



QQ会员活动运营平台 PHP7升级实践

Hansionxu徐汉彬



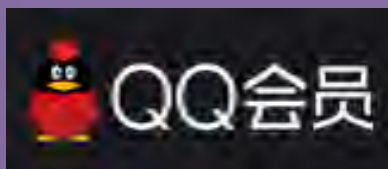
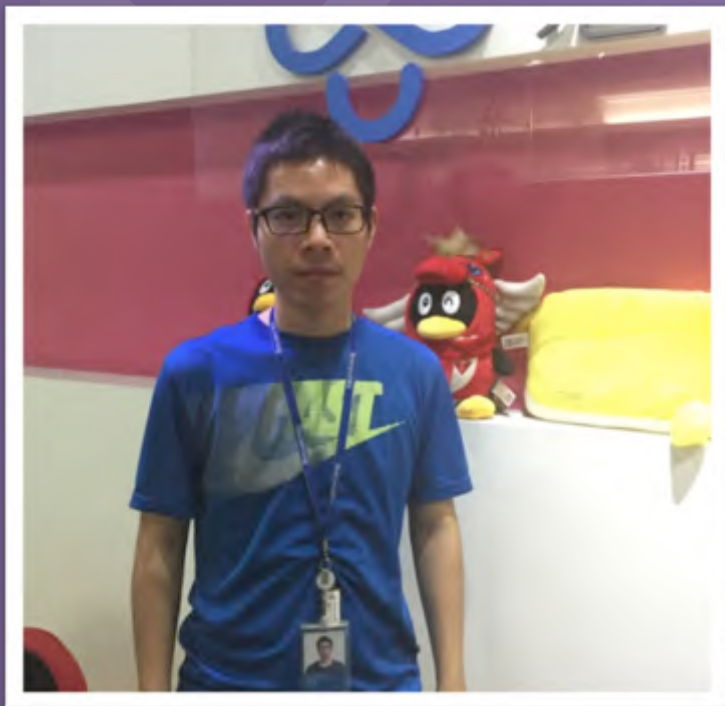
PHPCON

www.phpconchina.com



个人介绍

- Hansionxu (徐汉彬)
- 腾讯高级工程师 (SNG增值产品部)
- QQ会员体系合作线技术团队负责人, AMS平台负责人
- 曾就职于阿里巴巴、小满科技



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PART ONE

QQ会员活动运营平台介绍

什么是活动？

- 上线周期短
- 功能多样化
- 节假日推广



AMS平台介绍

- 简称AMS，承载QQ增值活动运营业务的Web系统
- 主要采用PHP实现的运营平台
- 业务涵盖众多业务：QQ、腾讯游戏、个性化、动漫阅读

3-8亿

Web系统
日请求

800+

同时在线
活动数

100+

涉及的存
储和服务

7w/s

高峰期每
秒CGI请求

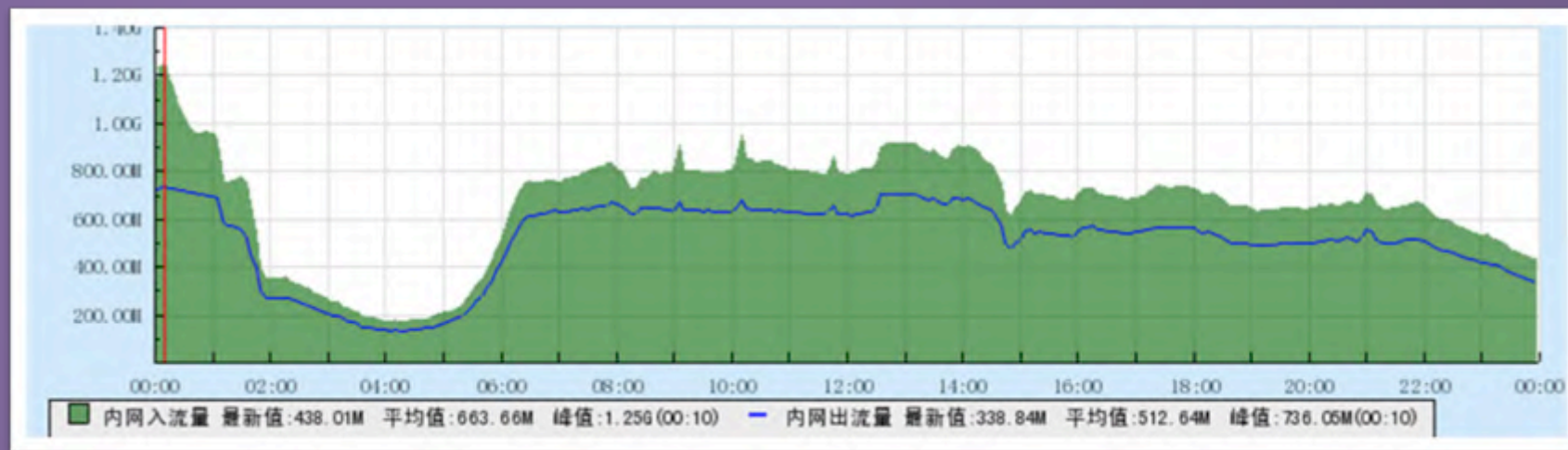


PART TWO

一个大流量活动的故事及根源分析

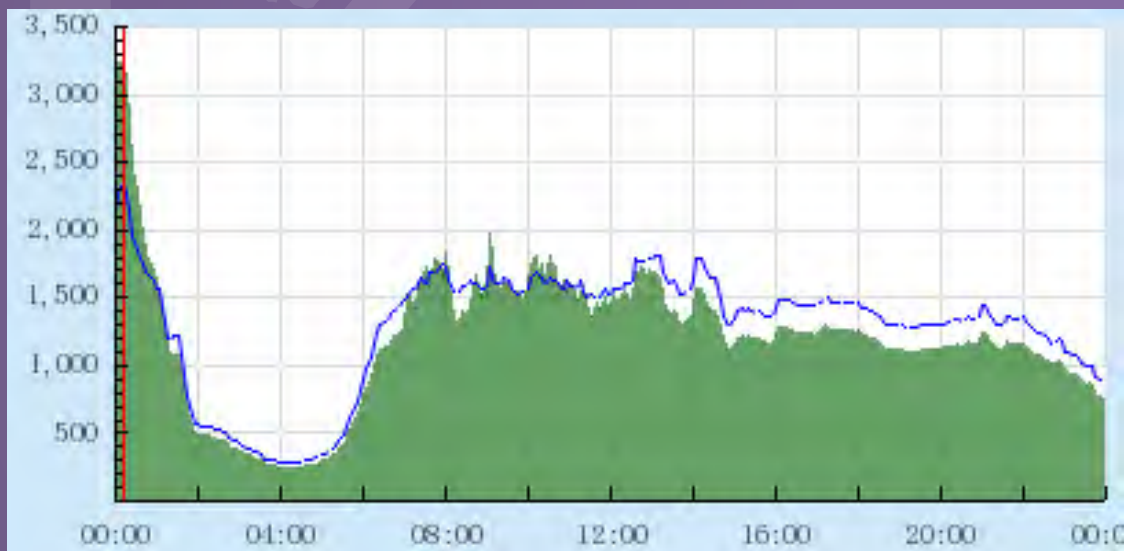
故事开端：流量冲击

- 《天天酷跑两周年》营收活动
- 广告推广超4亿（红点、手Q广告等）
- 内网入流量1.25G/s



CGI层CPU高负载

- 峰值流量过大
- 活动门槛低，单用户可以出发很多次CGI请求
- 后端部分服务延迟大增，甚至挂掉



故事的结局？



CGI层问题根源分析

扩容能力

- 无法快速扩容
- 敏感权限申请需要人工开通

单机并发

- Apache的prefork模式问题
- 后端延迟增加下的同步阻塞

单机性能

- PHP5.2的版本过于老旧
- 性能比较弱

CGI层的单体架构

- 特点：在一起，共甘共苦



AMS平台介绍

- 在系统早期，业务不算庞大时，非常具有优势

特点

- 所有功能集中在一起
- 部署为一套服务

优势

- 开发容易，代码都在一起
- 测试部署容易，只搭建一套环境
- 线上部署简单，直接复制服务和配置

系统扩大带来问题

效率

庞大的程序逻辑难以理解
代码耦合；新人加入难度高

协作

局部修改需要多方确认
测试回归复杂；多人协作

对开发文化影响

- 不敢敏捷开发，尤其是对于新人

阻碍频繁的发布

阻碍持续的构建和部署

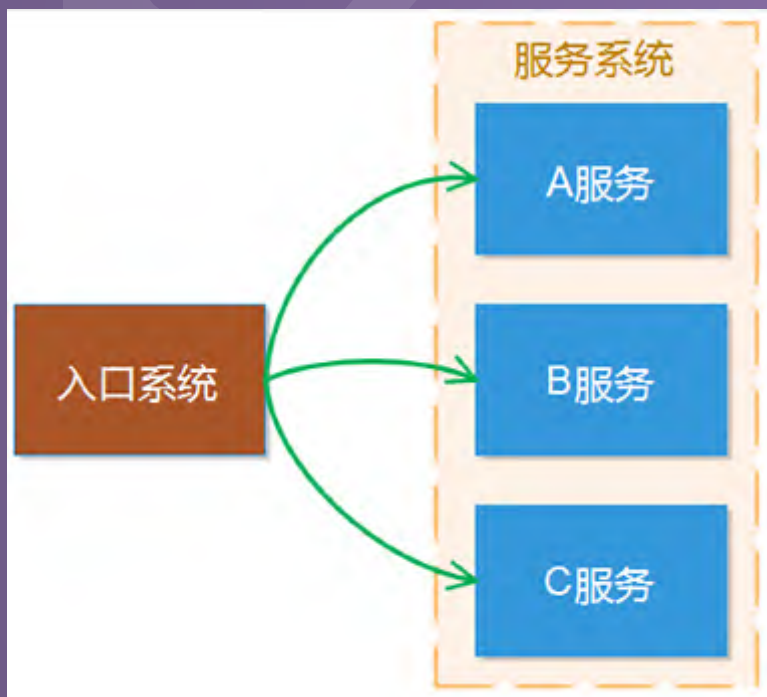
阻碍新技术的升级和应用

大量多人的协调工作

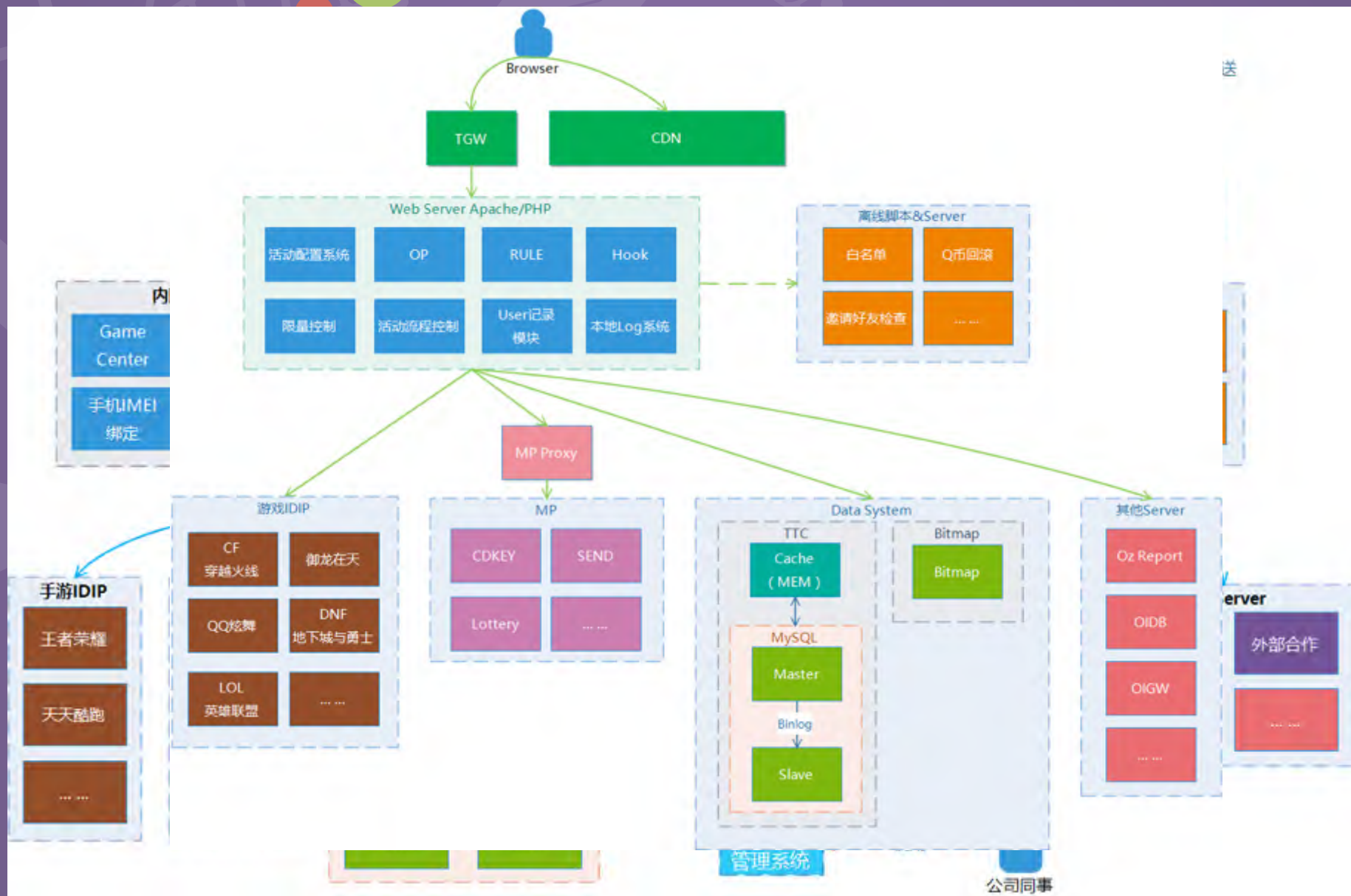


CGI层拆分

- Unix哲学：Do one thing and do it well
- SOA/微服务
- 后台Server很早就是进行拆分（服务化）
- CGI层也应该逐步推进拆分，为新技术的升级打下基础



AMS新老架构对比





PART THREE

PHP7升级实践

性能优化方案讨论

- 2015年下半年开始讨论
- AMS的Web Server开销主要在CPU，早期使用Apache2.0+PHP5.2 (prefork)
- 基础服务升级需要兼顾业务场景和投入成本（投入产出比）

HHVM

- 高性能
- 运维成本、向下兼容

Nginx+PHP-FPM

- 平滑
- 瓶颈在PHP-FPM

Node

- 原生支持异步化
- 迁移成本比较高

选择方案：PHP7+Apache2.4 (Event)

AMS升级面临的难点

- 选择的方案：**PHP7+ Apache2.4.18 (Event)**

需要面对的问题：

- Apache2.0->Apache2.4 (2008年)
- PHP5.2->PHP7 (2009年)
- Tphplib数量不少的基础扩展重新编译和升级 (线程安全)
- 语法兼容性问题
- 新软件面临的风险

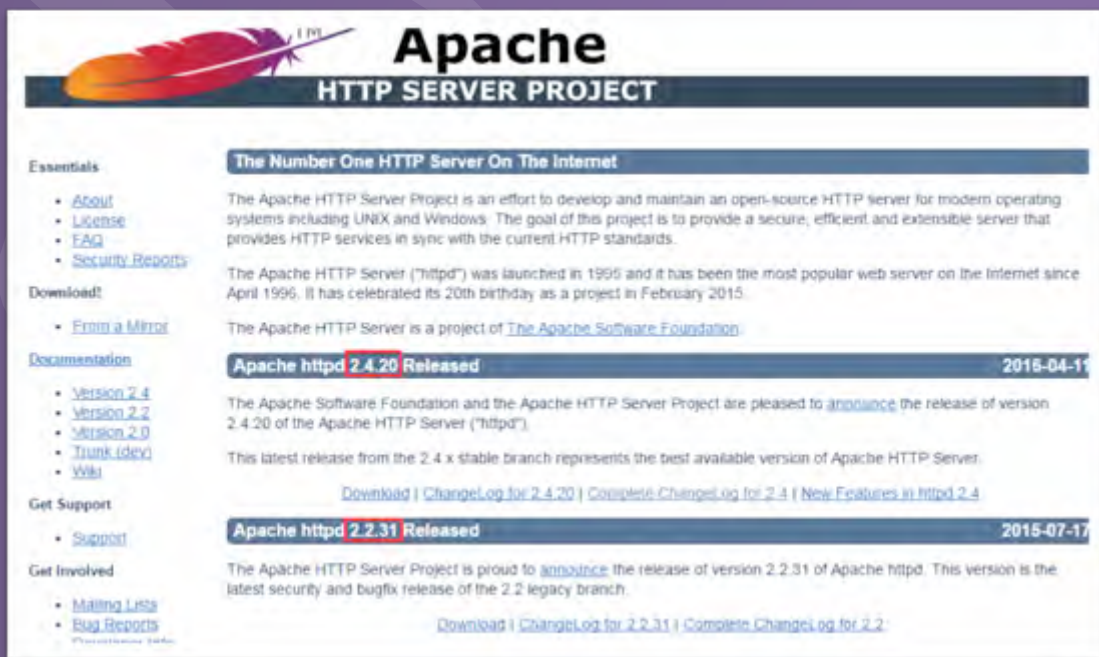
PHP5.2
Apache2.0
prefork

PHP5.6
Apache2.4
Event

PHP7.0
Apache2.4
Event

Apache2.2升级

- Apache2.0->2.2 (Httpd社区的并行双版本)



The screenshot shows the Apache HTTP Server Project website. The main heading is "Apache HTTP SERVER PROJECT". Below it, there's a section titled "The Number One HTTP Server On The Internet" with a description of the project. There are two news items: "Apache httpd 2.4.20 Released" dated 2016-04-11 and "Apache httpd 2.2.31 Released" dated 2015-07-17. The website also has navigation links for Essentials, Download!, Documentation, Get Support, and Get Involved.

基础软件版本

业务测试QPS

Apache2.0.59 + PHP5.2

187.51

Apache2.2.21 + PHP5.2

246.34

变化

提升31.3%

Apache2.4升级

- Apache2.4支持动态MPM模式
- 可配置切换Prefork/Worker/Event三个模式（风险降级）

```
--with-apr=/usr/local/apr \
"--with-pcre=/usr/local/pcre" \
"--enable-mpms-shared=all" \
"$@"
```

```
# Example:
# LoadModule foo_module modules/mod_foo.so
#
#LoadModule mpm_prefork_module modules/mod_mpm_prefork.so
#LoadModule mpm_worker_module modules/mod_mpm_worker.so
LoadModule mpm_event_module modules/mod_mpm_event.so
```

Prefork



Worker



Event

Apache2.4遇到的问题

- 问题：scoreboard is full not at MaxRequestWorkers (Apache2.4 + PHP5.6)，偶现，大流量高峰期才会触发

```
<IfModule mpm_event_module>
  StartServers          3
  ServerLimit           32
  MinSpareThreads      75
  MaxSpareThreads      100
  ThreadsPerChild       25
  MaxRequestWorkers    800
  MaxConnectionsPerChild 0
</IfModule>
```

解决方案：

- 定时重启
- 主动kill掉“过期”的“空等工作进程”
- Apache2.4.18 + PHP7.0不会触发

nobody	323	0.0	0.4	2502572	78360	?	SL1	10:32	0:23	/usr/local/services/apache-2.4/bin/httpd	-k start
nobody	352	0.0	0.4	2502572	79616	?	SL1	May05	0:44	/usr/local/services/apache-2.4/bin/httpd	-k start
nobody	4451	0.0	0.4	2500384	76056	?	SL1	10:39	0:24	/usr/local/services/apache-2.4/bin/httpd	-k start
nobody	8286	15.0	0.4	2500384	77224	?	SL1	22:15	0:21	/usr/local/services/apache-2.4/bin/httpd	-k start
root	8735	0.0	0.0	565900	12124	?	Ss	May02	0:25	/usr/local/services/apache-2.4/bin/httpd	-k start
nobody	9380	8.7	0.4	2499300	73852	?	SL1	22:16	0:05	/usr/local/services/apache-2.4/bin/httpd	-k start
nobody	10777	3.0	0.1	1182260	23544	?	SL1	22:17	0:00	/usr/local/services/apache-2.4/bin/httpd	-k start

```
[pid 379] 22:22:17.817350 epoll_wait(11, {}, 50, 100)
[pid 379] 22:22:17.917512 epoll_wait(11, {}, 50, 100)
[pid 379] 22:22:18.017615 epoll_wait(11, {}, 50, 100)
[pid 379] 22:22:18.117793 epoll_wait(11, {}, 50, 100)
[pid 379] 22:22:18.217984 epoll_wait(11, {}, 50, 100)
[pid 379] 22:22:18.318177 epoll_wait(11, {}, 50, 100)
[pid 379] 22:22:18.418363 epoll_wait(11, {}, 50, 100)
[pid 379] 22:22:18.518549 epoll_wait(11, {}, 50, 100)
[pid 379] 22:22:18.618702 epoll_wait(11, {}, 50, 100)
[pid 379] 22:22:18.718902 epoll_wait(11, {}, 50, 100)
[pid 379] 22:22:18.819082 epoll_wait(11, {}, 50, 100)
```


PHP5.2->PHP5.6

从PHP5.2升级到PHP5.6相对比较容易，我们主要的工作如下：

- 清理了部分不再使用的老扩展（tphplib有10个业务扩展）
- 解决掉线程安全问题
- 将公司内部tphplib等api编译到新的版本
- PHP代码语法基于PHP5.6的兼容（实际上变化不大）
- 部分扩展的同步调整，例如：apc扩展变为zend_opcache和apcu

PHP5.6->PHP7.0

- PHP5.6升级过程已经解决了不少问题
- 老函数名称兼容 (function_exists兼容)
- Tphplib升级 (8个扩展)
- 2016年4月下旬灰度, 5月初单集群全量

PHP7预研和学习

1. PHP7技术原理学习
2. 讨论升级方案

环境编译和环境搭建

1. 编译和搭建PHP7 + Apache2.4的环境
2. 解决环境相关的库依赖

兼容修正和测试

1. PHP7语法兼容工作, 让AMS3.0的代码能够兼容PHP7
2. AMS功能测试和bugfix
3. 性能压测

线上灰度

1. 打包为Pkg包
2. 灰度到线上机器
3. 观察系统稳定性
4. 修正异常问题

正式发布

1. 扩大灰度范围
2. 集群全量发布

PHP7升级的调试方法

- gdb + Core文件
- PHP代码: var_dump/exit
- 捕获worker进程的core: gdb -p/gdb c
- 查看worker进程工作处理: strace -Ttt -v -s1024 -f -p pid

```
Program received signal SIGSEGV, Segmentation fault.
add_assoc_long_ex (arg=0x0, key=0x7f50f894643 "retcode", key_len=7, n=13200) at /usr/local/src/php-7.0.5/zend/
1331      ret = zend_symtable_str_update(Z_ARRVAL_P(arg), key, key_len, &mp);
(gdb) bt
#0  add_assoc_long_ex (arg=0x0, key=0x7f50f894643 "retcode", key_len=7, n=13200) at /usr/local/src/php-7.0.5/
#1  0x00007f50f88280a9 in zim_tphp_cmem_getlist (execute_data=0x7f50e44138a0, return_value=0x7f50e4413870) at /
#2  0x00007f5105a2bbcb in ZEND_DO_FCALL_SPEC_HANDLER (execute_data=0x7f50e44137b0)
    at /usr/local/src/php-7.0.5/zend/zend_vm_execute.h:842
#3  0x00007f51059ef200 in execute_ex (ex=<value optimized out>) at /usr/local/src/php-7.0.5/zend/zend_vm_execu
#4  0x00007f5105a4a400 in zend_execute (op_array=<value optimized out>, return_value=<value optimized out>)
    at /usr/local/src/php-7.0.5/zend/zend_vm_execute.h:458
#5  0x00007f51059aaae4 in zend_execute_scripts (type=8, retval=0x0, file_count=3) at /usr/local/src/php-7.0.5/
#6  0x00007f510593acb0 in php_execute_script (primary_file=0x7f50e5f49ba0) at /usr/local/src/php-7.0.5/main/mai
#7  0x00007f5105a4eb6d in php_handler (r=0x7f50d0002970) at /usr/local/src/php-7.0.5/sapi/apache2handler/sapi_
#8  0x000000000044d210 in ap_run_handler (r=0x7f50d0002970) at config.c:170
#9  0x000000000045138e in ap_invoke_handler (r=0x7f50d0002970) at config.c:433
#10 0x00000000004648fa in ap_process_async_request (r=0x7f50d0002970) at http_request.c:410
#11 0x0000000000460c30 in ap_process_http_async_connection (c=0x7f50e00378e8) at http_core.c:154
#12 ap_process_http_connection (c=0x7f50e00378e8) at http_core.c:248
#13 0x0000000000458150 in ap_run_process_connection (c=0x7f50e00378e8) at connection.c:41
#14 0x00007f5109119fdd in process_socket (tfd=0x13c2f40, dummy=<value optimized out>) at event.c:1101
#15 worker_thread (tfd=0x13c2f40, dummy=<value optimized out>) at event.c:1960
#16 0x00007f510a2229d1 in start_thread () from /lib64/libpthread.so.0
#17 0x00007f5109d0b8fd in clone () from /lib64/libc.so.6
```

```
Loaded symbols for /usr/local/services/apache-2.4/php-7.0/lib/php/extensions/tphp_ttc.so
Reading symbols from /usr/local/services/apache-2.4/php-7.0/lib/php/extensions/tphp_clogger.so: .done.
Loaded symbols for /usr/local/services/apache-2.4/php-7.0/lib/php/extensions/tphp_clogger.so
Reading symbols from /usr/local/services/apache-2.4/php-7.0/lib/php/extensions/tphp_cmem.so: .done.
Loaded symbols for /usr/local/services/apache-2.4/php-7.0/lib/php/extensions/tphp_cmem.so
0x00007fc0462b975d in read () from /lib64/libpthread.so.0
Missing separate debuginfos, use: debuginfo-install expat-2.0.1-9.1.el6.x86_64 glibc-2.12-1.149.t11.5.W
.x86_64 krb5-libs-1.9-22.el6_2.1.x86_64 libcom_err-1.41.12-11.el6.x86_64 libgcc-4.4.6-4.t11.x86_64 libs
libstdc++-4.4.6-4.t11.x86_64 libtool-ltdl-2.2.6-15.5.el6.x86_64 libuuid-2.17.2-12.5.t11.x86_64 nss-soft
64 openssl-1.0.1e-42.t11.5.x86_64 zlib-1.2.3-27.el6.x86_64
(gdb) c
Continuing.
```

httpd的调试模式

便于于分析和追踪问题：

- 通过参数配置，启动为单进程单线程的运行状态
- Apache调试模式：`apachectl -k start -X -e debug`

```
<IfModule mpm_event_module>
  StartServers      3
  ServerLimit      32
  MinSpareThreads  75
  MaxSpareThreads  100
  ThreadsPerChild  25
  MaxRequestWorkers 800
  MaxConnectionsPerChild 10000
</IfModule>
```

```
[root@VM_158_66_centos bin]# ./apachectl -k start -X -e debug
[Wed Jun 22 16:04:00.772122 2016] [so:debug] [pid 565] mod_so.c(266): AH01575: loaded module mpm_event_module from /usr/local/apache/modules/mod_mpm_event.so
[Wed Jun 22 16:04:00.793848 2016] [so:debug] [pid 565:tid 140326288533248] mod_so.c(266): AH01575: loaded module authn_file_module from /usr/local/apache/modules/mod_authn_file.so
[Wed Jun 22 16:04:00.798942 2016] [so:debug] [pid 565:tid 140326288533248] mod_so.c(266): AH01575: loaded module authn_core_module from /usr/local/apache/modules/mod_authn_core.so
[Wed Jun 22 16:04:00.809910 2016] [so:debug] [pid 565:tid 140326288533248] mod_so.c(266): AH01575: loaded module authz_host_module from /usr/local/apache/modules/mod_authz_host.so
[Wed Jun 22 16:04:00.810561 2016] [so:debug] [pid 565:tid 140326288533248] mod_so.c(266): AH01575: loaded module authz_groupfile_module from /usr/local/apache/modules/mod_authz_groupfile.so
[Wed Jun 22 16:04:00.814941 2016] [so:debug] [pid 565:tid 140326288533248] mod_so.c(266): AH01575: loaded module authz_user_module from /usr/local/apache/modules/mod_authz_user.so
[Wed Jun 22 16:04:00.826225 2016] [so:debug] [pid 565:tid 140326288533248] mod_so.c(266): AH01575: loaded module authz_core_module from /usr/local/apache/modules/mod_authz_core.so
[Wed Jun 22 16:04:00.833876 2016] [so:debug] [pid 565:tid 140326288533248] mod_so.c(266): AH01575: loaded module access_compat_module from /usr/local/apache/modules/mod_access_compat.so
[Wed Jun 22 16:04:00.840082 2016] [so:debug] [pid 565:tid 140326288533248] mod_so.c(266): AH01575: loaded module auth_basic_module from /usr/local/apache/modules/mod_auth_basic.so
[Wed Jun 22 16:04:00.858361 2016] [so:debug] [pid 565:tid 140326288533248] mod_so.c(266): AH01575: loaded module reqtimeout_module from /usr/local/apache/modules/mod_reqtimeout.so
```



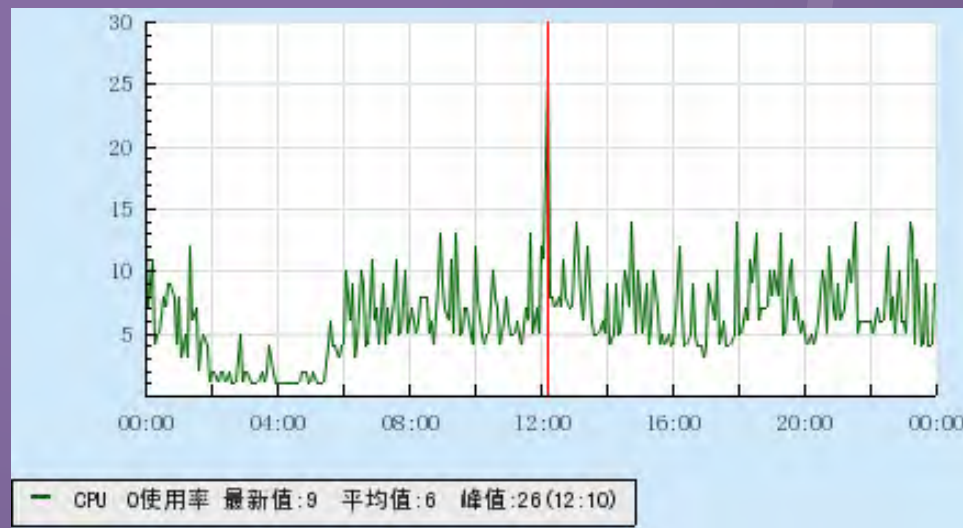
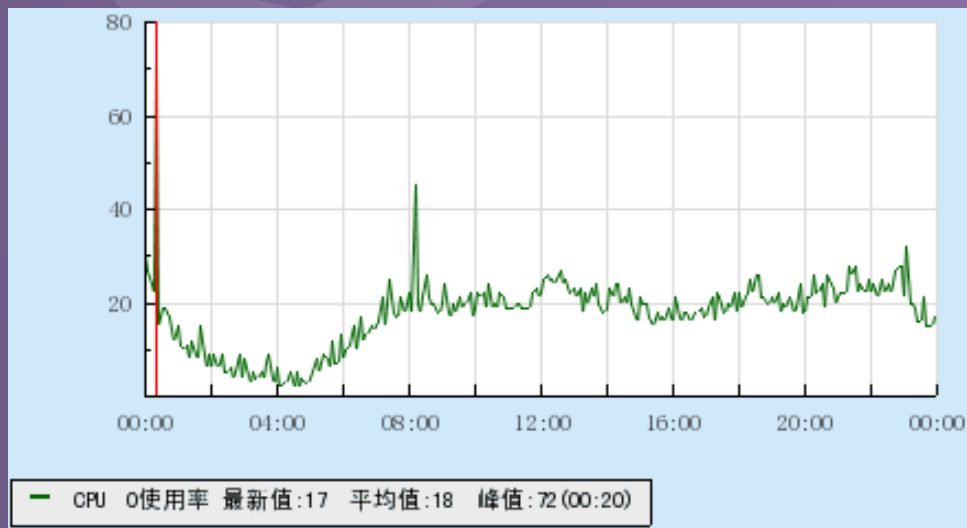
PART THREE

升级后的性能优化成果

性能表现

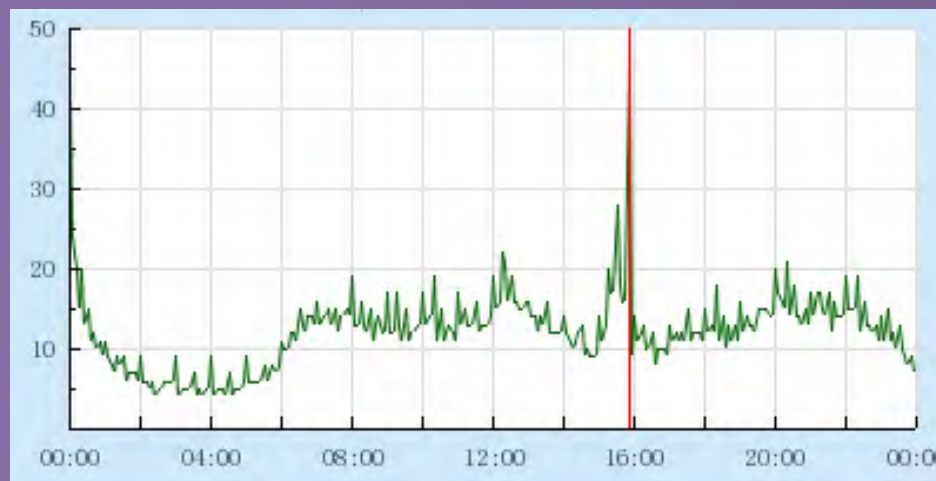
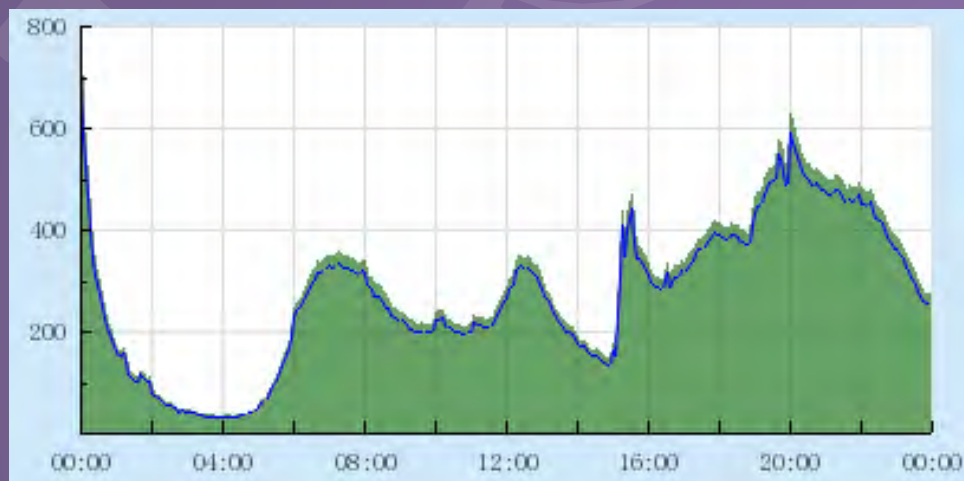
- 在PHP各个版本的单机性能压测结果

Web Server版本	单机QPS (业务请求)	CPU全天均值
Apache2.0+PHP5.2(prefork)	1013	18%
Apache2.4+PHP5.6(event)	1529	
Apache2.4+PHP7(event)	3021	6%

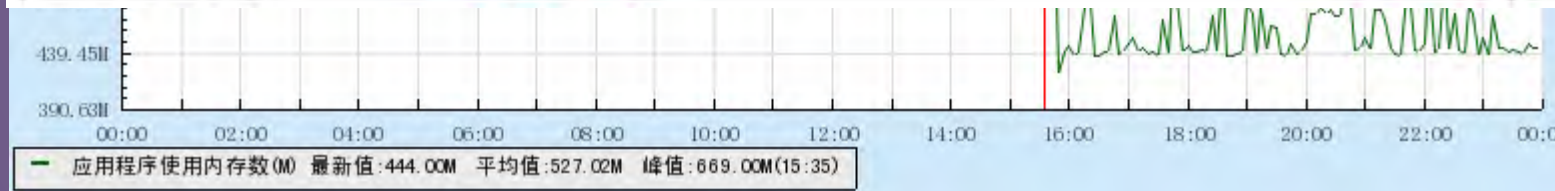


PHP7升级的现网数据

- 升级的机器的负载数据



服务	业务请求压测QPS	现网次高峰CPU负载 (TGW入包量650/s)	现网凌晨瞬时CPU高峰
PHP5.6	1477	24%	44%
PHP7.0	2675	13%	19%
性能变化	提升81%	下降45%	下降56%



Prefork和Event的资源开销

- `pidstat -ruh -p pid 1 10`
- 对比两台配置相近的现网机器，获得了参考性质的数据：

模式	单进程CPU使用率	内存	工作线程数(个)
Apache2.0+PHP5.2 (prefork)	1-2%	22.4M	1
Apache2.4+PHP7.0 (event)	10-13%	57.6M	25

```
# Time PID %usr %system %guest %CPU CPU minflt/s majflt/s VSZ RSS %MEM Command
1466163674 27849 8.00 5.00 0.00 13.00 20 241.00 0.00 2658068 60680 0.36 httpd
# Time PID %usr %system %guest %CPU CPU minflt/s majflt/s VSZ RSS %MEM Command
1466163675 27849 8.00 2.00 0.00 10.00 20 206.00 0.00 2657964 60684 0.36 httpd
# Time PID %usr %system %guest %CPU CPU minflt/s majflt/s VSZ RSS %MEM Command
1466163676 27849 8.00 2.00 0.00 10.00 20 197.00 0.00 2657964 60688 0.36 httpd
```

```
# Time PID %usr %system %guest %CPU CPU minflt/s majflt/s VSZ RSS %MEM Command
1466163643 11394 2.00 0.00 0.00 2.00 0 12.00 0.00 556696 23680 0.14 httpd
# Time PID %usr %system %guest %CPU CPU minflt/s majflt/s VSZ RSS %MEM Command
1466163644 11394 1.00 0.00 0.00 1.00 17 12.00 0.00 556696 23680 0.14 httpd
# Time PID %usr %system %guest %CPU CPU minflt/s majflt/s VSZ RSS %MEM Command
1466163645 11394 2.00 0.00 0.00 2.00 20 12.00 0.00 556696 23680 0.14 httpd
```


PHP7升级的参考资料

- AMS系统PHP7升级实践记录
- <http://hansionxu.blog.163.com/blog/static/241698109201651784036924/>

The background is a solid purple color. It features several faint, light purple icons: an open book, a globe, a graduation cap, and a microscope. On the right side, there is a network of interconnected nodes represented by blue, green, and red circles connected by thin yellow lines. On the left side, there are scattered circles in blue, green, and red, some of which are also connected by thin yellow lines.

**THANK YOU
FOR
WATCHING**

感谢聆听