

项目编号：2017N023

河南大学

大学生创新创业训练计划项目

使用手册

项目名称：基于分布式系统的服务器能耗监控系统

项目编号：2017N023 项目立项年度：2017

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河南大学大学生创新创业训练计划工作领导小组制

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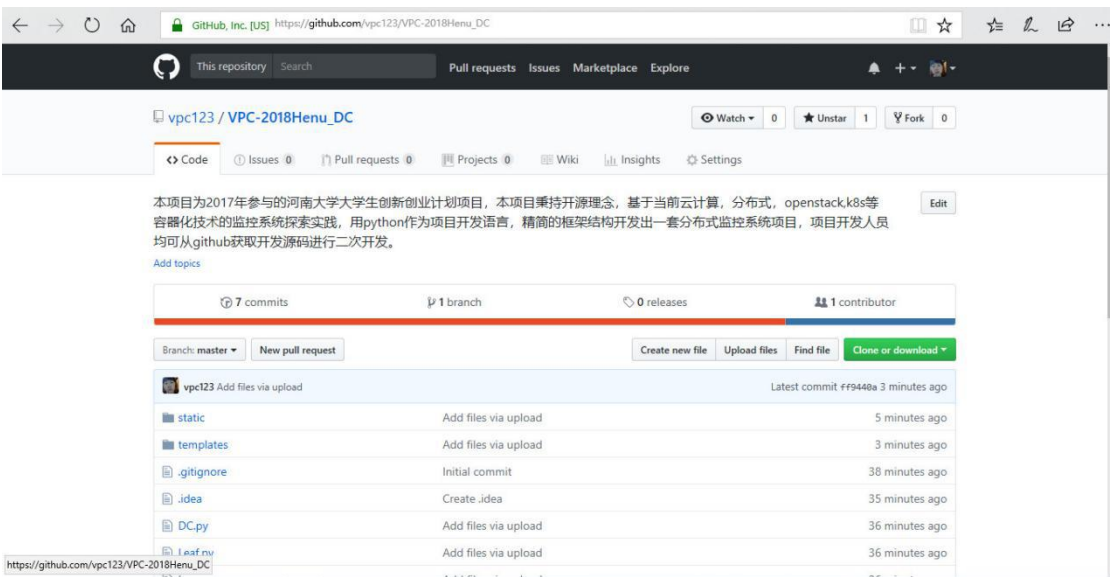
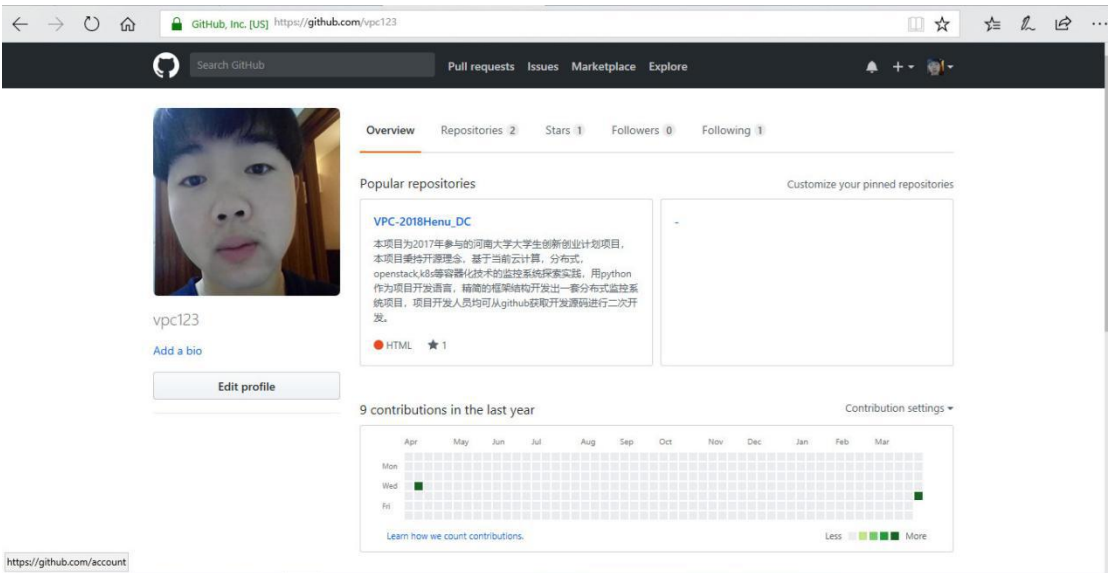
1 开发简介&代码结构

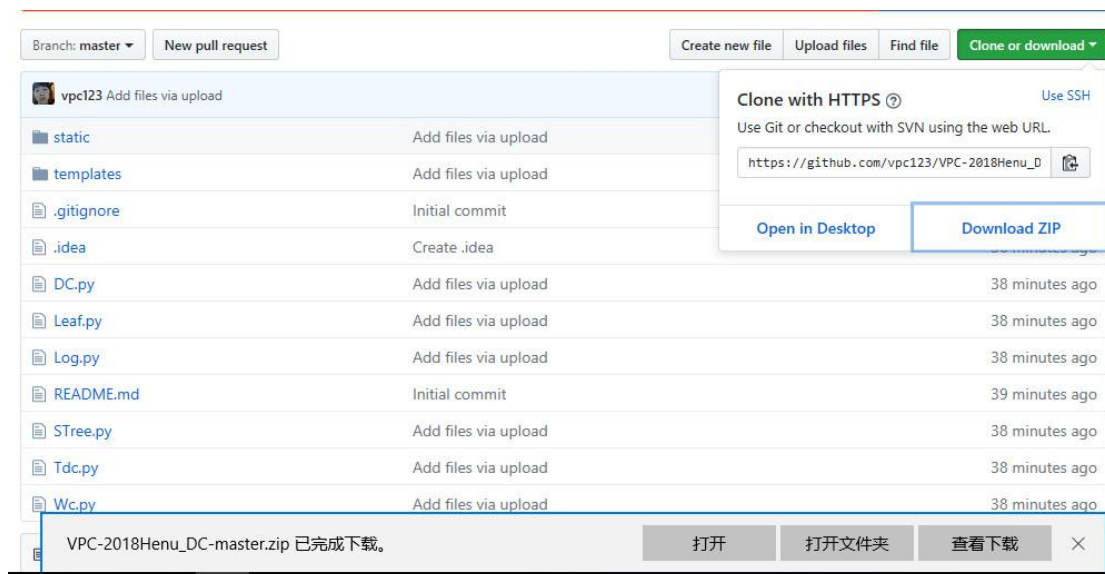
1.1 项目源码获取

1.1.1 github 获取

Github 地址:https://github.com/vpc123/VPC-2018Henu_DC.git

1.1.2 开源项目





1.2 开发语言与技术

软件代码开发结构：

开发语言：python

web 框架：tornado

前端技术：html,css,js,bootstrap,highcharts，Ajax

数据传送形式：mysql 数据存储，json 文件解析

其他技术：

- 1 网络通信（计算机网络通信）
- 2 分布式数据仓库存储
- 3 网络数据监控
- 4 大数据可视化
- 5 Ipv6 的 Api 应用接口

1.3 软件开发架构

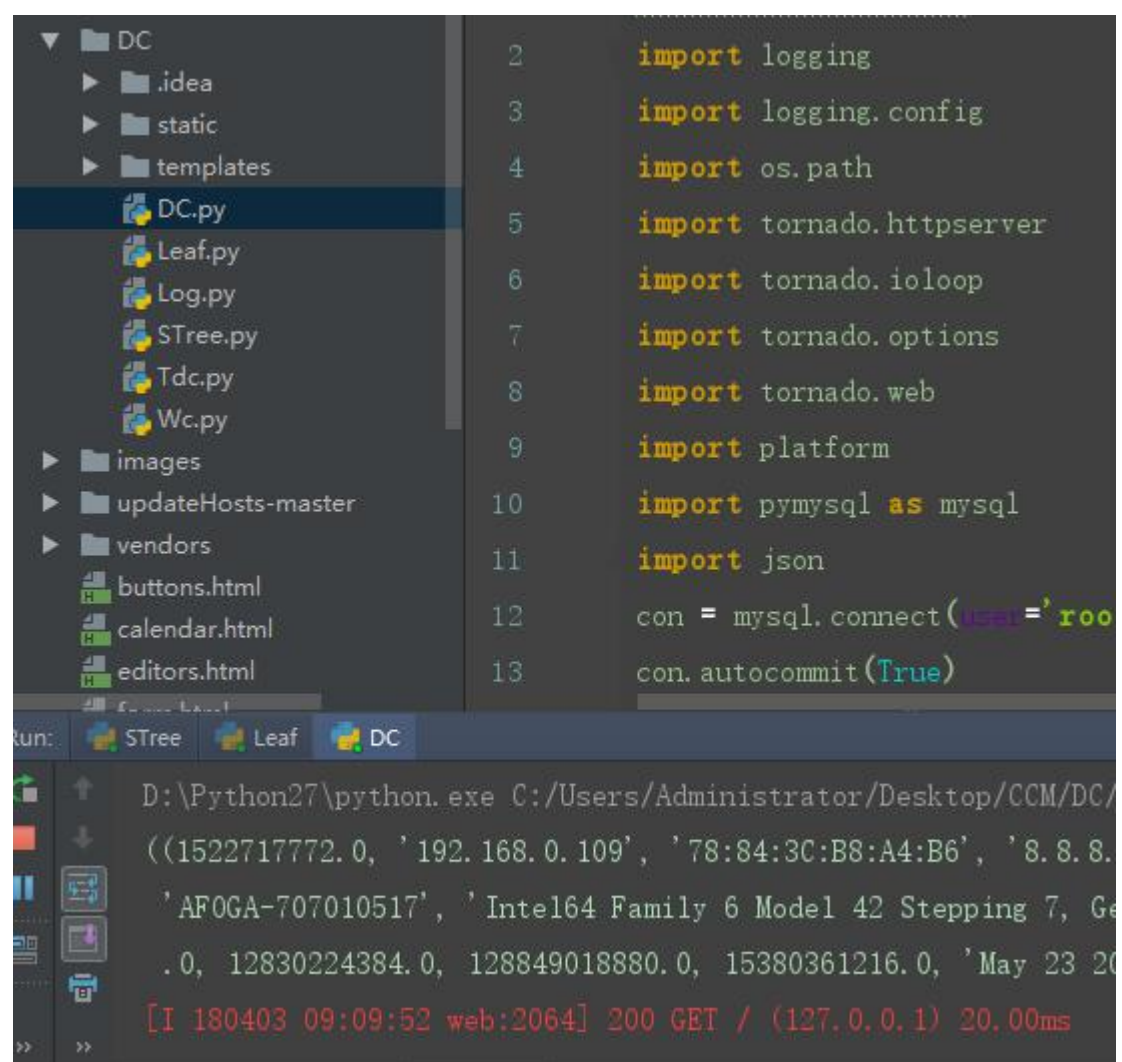
1.3.1 关键代码详解

DC.py:WEB 监控执行程序

Tree.py:集群系统数据收集端，进行监听存储节点发来的数据信息

Leaf.py:集群系统数据采集端，进行节点机器的信息数据采集工作，并发送到 master 端

1.3.1 代码开发结构图



The screenshot shows an IDE with a project structure on the left and code for DC.py on the right. The project structure includes a DC folder with subfolders .idea, static, and templates, and files DC.py, Leaf.py, Log.py, STree.py, Tdc.py, and Wc.py. Below these are folders images, updateHosts-master, and vendors, along with files buttons.html, calendar.html, and editors.html. The code for DC.py shows imports for logging, logging.config, os.path, tornado.httpserver, tornado.ioloop, tornado.options, tornado.web, platform, pymysql as mysql, and json. It also shows a database connection setup using pymysql.connect with user='root' and autocommit=True. The bottom of the screenshot shows a terminal window with a command prompt and a log message: [I 180403 09:09:52 web:2064] 200 GET / (127.0.0.1) 20.00ms.

```
2 import logging
3 import logging.config
4 import os.path
5 import tornado.httpserver
6 import tornado.ioloop
7 import tornado.options
8 import tornado.web
9 import platform
10 import pymysql as mysql
11 import json
12 con = mysql.connect(user='root')
13 con.autocommit(True)
```

Run: STree Leaf DC

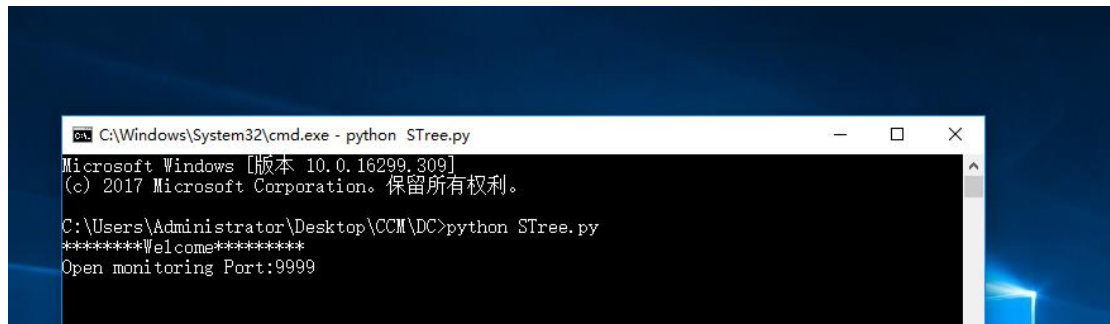
D:\Python27\python.exe C:/Users/Administrator/Desktop/CCM/DC/

((1522717772.0, '192.168.0.109', '78:84:3C:B8:A4:B6', '8.8.8.8', 'AF0GA-707010517', 'Intel64 Family 6 Model 42 Stepping 7, GenuineIntel', 0.0, 12830224384.0, 128849018880.0, 15380361216.0, 'May 23 2018', '180403 09:09:52 web:2064'] 200 GET / (127.0.0.1) 20.00ms

2 软件部署说明

2.1 Master 节点启动（windows10 监控）

分布式集群中 Windows10 开启数据服务 master 节点开始数据存储：



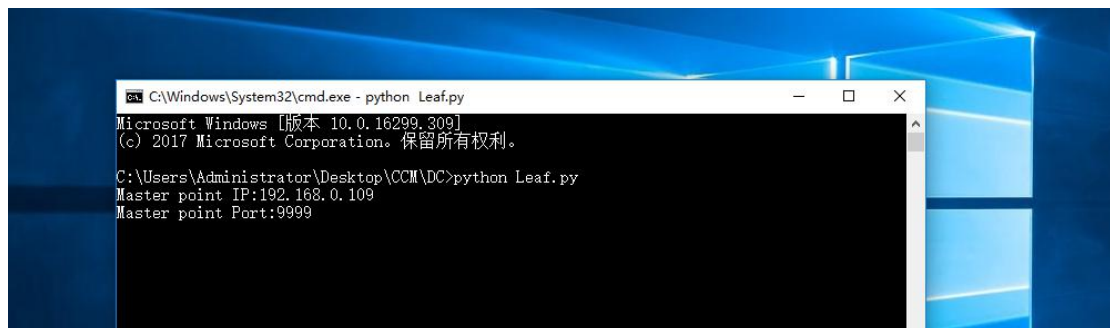
```
C:\Windows\System32\cmd.exe - python STree.py
Microsoft Windows [版本 10.0.16299.309]
(c) 2017 Microsoft Corporation. 保留所有权利。

C:\Users\Administrator\Desktop\CCM\DC>python STree.py
*****Welcome*****
Open monitoring Port:9999
```

2.2 Node 节点启动

2.2.1 windows10 版

分布式集群中 Windows10 开启数据采集监控节点：



```
C:\Windows\System32\cmd.exe - python Leaf.py
Microsoft Windows [版本 10.0.16299.309]
(c) 2017 Microsoft Corporation. 保留所有权利。

C:\Users\Administrator\Desktop\CCM\DC>python Leaf.py
Master point IP:192.168.0.109
Master point Port:9999
```

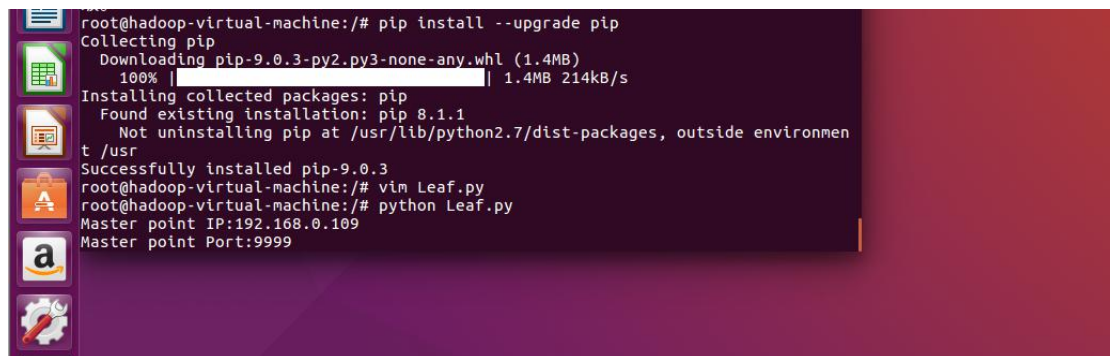
2.2.2 windows7 版

分布式集群中 Windows7 开启数据采集监控节点：



2.2.3 Linux(Ubuntu 版)

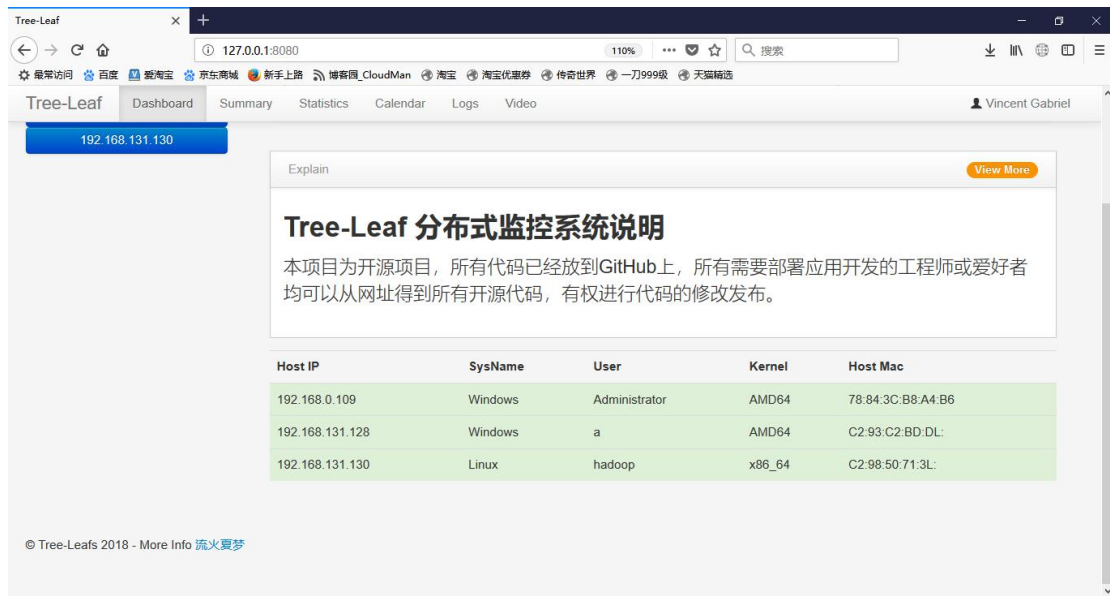
分布式集群中 ubuntu16.0.4 开启数据采集监控节点：



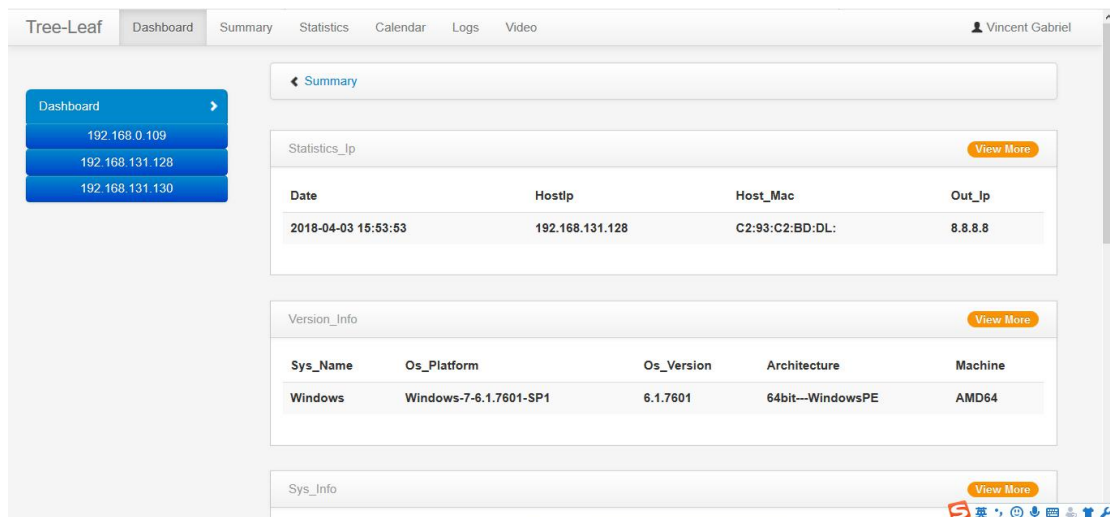
3 前端页面展示

3.1 Web UI(Tree-Leaf)前端监控页面：

3.1.1 首页（Dashboard）



3.1.2 Summary



Tree-Leaf

127.0.0.1:8080/Summary

110%

搜索

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[新手上路](#)
[博客园](#)
[CloudMan](#)
[淘宝](#)
[淘宝优惠券](#)
[传奇世界](#)
[一刀999级](#)
[天猫精选](#)

Tree-Leaf

Dashboard

Summary

Statistics

Calendar

Logs

Video

Vincent Gabriel

Version_Info

View More

Sys_Name	Os_Platform	Os_Version	Architecture	Machine
Windows	Windows-7-6.1.7601-SP1	6.1.7601	64bit---WindowsPE	AMD64

Sys_Info

View More

Pc_Name	Node	Processor	Login_Name	Terminal
a-PC.localdomain	a-PC	Intel64 Family 6 Model 42 Stepping 7, GenuineIntel	a	None

Cpu_Info

View More

Login_Name	Cpu_Times_User	Cpu_CountP	Cpu_CountL	Boot_Time
a	26.0	1	1	1522738818.0

3.1.3 Statistics 页面

Tree-Leaf

127.0.0.1:8080/Statistics

110%

搜索

[最常访问](#)
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[一刀999级](#)
[天猫精选](#)

Tree-Leaf

Dashboard

Summary

Statistics

Calendar

Logs

Video

Vincent Gabriel

Dashboard

192.168.0.109

192.168.131.128

192.168.131.130

< Statistics

总览

Cpu

Memory

Swap

Disk

Write&Read

Disk

View More

IP	Mac	Disk Used	Disk Free	Disk Present
192.168.0.109	78:84:3C:B8:A4:B6	98.6163482666G	21.3836517334G	82.0%

Memory

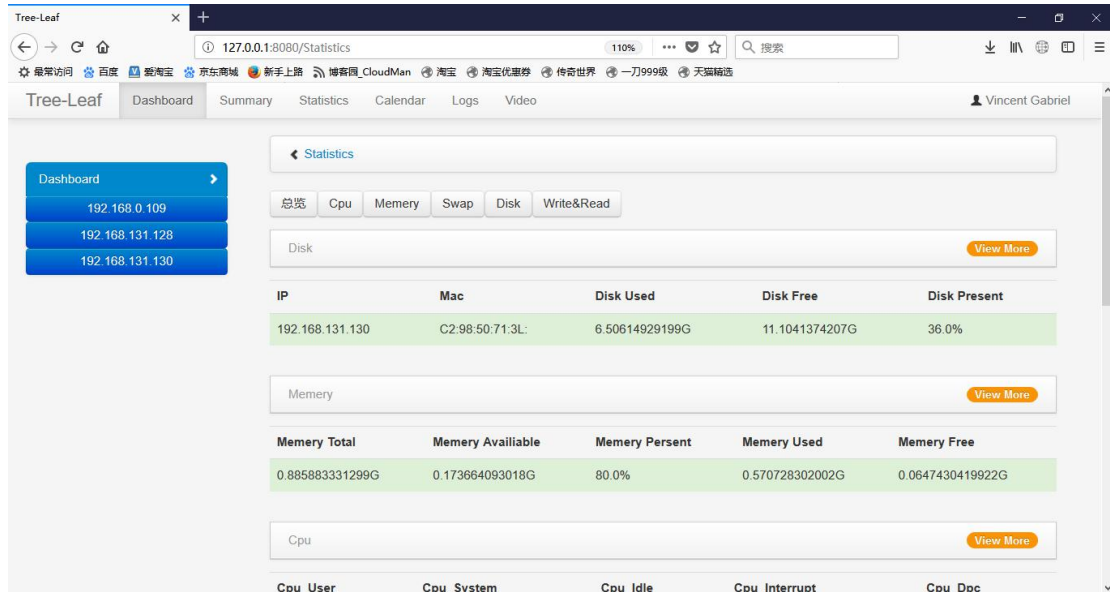
View More

Memory Total	Memory Available	Memory Percent	Memory Used	Memory Free
11.9490776062G	5.84911346436G	51.0%	6.09996414185G	5.84911346436G

Cpu

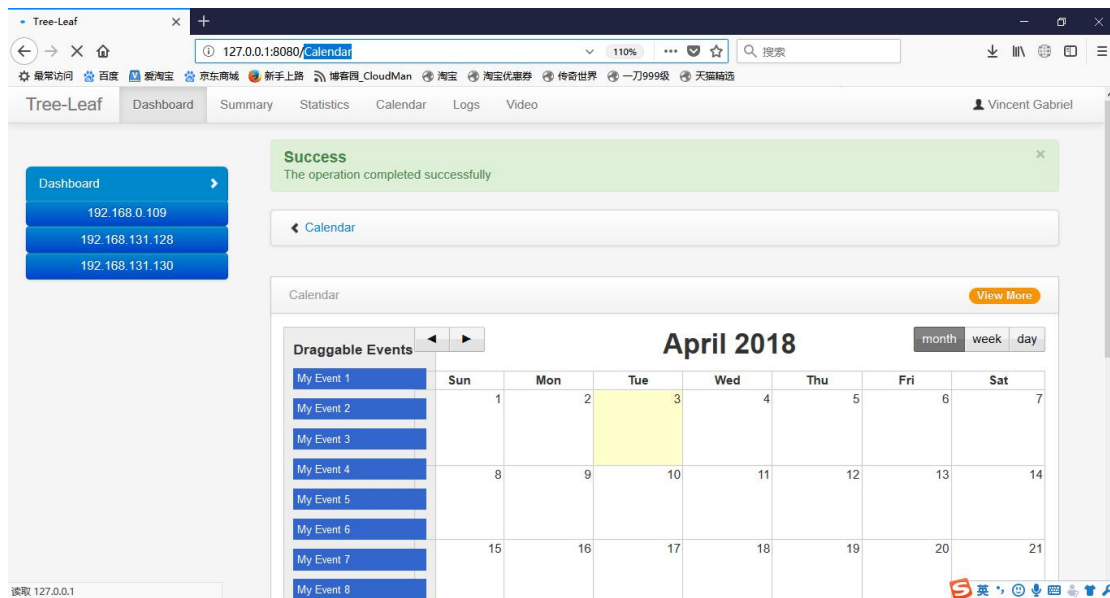
View More

Cpu_User	Cpu_System	Cpu_Idle	Cpu_Interrupt	Cpu_Dpc
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3.1.4 Calendar 页面信息

作用：用于突发日志记录



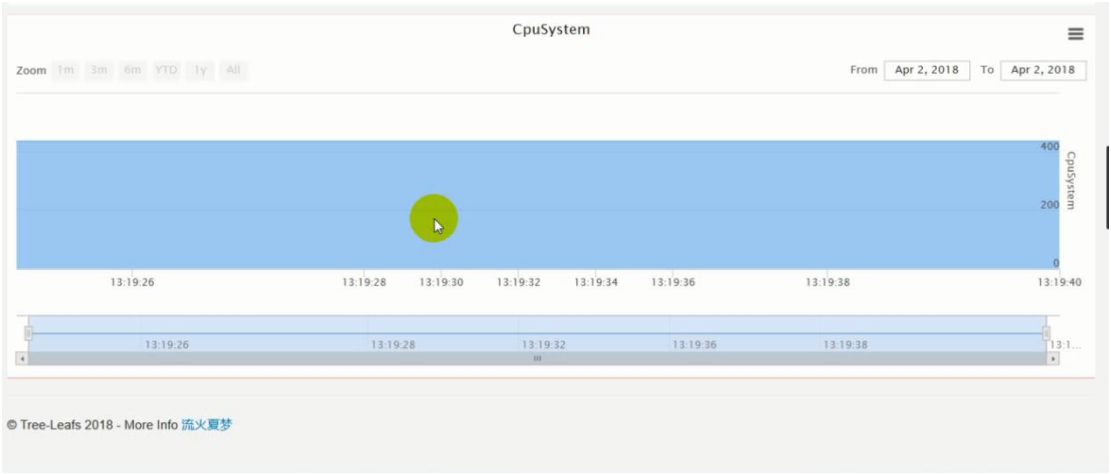
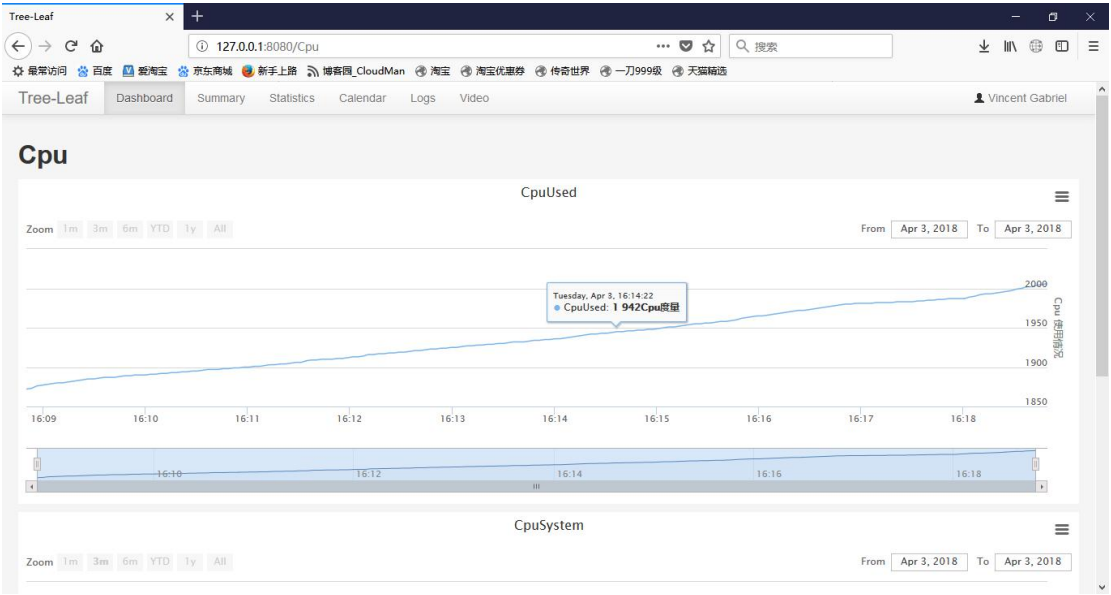
3.2 节点信息数据展示

特别说明：对于某些监测，为了方便数据的可读性，采用了不同的展示形式来突出其变化特征。（由于使用手册展示的局限性，可视化的多样性并未全面展示。）

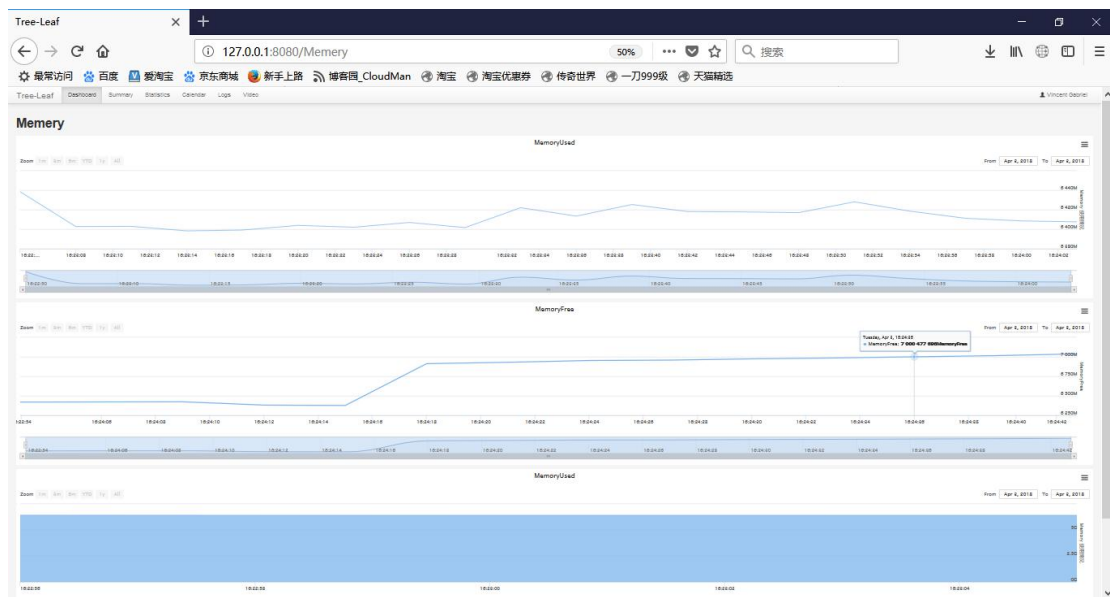
可视化展示涉及：面积图，曲线图，饼图，折线图等多种展示效果。

下图展示数据均是实时显示。

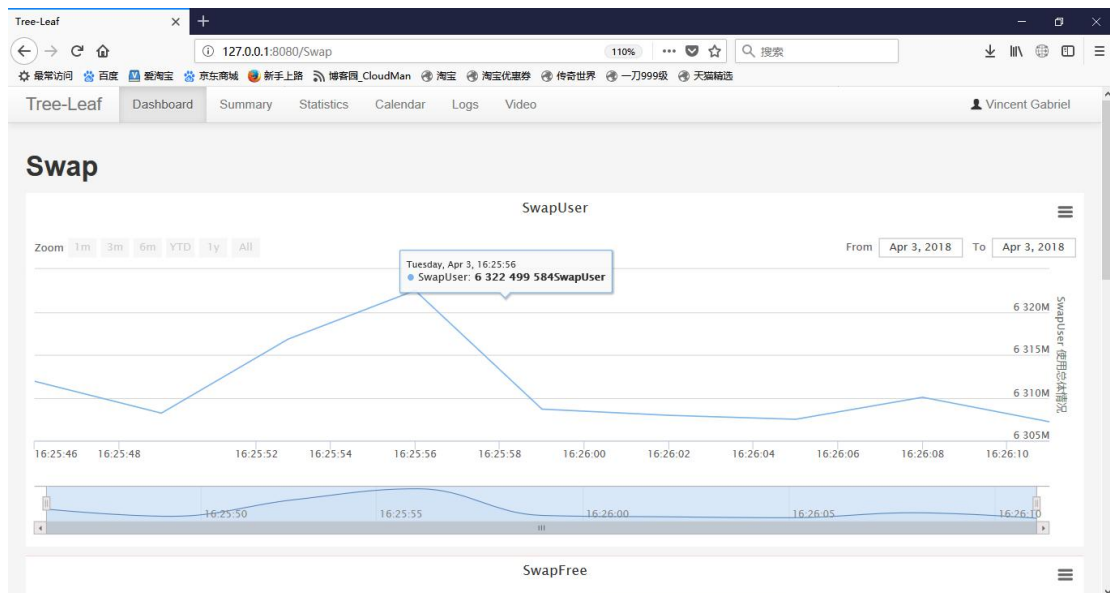
3.2.1 Cpu 数据动态加载



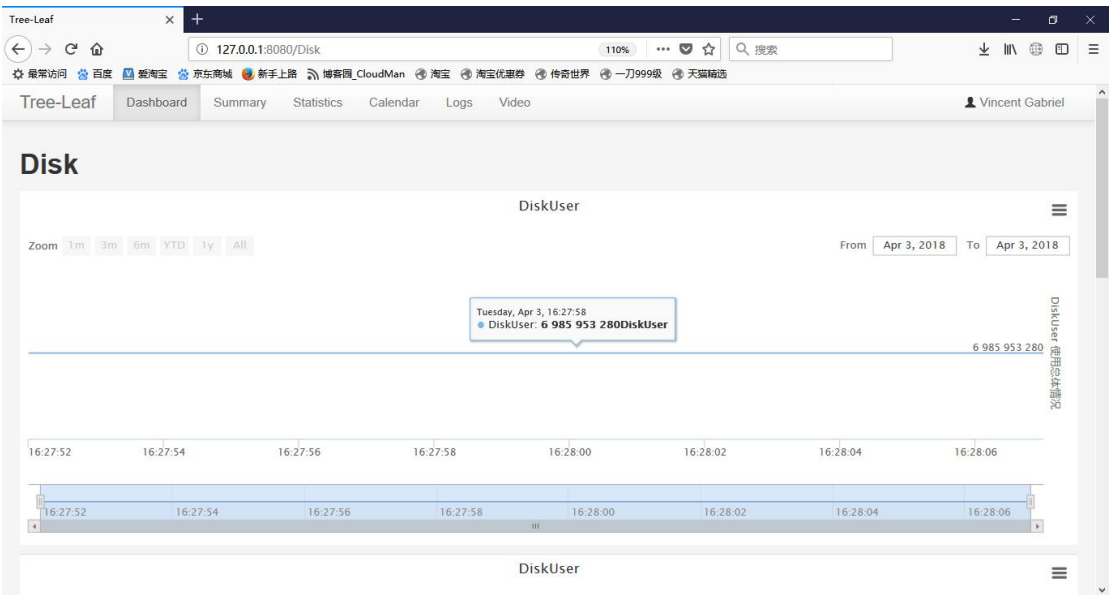
3.2.2 Memory 数据动态加载



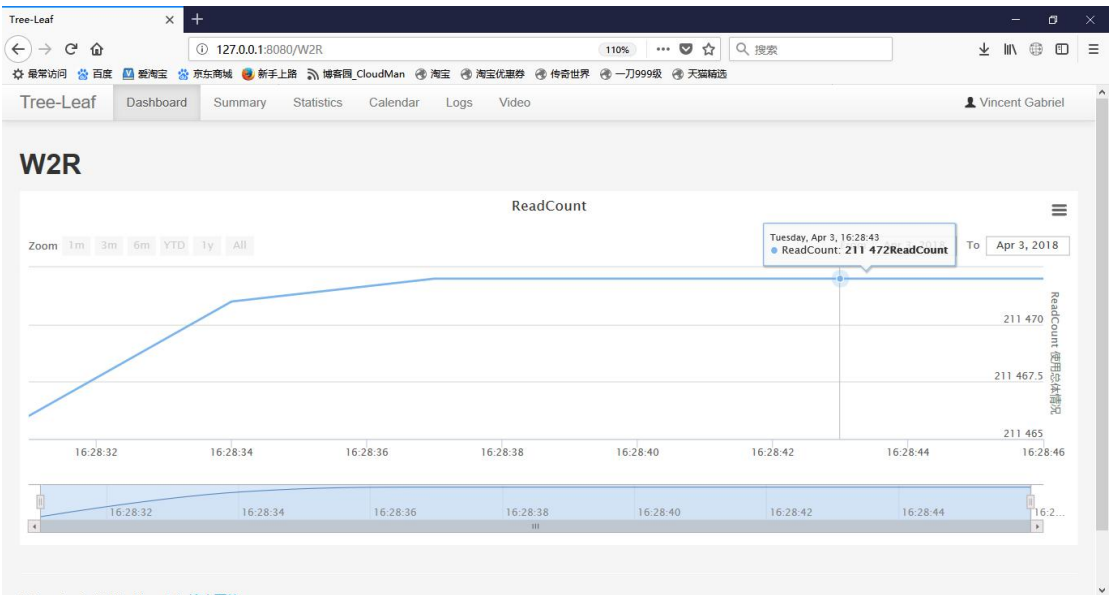
3.2.3 Swap 数据动态加载



3.2.4 Disk 数据动态加载

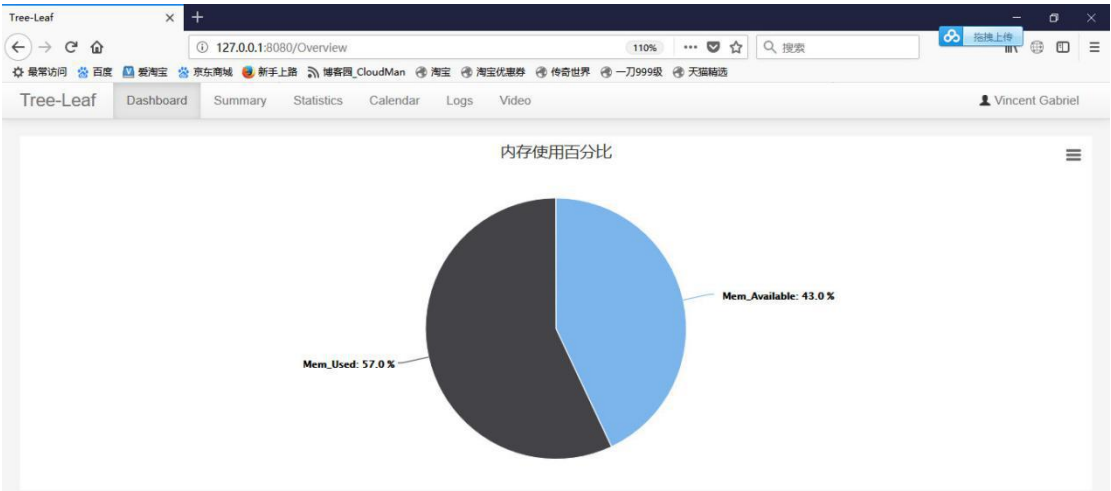


3.2.5 网络流量数据动态加载



系统能耗数据展示

系统运行参数变化（内存）



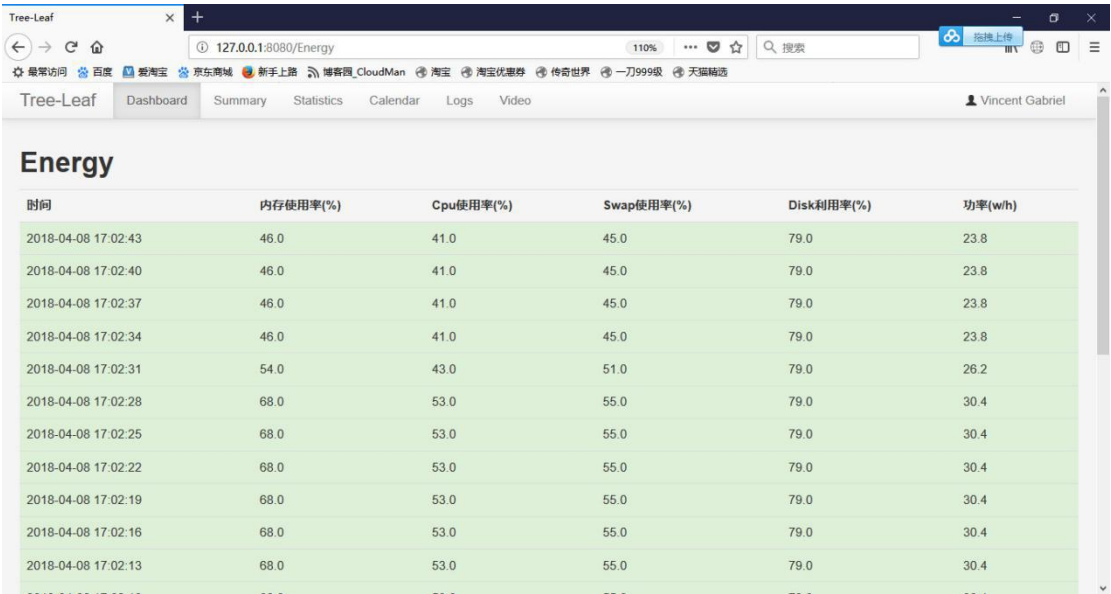
能耗波动变化估值表格展示

1 当系统运行大型消耗资源应用时（能耗波动）

A screenshot of a web browser window titled "Tree-Leaf" at the URL "127.0.0.1:8080/Energy". The browser shows a table of energy consumption data. The table has 6 columns: "Time", "CPU", "Memory", "Disk", "Network", and "Power". The data is recorded from 2018-04-08 16:59:20 to 2018-04-08 16:58:50. The table is displayed within a web browser window titled "Tree-Leaf" at the URL "127.0.0.1:8080/Energy". The browser's address bar shows the URL and a search bar. The page has a navigation bar with tabs: "Tree-Leaf", "Dashboard", "Summary", "Statistics", "Calendar", "Logs", and "Video". The user "Vincent Gabriel" is logged in.

Time	CPU	Memory	Disk	Network	Power
2018-04-08 16:59:20	63.0	51.0	52.0	79.0	28.9
2018-04-08 16:59:17	62.0	51.0	51.0	79.0	28.6
2018-04-08 16:59:14	62.0	51.0	51.0	79.0	28.6
2018-04-08 16:59:11	62.0	51.0	51.0	79.0	28.6
2018-04-08 16:59:08	62.0	51.0	51.0	79.0	28.6
2018-04-08 16:59:05	62.0	51.0	51.0	79.0	28.6
2018-04-08 16:59:02	62.0	52.0	50.0	79.0	28.6
2018-04-08 16:58:59	58.0	48.0	50.0	79.0	27.4
2018-04-08 16:58:56	52.0	44.0	48.0	79.0	25.6
2018-04-08 16:58:53	49.0	42.0	47.0	79.0	24.7
2018-04-08 16:58:50	48.0	41.0	47.0	79.0	24.4

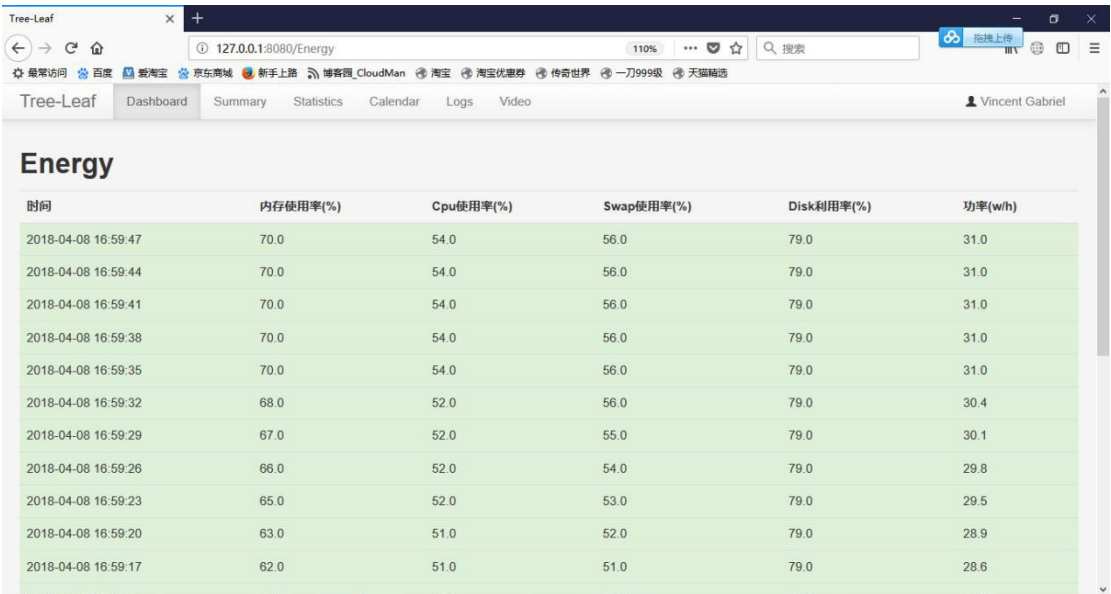
2 当系统取消大型资源消耗应用时（能耗波动）



The screenshot shows the 'Energy' section of the Tree-Leaf dashboard. The table displays resource usage metrics over time. As the large application is canceled, the power consumption (功率(w/h)) drops from 26.2 to 23.8.

时间	内存使用率(%)	Cpu使用率(%)	Swap使用率(%)	Disk利用率(%)	功率(w/h)
2018-04-08 17:02:43	46.0	41.0	45.0	79.0	23.8
2018-04-08 17:02:40	46.0	41.0	45.0	79.0	23.8
2018-04-08 17:02:37	46.0	41.0	45.0	79.0	23.8
2018-04-08 17:02:34	46.0	41.0	45.0	79.0	23.8
2018-04-08 17:02:31	54.0	43.0	51.0	79.0	26.2
2018-04-08 17:02:28	68.0	53.0	55.0	79.0	30.4
2018-04-08 17:02:25	68.0	53.0	55.0	79.0	30.4
2018-04-08 17:02:22	68.0	53.0	55.0	79.0	30.4
2018-04-08 17:02:19	68.0	53.0	55.0	79.0	30.4
2018-04-08 17:02:16	68.0	53.0	55.0	79.0	30.4
2018-04-08 17:02:13	68.0	53.0	55.0	79.0	30.4

3 系统稳定运行大型资源消耗应用时（能耗波动）



The screenshot shows the 'Energy' section of the Tree-Leaf dashboard. The table displays resource usage metrics over time. During the stable operation of a large application, the power consumption (功率(w/h)) decreases from 31.0 to 28.6.

时间	内存使用率(%)	Cpu使用率(%)	Swap使用率(%)	Disk利用率(%)	功率(w/h)
2018-04-08 16:59:47	70.0	54.0	56.0	79.0	31.0
2018-04-08 16:59:44	70.0	54.0	56.0	79.0	31.0
2018-04-08 16:59:41	70.0	54.0	56.0	79.0	31.0
2018-04-08 16:59:38	70.0	54.0	56.0	79.0	31.0
2018-04-08 16:59:35	70.0	54.0	56.0	79.0	31.0
2018-04-08 16:59:32	68.0	52.0	56.0	79.0	30.4
2018-04-08 16:59:29	67.0	52.0	55.0	79.0	30.1
2018-04-08 16:59:26	66.0	52.0	54.0	79.0	29.8
2018-04-08 16:59:23	65.0	52.0	53.0	79.0	29.5
2018-04-08 16:59:20	63.0	51.0	52.0	79.0	28.9
2018-04-08 16:59:17	62.0	51.0	51.0	79.0	28.6

能耗测试仪根据系统波动采集到的实时变化能耗数据



