BufferedInputStream.java:334)
2599 - locked <0x000000079998c960> (a java.io.BufferedInputStream)
2600 at sun.net.www.MeteredStream.read(MeteredStream.java:134)
2601 - locked <0x000000079998c8d0> (a sun.net.www.http.KeepAliveStream)
2602 at java.io.FilterInputStream.read(FilterInputStream.java:133)
2603 at sun.net.www.protocol.http.HttpURLConnection$HttpInputStream.read(HttpURLConnection
2604 at sun.net.www.protocol.http.HttpURLConnection$HttpInputStream.read(HttpURLConnection
2605 at com.nhncorp.keris.ebook.common.controller.FileDownloadURLView.renderMergedOutput
2606 at org.springframework.web.servlet.view.AbstractView.render(AbstractView.java:250)
2607 at org.springframework.web.servlet.DispatcherServlet.render(DispatcherServlet.java:

```

Java의 HttpURLConnection가 호출한 URL의 Socket 응답을 기다리는 중

스레드 덤프 시점에 559초 가량 실행중

스레드 덤프 분석기 > 2018-10-26 22:09:52 (F563FFAE-CC45-4533-89F4-E4CD2DE9784F)

#	Line#	Type	Name	State	URL	Durati...	CPU T
1	1,862	Active Thread	ajp-thread-poo...	RUNNABLE	/securityFileDownl...	264,67...	
2	2,591	Active Thread	ajp-thread-poo...	RUNNABLE	/securityFileDownl...	559,79...	
3	17	Lock		locked			
4	32	Lock		locked			
5	50	Lock		Locked ownable ...			
6	283	Lock		locked			
7	291	Lock		Locked ownable ...			
8	300	Lock		locked			
9	308	Lock		Locked ownable ...			
10	1,870	Lock		locked			
11	1,872	Lock		locked			

Java의 HttpURLConnection은 Timeout / Pooling을 지원하지 않아 HttpClient로 변경해야 함



# 스레드 덤프 분석 주요 패턴



openmaru



## Logging 처리가 느릴 때

```
2773 java.lang.Thread.State: RUNNABLE
2774 at java.security.AccessController.doPrivileged(Native Method)
2775 at org.jboss.logmanager.ClassLoaderLogContextSelector.getLogContext(ClassLoaderLogContextSelector.java:137)
2776 at org.jboss.logmanager.ThreadLocalLogContextSelector.getLogContext(ThreadLocalLogContextSelector.java:55)
2777 at org.jboss.as.logging.logmanager.WildFlyLogContextSelectorImpl.getLogContext(WildFlyLogContextSelectorImpl.java:59)
2778 at org.jboss.logmanager.LogContext.getLogContext(LogContext.java:295)
2779 at org.jboss.as.logging.stdio.LogContextStdioContextSelector.getStdioContext(LogContextStdioContextSelector.java:49)
2780 at org.jboss.stdio.StdioContext$1.getDelegate(StdioContext.java:148)
2781 at org.jboss.stdio.StdioContext$DelegatingPrintStream.write(StdioContext.java:264)
2782 at sun.nio.cs.StreamEncoder.writeBytes(StreamEncoder.java:221)
2783 at sun.nio.cs.StreamEncoder.implFlushBuffer(StreamEncoder.java:291)
2784 at sun.nio.cs.StreamEncoder.implFlush(StreamEncoder.java:295)
2785 at sun.nio.cs.StreamEncoder.flush(StreamEncoder.java:141)
2786 - locked <0x00000006cf0ca860> (a java.io.OutputStreamWriter)
2787 at java.io.OutputStreamWriter.flush(OutputStreamWriter.java:229)
2788 at org.apache.log4j.helpers.QuietWriter.flush(QuietWriter.java:66)
2789 at org.apache.log4j.WriterAppender.subAppend(WriterAppender.java:377)
2790 at org.apache.log4j.WriterAppender.append(WriterAppender.java:176)
2791 at org.apache.log4j.AppenderSkeleton.doAppend(AppenderSkeleton.java:286)
2792 - locked <0x00000006cf0ca580> (a org.apache.log4j.ConsoleAppender)
2793 at org.apache.log4j.helpers.AppenderAttachableImpl.appendLoopOnAppenders(AppenderAttachableImpl.java:67)
2794 at org.apache.log4j.Category.callAppenders(Category.java:218)
```

Log4j에서 Log를 Write할 때 느림

#	Lin.	Type	Name	State	URL	Durat.	CPU Tl.	Class	At	Addr.
1	650	Active Thre	default task-246	RUNNABLE	/cnet/front/exame...	14,403	352.9	java.net.So	0x000	
2	924	Active Thre	default task-238	BLOCKED	/cnet/front/exame...	33,986	693.4	org.apache	0x000	
3	1,061	Active Thre	default task-236	BLOCKED	/cnet/front/exame...	33,058	628.9	org.apache	0x000	
4	1,181	Active Thre	default task-235	BLOCKED	/cnet/front/exame...	39,877	745.3	org.apache	0x000	
5	1,588	Active Thre	default task-215	BLOCKED	/cnet/front/exame...	30,246	745.2	org.apache	0x000	
6	1,737	Active Thre	default task-212	BLOCKED	/cnet/front/exame...	32,150	637.7	org.apache	0x000	
7	1,983	Active Thre	default task-204	BLOCKED	/cnet/front/exame...	30,869	627.5	org.apache	0x000	
8	2,117	Active Thre	default task-202	BLOCKED	/cnet/front/exame...	38,711	757.2	org.apache	0x000	
9	2,314	Active Thre	default task-196	BLOCKED	/cnet/front/exame...	30,347	608.5	org.apache	0x000	
10	2,498	Active Thre	default task-193	BLOCKED	/cnet/front/exame...	38,861	757.6	org.apache	0x000	
11	2,620	Active Thre	default task-191	BLOCKED	/cnet/front/exame...	32,901	655.2	org.apache	0x000	
12	2,772	Active Thre	default task-188	RUNNABLE	/cnet/front/exame...	34,560	673.6	java.securi	0x000	
13	3,143	Active Thre	default task-176	BLOCKED	/cnet/front/exame...	31,438	613.1	org.apache	0x000	
14	3,281	Active Thre	default task-174	BLOCKED	/cnet/front/exame...	25,674	559.1	org.apache	0x000	
15	3,419	Active Thre	default task-172	RUNNABLE	/cnet/front/exame...	40,398	766.5	java.net.So	0x000	
16	3,633	Active Thre	default task-168	BLOCKED	/cnet/front/exame...	26,471	502.3	org.apache	0x000	
17	4,007	Active Thre	default task-151	BLOCKED	/cnet/front/exame...	29,606	589.9	org.apache	0x000	
18	4,144	Active Thre	default task-149	BLOCKED	/cnet/front/exame...	26,854	555.2	org.apache	0x000	
19	4,278	Active Thre	default task-147	BLOCKED	/cnet/front/exame...	27,212	564.5	org.apache	0x000	
20	4,400	Active Thre	default task-146	BLOCKED	/cnet/front/memb...	1,145	11.3	org.apache	0x000	
21	4,577	Active Thre	default task-143	BLOCKED	/cnet/front/exame...	37,405	694.4	org.apache	0x000	
22	5,179	Active Thre	default task-110	BLOCKED	/cnet/front/exame...	28,692	618.0	org.apache	0x000	
23	5,302	Active Thre	default task-109	BLOCKED	/cnet/front/exame...	12,069	282.6	org.apache	0x000	
24	5,589	Active Thre	default task-98	BLOCKED	/cnet/front/exame...	31,622	630.8	org.apache	0x000	

```
2773 java.lang.Thread.State: RUNNABLE
2774 at java.security.AccessController.doPrivileged(Native Method)
2775 at org.jboss.logmanager.ClassLoaderLogContextSelector.getLogContext(ClassLoaderLogContextSelector.java:137)
2776 at org.jboss.logmanager.ThreadLocalLogContextSelector.getLogContext(ThreadLocalLogContextSelector.java:55)
2777 at org.jboss.as.logging.logmanager.WildFlyLogContextSelectorImpl.getLogContext(WildFlyLogContextSelectorImpl.java:59)
2778 at org.jboss.logmanager.LogContext.getLogContext(LogContext.java:295)
2779 at org.jboss.as.logging.stdio.LogContextStdioContextSelector.getStdioContext(LogContextStdioContextSelector.java:49)
2780 at org.jboss.stdio.StdioContext$1.getDelegate(StdioContext.java:148)
2781 at org.jboss.stdio.StdioContext$DelegatingPrintStream.write(StdioContext.java:264)
2782 at sun.nio.cs.StreamEncoder.writeBytes(StreamEncoder.java:221)
2783 at sun.nio.cs.StreamEncoder.implFlushBuffer(StreamEncoder.java:291)
2784 at sun.nio.cs.StreamEncoder.implFlush(StreamEncoder.java:295)
2785 at sun.nio.cs.StreamEncoder.flush(StreamEncoder.java:141)
2786 - locked <0x00000006cf0ca860> (a java.io.OutputStreamWriter)
2787 at java.io.OutputStreamWriter.flush(OutputStreamWriter.java:229)
2788 at org.apache.log4j.helpers.QuietWriter.flush(QuietWriter.java:66)
2789 at org.apache.log4j.WriterAppender.subAppend(WriterAppender.java:377)
2790 at org.apache.log4j.WriterAppender.append(WriterAppender.java:176)
2791 at org.apache.log4j.AppenderSkeleton.doAppend(AppenderSkeleton.java:286)
2792 - locked <0x00000006cf0ca580> (a org.apache.log4j.ConsoleAppender)
2793 at org.apache.log4j.helpers.AppenderAttachableImpl.appendLoopOnAppenders(AppenderAttachableImpl.java:67)
2794 at org.apache.log4j.Category.callAppenders(Category.java:218)
2795 at org.apache.log4j.Category.log(Category.java:1168)
2796 at org.apache.log4j.Category.log(Category.java:1177)
2797 at org.apache.commons.logging.impl.Log4JLogger.debug(Log4JLogger.java:177)
2798 at org.springframework.jdbc.datasource.DataSourceTransactionManager.doBegin(DataSourceTransactionManager.java:221)
2800 at org.springframework.transaction.support.AbstractPlatformTransactionManager.getTransaction(AbstractPlatformTransactionManager.java:288)
2801 at org.springframework.transaction.interceptor.TransactionAspectSupport.createTransactionIfNecessary(TransactionAspectSupport.java:41)
2802 at org.springframework.transaction.interceptor.TransactionAspectSupport.invokeWithinTransaction(TransactionAspectSupport.java:355)
2803 at org.springframework.transaction.interceptor.TransactionInterceptor.invoke(TransactionInterceptor.java:94)
2804 at org.springframework.aop.framework.ReflectiveMethodInvocation.proceed(ReflectiveMethodInvocation.java:172)
2805 at org.springframework.aop.framework.interceptor.AbstractMethodInvocation.invoke(AbstractMethodInvocation.java:20)
2806 at org.springframework.aop.framework.interceptor.TransactionInterceptor.invoke(TransactionInterceptor.java:172)
2807 at org.springframework.aop.interceptor.ExposeInvocationInterceptor.invoke(ExposeInvocationInterceptor.java:91)
2808 at org.springframework.aop.framework.ReflectiveMethodInvocation.proceed(ReflectiveMethodInvocation.java:172)
2809 at org.springframework.aop.framework.cglibadvice.CglibAopProxy.invoke(CglibAopProxy.java:633)
2810 at org.springframework.aop.framework.adapter.MethodInvocationAdapter.invoke(MethodInvocationAdapter.java:12)
2811 at org.springframework.aop.framework.adapter.MethodInvocationAdapter.invoke(MethodInvocationAdapter.java:148)
2812 at org.springframework.aop.framework.adapter.MethodInvocationAdapter.invoke(MethodInvocationAdapter.java:148)
2813 at sun.reflect.GeneratedMethodAccessor524.invoke(Unknown Source)
2814 at sun.reflect.DelegatingMethodAccessorImpl.invoke(DelegatingMethodAccessorImpl.java:43)
2815 at java.lang.reflect.Method.invoke(Method.java:498)
2816 at org.springframework.web.bind.annotation.support.HandlerMethodInvoker.invokeHandlerMethod(HandlerMethodInvoker.java:176)
2817 at org.springframework.web.servlet.mvc.annotation.AnnotationMethodHandlerAdapter.invokeHandlerMethod(AnnotationMethodHandlerAdapter.java:176)
```



# 스레드 덤프 분석 주요 패턴



## 파일 I/O가 느릴 때

파일 List를 가져오는 함수에서 응답이 없음

```
2380
2381 "http-thread-pool-threads - 170" prio=10 tid=0x00000007fde08af800 nid=0x1bc5 runnable [0x00000007fde08af800]
2382 java.lang.Thread.State: RUNNABLE
2383 at java.io.UnixFileSystem.list(Native Method)
2384 at java.io.File.list(File.java:1116)
2385 at onnara.dct.util.HwpManager.renewDirectoryList(HwpManager.java:608)
2386 at onnara.dct.util.HwpManager.convertFileSuccess(HwpManager.java:532)
```



#	Line#	Type	Name	State	URL	Durati	CPU Ti.	Class	At	Addr.
1	143	Active Thread	http-thread-po...	RUNNABLE	/bms/dct/viewrep...	52,516	42.7	java.io.Uni...	0x00...	
2	222	Active Thread	http-thread-po...	RUNNABLE	/bms/dct/viewrep...	479,891	457.2	java.io.Uni...	0x00...	
3	365	Active Thread	http-thread-po...	RUNNABLE	/bms/dct/viewrep...	94,384	58.5	java.io.Uni...	0x00...	
4	540	Active Thread	http-thread-po...	RUNNABLE	/bms/dct/viewrep...	311,772	222.5	java.io.Uni...	0x00...	
5	763	Active Thread	http-thread-po...	RUNNABLE	/bms/dct/viewrep...	54,533	45.9	java.io.Uni...	0x00...	
6	842	Active Thread	http-thread-po...	RUNNABLE	/bms/dct/viewrep...	299,020	273.9	java.io.Uni...	0x00...	
7	953	Active Thread	http-thread-po...	RUNNABLE	/bms/dct/viewrep...	86,619	53.7	java.io.Uni...	0x00...	
8	1,064	Active Thread	http-thread-po...	WAITING	/bms/dct/enl/bms...	80	5.8	sun.misc.U...		
9	1,160	Active Thread	http-thread-po...	RUNNABLE	/bms/dct/viewrep...	332,574	193.7	java.io.Uni...	0x00...	
10	1,303	Active Thread	http-thread-po...	RUNNABLE	/bms/dct/viewrep...	52,087	48.7	java.io.Uni...	0x00...	
11	1,382	Active Thread	http-thread-po...	RUNNABLE	/bms/dct/viewrep...	410,211	291.1	java.io.Uni...	0x00...	
12	1,621	Active Thread	http-thread-po...	RUNNABLE	/bms/dct/viewrep...	193,287	219.7	java.io.Uni...	0x00...	
13	1,745	Active Thread	http-thread-po...	RUNNABLE	/bms/dct/viewrep...	32,578	23.1	java.io.Uni...	0x00...	

#	Created	Host	Instance	Level	UUID
1	2019-12-09 09:37:45	101.0.115.90	onnara32	INFO	53112AB9-D876-4275-8190-6F03C4282C77
2	2019-12-09 08:58:15	101.0.115.90	onnara32	INFO	8000DAF8-988F-4265-8E29-2A614CC8BE0E
3	2019-12-08 15:25:37	101.0.115.90	onnara32	INFO	D411D21A-241C-497E-9E29-97D0B272B...
4	2019-12-08 15:24:28	101.0.115.90	onnara32	INFO	8A88ADC2-2D80-460F-ADAF-DC390F6C7...
5	2019-12-04 15:23:27	101.0.115.90	onnara32	INFO	616A0353-78FB-4599-886C-CC2868DA0...

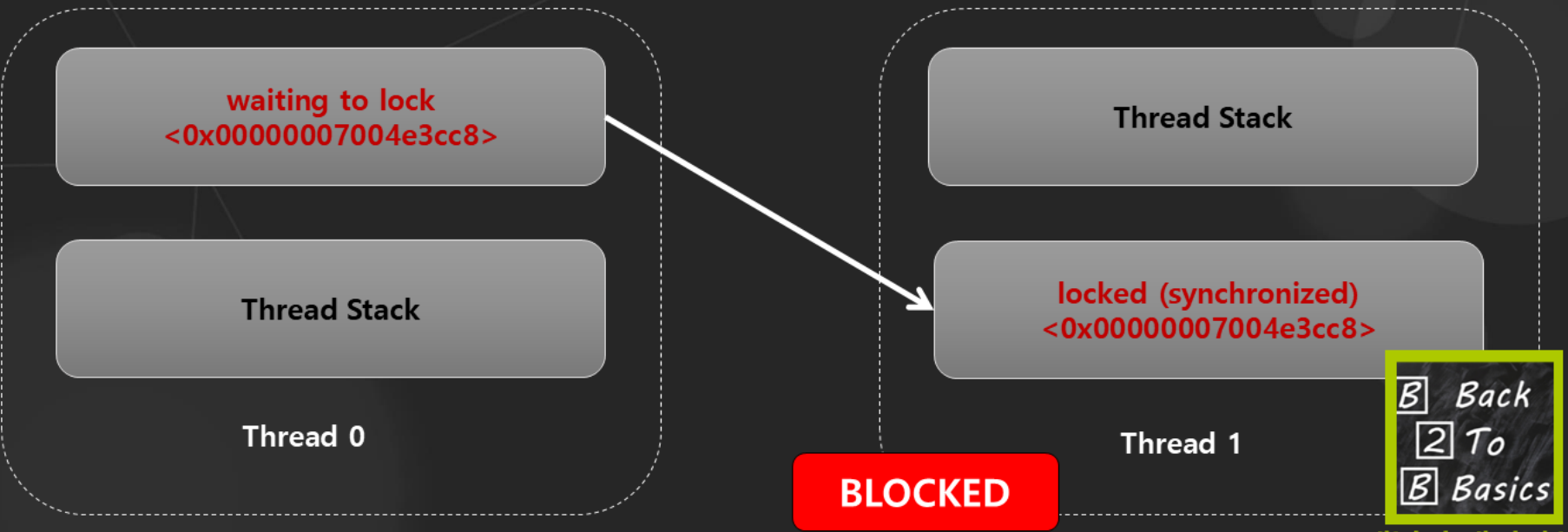
```
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2381 "http-thread-pool-threads - 170" prio=10 tid=0x00000007fde08af800 nid=0x1bc5 runnable [0x00000007fde08af800]
2382 java.lang.Thread.State: RUNNABLE
2383 at java.io.UnixFileSystem.list(Native Method)
2384 at java.io.File.list(File.java:1116)
2385 at onnara.dct.util.HwpManager.renewDirectoryList(HwpManager.java:608)
2386 at onnara.dct.util.HwpManager.convertFileSuccess(HwpManager.java:532)
2387 at onnara.dct.util.HwpManager.convertFileSuccess(HwpManager.java:491)
2388 at onnara.dct.util.HwpManager.execute(HwpManager.java:438)
2389 at onnara.dct.submit.service.impl.BmsDctFileMigrationServiceImpl.convertDocument(BmsDctFileMigrationServiceImpl.java:187)
2390 at onnara.dct.submit.service.impl.BmsDctFileMigrationServiceImpl.migrationBmsDctCommFile(BmsDctFileMigrationServiceImpl.java:152)
2391 at onnara.dct.submit.service.impl.BmsDctFileMigrationServiceImpl.migrationSubmit(BmsDctFileMigrationServiceImpl.java:152)
2392 at onnara.dct.submit.service.impl.BmsDctSubmitServiceImpl.getFileInfos(BmsDctSubmitServiceImpl.java:3225)
2393 at onnara.dct.submit.service.impl.BmsDctSubmitServiceImpl.getDocumentTheme(BmsDctSubmitServiceImpl.java:3233)
2394 at sun.reflect.GeneratedMethodAccessor1228.invoke(Unknown Source)
2395 at sun.reflect.DelegatingMethodAccessorImpl.invoke(DelegatingMethodAccessorImpl.java:43)
2396 at java.lang.reflect.Method.invoke(Method.java:606)
2397 at org.springframework.aop.support.AopUtils.invokeJoinpointUsingReflection(AopUtils.java:117)
2398 at org.springframework.aop.framework.ReflectiveMethodInvocation.invokeJoinpoint(ReflectiveMethodInvocation.java:198)
2399 at org.springframework.aop.framework.ReflectiveMethodInvocation.proceed(ReflectiveMethodInvocation.java:157)
2400 at org.springframework.aop.aspectj.AspectJAfterThrowingAdvice.invoke(AspectJAfterThrowingAdvice.java:58)
2401 at org.springframework.aop.framework.ReflectiveMethodInvocation.proceed(ReflectiveMethodInvocation.java:179)
2402 at org.springframework.aop.interceptor.AbstractTraceInterceptor.invoke(AbstractTraceInterceptor.java:135)
2403 at org.springframework.aop.framework.ReflectiveMethodInvocation.proceed(ReflectiveMethodInvocation.java:179)
2404 at org.springframework.aop.interceptor.ExposeInvocationInterceptor.invoke(ExposeInvocationInterceptor.java:92)
2405
```



# Thread Dump의 Blocked의 의미

- 여러 스레드에서 같은 변수나 메소드를 변경할 경우
- synchronized로 다른 스레드의 처리가 끝날 때 까지 제어가 넘어가지 않도록 보호

```
// 특정한 객체에 lock을 걸고자 할 때  
synchronized(객체의 참조변수){  
    // ...  
}  
  
// 메서드에 lock을 걸고자할 때  
public synchronized void methodName(){  
    // ...  
}
```





# OPENMARU APM 스레드 덤프 분석 예시



Q Thread Dump Analyzer > 2017-06-15 10:31:20 (E52CF04A-558F-43A5-8E56-3321F479E1CB)

#	Lin.	Type	Name	State	URL	Durat.	CPU %	Class	At	Addr.
1	650	Active Thre	default task-246	RUNNABLE	/cnet/front/exame	14,403	352.9	java.net.Socket	0x0000	
2	924	Active Thre	default task-238	BLOCKED	/cnet/front/exame	33,986	693.4	org.apache...	0x0000	
3	1,061	Active Thre	default task-236	BLOCKED	/cnet/front/exame	33,058	628.9	org.apache...	0x0000	

Record ID: 606

Thread Dump Text > 2017-06-15 10:31:20 (E52CF04A-558F-43A5-8E56-3321F479E1CB)

```

None
922 None
923 java.lang.Thread.State: BLOCKED (on object monitor)
at org.apache.log4j.AppenderSkeleton.doAppend(AppenderSkeleton.java:247)
   waiting to lock <0x00000006cf0ca580> (a org.apache.log4j.ConsoleAppender
   owned by #2791)
926 at org.apache.log4j.AppenderSkeleton.doAppend(AppenderSkeleton.java:247)
927 - waiting to lock <0x00000006cf0ca580> (a org.apache.log4j.ConsoleAppender
928 at org.apache.log4j.helpers.AppenderAttachableImpl.appendEvent(
929   AppenderAttachableImpl.java:67)
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# 스레드 덤프 분석 주요 패턴의 주요 해결방법



DB 쿼리가 느릴 때



쿼리 튜닝

DB 연결풀 개수 튜닝



HTTP 호출이 느릴 때



HttpClient로 변경(URLConnection사용하지 말것)

Pooling하여 처리 / 개수 튜닝



Logging 처리가 느릴 때



디버그 로그 운영 사용금지

Console/파일로 함께 남기지 말 것



파일 I/O가 느릴 때



파일 I/O 튜닝, 스토리지 확인



Lock이 걸릴 때



애플리케이션 개발시 Lock 최소화

# Application Performance Management

# OPENNARU Quick Service



# OPENNARU Quick Service 란?



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고객사

1 시스템 이슈발생



2 스크린 덤프와 모니터링 화면 전달



3 오픈나루 서비스 데스크 접수



4 장애 분석



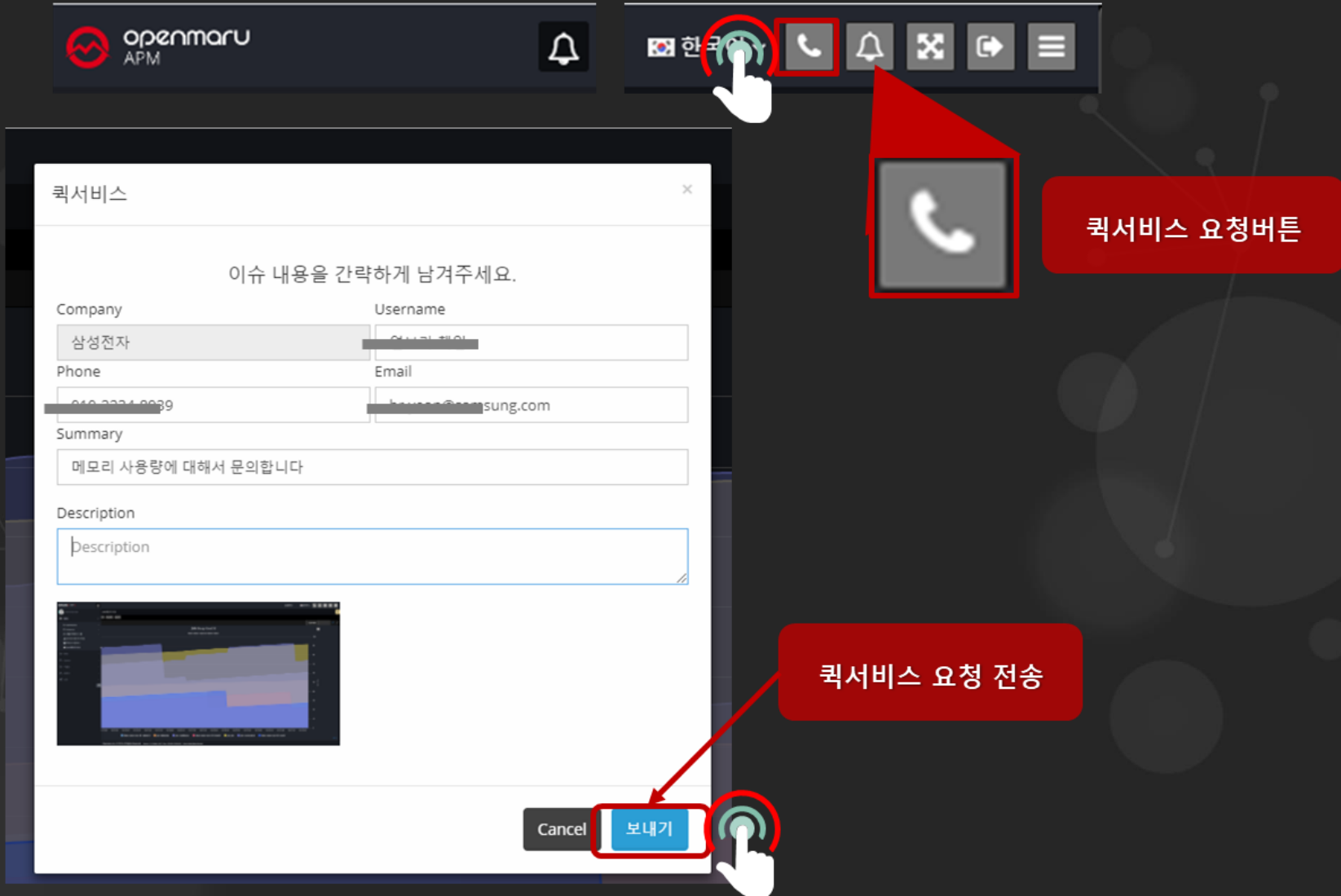
5 장애 분석 보고서 전달



오픈나루



# Quick Service 원격 진단 요청 - ① 모든 화면에서 가능



퀵서비스

이슈 내용을 간략하게 남겨주세요.

Company: 삼성전자      Username: [redacted]

Phone: 010-3334-0039      Email: hwsung@samsung.com

Summary: 메모리 사용량에 대해서 문의합니다

Description: Description

Cancel      보내기

퀵서비스 요청버튼

퀵서비스 요청 전송

# Quick Service 원격 진단 요청 - ② 스레드 덤프



Administrator

WAS

실시간 요청 모니터링

① 리스트 중에서 분석 요청할 스레드 덤프를 선택

#	Created	Host	Instance	Level
1	2020-01-19 15:30:38	10.128.2.163	dk-ocp-tom-7-nsk6b	INFC

② '퀵서비스' 버튼을 클릭

퀵서비스

이슈 내용을 간략하게 남겨주세요.

Company	Username
오픈나루	나오픈
Phone	Email
000-0000-0000	support@openmaru.com

Summary

threadDump\_WAS\_dk-ocp-tom-7-nsk6b

Description

Description

③ 요청내용 입력 후 보내기 클릭

Cancel 보내기

# Quick Service 원격 진단 요청 – ③ Transaction Detail

① 리스트 중에서 분석 요청할 스레드 덤프를 선택

Quick Service

Export to Excel

② '퀵서비스' 버튼을 클릭

Agent Type	Server IP	Client IP	Instance ID	URL	Status	Warn	Duration(ms)	SQL Time(ms)	Fetch Gab	Fetch Count	External	Time
WAS	10.128.2.177	192.168.23.100	dk-ocp-jws52-	/	404	0	1	0	0	0	0	1.27 2020-01-16 10:34:28.310
WAS	10.128.2.163	192.168.23.100	dk-ocp-tom-7-	/	500	0	1	0	0	0	0	1.40 2020-01-16 10:34:35.748
WAS	10.128.2.163	0.0.0.0	dk-ocp-tom-7-	unknown	500	0	1	0	0	0	0	0.91 2020-01-16 10:36:10.087
WAS	10.128.2.163	0.0.0.0	dk-ocp-tom-7-	unknown							0	0.77 2020-01-16 10:36:10.185
WAS	10.128.2.163	0.0.0.0	dk-ocp-tom-7-	unknown							0	1.20 2020-01-16 10:36:10.221
WAS	10.128.2.163	0.0.0.0	dk-ocp-tom-7-	unknown							0	0.66 2020-01-16 10:36:15.091

퀵서비스

Please leave a brief description of the issue.

Company	Username
오픈나루	나오픈
Phone	Email
000-0000-0000	support@openmaru.com

Summary  
Transaction trace '/' in dk-ocp-tom-7-nsk6b@10.128.2.163

Description  
Description



③ 요청내용 입력 후 보내기 클릭

Cancel 보내기

**Transaction Detail** | Trace | StackTrace

Name	Value
Request URL	GET / <a href="#">View URL</a>
Request Host	khan-jbossweb50-tomcat9-test1.app.ocp-test-dk.ope
Client IP	192.168.23.100 <a href="#">User Location</a>
Start Time	2020-01-16 10:34:35.748
Duration (ms)	1
JDBC Time (ms)	0
Thread Name	http-nio-8080-exec-10
IP	10.128.2.163
Agent Type	WAS

**Method Traces**

```
=====
[Num.][ Start Time | Elapsed | % | Excludi | A-Gab | CPUtime ]
```

# Application Performance Management

## 메모리 관련 이슈



- **메모리 부족**

- **Heap의 메모리 OutOfMemory 에러**

- 특정 시각에 급격한 메모리 증가
- 급격한 증가/점차적인 메모리 증가

- **Native 메모리의 OutOfMemory 에러**

- RES 등 OS에서 사용하는 영역에서 발생하는 메모리 부족현상
- 급격한 증가/점차적인 메모리 증가

- **Memory Leak**

- 메모리 사용량이 계속 증가해 결과적으로 메모리 부족 상태
- HTTP Session 오브젝트의 증가, JDBC 관련 오브젝트의 close 새어 캐시 오브젝트가 원인 등이 있음

- **Java VM 버그**

- 매우 드문 경우이지만 JVM 버그의 가능성이 있기 때문에 JVM 버그 정보 조회

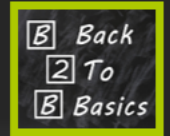


증상과 원인

# Java Heap Memory



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개념과 배경지식

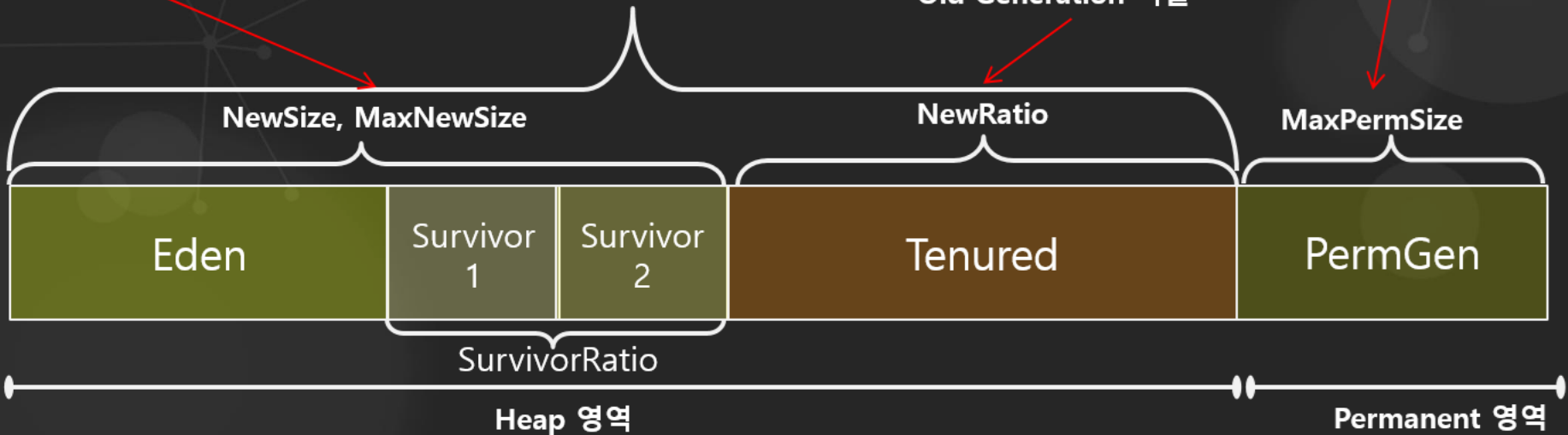
- **Heap 영역**
  - **Eden 영역**
    - 새롭게 작성된 오브젝트를 저장
    - 생존 기간의 짧은 오브젝트는 Eden 영역에서 GC의 대상
  - **Tenured 영역**
    - Eden 영역에서 GC 대상이 되지 않은 old 오브젝트를 저장
- **Permanent 영역**
  - **PermGen**
    - 클래스 오브젝트와 그 외의 시스템 레벨의 오브젝트를 저장

-XX:NewSize :  
Eden 사이즈

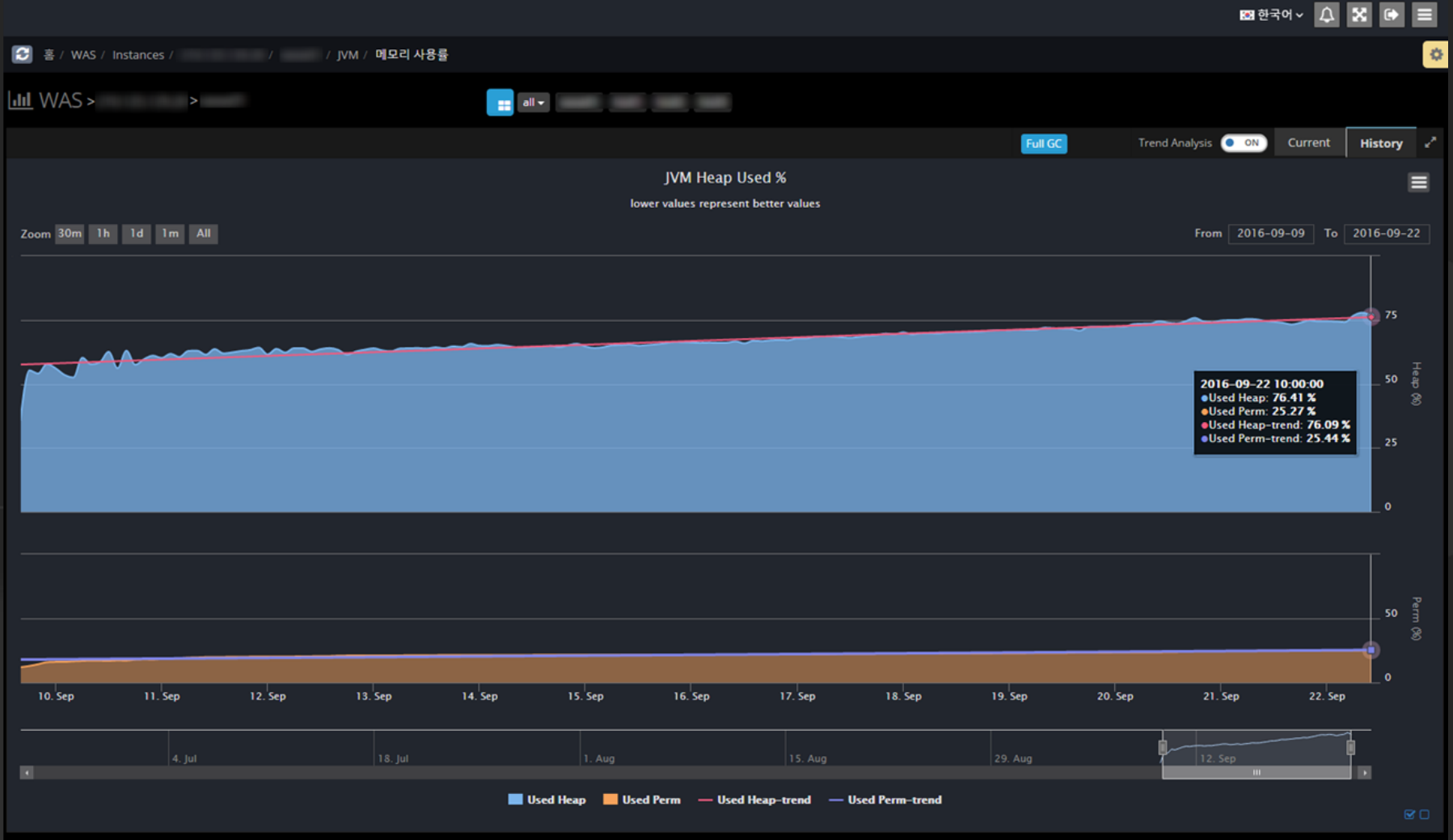
-Xmx : 최대 heap 사이즈  
-Xms : 최소 heap 사이즈

-XX:NewRatio : New와  
Old Generation 비율

-XX:MaxPermSize :  
PermGen 최대사이즈



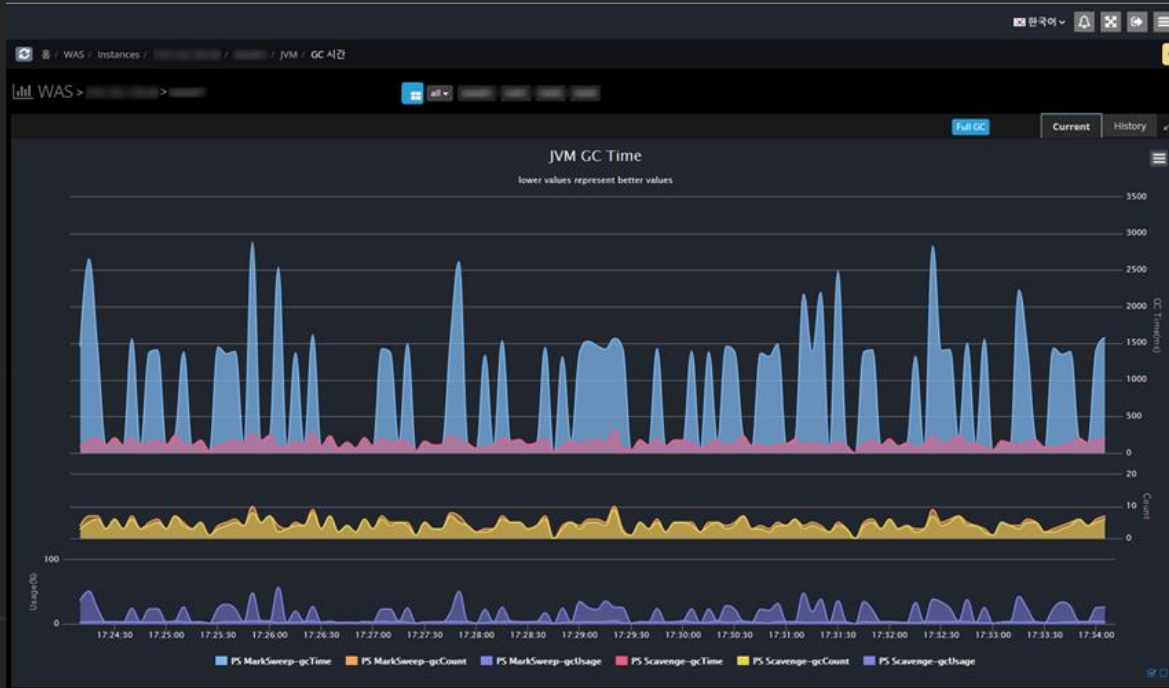
# JVM 메모리 상황을 Byte 단위로 분석



# JVM GC 시간/횟수 상황을 분석



- Java VM Heap GC 현황을 실시간으로 모니터링



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- Java VM GC 히스토리



Openmaru, Inc. © 2016. All Rights Reserved. Version: 1.7.1, Build: 2320, Time: 2016-09-07 22:26:36 [User Guide]

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# 메모리가 급격히 부족한 경우

## 이벤트 → 이벤트 목록

URL에서 10만건 데이터를 가져오는 중  
20만건의 데이터를 가져오는 중을 알려줌

1	2017-12-15 15:05:04	경고-WARN	ALERT_TOO_MANY_FETCH	DB ResultSet Fetch	너무 많은 데이터베이스 ResultSet fetch가 감지되었습니다. /member/mobile/select/SelectBoardView.do에서 200000개 이상을 fetch하는 중(현재 소요시간:16211ms).	DB0E...	210.90.107.181	WAS	homepage11
2	2017-12-15 15:04:56	경고-WARN	ALERT_TOO_MANY_FETCH	DB ResultSet Fetch	너무 많은 데이터베이스 ResultSet fetch가 감지되었습니다. /member/mobile/select/SelectBoardView.do에서 100000개 이상을 fetch하는 중(현재 소요시간:8169ms).	A3FD...	210.90.107.181	WAS	homepage11
3	2017-12-15 15:04:52	경고-WARN	ALERT_TOO_MANY_FETCH	DB ResultSet Fetch	너무 많은 데이터베이스 ResultSet fetch가 감지되었습니다. /member/mobile/select/SelectBoardView.do에서 200000개 이상을 fetch하는 중(현재 소요시간:14258ms).	F020...	210.90.107.181	WAS	homepage14
4	2017-12-15 15:04:46	경고-WARN	ALERT_TOO_MANY_FETCH	DB ResultSet Fetch	너무 많은 데이터베이스 ResultSet fetch가 감지되었습니다. /member/mobile/select/SelectBoardView.do에서 100000개 이상을 fetch하는 중(현재 소요시간:7358ms).	8755...	210.90.107.181	WAS	homepage14
5	2017-12-15 14:44:15	경고-WARN	ALERT_TOO_MANY_FETCH	DB ResultSet Fetch	너무 많은 데이터베이스 ResultSet fetch가 감지되었습니다. /member/mobile/select/SelectBoardView.do에서 200000개 이상을 fetch하는 중(현재 소요시간:11544ms).	DB69...	210.90.107.181	WAS	homepage11
6	2017-12-15 14:44:09	경고-WARN	ALERT_TOO_MANY_FETCH	DB ResultSet Fetch	너무 많은 데이터베이스 ResultSet fetch가 감지되었습니다. /member/mobile/select/SelectBoardView.do에서 100000개 이상을 fetch하는 중(현재 소요시간:5897ms).	F657...	210.90.107.181	WAS	homepage11
7	2017-12-15 01:17:08	경고-WARN	ALERT_TOO_MANY_FETCH	DB ResultSet Fetch	너무 많은 데이터베이스 ResultSet fetch가 감지되었습니다. /member/mobile/select/SelectBoardView.do에서 200000개 이상을 fetch하는 중(현재 소요시간:13697ms).	9967...	210.90.107.181	WAS	homepage14
8	2017-12-15 01:17:02	경고-WARN	ALERT_TOO_MANY_FETCH	DB ResultSet Fetch	너무 많은 데이터베이스 ResultSet fetch가 감지되었습니다. /member/mobile/select/SelectBoardView.do에서 100000개 이상을 fetch하는 중(현재 소요시간:7454ms).	BOE9...	210.90.107.181	WAS	homepage14

너무 많은 데이터베이스 ResultSet fetch가 감지되었습니다. /member/mobile/select/SelectBoardView.do에서 200000개 이상을 fetch하는 중(현재 소요시간:16211ms).

너무 많은 데이터베이스 ResultSet fetch가 감지되었습니다. /member/mobile/select/SelectBoardView.do에서 100000개 이상을 fetch하는 중(현재 소요시간:8169ms).

대용량 Fetch이후에

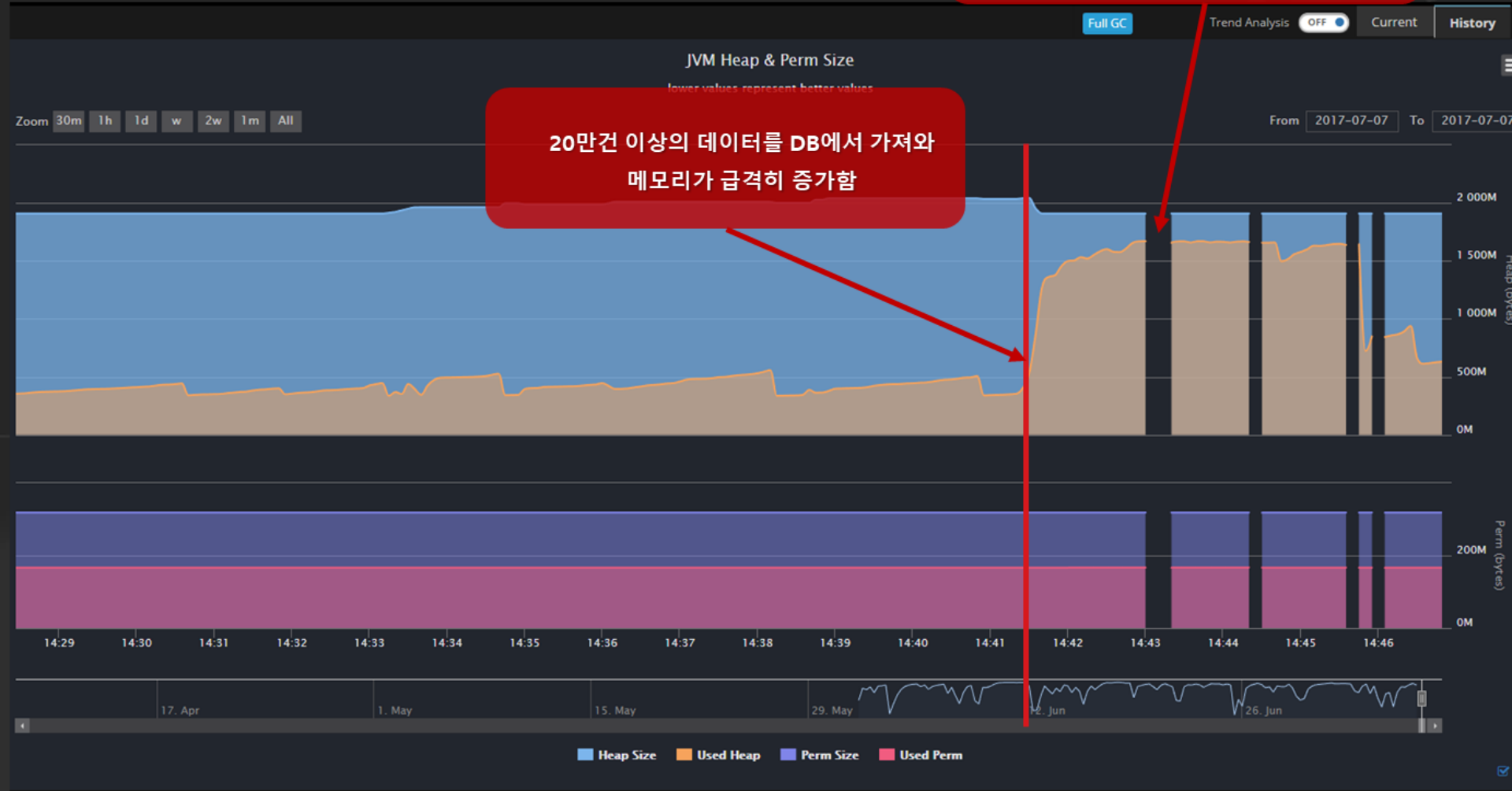
- 1) Heap 사용량 경고 발생
- 2) GC 사용시간 경고 발생
- 3) WAS 재접속 현상도 발생

경고-WARN	EVENT_WARN_THRESHOLD_EXCEED	GC Usage %	'GC Usage %' (평균값: 20.62)이 경고(WARN) 임계값 '20'을 넘었습니다.	...	3..
심각-CRIT...	EVENT_CRITICAL_THRESHOLD_EXC...	GC Usage %	'GC Usage %' (평균값: 38.91)이 심각(CRITICAL) 임계값 '35'을 넘었습니다.	...	5..
경고-WARN	EVENT_WARN_THRESHOLD_EXCEED	GC Usage %	'GC Usage %' (평균값: 33.77)이 경고(WARN) 임계값 '20'을 넘었습니다.	...	0..
정보-INFO	EVENT_AGENT_CONNECTED		WAS가 시작되어 에이전트가 연결되었습니다.	...	3..
경고-WARN	EVENT_WARN_THRESHOLD_EXCEED	APDEX	'APDEX' (평균값: 67.19)이 경고(WARN) 임계값 '70'을 넘었습니다.	...	F..
경고-WARN	EVENT_WARN_THRESHOLD_EXCEED	Pending Tr...	'Pending Transactions' (평균값: 33)이 경고(WARN) 임계값 '30'을 넘었...	...	8..
경고-WARN	EVENT_WARN_THRESHOLD_EXCEED	Heap Usag...	'Heap Usage %' (평균값: 86.01)이 경고(WARN) 임계값 '85'를 넘었습니...	...	7..
심각-CRIT...	EVENT_CRITICAL_THRESHOLD_EXC...	GC Usage %	'GC Usage %' (평균값: 96.7)이 심각(CRITICAL) 임계값 '35'를 넘었습니...	...	5..
경고-WARN	EVENT_WARN_THRESHOLD_EXCEED	Heap Usag...	'Heap Usage %' (평균값: 85.09)이 경고(WARN) 임계값 '85'를 넘었습니...	...	2..
심각-CRIT...	EVENT_CRITICAL_THRESHOLD_EXC...	APDEX	'APDEX' (평균값: 46.88)이 심각(CRITICAL) 임계값 '50'을 넘었습니다.	...	1..
경고-WARN	EVENT_WARN_THRESHOLD_EXCEED	GC Usage %	'GC Usage %' (평균값: 20.61)이 경고(WARN) 임계값 '20'을 넘었습니다.	...	E..
심각-CRIT...	EVENT_CRITICAL_THRESHOLD_EXC...	GC Usage %	'GC Usage %' (평균값: 37.81)이 심각(CRITICAL) 임계값 '35'를 넘었습...	...	0..

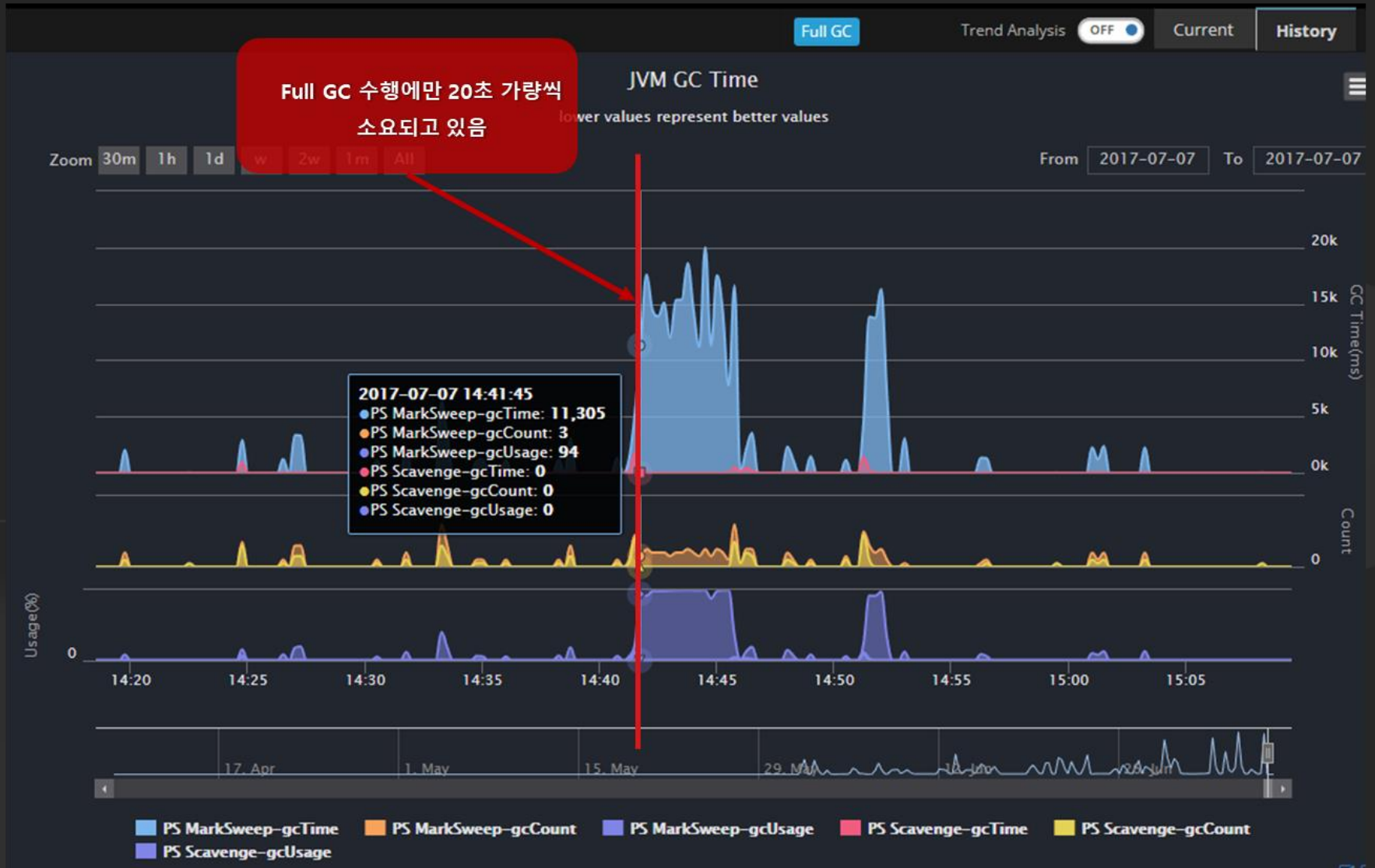
# 대용량 Fetch로 인해 발생하는 현상

메모리 부족으로 Full GC 발생하여  
에이전트도 재 접속되어 데이터 수집 못 함

20만건 이상의 데이터를 DB에서 가져와  
메모리가 급격히 증가함



# 대용량 Fetch 이후의 메모리 GC 현황



# OutOfMemory 오류 - 많은 DB ResultSet fetch 감지



Agent Type	Server IP	Client IP	Instance ID	URL	Status	Duration(ms)	SQL Time(ms)	Fetch Gab	Fetch Count	External Time	CPU Time(ms)	Start Time
WAS	192.168.1.25	110.70.56.200	myacv-1-25	/member/auth	500	178,684	93	178,543	92,982	0	3,203.13	2017-12-11 18:30:47.75
WAS	192.168.1.25	223.62.8.206	myacv-1-25	/member/auth	200	146,325	9,265	0	2	0	31.25	2017-12-11 18:31:19.92
WAS	192.168.1.25	223.62.8.206	myacv-1-25	/member/auth	200	143,590	0	0	2	0	31.25	2017-12-11 18:31:22.66
WAS	192.168.1.25	223.62.8.206	myacv-1-25	/log/tracking	200	134,481	0	0	0	0	15.63	2017-12-11 18:31:31.78
WAS	192.168.1.25	220.94.248.31	myacv-1-25	/log/tracking	200	129,779	0	0	0	0	46.88	2017-12-11 18:31:36.50
WAS	192.168.1.25	110.70.56.200	myacv-1-25	/member/auth	200	127,184	4,093	0	1	0	46.88	2017-12-11 18:31:39.06
WAS	192.168.1.25	223.62.8.206	myacv-1-25	/log/tracking	200	124,559	37,827	0	0	0	31.25	2017-12-11 18:31:41.69
WAS	192.168.1.25	219.248.121.3	myacv-1-25	/member/firstAct	200	119,107	0	0	1	0	78.13	2017-12-11 18:31:47.12

인스턴스에서 OutOfMemory 오류가 발생

로직에 따라 SQL 쿼리의 WHERE 조건절에 필요한 조건이 빠져 테이블 Full Scan이 발생함

```

Transaction Detail
SELECT
  A.contactId AS contactId, A.userName AS userName, A.memberShipNo AS membershipNo, A.userId AS userId, A.userPwd AS userPwd, A.name AS name,
  A.mobileNumber AS mobileNumber, A.gender AS gender, A.dob AS dob, A.registeredFrom AS registeredFrom, A.accessToken AS accessToken, A.emailClass AS emailClass,
  A.isSubmitted AS isSubmitted, A.pushYN AS pushYN, A.status AS status, A.grade AS grade, A.grandPoint AS grandPoint, A.usePoint AS usePoint, A.totalPoint AS totalPoint,
  A.deviceToken AS deviceToken, A.deviceType AS deviceType, A.accessToken AS accessToken, A.accessType AS accessType, A.membershipPoint AS membershipPoint,
  A.secretToken AS secretToken, A.authToken AS authToken, A.authTokenTime AS authTokenTime, ISNULL(A.barcodeImage, '') AS barcodeImage, A.virtualCardNumber AS virtualCardNumber,
  ISNULL(A.diop, 0) AS diop,
  ISNULL(A.CylinderInfoR, '') AS CylinderInfoR,
  ISNULL(A.Axis, 0) AS Axis,
  A.acuvueUserN AS acuvueUserN,
  A.createdDate AS createdDate,
  A.yDate AS yDate,
  A.firstPaymen AS firstPaymen,
  A.cardExpiryD AS cardExpiryD,
  A.acuvueChang AS acuvueChang,
FROM Contact A
WHERE 1=1
AND
AND ISNULL(A.CsStatus, '') != 'delete'

/*mobileNumber is null*/
ORDER BY ContactId DESC
[ 14][09:30:47.786] 93| 0| 93| 0.0| + com.microsoft.sqlserver.jdbc.SQLServerPreparedStatement
> DB : URL: jdbc:sqlserver://52.193.49.249:1433;authentication
rCertificate=false;sendStringParametersAsUnicode=false;selectMethod=direct;responseBuffering=adaptive;packetSize=8000;
false;disableStatementPooling=true;databaseName=ACE;applicationName=Microsoft JDBC Driver for SQL Server;applicationIn
> Query : /* MemberDao.selectList */ SELECT A.contactId AS contactId, A.userName AS userName, A.memberShipNo AS membershipNo, A.userId AS user
Id, A.userPwd AS userPwd, A.name AS name, A.mobileNumber AS mobileNumber, A.gender AS gender, A.dob AS dob, A.registeredFrom AS registeredFrom, A.accessToken AS accessToken, A.emailClass AS emailClass,
N, A.isSubmitted AS isSubmitted, A.pushYN AS pushYN, A.status AS status, A.grade AS grade, A.grandPoint AS grandPoint, A.usePoint AS usePoint, A.totalPoint AS totalPoint, A.deviceToken AS deviceToken, A.d

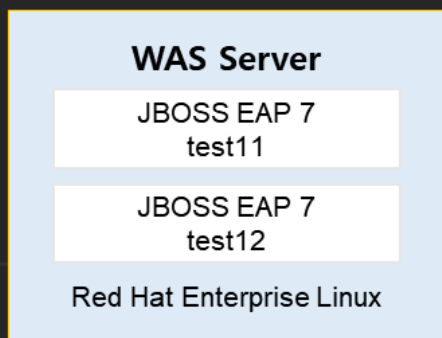
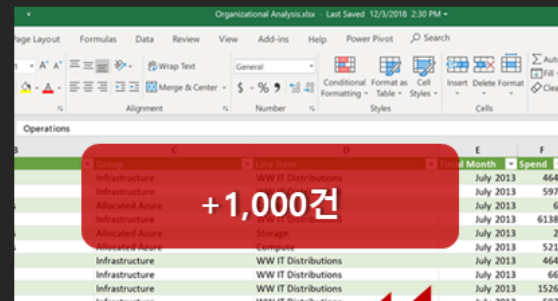
```

WHERE 1=1

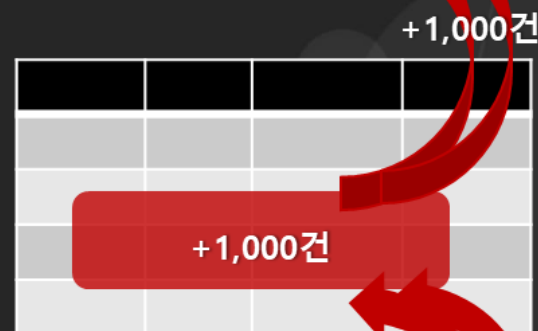
AND A.Status = 'D'  
AND ISNULL(A.CsStatus, '') != 'delete'

해결책 : 사용자가 선택한 값이 없을 때에도 WHERE 조건절이 생성되도록 애플리케이션을 변경해야 함

# Excel 파일을 출력하는 경우



## OutOfMemoryError



# Java에서 Excel 파일 생성 방법

- Apache POI 라이브러리

API Type	HSSF (.xls)		XSSF (.xlsx)		SXSSF
	eventmodel	usermodel	eventmodel	usermodel	
	Streaming (ala SAX)	In memory tree (ala DOM)	Streaming (ala SAX)	In memory tree (ala DOM)	Buffered Streaming
CPU and Memory Efficiency	Good	Varies	Good	Varies	Good
Forward Only	Yes	No	Yes	No	Yes
Read Files	Yes	Yes	Yes	Yes	No
Write Files	No	Yes	No	Yes	Yes
<b>Feature:</b>					
create sheets / rows / cells	No	Yes	No	Yes	Yes
styling cells	No	Yes	No	Yes	Yes
delete sheets / rows/cells	No	Yes	No	Yes	No
shift rows	No	Yes	No	Yes	No
cloning sheets	No	Yes	No	Yes	No
formula evaluation	No	Yes	No	Yes	No
cell comments	No	Yes	No	Yes	No
pictures	No	Yes	No	Yes	Yes

- HSSF : 2007이전 버전
- XSSF : 2007이후 버전(라인 수 제한없음)
- SXSSF : 2007이후 속도 빠름, flushRows필요

- JXLS

OPENMARU APM에서 엑셀 생성에 사용하는 모듈



DATA

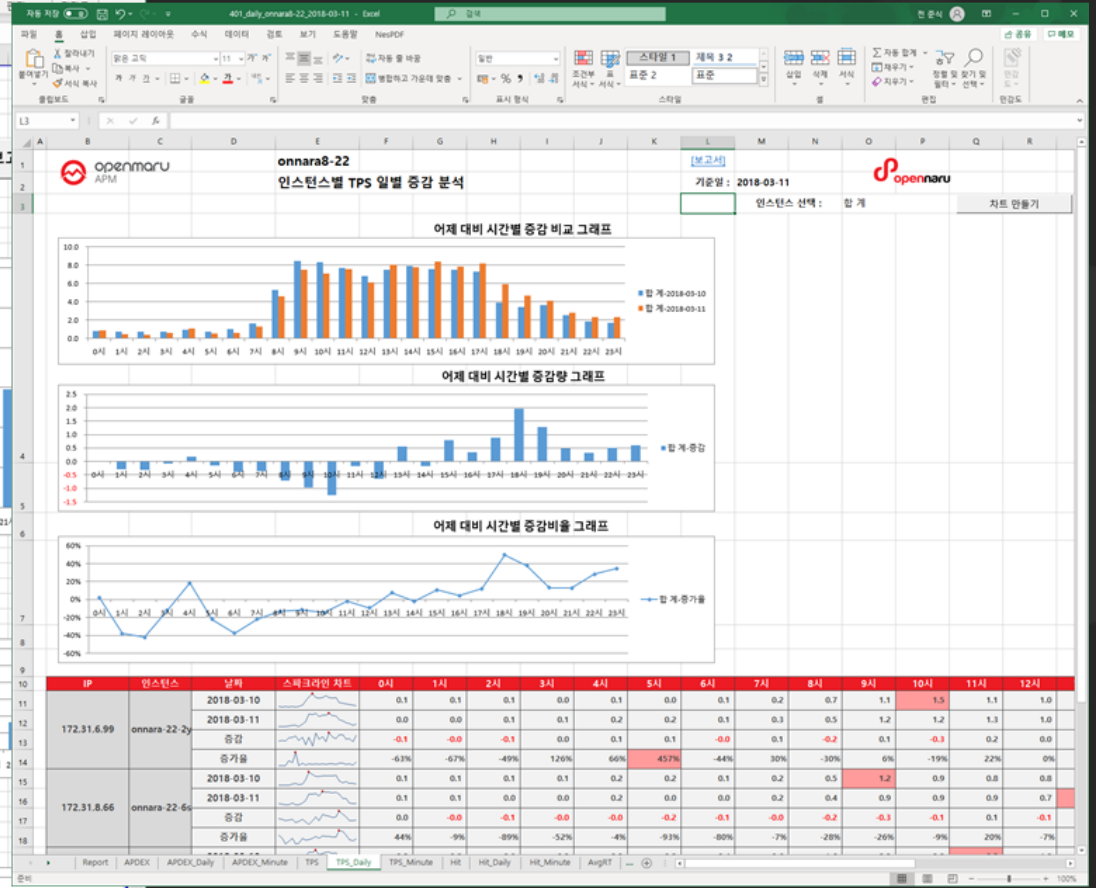
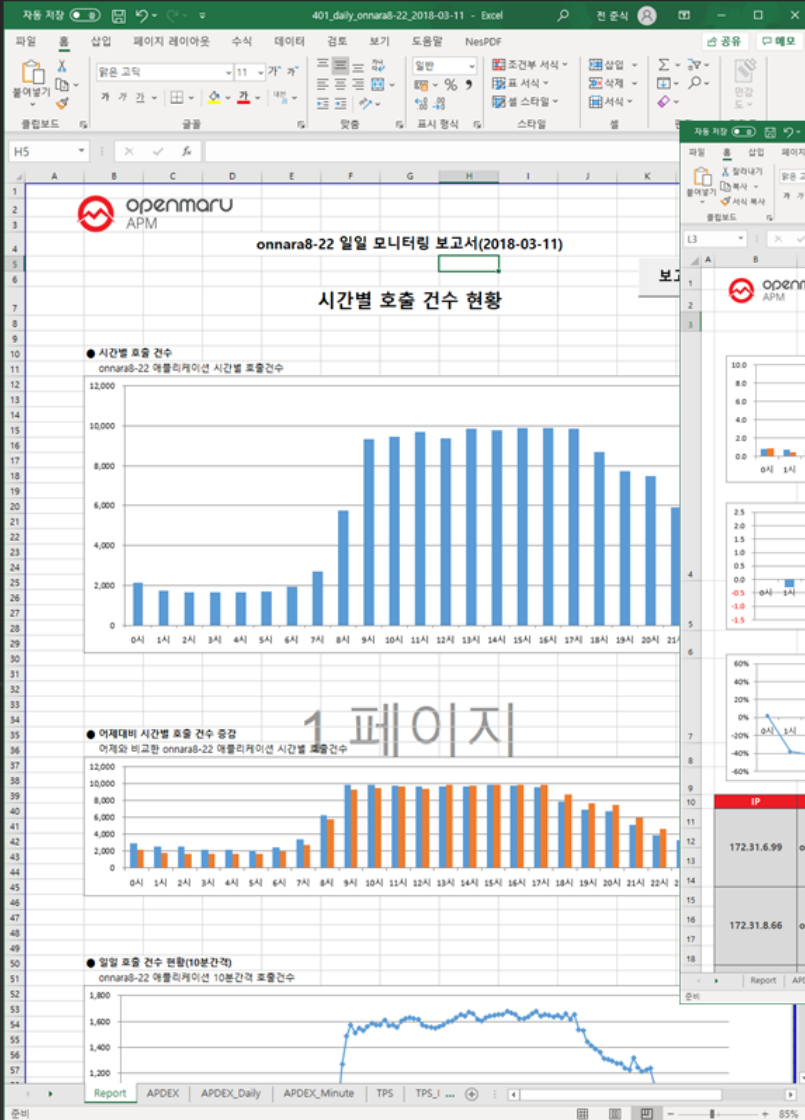


Excel Template



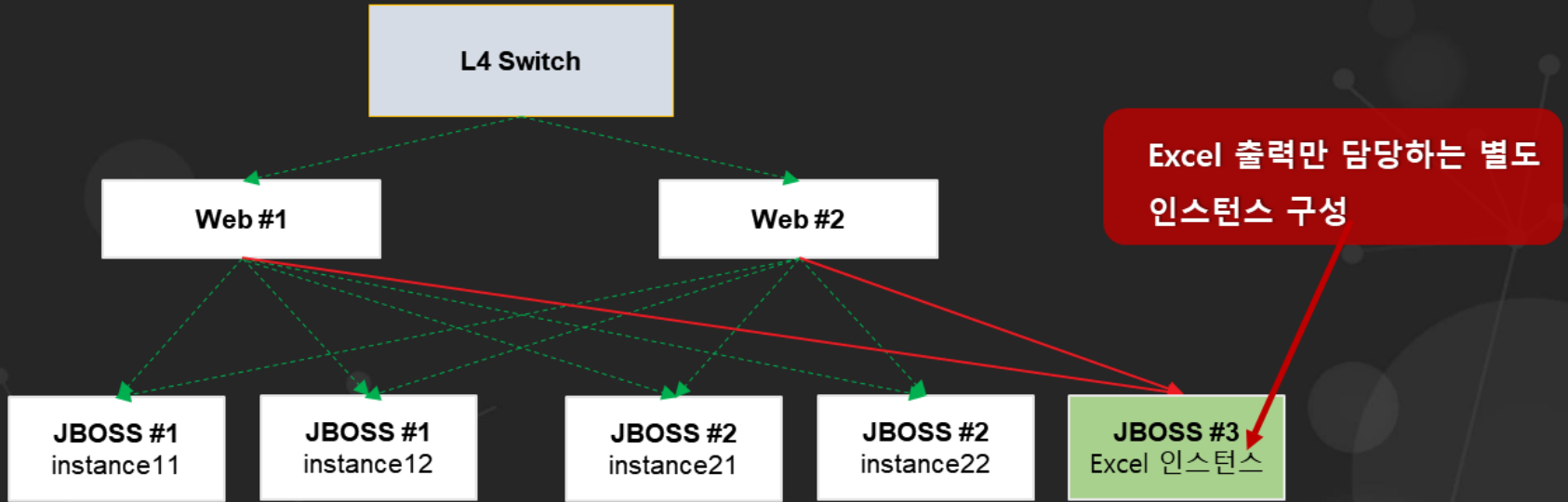
Excel 파일

# OPENMARU APM의 일일/주간 보고서

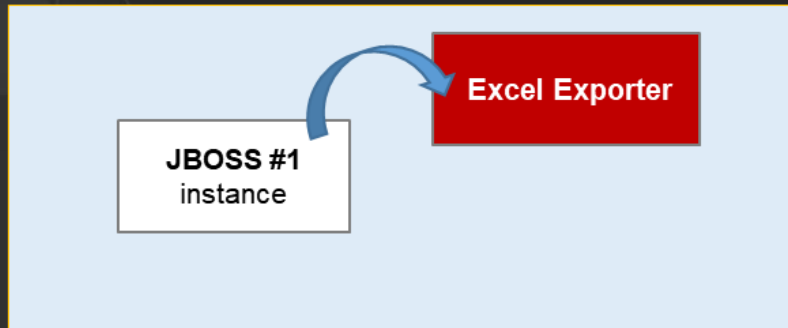


# SXSSF 사용할 수 없는 경우 대안

- 별도 인스턴스 구성



- 프로세스 Fork



- DOM 방식의 기존 방식을 그대로 사용
- 별도의 프로세스로 실행
- 사용되는 JVM 메모리 크기 지정
- 프로세스 Hang 모니터링 / 강제 종료



# OPENNARU Quick Service 란?



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고객사

1 시스템 이슈 발생



2 스택 덤프와 모니터링 화면 전달



4 장애 분석



5 장애 분석 보고서 전달



3 오픈나루 서비스 데스크 접수



오픈나루

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제품이나 서비스에 관한 문의

콜 센터 : 02-469-5426 ( 휴대폰 : 010-2243-3394 )

전자메일 : [sales@openmaru.com](mailto:sales@openmaru.com)

2019년도 신입 · 경력 채용 공고

당신과 **함께** 오픈소스 정상에서  
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