Ubisense

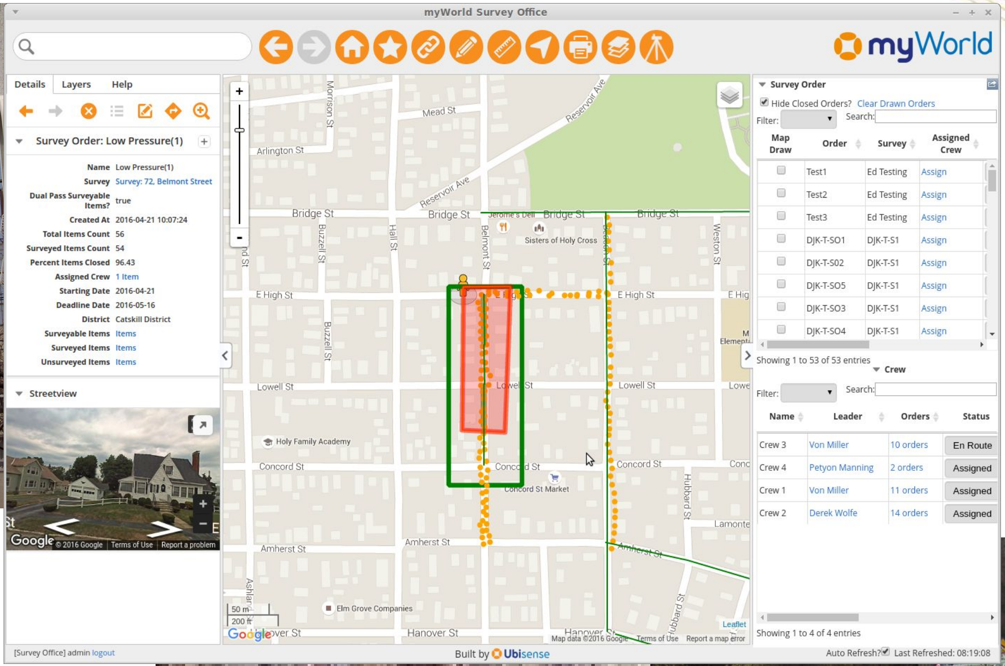
Enterprise Location Intelligence

GeoServer Clustering Revisited

Getting Your Docker On

Derek Kern - Ubisense, Inc

We use GeoServer a lot



myWorld Survey Office

Survey Order: Low Pressure(1)

Name	Low Pressure(1)
Survey	Survey: 72, Belmont Street
Dual Pass Surveyable Items?	true
Created At	2016-04-21 10:07:24
Total Items Count	56
Surveyed Items Count	54
Percent Items Closed	96.43
Assigned Crew	1 Item
Starting Date	2016-04-21
Deadline Date	2016-05-16
District	Catskill District
Surveyable Items	Items
Surveyed Items	Items
Unsurveyed Items	Items

Survey Order

☑ Hide Closed Orders? Clear Drawn Orders

Filter: Search:

Map Draw	Order	Survey	Assigned Crew
□	Test1	Ed Testing	Assign
□	Test2	Ed Testing	Assign
□	Test3	Ed Testing	Assign
□	DJK-T-SO1	DJK-T-S1	Assign
□	DJK-T-S02	DJK-T-S1	Assign
□	DJK-T-SO5	DJK-T-S1	Assign
□	DJK-T-SO3	DJK-T-S1	Assign
□	DJK-T-SO4	DJK-T-S1	Assign

Showing 1 to 53 of 53 entries

Crew

Filter: Search:

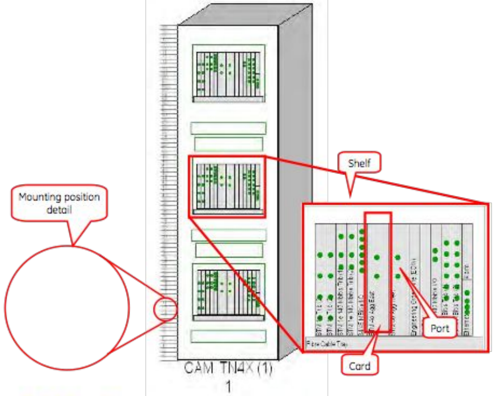
Name	Leader	Orders	Status
Crew 3	Von Miller	10 orders	En Route
Crew 4	Petyon Manning	2 orders	Assigned
Crew 1	Von Miller	11 orders	Assigned
Crew 2	Derek Wolfe	14 orders	Assigned

Showing 1 to 4 of 4 entries

[Survey Office] admin logout

Built by Ubisense

Auto Refresh? ☑ Last Refreshed: 08:19:08



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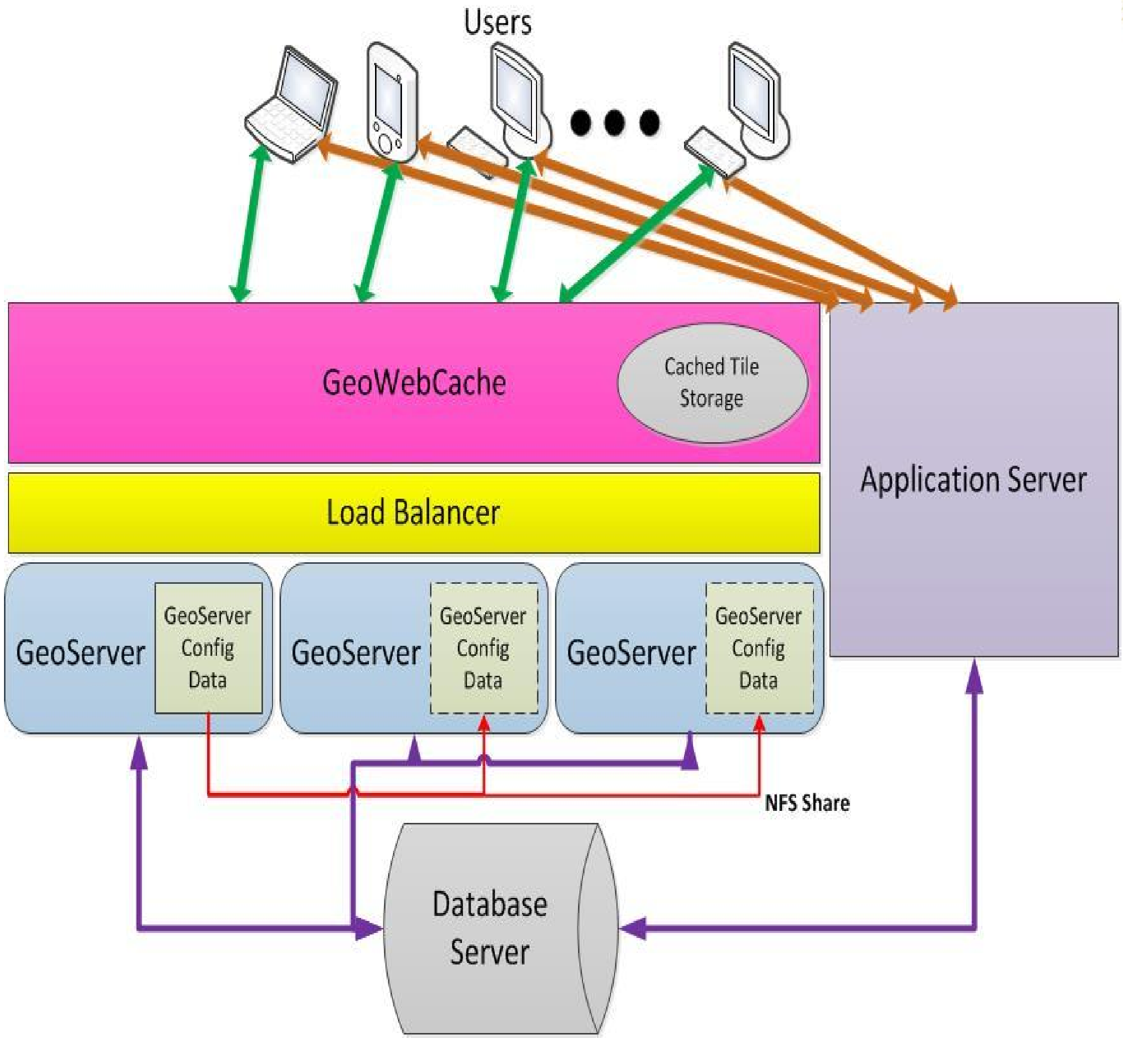
Quick Introduction

This talk is a follow up

- I gave a talk entitled **“High Performance Geoserver Clusters”** at **Foss4g NA 2016**
  - https://youtu.be/YvnM2MXrlng
- The talk concerned the reasoning / processes involved in scaling and clustering GeoServer / GeoWebCache
- We walked through a number of different cluster designs, until most of the design challenges had been accounted for
- This talk shouldn’t have been revelatory. Rather, it followed naturally from the process of addressing the issues that come with clustering GeoServer / GeoWebCache

Final architecture from last year



Final architecture from last year

- This architecture has a single, unified GeoWebCache instance in front the GeoServer instances. It is responsible for caching tiles. Most often, the GeoServer instances are tile generators
- GeoWebCache uses the load balancer to determine which GeoServer instance will generate the next needed tile
- This architecture can exploit the maximum amount of tiling capacity from the GeoServer instances
    - I want to amend this statement →It squeezes the most out of the GeoServer instances, but not necessarily the hardware

Final architecture from last year

- This architecture had two minor problems
  - GeoWebCache has its own configuration data that must be maintained. Furthermore, this configuration data is dependent upon the configuration of the GeoServer instances
  - A GeoWebCache layer cache must be cleared whenever the associated GeoServer layer undergoes a configuration data change
  - **Both of these problems were managed using scripts**

Considerations from last year

1. At least one GeoWebCache server is needed so that tiles can be cached and managed. Unified is best
2. A load balancer needs to be in front of GeoServer instances. This load balancer is used by GeoWebCache to determine which GeoServer will fulfill a tile request. It can also be used to service dynamic requests from clients
3. An approach is needed so that GeoServer / GeoWebCache configuration data can be easily managed

*** Keep these in mind**

What this talk is about

- I wanted to transition the final architecture from last year onto Docker and Docker Swarm. How easy/difficult would it be to transition?
- We will walk through a brief comparison of the two architectures
- We will examine a new Docker-based architecture through the prism of the considerations from last year
- We will also see some benchmark data generated using the Docker-Swarm-based architecture

Docker and Swarm Intro-blurbs

Docker in a small nutshell

- Docker is a very lightweight, containerization technology. Containers do not require hypervisors in that they run directly on the host operating system kernel
- It provides the ability to package applications, and all required prerequisites, into containers that can be executed in isolation from the host operating system
- Many containers can be (and typically are) run simultaneously on a single host
- Overall, the container model offers freedom from the complexity of (1) blending applications within a single OS and (2) fully utilizing available hardware

Docker Swarm in a small nutshell

- Docker Swarm is used to create and manage clusters of Docker containers. Kubernetes is an alternative
- Swarm 'X' consists of the compute nodes that have joined 'X'
  - docker swarm init ← Initialize the swarm
  - docker swarm join ← A node joins the swarm
- Once a swarm is constituted, services are defined to run within the swarm
  - docker service create ← Create a service
    - Minimally, provide a service name, image, and replica count (i.e. number of containers running the provided image)

Docker Swarm routing mesh

- Services are given a port number as well
  - e.g. an Apache service might be defined to port 80
- When a service is given a port number, all nodes in a swarm will respond on that port number by passing requests to the defined service. This occurs whether a node is running a replica for the requested service or not
- The upshot of this is that load balancing is built into Docker Swarm. Load balancing is implied by the fact that the swarm manager is allowed to determine the best node to run a replica

*An external load balancer can be used

- Consequence: Sticky sessions aren't available

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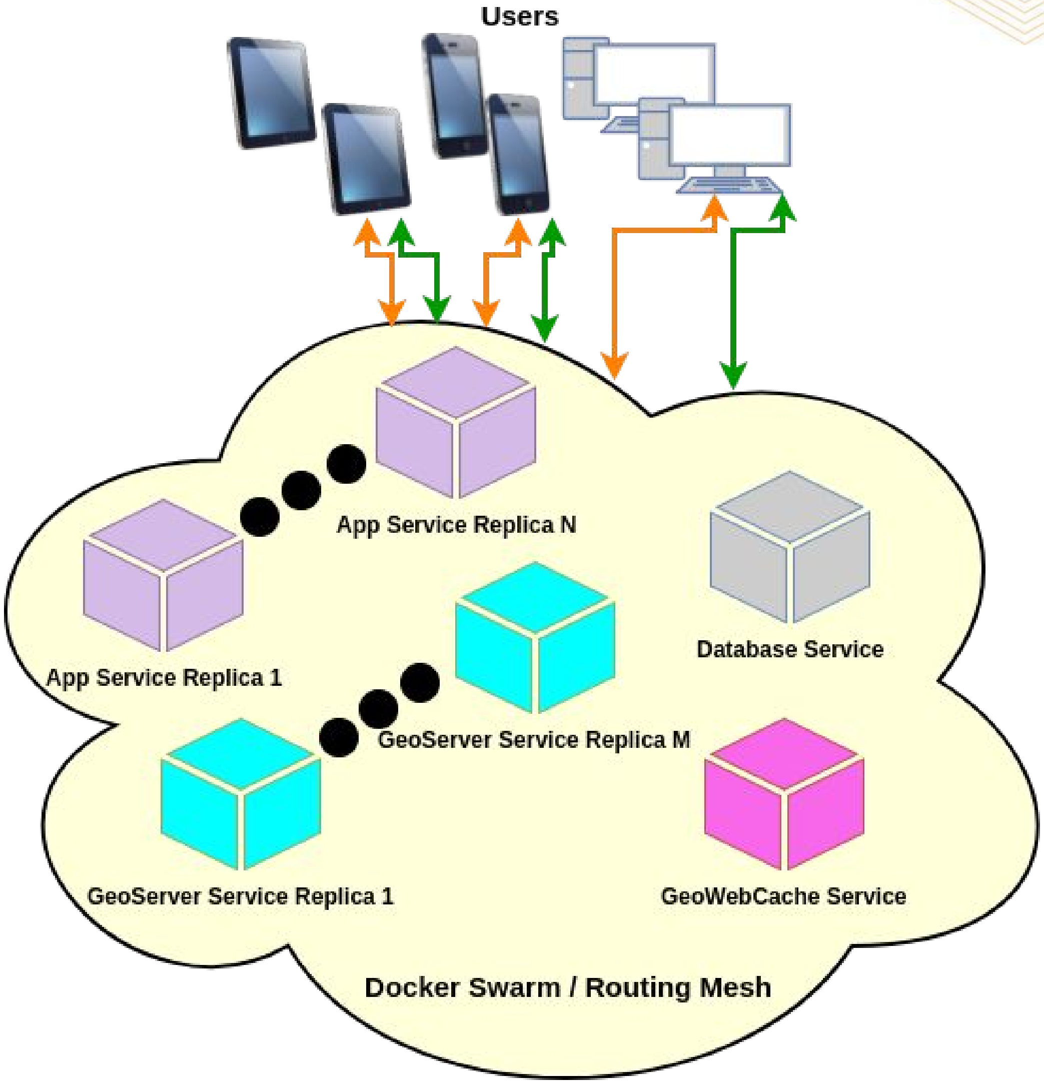
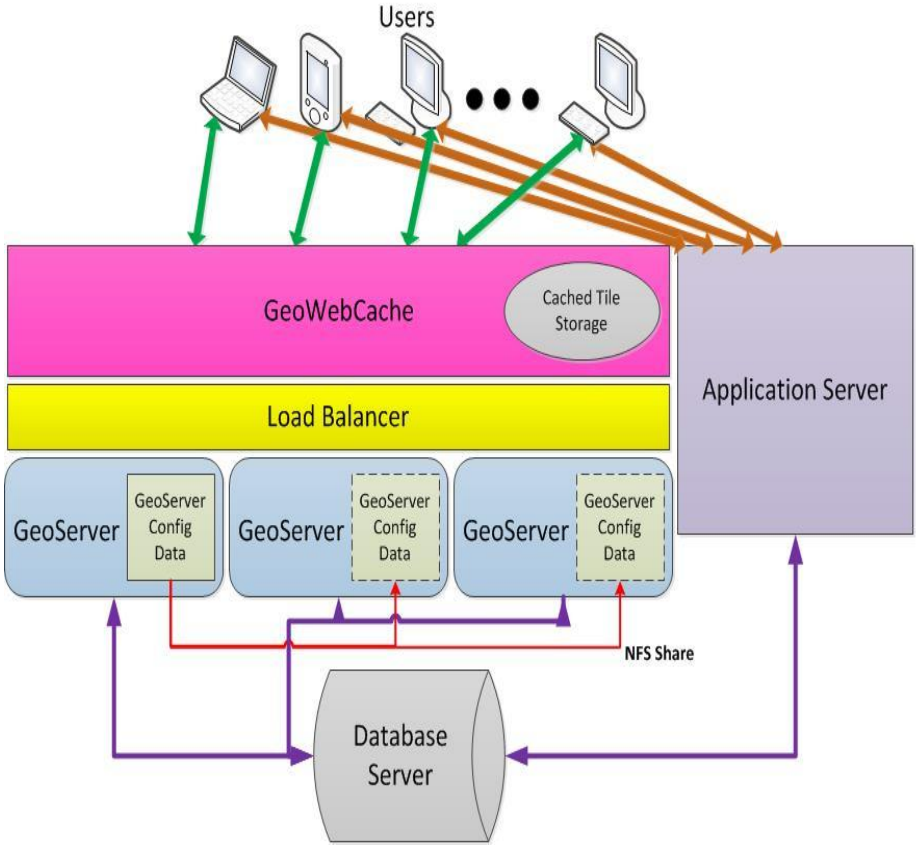
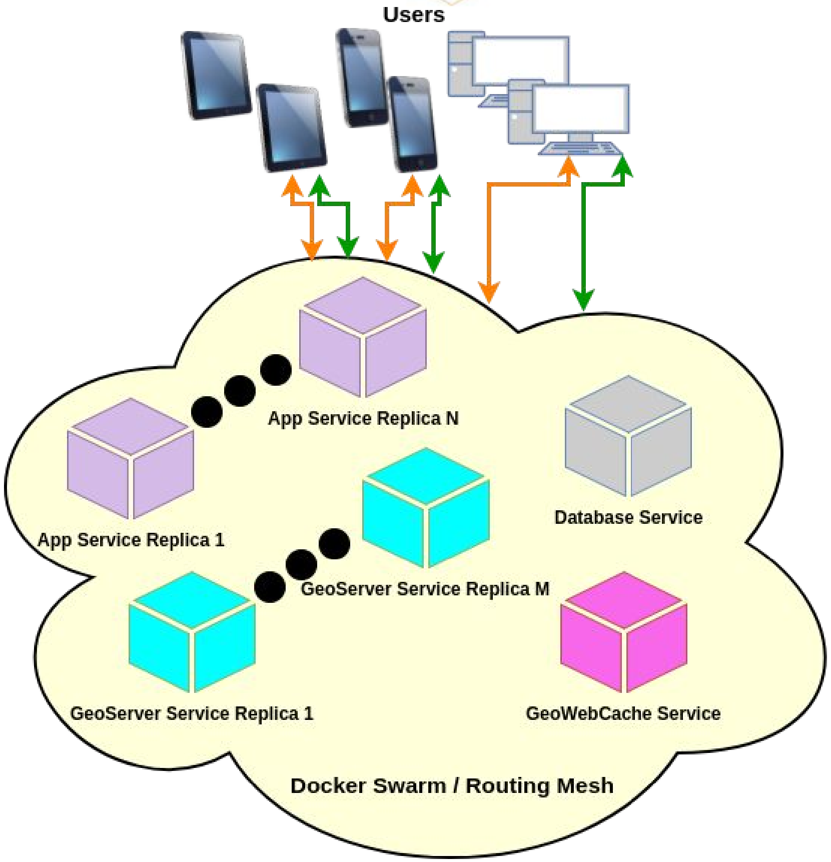
GeoServer, GeoWebCache, and Docker in concert

Docker Swarm Architecture



Architectures side by side





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GeoServer Container Definition

Dockerfile

```
FROM centos:6

RUN yum update -y && yum install -y wget unzip
RUN yum install -y java-1.8.0-openjdk
RUN wget "http://mirror.cogentco.com/.../apache-tomcat-8.5.16.tar.gz" && \
    cd /usr/lib && \
    tar xzvf /tmp/apache-tomcat-8.5.16.tar.gz
RUN wget "https://downloads.sourceforge.net/...geoserver-2.11.1-bin.zip" && \
    cd /usr/lib && \
    unzip /tmp/geoserver-2.11.1-bin.zip

COPY geoserver_data_dir /usr/lib/geoserver-2.11.1/data_dir

ENV JAVA_HOME /usr/lib/jvm/jre-1.8.0-openjdk-1.8.0.131-0.b11.el6_9.x86_64
ENV CATALINA_HOME /usr/lib/apache-tomcat-8.5.16
ENV GEOSERVER_HOME /usr/lib/geoserver-2.11.1

ENTRYPOINT ${GEOSERVER_HOME}/bin/startup.sh

EXPOSE 8080
```

Easy!

Through the prism

Are these still problems?

- Reminder: the final architecture from last year had two minor problems
  - GeoWebCache has its own configuration data that must be maintained
  - A GeoWebCache layer cache must be cleared whenever the associated GeoServer layer undergoes a configuration data change

- Answer: Yes, but these problems, again, are soluble using scripting….and some thoughtful Docker image design

Considerations from last year

1. At least one GeoWebCache server is needed so that tiles can be cached and managed. Unified is best

- GeoWebCache can also be run as a service within the same swarm as GeoServer
- Note that, typically, GeoServer and GeoWebCache use the same port, 8080. In this architecture, given that each will run within a different service (and the existence routing mesh), they cannot
- Let GeoServer use port **8081** and GeoWebCache use port **8080**

Considerations from last year

2. A load balancer needs to be in front of GeoServer instances. This load balancer is used by GeoWebCache to determine which GeoServer will fulfill a tile request. It can also be used to service dynamic requests from clients

- By default, load balancing is handled by the Docker Swarm routing mesh
- An external load balancer can be used

Considerations from last year

3. An approach is needed so that GeoServer / GeoWebCache configuration data can be easily managed

- There are a variety of approaches
  - #1: A share can be mapped into swarm containers
    - Permissions management can be hairy
  - #2: Start detached GeoServer container to make configuration changes. Export the configuration. Rebuild containers using the configuration data
- I chose option #2

Benchmark

Benchmark

- I spun up three medium instances on Amazon EC2 using the “Amazon Linux AMI 2017.03.1 (HVM), SSD Volume Type” image
- Medium instances have **4 Gb RAM** and **2 Intel Xeon hyperthreaded cores**
- Docker Swarm services
  - **db** - PostgreSQL 9.6 / PostGIS 2.3 with one replica
  - **geoserver** - GeoServer 2.11.1 with variable replicas
- Scaling is achieved by increasing the number of replicas within the geoserver service

Benchmark

- The benchmark was performed by:
  - Gathering web requests from GeoServer access logs into a very large file
  - Massaging this data so that it was appropriate for Apache JMeter
  - Building JMeter configurations for each of the GeoServer cluster configurations
  - Running JMeter for each configuration over the request file

Benchmark - Swarming

Display of the swarm nodes

```
ID                           HOSTNAME       STATUS  AVAILABILITY  MANAGER STATUS
93smex2pyf2x6r435syjw2b4z    ip-10-0-0- 227  Ready   Active
lurqbjr2thhat923btf7d2q1r *  ip-10-0-0- 249  Ready   Active        Leader
md0qrrfayj03kbm8z6nrlrdjx    ip-10-0-0- 233  Ready   Active
```

Display of the db service with one replica - It is running on node 249

```
[ec2-user@ip-10-0-0-249 postgresql_postgis_server]$ docker service ps db
ID            NAME  IMAGE                                           NODE           DESIRED
STATE  CURRENT STATE           ERROR  PORTS
bn1ol18y2aer  db.1  34.200.171.72:5000/postgresql_postgis_server:1  ip-10-0-0-  249  Running
```

Display of the geoserver service with one replica - It is running on node 233

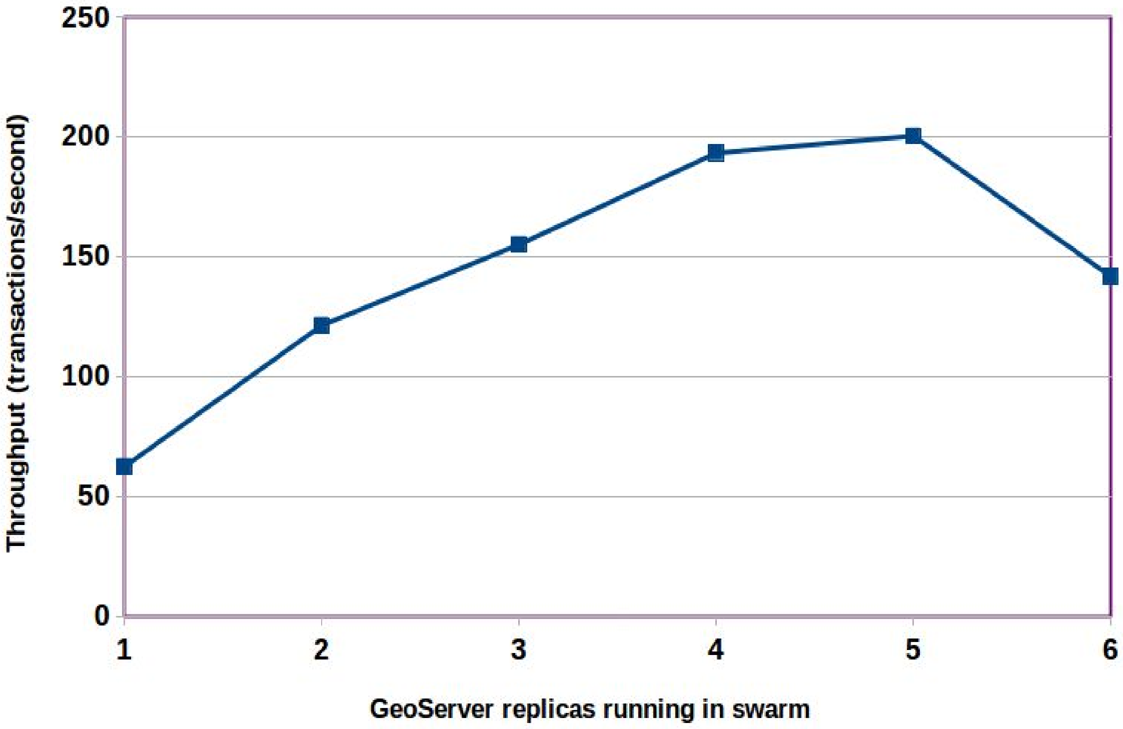
```
[ec2-user@ip-10-0-0-249 postgresql_postgis_server]$ docker service ps geoserver
ID            NAME         IMAGE                                  NODE           DESIRED
STATE  CURRENT STATE          ERROR  PORTS
vu04ylunkkx4  geoserver.1  34.200.171.72:5000/geoserver_server:1  ip-10-0-0-  233  Running
```

Display of the geoserver service with three replicas - One is running on node 249

```
[ec2-user@ip-10-0-0-249 postgresql_postgis_server]$ docker service ps geoserver
ID            NAME         IMAGE                                  NODE           DESIRED
STATE  CURRENT STATE                   ERROR  PORTS
5gl77ne4zvil  geoserver.1  34.200.171.72:5000/geoserver_server:1  ip-10-0-0-  233  Running
rbrvwcprijh3  geoserver.2  34.200.171.72:5000/geoserver_server:1  ip-10-0-0-  227  Running
8mgjzcnp753l  geoserver.3  34.200.171.72:5000/geoserver_server:1  ip-10-0-0-  249  Running
```

Benchmark - Results

- The performance jump from 1 to 2 replicas is substantial. It is almost 2X
- The performance jump from 2 to 3 replicas is less substantial. This is likely due to a replica sharing the node running the db service replica
- The performance slumps from 5 to 6 replicas. At this point, all nodes have 2 replicas and one is also running the db replica



Wrap up

Conclusion

- It was shockingly easy to create a usable GeoServer / GeoWebcache cluster, e.g. the benchmark construction took less than 3 hours
- Docker and Swarm allow us to take the final architecture from last year and stretch it to more fully utilize available hardware
- For this application, Docker and Swarm introduce no significant difficulties and greatly simplify “scaling-in” to available hardware
- Swarm provides the ability to dynamically scale a GeoServer cluster to match usage

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Thank you!

FIND OUT MORE
Derek Kern
Principal Architect
Email: **derek.kern@ubisense.net**
www.ubisense.net