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分布式爬虫

大纲

- 分布式系统概述
- 主从服务设计

分布式系统

Deduce of Distributed System - I

- A *program*

  is the code you write.

- A *process*

  is what you get when you run it.

- A *message*

  is used to communicate between processes.

- A *packet*

  is a fragment of a message that might travel on a wire.

- A *protocol*

  is a formal description of message formats and the rules that two processes must follow in order to exchange those messages.

Distributed System - II

- A *network*

  is the infrastructure that links computers, workstations, terminals, servers, etc. It consists of routers which are connected by communication links.

- A *component*

  can be a process or any piece of hardware required to run a process, support communications between processes, store data, etc.

- A *distributed system*

  is an application that executes a collection of protocols to coordinate the actions of multiple processes on a network, such that all components cooperate together to perform a single or small set of related tasks.

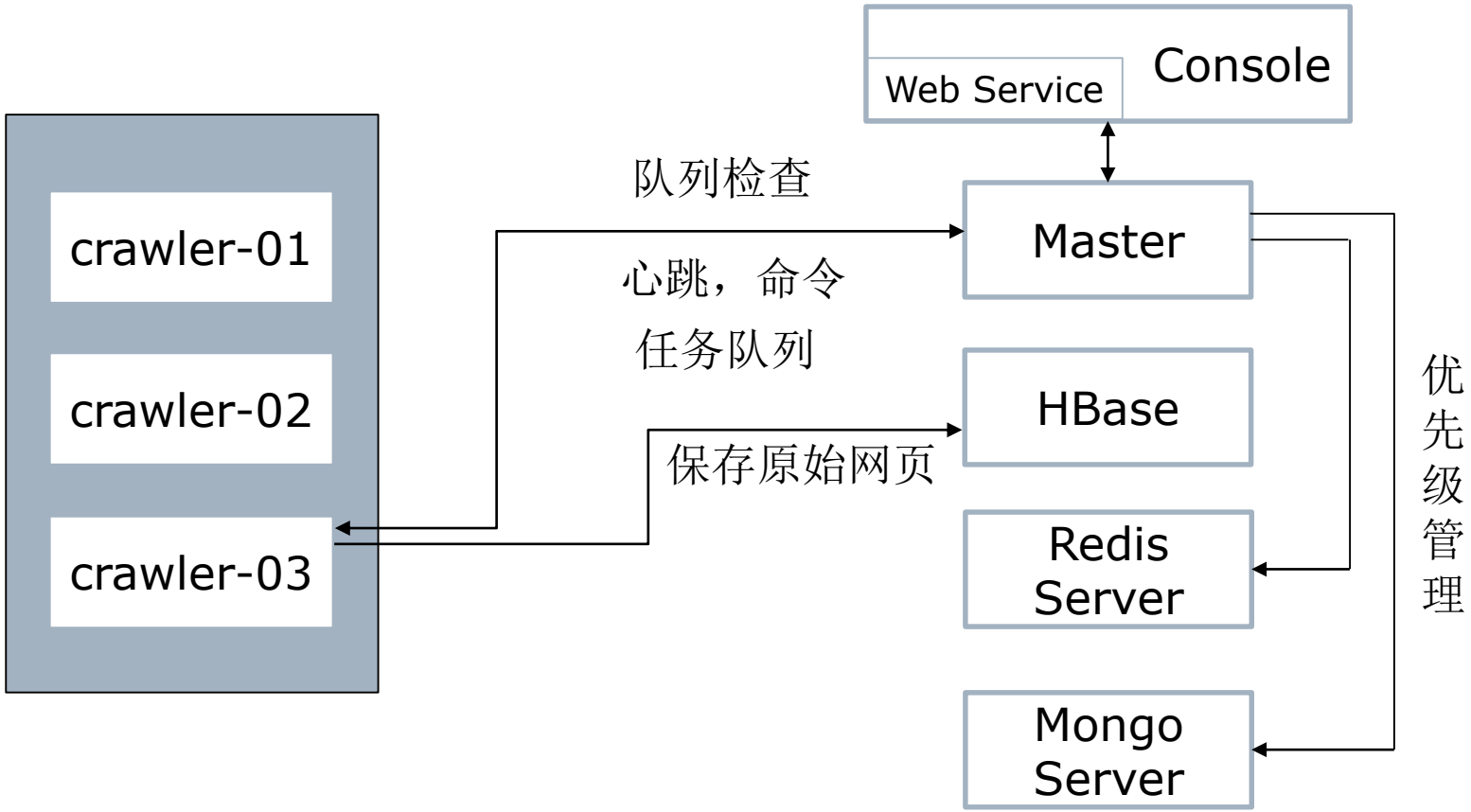
Advantage

- Fault-Tolerant: It can recover from component failures without performing incorrect actions.
- Highly Available: It can restore operations, permitting it to resume providing services even when some components have failed.
- Recoverable: Failed components can restart themselves and rejoin the system, after the cause of failure has been repaired.
- Consistent: The system can coordinate actions by multiple components often in the presence of concurrency and failure. This underlies the ability of a distributed system to act like a non-distributed system.
- Scalable: It can operate correctly even as some aspect of the system is scaled to a larger size.
- Predictable Performance: The ability to provide desired responsiveness in a timely manner.
- Secure: The system authenticates access to data and services

Challenge

- Replications and migration cause need for ensuring consistency and distributed decision-making
- Failure modes: Not assuming data received is same as sent
- Concurrency: Update/Replication/Cache/Failure …
- Heterogeneity: Network, hardware, OS, languages, developers
- Scalability: Architecture must be able to handle increase of users, resources, etc. Considering cost of physical resources, performance loss, bottleneck
- Security

分布式爬虫系统


Console
Web Service
队列检查
心跳，命令
任务队列
Master
crawler-01
crawler-02
crawler-03
HBase
保存原始网页
Redis
Server
Mongo
Server
优先级管理

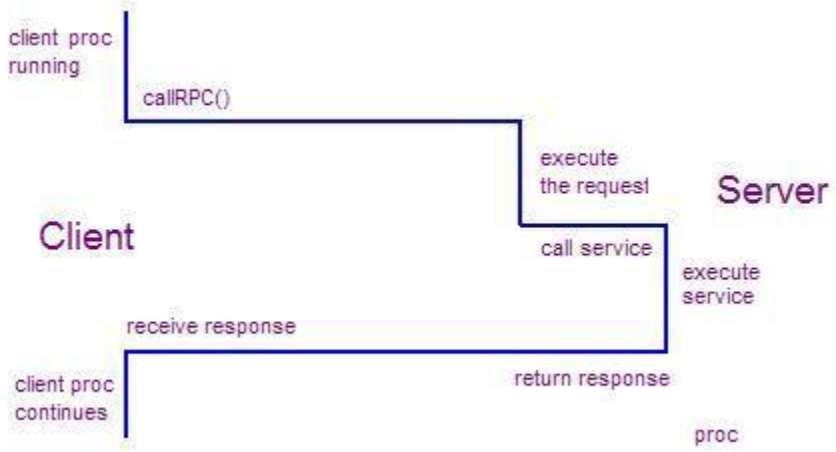
Master-Slave 结构

Master-Slave 结构

- 有一个主机，对所有的服务器进行管理。绝大多数分布式系统，都是 Master-Slave 的主从模式。而之前我们的爬虫，是完全独立的，依次从url队列里获取url，进行抓取
- 当爬虫服务器多的时候，必须能通过一个中心节点对从节点进行管理
- 能对整体的爬取进行控制
- 爬虫之间信息共享的桥梁
- 负载控制

Remote Procedure Calls

- Specifies the protocol for client-server communication
- Develops the client program
- Develops the server program



Protocol – Message Type

```
# message type, REGISTER, UNREGISTER and HEARTBEAT
MSG_TYPE        = 'TYPE’
# send register
REGISTER        = 'REGISTER’
# unregister client with id assigned by master
UNREGISTER      = 'UNREGISTER’
# send heart beat to server with id
HEARTBEAT       = 'HEARTBEAT’
# notify master paused with id
PAUSED          = 'PAUSED’
# notify master resumed with id
RESUMED         = 'RESUMED’
# notify master resumed with id
SHUTDOWN        = 'SHUTDOWN’
```

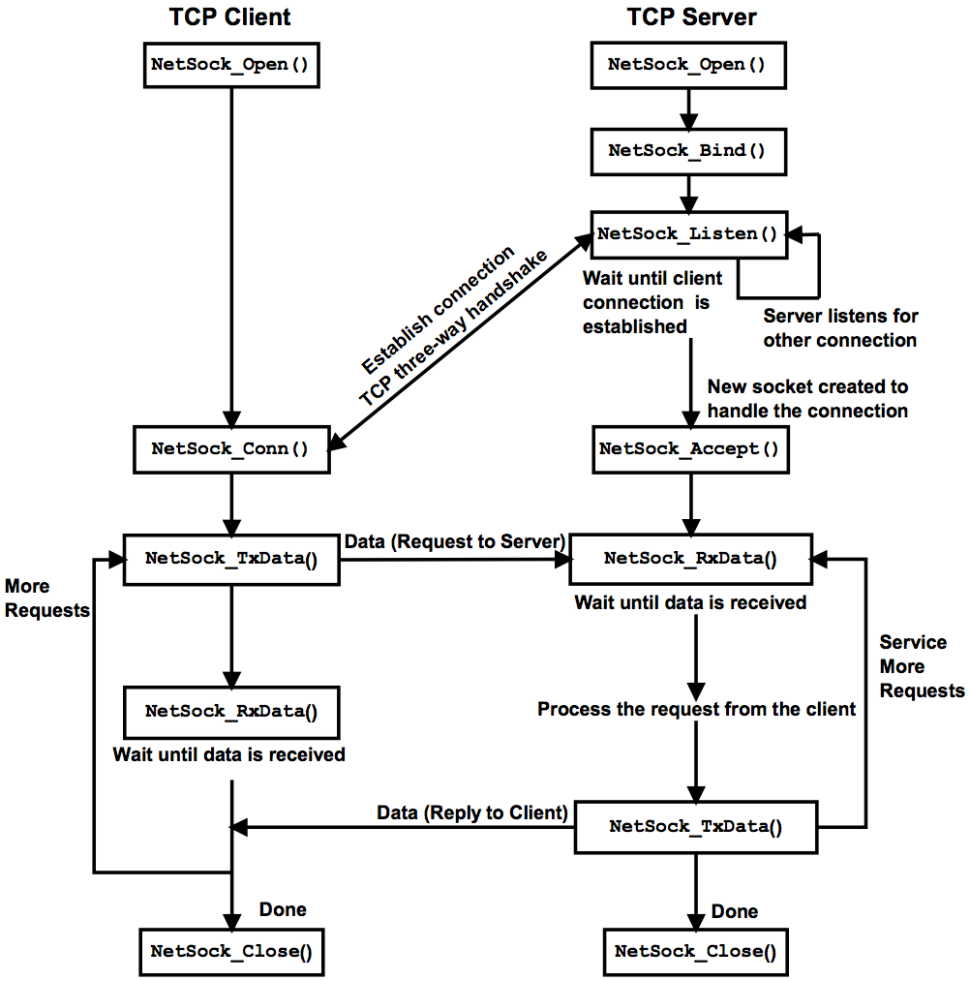
Protocol - Actions

```
# server status key word
ACTION_REQUIRED      = 'ACTION_REQUIRED’
# server require pause
PAUSE_REQUIRED       = ‘PAUSE_REQUIRED’
# server require pause
RESUME_REQUIRED      = 'RESUME_REQUIRED’
# server require shutdown
SHUTDOWN_REQUIRED          = 'SHUTDOWN_REQUIRED'
```

Protocol – Key Definition

```
# server status key word
SERVER_STATUS          = SERVER_STATUS
# client id key word
CLIENT_ID              = 'CLIENT_ID'
# error key work
ERROR                  = ERROR'
```

Socket


TCP Client
TCP Server
NetSock_Open()
NetSock_Open()
NetSock_Bind()
NetSock_Listen()
Wait until client connection is established
Server listens for other connection
Establish connection TCP three-way handshake
New socket created to handle the connection
NetSock_Conn()
NetSock_Accept()
NetSock_TxData()
Data (Request to Server)
NetSock_RxData()
More Requests
Wait until data is received
Service More Requests
NetSock_RxData()
Process the request from the client
Wait until data is received
Data (Reply to Client)
NetSock_TxData()
Done
Done
NetSock_Close()
NetSock_Close()

Create Client Socket

```
#create an INET, STREAMing socket
s = socket.create_connection( socket.AF_INET,
                                        socket.SOCK_STREAM)
```

AF_INET -- IPv4 Internet protocols

SOCK_STREAM, SOCK_DGRAM, SOCK_RAW -- socket types (SOCK_STREAM TCP, SOCK_DGRAM UDP)

Create Server Socket

```
#create an INET, STREAMing socket
serversocket = socket.socket( socket.AF_INET,
                              socket.SOCK_STREAM)
#bind the socket to a public host, and a well-known port
serversocket.bind((socket.gethostname(), 20010))
#become a server socket
serversocket.listen(5)
```

listen(backlog) -- number of unaccepted connections that the system will allow before refusing new connections, at least 0

Create Server Socket

```
while True:
        #accept connections from outside
        (clientsocket, address) = serversocket.accept()
        #now do something with the clientsocket
        #in this case, we'll pretend this is a threaded
        server ct = client_thread(clientsocket)
        ct.run()
```

Ways to listen

- a new thread to handle clientsocket
- a new process
- use non-blocking socket

Non-blocking mode listening

- connection.setblocking(False),

  send, recv, connect and accept returns immediately

  connection.setblocking(False) is equivalent to settimeout(0.0)

- asyncore

  Provides the basic infrastructure for writing asynchronous

  socket service clients and servers.

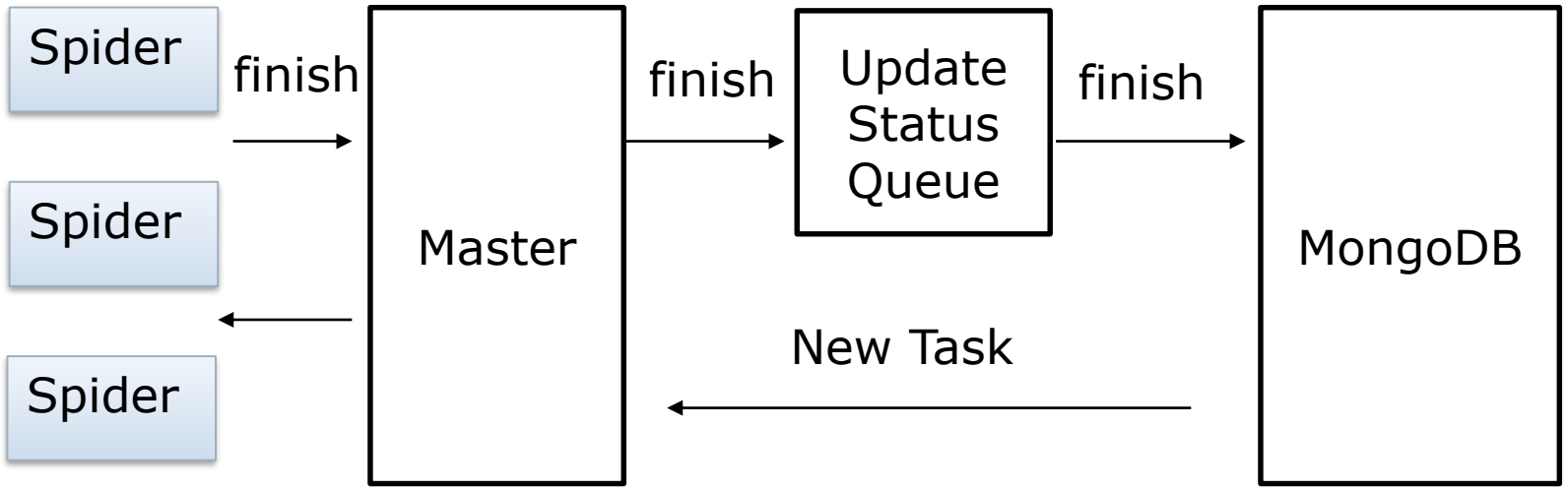
Event	Description
handle_connect()	Implied by the first read or write event
handle_close()	Implied by a read event with no data available
handle_accept()	Implied by a read event on a listening socket

Ways to end communication

- fixed length message: **while** totalsent < MSGLEN:
- delimited: some message**\0**
- indicates message length in beginning: LEN: 50;
- shutdown connection: server call close(), clietn recv() returns 0

串行化处理

为了防止数据库被过度访问，可以由前端统一管理任务队列，这时，可以在前端消息请求与数据库之间再建立一层任务队列，用于隔离一部分的数据更新操作



消息队列

消息队列用来解耦一些不需要同步调用的服务或者订阅一些通知以及系统的变化。

使用消息队列可以实现服务解耦、异步处理、流量缓冲等。案例：

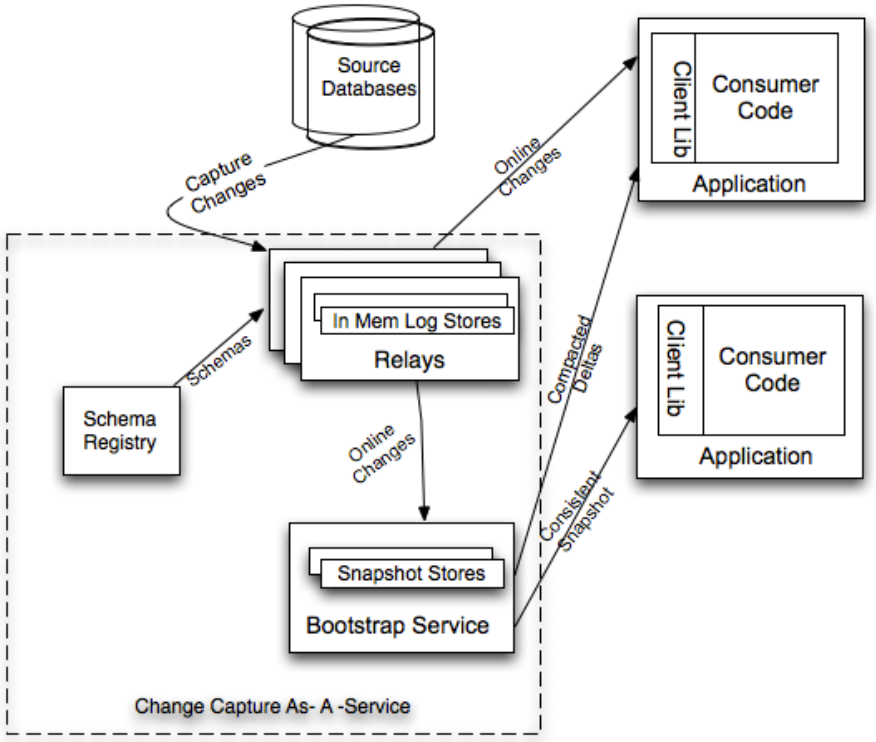
日志系统：日志系统一般是同步的，本身会有一个缓冲区，缓冲区满的时候再写入到磁盘。高峰期，log 系统写磁盘的时候会造成线程的阻塞，可以通过消息发送给logger，由logger来处理

数据同步：降MySQL的数据变更同步到 Redis 里，可以使用消息队列，例如 linkedin 发布的 databus 方案，根据日志系统，依次对数据进行同步操作

任务队列：对于爬虫，抓取状态的更新不需要原子性操作，所以可以通过消息队列，把更新的任务放到独立的队列里，依次完成对爬取状态的更新，使得爬虫状态更新的线程可以快速返回

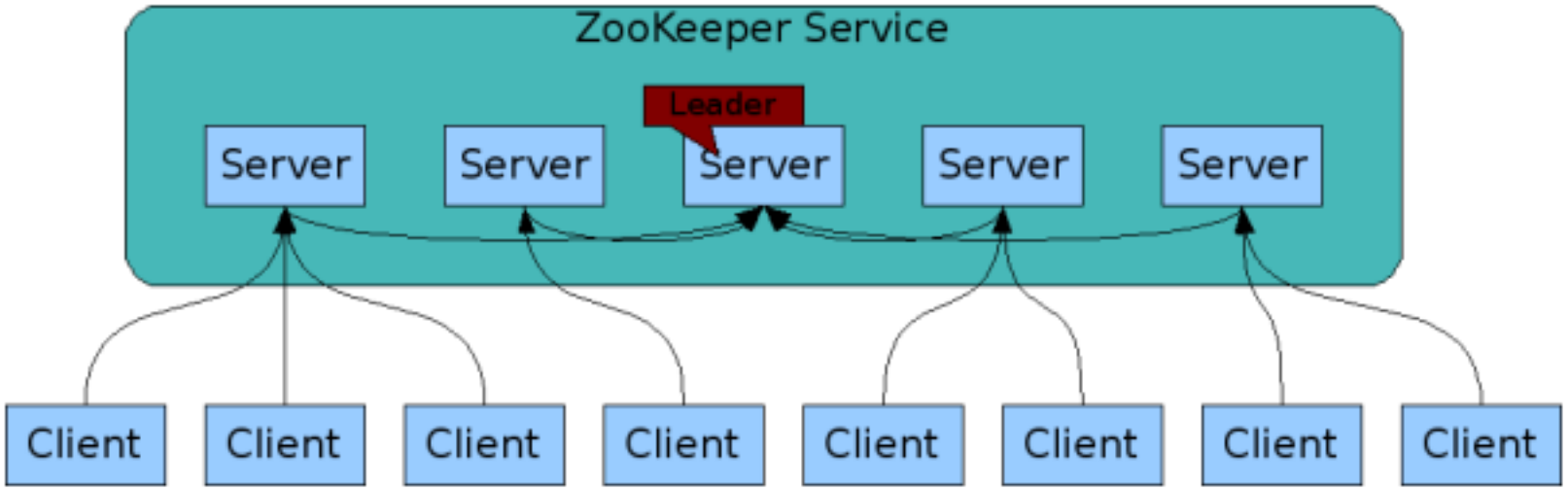
MySQL 与 Redis 的同步

我们可以通过 databus 来实现 MySQL 数据与 Redis 的更新操作，把 MySQL 的数据变化同步到 Redis



容灾处理

在集群环境下，当 Master 的服务宕机的时候，我们需要有备份的Master能自动接替Master的工作，在这里可以使用 ZooKeeper 来配置自动化的集群注册和管理



疑问

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联系我们

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