**CARESTREAM HEALTH**

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| --- | --- |
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| **Project : KIOSK PUMA CS System** | **Product : KIOSK** |
| **Document Title: Kiosk PUMA CS Performance Testing Report** | |

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# Test Environment

Test environment：We use the follow machine to do our performance testing work.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Server Name** | **Type** | **CPU** | | **Hard Disk** | | **RAM** | | **OS** | | **Required Software** | |
| CS Server | Hyper-v virtual machine | Intel core(TM) i7-6700 3.40GHz \*2 | 200G SCSI Disk  Seagate MD3002 | | 8G | | Windows 2008 R2 Standard | | MySQL Server 5.7  IIS 7 | |
| Performance control | Dell optiplex 9020 | Intel core(TM) i7-4790 3.6GHZ\*6 | 1T SATA Disk | | 8G | | Win7 64bit | | Load runner | |

Figure 1.1 Hardware List

# Test Requirement

The PUMA system will support report printing and notice push service for different department of entire hospital. We will integrate the 3rd party system and patients can print their reports in ONE terminal. The message push service will also be included in the product. Patients can query different information, and get report status notice service from the product. The architecture as follow:

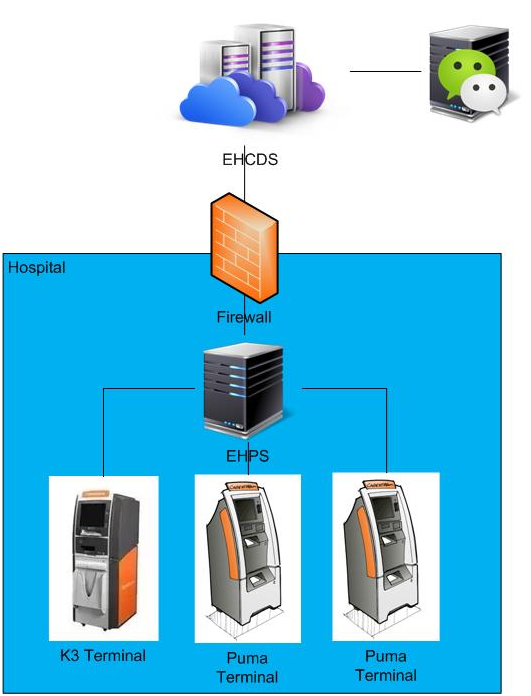


Figure 3.1.1

We will focus on the CS system performance testing work. We will simulate the web service call and send requests to CS server, and monitor the transactions response time, service performance and hardware resource usage. This scenario will include get the 2D Image code, register users for WeChat, push the message to users, query report film status change, create reservation and query etc.

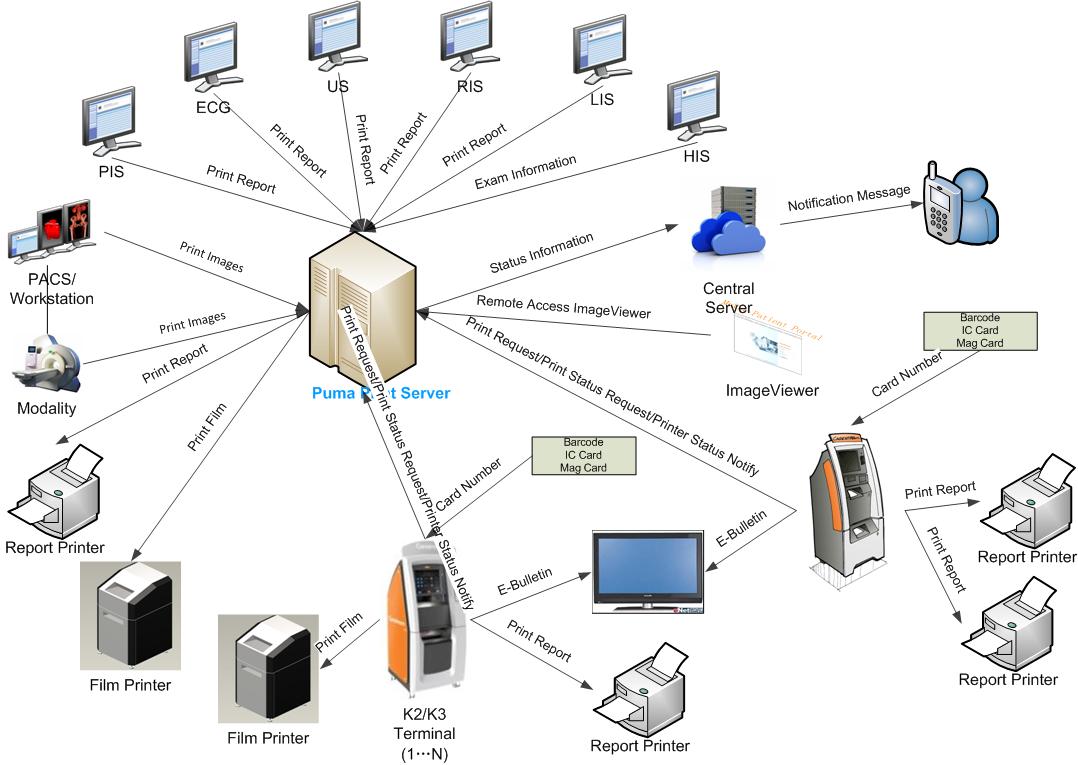


Figure 3.1.2

## Test Scenario

The testing work will simulate the real work flow include get the 2D Image code, register users for WeChat, push the message to users, query report film status change, create reservation and query etc.

This scenario is smoking test.We should to verify the system can work well under current stress.

## Test Tool

Load Runner: Simulate the patient operations by http or web service.

# Testing work （Phase 1）

## Strategy and Scenario Setting

1. Simulate the 3rd system to get the We chat QR code by web service and get the related information from database.
2. Subscribe the users by We chat service and give the open ID for users.
3. Create the patient report information and make it status from created to printed. The local service will push the message to users with database or service trigger.
4. Create the patient film information and make it status from created to printed. The local service will push the message to users with database or service trigger.
5. Create patient reservation information and make it reservation date is next day. The reservation information will update randomly.
6. Set the operations of step3 – step4 execute randomly and the value is 45%,45% and 10%.
7. Create patient query operations after step3-step5.
8. Prepare 10 virtual users to simulate the operations from step1 to step7.
9. Monitor the hardware resource usage on CS.
10. Monitor the resource usage for database on CS.
11. Start/Stop 2 virtual users every 5 seconds and run the scenario for 8 hours.

## Background Data

We use SQL command statement to add large data in the database, the detail information as follow:

|  |  |
| --- | --- |
| **Table Name** | **Data Volume (records)** |
| ECS.filmreportstatus | 0 |
| ECS.examreservation | 0 |
| ECS.notificationmessage | 0 |
| ECS.wechatclient | 0 |
| ECS.qrcodesceneinfo | 0 |
|  |  |

Figure 3.2.1 Background Data

## Other Setting:

### Database setting

Keep all parameters with install default.

### IIS setting

Default value.

## Test Object version

CS version 3.0.3.0.190

## Test Error

There are some errors exist in the testing work and logged as follow:

|  |  |  |
| --- | --- | --- |
| No | description | Counts |
| 1 | A\_Patient\_Register.c(74): Continuing after Error -26377: No match found for the requested parameter "Get2DCodeImageResult". Either the specified boundaries were not found in the response or the matched text is longer than current max html parameter size of 10240 bytes. The total length of the response is 300 bytes. You can use "web\_set\_max\_html\_param\_len" to increase the max parameter size. | 64 |
| 2 | A\_Patient\_Register.c(101): Error: Get2DCodeImage from CS operations failed. The http response content size is 0! | 511241 |
| 3 | A\_Patient\_Register.c(72): Error: Cannot start transaction "Patient operations\_ Get2DCodeImage". This Vuser already started a transaction with the same name, and has not yet processed the corresponding lr\_end\_transaction statement. | 54 |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

Error analyzes:

Follow these error messages, we can find that the get 2D code Image services failed frequently. This error will affect other patient operations such as register and query operations because the step is the precondition. We should fix the issues in next testing works.

## Test result

### Transactions result

After the testing work, the related records increased in database as follow:

|  |  |
| --- | --- |
| **Table** | **Increase count** |
| ECS.filmreportstatus | 6767 |
| ECS.examreservation | 766 |
| ECS.notificationmessage | 28594 |
| ECS.wechatclient | 7470 |
| ECS.qrcodesceneinfo | 7534 |

Figure 3.6.1.1 Test result from DB

### Test Statistic Report

|  |  |
| --- | --- |
| Analysis Summary | Period: 19/03/2018 17:20:38 - 20/03/2018 05:52:09 |

|  |  |
| --- | --- |
| **Scenario Name:** | Scenario1 |
| **Results in Session:** | D:\ECS\CS\_Patient\_Query\_opertion\res\res.lrr |
| **Duration:** | 12 hours, 31 minutes and 31 seconds. |

|  |
| --- |
| Statistics Summary |

|  |  |  |
| --- | --- | --- |
| [**Maximum Running Vusers:**](file:///C:\Users\19007296_local\AppData\Local\Temp\VuserStateGraph) |  | 10 |
| [**Total Throughput (bytes):**](file:///C:\Users\19007296_local\AppData\Local\Temp\Throughput) | [Show SLA Results](slarules:total_throughput) | 34,033,356 |
|  |  |  |
|  |  |  |
| [**Average Throughput (bytes/second):**](file:///C:\Users\19007296_local\AppData\Local\Temp\Throughput) | [Show SLA Results](slarules:average_throughput) | 755 |
|  |  |  |
|  |  |  |
| [**Total Hits:**](file:///C:\Users\19007296_local\AppData\Local\Temp\HitsperSecond) | [Show SLA Results](slarules:total_hits) | 39,319 |
|  |  |  |
|  |  |  |
| [**Average Hits per Second:**](file:///C:\Users\19007296_local\AppData\Local\Temp\HitsperSecond) | [Show SLA Results](slarules:average_hits) | 0.872 | [**View HTTP Responses Summary**](file:///C:\Users\19007296_local\AppData\Local\Temp\303268440.html#1) |
|  |  |  |  |
|  |  |  |  |

|  |  |  |
| --- | --- | --- |
| |  | | --- | | You can define SLA data using the [SLA configuration wizard](slaconfig:) | | You can analyze transaction behavior using the [Analyze Transaction mechanism](analyze:) | |

|  |
| --- |
| Transaction Summary |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| [**Transactions:**](file:///C:\Users\19007296_local\AppData\Local\Temp\TransactionSummary) | Total Passed: 51,001 | Total Failed: 121 | Total Stopped: 0 | [**Average Response Time**](file:///C:\Users\19007296_local\AppData\Local\Temp\ResponseTime) |

|  |
| --- |
|  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Transaction Name** | **Minimum** | **Average** | **Maximum** | **Std. Deviation** | **90 Percent** | **Pass** | **Fail** | **Stop** |
| [Create ExamReservation](file:///C:\Users\19007296_local\AppData\Local\Temp\ResponseTime0000(Create%20ExamReservation)0000) | 0.106 | 1.48 | 5.444 | 0.672 | 2.411 | 643 | 0 | 0 |
| [Create Film](file:///C:\Users\19007296_local\AppData\Local\Temp\ResponseTime0000(Create%20Film)0000) | 0.172 | 1.192 | 5.043 | 0.804 | 2.309 | 3,009 | 0 | 0 |
| [Create Paper report](file:///C:\Users\19007296_local\AppData\Local\Temp\ResponseTime0000(Create%20Paper%20report)0000) | 0.181 | 1.186 | 5.104 | 0.784 | 2.32 | 2,995 | 0 | 0 |
| [Patient operations\_ Get2DCodeImage](file:///C:\Users\19007296_local\AppData\Local\Temp\ResponseTime0000(Patient%20operations_%20Get2DCodeImage)0000) | 0.233 | 0.859 | 2.414 | 0.23 | 1.099 | 6,603 | 121 | 0 |
| [QueryReportFilmStatus](file:///C:\Users\19007296_local\AppData\Local\Temp\ResponseTime0000(QueryReportFilmStatus)0000) | 0.004 | 1.306 | 8.041 | 0.864 | 2.216 | 11,792 | 0 | 0 |
| [QueryReportFilmStatus\_Pass](file:///C:\Users\19007296_local\AppData\Local\Temp\ResponseTime0000(QueryReportFilmStatus_Pass)0000) | 0 | 0 | 0 | 0 | 0 | 11,965 | 0 | 0 |
| [QueryReservation](file:///C:\Users\19007296_local\AppData\Local\Temp\ResponseTime0000(QueryReservation)0000) | 0.041 | 0.482 | 3.305 | 0.476 | 1.024 | 701 | 0 | 0 |
| [QueryReservation\_Pass](file:///C:\Users\19007296_local\AppData\Local\Temp\ResponseTime0000(QueryReservation_Pass)0000) | 0 | 0 | 0 | 0 | 0 | 702 | 0 | 0 |
| [Subscribe\_Patinet](file:///C:\Users\19007296_local\AppData\Local\Temp\ResponseTime0000(Subscribe_Patinet)0000) | 0.054 | 0.577 | 4 | 0.402 | 0.946 | 6,602 | 0 | 0 |
| [Update ExamReservation](file:///C:\Users\19007296_local\AppData\Local\Temp\ResponseTime0000(Update%20ExamReservation)0000) | 0.554 | 1.343 | 4.1 | 0.517 | 1.849 | 60 | 0 | 0 |
| [Update Film](file:///C:\Users\19007296_local\AppData\Local\Temp\ResponseTime0000(Update%20Film)0000) | 0.712 | 1.889 | 6.187 | 0.563 | 2.505 | 2,985 | 0 | 0 |
| [Update Paper report](file:///C:\Users\19007296_local\AppData\Local\Temp\ResponseTime0000(Update%20Paper%20report)0000) | 0.279 | 1.838 | 5.49 | 0.569 | 2.49 | 2,944 | 0 | 0 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Service Level Agreement Legend:** | C:\Users\19007296_local\AppData\Local\Temp\led_ok.gif | Pass | C:\Users\19007296_local\AppData\Local\Temp\led_error.gif | Fail | C:\Users\19007296_local\AppData\Local\Temp\led_no_data.gif | No Data |

|  |
| --- |
| HTTP Responses Summary |

|  |  |  |
| --- | --- | --- |
| **HTTP Responses** | **Total** | **Per second** |
| [HTTP\_200](file:///C:\Users\19007296_local\AppData\Local\Temp\HttpReturnCodes0001(HTTP_200)0001) | 39,318.8 | 0.872 |

Figure 3.6.2.1 Summary Report

Follow the summary result information; we can get the information that:

All testing work duration time is 12 hours and 31 minutes. There are 51001 transactions passed and 121 transactions failed.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Transaction Name** | **Minimum** | **Average** | **Maximum** | **Std. Deviation** | **90 Percent** | **Pass** | **Fail** | **Stop** |
| [Patient operations\_ Get2DCodeImage](file:///C:\Users\19007296_local\AppData\Local\Temp\ResponseTime0000(Patient%20operations_%20Get2DCodeImage)0000) | 0.233 | 0.859 | 2.414 | 0.23 | 1.099 | 6,603 | 121 | 0 |

Figure 3.6.2.2 big value of response time

We monitor this issue and find the root reason is cause by the database. The error log information as follow:

2018-03-20 05:20:53,246 [29] ERROR Utility.Logger - Connection String: Server=localhost;Port=3306;Database=ECS;Uid=sa;Pwd=sa20021224$

MySql.Data.MySqlClient.MySqlException (0x80004005): Too many connections

at MySql.Data.MySqlClient.MySqlStream.ReadPacket()

at MySql.Data.MySqlClient.NativeDriver.Open()

at MySql.Data.MySqlClient.Driver.Open()

at MySql.Data.MySqlClient.Driver.Create(MySqlConnectionStringBuilder settings)

at MySql.Data.MySqlClient.MySqlPool.CreateNewPooledConnection()

at MySql.Data.MySqlClient.MySqlPool.GetPooledConnection()

at MySql.Data.MySqlClient.MySqlPool.TryToGetDriver()

at MySql.Data.MySqlClient.MySqlPool.GetConnection()

at MySql.Data.MySqlClient.MySqlConnection.Open()

at MySqlUtil.DBUtility.UpdateData(String sql)

The connection in MySQL database is 100 as default value; we should enhance the value or change the automation script in order to enhance the system and testing work.

### Transaction summary result

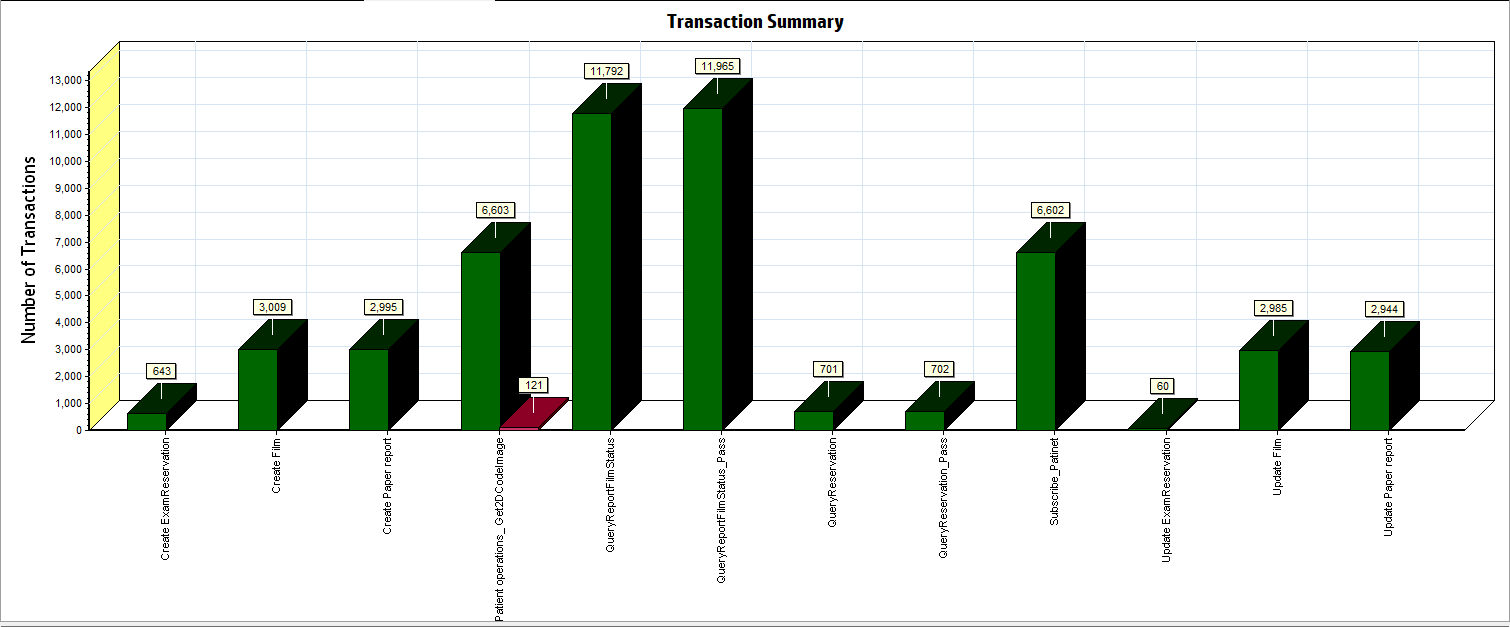
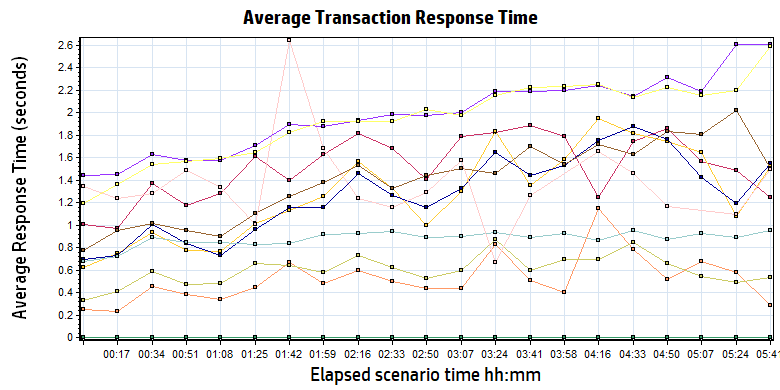


Figure 3.6.3.1 Transaction Summary

We can notice that there are some transactions failed during the testing work. We should find out the reason and fix it in the next version.

### Transaction response time result

We can get the transaction response time information from the figure as follow:



|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Color | | Scale | Measurement | Minimum | Average | Maximum | Std. Deviation | |
|  | | 1 | Create ExamReservation | 0.106 | 1.480 | 5.444 | 0.672 | |
|  | | 1 | Create Film | 0.172 | 1.192 | 5.043 | 0.804 | |
|  | | 1 | Create Paper report | 0.181 | 1.186 | 5.104 | 0.784 | |
|  | | 1 | Patient operations\_ Get2DCodeImage | 0.233 | 0.859 | 2.414 | 0.230 | |
|  | | 1 | QueryReportFilmStatus | 0.004 | 1.306 | 8.041 | 0.864 | |
|  | | 1 | QueryReportFilmStatus\_Pass | 0.000 | 0.000 | 0.000 | 0.000 | |
|  | | 1 | QueryReservation | 0.041 | 0.482 | 3.305 | 0.476 | |
|  | | 1 | QueryReservation\_Pass | 0.000 | 0.000 | 0.000 | 0.000 | |
|  | | 1 | Subscribe\_Patinet | 0.054 | 0.577 | 4.000 | 0.402 | |
|  | | 1 | Update ExamReservation | 0.554 | 1.343 | 4.100 | 0.517 | |
|  | | 1 | Update Film | 0.712 | 1.889 | 6.187 | 0.563 | |
|  | | 1 | Update Paper report | 0.279 | 1.838 | 5.490 | 0.569 | |
|  | | | | | | |

Figure 3.6.4.1 Transaction response time

We can find that the average response time for all transaction is less than 3 seconds.

## Performance bottleneck analysis

### Hardware usage analysis

We can get the hardware usage information from the figure as follow:

N/A

|  |
| --- |
|  |

Figure 3.6.4.1 Transaction response time

We do not monitor the server hardware resource usage because this phase testing work is smoking test. We will do this work next phase.

### MySQL Server resource usage analysis

We can get the MySQL server resource usage information from the figure as follow:

N/A

|  |
| --- |
|  |

Figure 3.7.2.1 Database result

|  |
| --- |
| C:\Users\Administrator\Desktop\Performance result\20170531_1\Report\dot_trans.gif |

We do not monitor the server hardware resource usage because this phase testing work is smoking test. We will do this work next phase.

## Test Conclusion

As current hardware and software setting, the system performance cannot meet the requirements of design. There are only 6,602 patients subscribed in CS in 12 hours but the goal is subscribe 10,000 patients in 8 hours.

Some transactions are failed; the database settings need update and enhance the performance.

The issues summary information as follow:

1. Some transaction is failed which cause by database or service. It must be resolve before publish.
2. The wechat service has some limited and we need design a mock service to confirm the message can push and query successfully.

We execute the performance testing scenario without database and mock service. We do this testing work in order to test the original performance under the current configurations. We should do some enhance works such as update the setting of database; update the test script and so on. After the develop team publish the mock service, we will start the real testing work as soon as possible.

QA team will continue design the test script and update the settings of DB to enhance the system performance.

# Testing work （Phase 2）

The CS system will upgrade in ChongQing province hospital. Team arranges this phase performance testing work to insure the system can works well in the site.

We execute the performance testing work on the actual hospital server.

## Test Environment

Test environment：We use the follow machine to do our performance testing work. It is actual environment of the customer`s.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Server Name** | **Type** | **CPU** | | **Hard Disk** | | **RAM** | | **OS** | | **Required Software** | |
| CS Application Server | Ali-Cloud server | Intel Xeon(R) platinum 8136 CPU 2.50GHz \*2 | 40GB | | 8G | | Windows 2016 data center | |  | |
| CS Database server | Ali-Cloud server | Intel Xeon(R) platinum 8136 CPU 2.50GHz \*2 | 1T SATA Disk | | 8G | | Centos 7.4 x64 | | MySQL Server 5.7 | |

Figure 4.1.1 Background Data

## Background Data

Before execute the performance testing, the CS has some history data and size as follow:

|  |  |  |
| --- | --- | --- |
| Table | Rows | Description |
| qrcodesceneinfo | 177157 | Store the register patient QR code |
| notificationmessage | 688534 | The message notify information to patient |
| filmreportstatus | 159679 | The patient film and report status |
| examreservation | 17407 | The patient exam reservation information. |

Figure 4.2.1 Background Data

## Strategy and Scenario Setting

Simon Huang develops a mock service to simulate the WeChat platform service to make sure the CS workflow can works smoothly. All requests which send to WeChat platform will use this mock and get the true status from this mock service.

Ralf Wang designs a web service to get the QR id from database to subscribe the patients.

We design the performance testing scenario as follow:

1. Prepare 20 virtual users to simulate the patient typically workflow include register, query and message notify operations.
2. The virtual users will register in CS system, randomly create or update the film, report and reservation information and query the status.
3. Each virtual will wait for 3 seconds after it finish one workflow.
4. The scenario will execute for 12 hours.

## Other Setting:

### Database setting

Version Mysql 5.7. The configuration keep all default, do not change any parameters.

### IIS setting

Default value.

## Test Object version

CS version 3.0.3.0.200

## Test Error

There are no errors exist in the testing work and logged as follow:

|  |  |  |
| --- | --- | --- |
| No | description | Counts |
| 1 |  |  |

Error analyzes: N/A

## Test result

### Transactions result

After the testing work, the related result as follow:

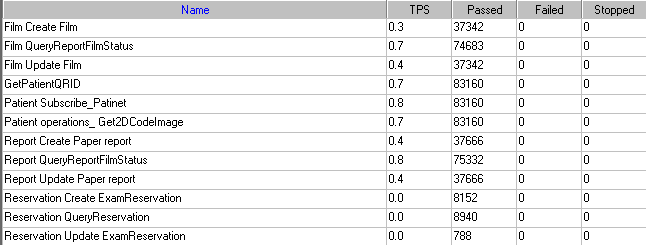


Figure 3.7.1.1 Test result

Transaction description:

|  |  |
| --- | --- |
| **Transaction Name** | **Description** |
| Film Create Film: | Simulate user has a new film created. User will receive a message like ‘You have a film need to print’ from WeChat. |
| Film Update film: | Simulate the user`s film status to printed. User will receive a message like ‘Your film has printed.’ from WeChat. |
| Film QueryReportFilmStatus: | Simulate user operations to query the film status information include created and printed status. |
| Patient Subscribe\_Patient | Simulate the user to register in WeChat by scan the 2D Code image. |
| Patient operations\_Get2DCodeImage | Simulate the 3rd system to get the patient`s 2D code image from CS system. |
| Report create Paper report | Simulate user has a new paper report created. User will receive a message like ‘You have a report need to print’ from WeChat. |
| Report Update report | Simulate the user`s paper report status to printed. User will receive a message like ‘Your report has printed.’ from WeChat. |
| Report QueryReportFilmStatus | Simulate user operations to query the paper report status information include created and printed status. |
| Reservation Create ExamReservation | Simulate user create a reservation in CS system. |
| Reservation Update ExamReservation | Simulate user update reservation information in CS system. |
| Reservation QueryReservation | Simulate patient to query the reservation information and receive message from WeChat. |
|  |  |

### Test Statistic Report

|  |  |
| --- | --- |
| Analysis Summary | Period: 2018/5/8 10:57 - 2018/5/8 23:00 |

|  |  |
| --- | --- |
| **Scenario Name:** | Scenario1 |
| **Results in Session:** | C:\Users\Administrator\AppData\Local\Temp\res\res.lrr |
| **Duration:** | 12 hours, 3 minutes and 12 seconds. |

|  |
| --- |
| Statistics Summary |

|  |  |  |
| --- | --- | --- |
| [**Maximum Running Vusers:**](file:///E:\PerformanceResult\CS%20result\CS_phase2\VuserStateGraph) |  | 20 |

|  |  |  |
| --- | --- | --- |
| |  | | --- | | You can define SLA data using the [SLA configuration wizard](slaconfig:) | | You can analyze transaction behavior using the [Analyze Transaction mechanism](analyze:) | |

|  |
| --- |
| Transaction Summary |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| [**Transactions:**](file:///E:\PerformanceResult\CS%20result\CS_phase2\TransactionSummary) | Total Passed: 567,391 | Total Failed: 0 | Total Stopped: 0 | [**Average Response Time**](file:///E:\PerformanceResult\CS%20result\CS_phase2\ResponseTime) |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Transaction Name** | **SLA Status** | **Minimum** | **Average** | **Maximum** | **Std. Deviation** | **98 Percent** | **Pass** | **Fail** | **Stop** |
| [Film Create Film](file:///E:\PerformanceResult\CS%20result\CS_phase2\ResponseTime0000(Film%20Create%20Film)0000) | [Show SLA Results](slarules:transaction_response_time_FilmCreateFilm) | 0.226 | 0.386 | 95.207 | 0.605 | 1.078 | 37,342 | 0 | 0 |
| [Film QueryReportFilmStatus](file:///E:\PerformanceResult\CS%20result\CS_phase2\ResponseTime0000(Film%20QueryReportFilmStatus)0000) | [Show SLA Results](slarules:transaction_response_time_FilmQueryReportFilmStatus) | 0.167 | 0.202 | 15.759 | 0.211 | 0.499 | 74,683 | 0 | 0 |
| [Film Update Film](file:///E:\PerformanceResult\CS%20result\CS_phase2\ResponseTime0000(Film%20Update%20Film)0000) | [Show SLA Results](slarules:transaction_response_time_FilmUpdateFilm) | 0.218 | 0.36 | 35.56 | 0.366 | 0.936 | 37,342 | 0 | 0 |
| [GetPatientQRID](file:///E:\PerformanceResult\CS%20result\CS_phase2\ResponseTime0000(GetPatientQRID)0000) | [Show SLA Results](slarules:transaction_response_time_GetPatientQRID) | 0.218 | 0.318 | 12.137 | 0.19 | 0.722 | 83,160 | 0 | 0 |
| [Patient operations\_ Get2DCodeImage](file:///E:\PerformanceResult\CS%20result\CS_phase2\ResponseTime0000(Patient%20operations_%20Get2DCodeImage)0000) | [Show SLA Results](slarules:transaction_response_time_Patientoperations_Get2DCodeImage) | 0.234 | 0.337 | 7.254 | 0.213 | 0.835 | 83,160 | 0 | 0 |
| [Patient Subscribe\_Patinet](file:///E:\PerformanceResult\CS%20result\CS_phase2\ResponseTime0000(Patient%20Subscribe_Patinet)0000) | [Show SLA Results](slarules:transaction_response_time_PatientSubscribe_Patinet) | 0.172 | 0.227 | 36.488 | 0.225 | 0.542 | 83,160 | 0 | 0 |
| [Report Create Paper report](file:///E:\PerformanceResult\CS%20result\CS_phase2\ResponseTime0000(Report%20Create%20Paper%20report)0000) | [Show SLA Results](slarules:transaction_response_time_ReportCreatePaperreport) | 0.226 | 0.378 | 12.051 | 0.286 | 1.071 | 37,666 | 0 | 0 |
| [Report QueryReportFilmStatus](file:///E:\PerformanceResult\CS%20result\CS_phase2\ResponseTime0000(Report%20QueryReportFilmStatus)0000) | [Show SLA Results](slarules:transaction_response_time_ReportQueryReportFilmStatus) | 0.168 | 0.202 | 10.171 | 0.174 | 0.515 | 75,332 | 0 | 0 |
| [Report Update Paper report](file:///E:\PerformanceResult\CS%20result\CS_phase2\ResponseTime0000(Report%20Update%20Paper%20report)0000) | [Show SLA Results](slarules:transaction_response_time_ReportUpdatePaperreport) | 0.218 | 0.362 | 19.391 | 0.328 | 0.952 | 37,666 | 0 | 0 |
| [Reservation Create ExamReservation](file:///E:\PerformanceResult\CS%20result\CS_phase2\ResponseTime0000(Reservation%20Create%20ExamReservation)0000) | [Show SLA Results](slarules:transaction_response_time_ReservationCreateExamReservation) | 0.187 | 0.287 | 21.091 | 0.34 | 0.952 | 8,152 | 0 | 0 |
| [Reservation QueryReservation](file:///E:\PerformanceResult\CS%20result\CS_phase2\ResponseTime0000(Reservation%20QueryReservation)0000) | [Show SLA Results](slarules:transaction_response_time_ReservationQueryReservation) | 0.17 | 0.201 | 4.922 | 0.185 | 0.686 | 8,940 | 0 | 0 |
| [Reservation Update ExamReservation](file:///E:\PerformanceResult\CS%20result\CS_phase2\ResponseTime0000(Reservation%20Update%20ExamReservation)0000) | [Show SLA Results](slarules:transaction_response_time_ReservationUpdateExamReservation) | 0.187 | 0.285 | 2.808 | 0.252 | 1.03 | 788 | 0 | 0 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Service Level Agreement Legend:** | E:\PerformanceResult\CS result\CS_phase2\led_ok.gif | Pass | E:\PerformanceResult\CS result\CS_phase2\led_error.gif | Fail | E:\PerformanceResult\CS result\CS_phase2\led_no_data.gif | No Data |

Figure 4.7.2.1 Summary Report

From this figure we can find that 98% transactions` response time are less than 1.1 seconds. The average response time is less than 0.5 seconds. The performance is very well.

### Transaction summary result

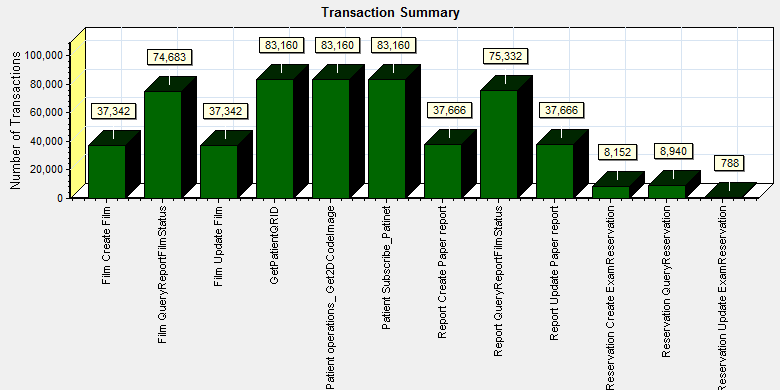
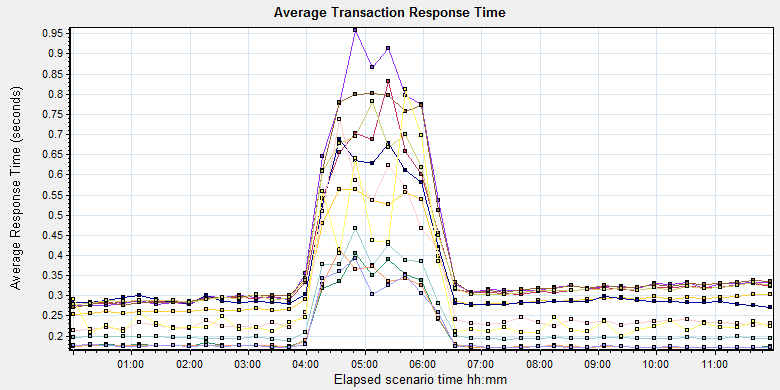


Figure 4.7.3.1 Transaction Summary

We can find that all transaction are passed.

### Transaction response time result

We can get the transaction response time information from the figure as follow:



|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Color | Scale | Measurement | Graph's Minimum | Graph's Average | Graph's Maximum | Graph's Median | Graph's Std. Deviation | |  | 1 | Film Create Film | 0.276 | 0.398 | 0.958 | 0.319 | 0.194 | |  | 1 | Film QueryReportFilmStatus | 0.172 | 0.206 | 0.405 | 0.175 | 0.068 | |  | 1 | Film Update Film | 0.279 | 0.368 | 0.832 | 0.314 | 0.139 | |  | 1 | GetPatientQRID | 0.254 | 0.324 | 0.565 | 0.289 | 0.098 | |  | 1 | Patient operations\_ Get2DCodeImage | 0.272 | 0.343 | 0.687 | 0.285 | 0.126 | |  | 1 | Patient Subscribe\_Patinet | 0.19 | 0.231 | 0.468 | 0.196 | 0.077 | |  | 1 | Report Create Paper report | 0.27 | 0.388 | 0.802 | 0.32 | 0.17 | |  | 1 | Report QueryReportFilmStatus | 0.172 | 0.206 | 0.415 | 0.176 | 0.068 | |  | 1 | Report Update Paper report | 0.278 | 0.37 | 0.781 | 0.314 | 0.14 | |  | 1 | Reservation Create ExamReservation | 0.214 | 0.291 | 0.738 | 0.233 | 0.133 | |  | 1 | Reservation QueryReservation | 0.172 | 0.203 | 0.392 | 0.175 | 0.063 | |  | 1 | Reservation Update ExamReservation | 0.2 | 0.285 | 0.812 | 0.223 | 0.141 | |
|  |
|  |
| E:\PerformanceResult\CS result\CS_phase2\Report\dot_trans.gif |
|  |
| |  | | --- | |  | |

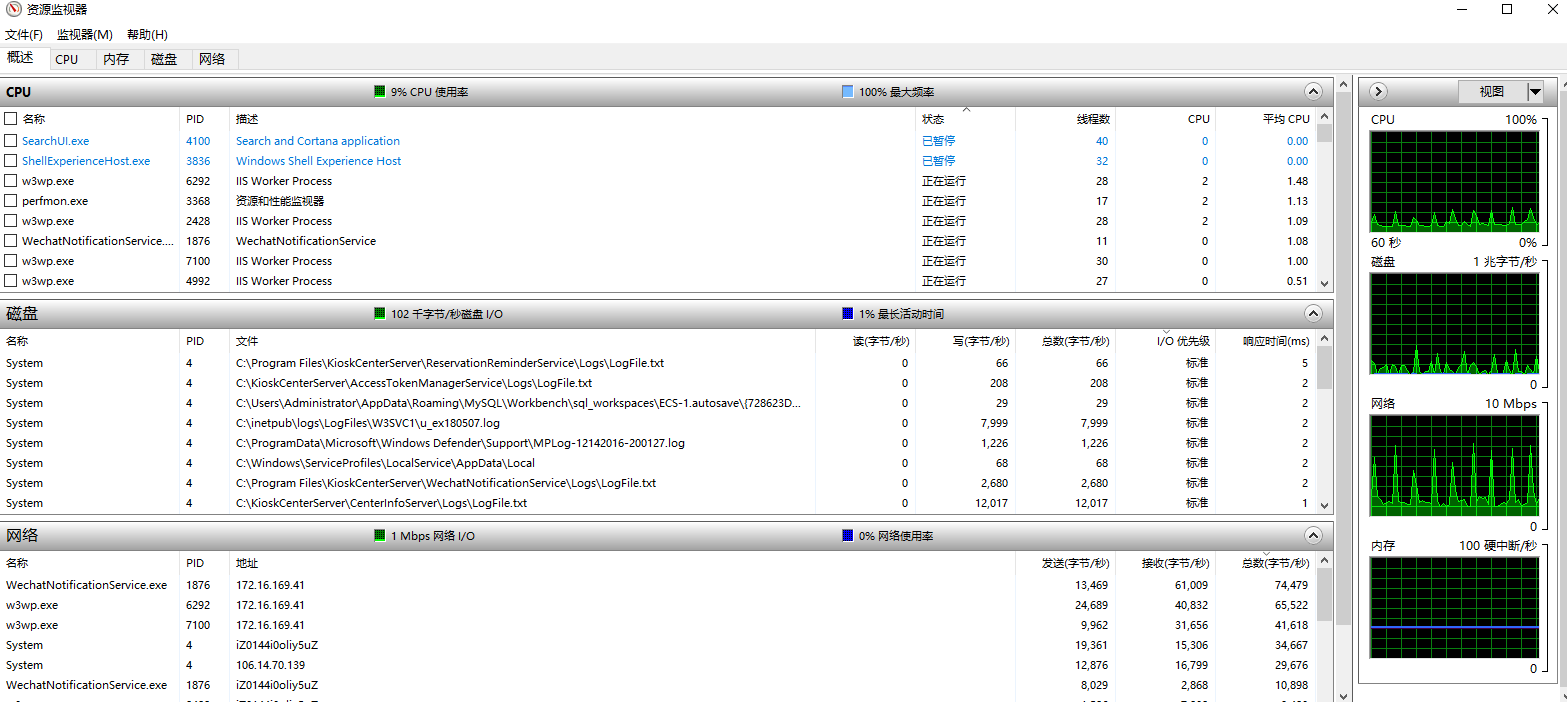
Figure 4.7.4.1 Transaction response time

We can find that the average response time for all transaction is less than 0.5 seconds. We notice the response time increase for one time after the testing execute 4 hours and Duarte for 3 hours. We guess it caused by the network or Mysql database. We will monitor this issues in next testing work.

## Performance bottleneck analysis

### Hardware usage analysis

We can get the hardware usage information from the figure as follow:



|  |
| --- |
|  |

Figure 4.8.1.1 All

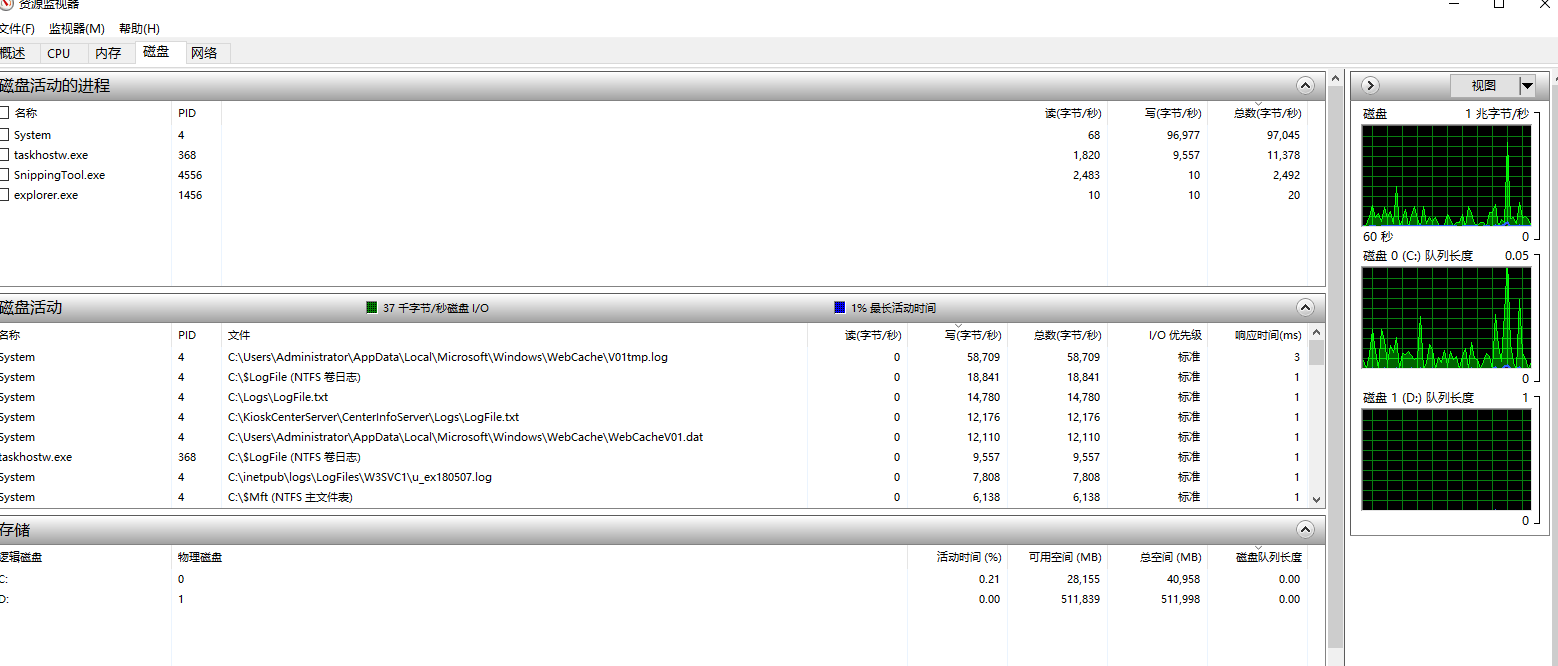


Figure 4.8.1.2 Disk

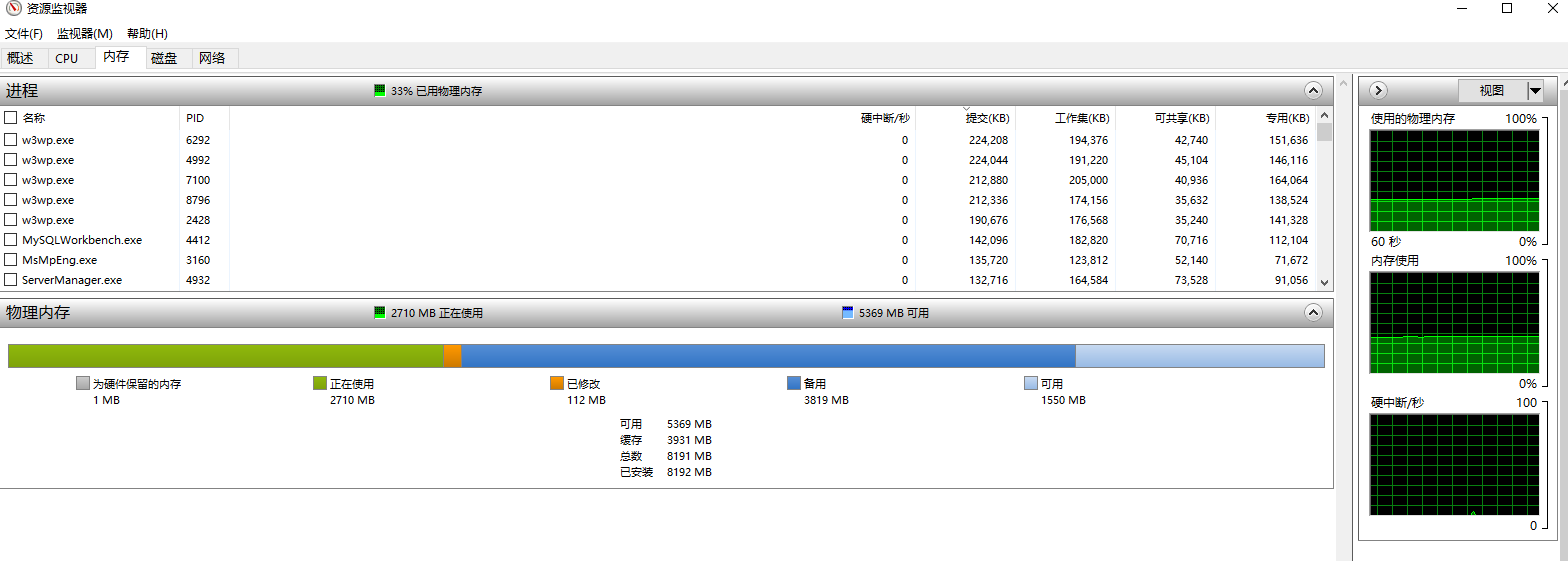


Figure 4.8.1.3 Memory

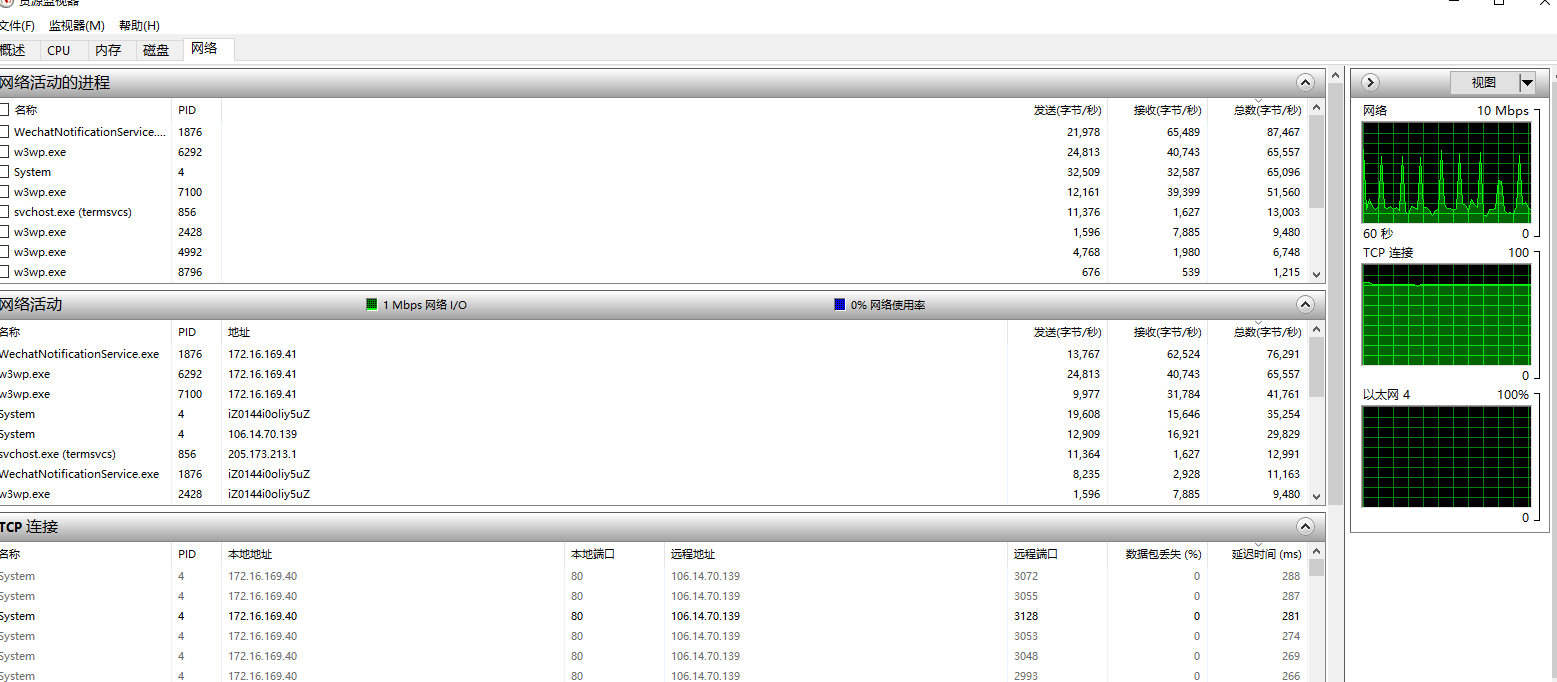
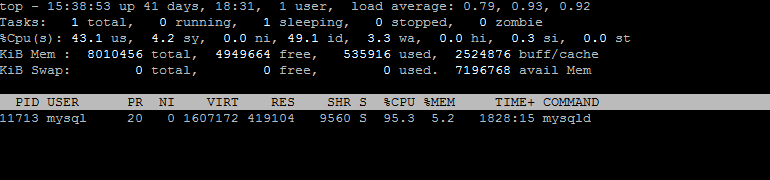


Figure 4.8.1.4 Net Work

The test tool cannot record the system performance result. The Ali-cloudy has some limited. We use the system performance monitor tool to monitor the result. There are no hardware and software bottle neck. The resource usages are very low and have enough resource to handle the system stress.

### MySQL Server resource usage analysis

We can get the MySQL server resource usage information from the figure as follow:



|  |
| --- |
| vmstat2.PNG |

Figure 4.8.2.1 Database server hardware usage

|  |
| --- |
| C:\Users\Administrator\Desktop\Performance result\20170531_1\Report\dot_trans.gif |

We find that the CPU usage is 43.1%, it less than 90% performance threshold value. Server has enough memory resource for system. There is 4.9GB free memory for system to use. There are no bottle neck issues for server.

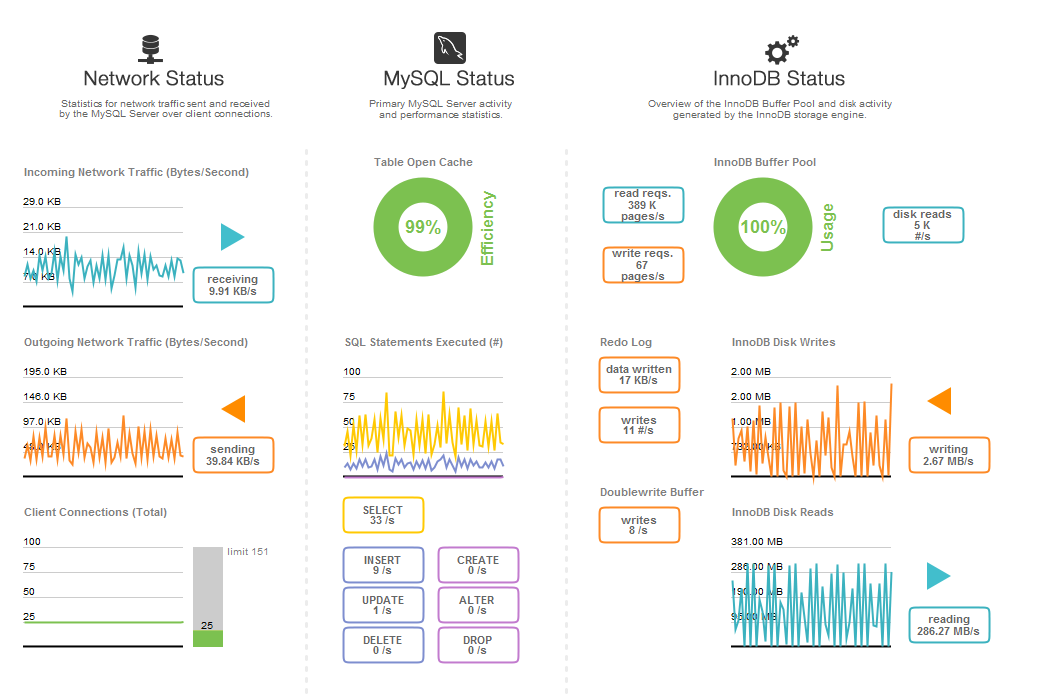


Figure 4.8.2.2 Database status

From this figure, we find that the database buffer pool is 100% usage. We use the MySQL database with the default setting. Some configuration value is not suitable for our system. We should change some setting to make our system works smoothly. I will give some advice in suggestion chapter.

## Optimization

### System design

As the current design, we have no rule to process the history data. The data size will increase with the time. I suggest we should design a rule to clean the history data interval. We only keep latest 30-60 days` records. If the customers need whole history data, we can move other data to a history table.

### SQL statement

We find several SQL statement do use the full scans during the testing work. We need redesign them to enhance the performance.

**SQL 1 :**

*SELECT `examreservation` . `examid` , `examreservation` . `hospitalid`*

*FROM `examreservation`*

*WHERE `examreservation` . `remindernotifystatus` = ?*

*AND `examreservation` . `statusid` IN (...)*

*AND `examreservation` . `resexamdatetimebegin` < ?*

*AND `examreservation` . `resexamdatetimebegin` > ?*

There are only examid and hosptialid column has index. The ‘examid’ id the primaryid. Please add the index for other column which used by filter condition. There are ‘resexamdatetimebegin’, ’ remindernotifystatus’, ‘statusid’.

Second, please avoid use ‘IN’ operator. The operator will cause multiple join operations. That means if there are 3 conditions in this operator, database will filter the data by the condition one by one and join the result successively. It will cost a lot of CPU resource.

**SQL2:**

*SELECT `hospital` . `hospitalid` , `hospital` . `hospitalvirtualip`*

*FROM `hospital`*

Please add index for column ‘hospitalvirtualip’

**SQL3:**

*SELECT `wechatclient` . `hospitalid` , `wechatclient` . `patientid`*

*FROM `wechatclient`*

*WHERE `openid` = ?*

*AND `patientid` != ?*

*AND `validated` = ?*

Please add index for column ‘patientid’ and ‘validated’.

**SQL4:**

*SELECT \* FROM `ecs` . `notificationmessage`*

*WHERE `notifystatus` = ?*

The table notification has larger data. It will cost a lot resource, please add the index for column ‘notifystatus’. Second, if we do not need all columns data from this table, please do not use ‘\*’ operator in order to reduce the transfer data for system.

**SQL5:**

*SELECT `settingvalue`*

*FROM `settings`*

*WHERE `settingkey` = ?*

*AND `hospitalid` = ?*

Add the index for column ‘settingkey’ and ‘hospitalid’.

**SQL6:**

*SELECT `isthirdparty`*

*FROM `ecs` . `wechatofficialaccount`*

*WHERE `originalid` = ?*

Please add the index for column ‘originalid’.

**SQL7:**

*SELECT \**

*FROM `ecs` . `wechatofficialaccount`*

*WHERE `originalid` = ?*

Please add index for column ‘originalid’. This SQL is simulate with SQL6, please ensure you need query all row data from database. If not, please only query the column you need to reduce the transfer data for net.

PS:

I find there are many statements execute for many times. Shall we modify these SQL statements to stored procedure? It will easy for 3rd party system to use. Procedure will not produce extra execute plan, it will reduce the memory usage.

### Database setting

We execute the performance testing works with the default settings of database. We should to change some parameter of it to enhance the process ability of system.

These settings need discuss with team and identify by the actual testing.

Max\_connection = 300

innodb\_buffer\_pool\_size=4G

innodb\_additional\_mem\_pool=16M

innodb\_flush\_method =O\_DIRECT

innodb\_log\_file\_size=256M

innodb\_log\_buffer\_size=4M

innodb\_flush\_logs\_at\_trx\_commit=1

innodb\_file\_io\_threads=4

innodb\_open\_files=800

innodb\_file\_per\_table =1

I suggest modify the first 4 parameters for our system. Others can modify if we really need or identify them by testing works. If team need monitor the slow SQL statement, we can add these settings to configuration file.

log-slow-queries = /tmp/mysql-slow.log

long\_query\_time = 2

## Test Conclusion

As current hardware and software setting, the system performance can meet the requirements of design.

There are 83,160 patients subscribed in CS system and CS pushed 168,177 notice messages to patients during the testing work. System also processed 158,955 query requests. The system process ability can meet the requirement of our system.

After the testing works, there are 856,793 row records in table ‘ecs. Notificationmessage’ of MySQL database. This table stores the records of the message which pushed to patients.

I collected the data in current CS system in ChongQing hospitals. There are 285,360 row data in database which recorded time between 2015-08-25 and 2018-05-09. That means the site processed 285,360 in past 2.7years. Compare the performance testing result, we calculates that the system can works well for 8.1 years.

( 856,793/285,360)\*2.7 ≈ 8.1

So we can ensure the system can works well under current stress for at least 3 years.

Even the system has a high performance at current stress and setting. But we still need to do some update operations to enhance the system.

1. Create a service or rule to clean history data to reduce the database size. It will It will enhance the performance of system.
2. Modify the unreasonable SQL statement which use the full scans or response time is high.
3. Use reasonable setting of database instead of the default one.

Describe the overall verification and validation testing objectives.

Please make appropriate modifications to the sample text so it accurately reflects this project.

**<End of Document>**