Satellite at Scale
How Walmart manages the massive IT infrastructure at the heart of the retail giant

Darin Lively, Brian Ameling, & John Henley
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This presentation contains specific configuration and parameters optimized to Walmart's environment. These are likely not the exact configurations or parameters that you will use in your environment. But if they can scale, we know you can, too.
Walmart’s Satellite 6 Journey

PART ONE  Walmart & Red Hat Joint Engineering

PART TWO  Large-Scale Satellite Operations

PART THREE  Satellite Infrastructure Considerations

PART FOUR  Managing Satellite Clients at Scale

PART FIVE  Operational Improvements

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Partnership

- Two companies working together on a common goal to meet and exceed their business demands.

Collaboration

- Collaborative relationship with Red Hat that can be mirrored by any size customer
  - RHT listens, helps pull together sat releases that benefit the larger customer base (whatever scale you're at)
  - BZs & RFEs are here and the process is open to anyone.
  - Walmart + Red Hat had a positive Red Hat field Engineering experience
  - This is over, but we're creating some programs to continue the benefits

Joint Engineering Effort

- Repeatable process, open to anyone

Improving Satellite for all
Large-Scale Satellite Operations
WHAT WALMART BUSINESS SCALE LOOKS LIKE

2.3M ASSOCIATES

11,700 STORES

28 COUNTRIES

150+ DISTRIBUTION CENTERS

270M CUSTOMERS/WEEK
WHAT WALMART SATELLITE SCALE LOOKS LIKE

- 60K HOSTS
- 64 CONTENT VIEWS
- 9 LIFECYCLE ENVIRONMENTS
- 3.9K PULP REPOS
- 234K PACKAGES
- 182K PACKAGE DOWNLOADS/HOUR PEAK
- 46 ACTIVATION KEYS
- 22 CAPSULES
- 1 SATELLITE
Satellite Infrastructure Considerations
CUSTOMIZATIONS

- Hiera customizations
- Apache overrides
- Limits files
- Kernel tunables
- Postgres
- Logrotate
- Pulp concurrency
HIERA CUSTOMIZATIONS

/etc/foreman-installer/custom-hiera.yaml

```
apache::purge_configs: false

apache::mod::passenger::passenger_max_pool_size: 150
apache::mod::passenger::passenger_max_request_queue_size: 100
apache::mod::passenger::passenger_stat_throttle_rate: 120
apache::mod::passenger::passenger_max_requests: 1000
apache::mod::passenger::passenger_min_instances: 6
apache::mod::passenger::passenger_start_timeout: 90
apache::mod::passenger::passenger_max_preloader_idle_time: 0

apache::keepalive: "On"
apache::max_keepalive_requests: 0
apache::keepalive_timeout: 5

apache::mod::prefork::startservers: 8
apache::mod::prefork::minspareservers: 5
apache::mod::prefork::maxspareservers: 20
apache::mod::prefork::serverlimit: 1024
apache::mod::prefork::maxclients: 1024
apache::mod::prefork::maxrequestsperchild: 4000

katello::num_pulp_workers: 16
```

--- INSERT ---
<IfModule mod_passenger.c>
  PassengerMaxPoolSize 150
  PassengerMaxRequestQueueSize 100
  PassengerStatThrottleRate 120
  PassengerMaxRequests 1000
</IfModule>

<VirtualHost *:443>
  PassengerMinInstances 6
  PassengerStartTimeout 90
  PassengerMaxPreloaderIdleTime 0
</VirtualHost>

KeepAlive On
MaxKeepAliveRequests 0
KeepAliveTimeout 5

<IfModule mpm_prefork_module>
  StartServers 8
  MinSpareServers 5
  MaxSpareServers 20
  ServerLimit 1024
  MaxClients 1024
  MaxRequestsPerChild 4000
</IfModule>

-- INSERT --
LIMITS FILES

/etc/systemd/system/*

/etc/systemd/system/httpd.service.d/limits.conf
[Service]
LimitNOFILE=1000000
LimitCORE=15000000

/etc/systemd/system/qdrouterd.service.d/limits.conf
[Service]
LimitNOFILE=1000000

/etc/systemd/system/qpidd.service.d/limits.conf
[Service]
LimitNOFILE=1000000

-- INSERT --
KERNEL TUNABLES

/etc/sysctl.conf

```
fs.aio-max-nr = 1000000
vm.swappiness = 1
kernel.sem = 250 128000 32 128
vm.dirty_background_ratio = 5
vm.dirty_ratio = 10
vm.dirty_expire_centisecs = 500
vm.dirty_writeback_centisecs = 100
fs.suid_dumpable = 1
```

--- INSERT ---
### POSTGRES

```
max_connections = 1000
shared_buffers = 4GB
checkpoint_segments = 32
checkpoint_completion_target = 0.9
effective_cache_size = 16GB
work_mem = 4MB
log_min_duration_statement = 500
```

--- INSERT ---
LOGROTATE

httpd
/var/log/httpd/*.log

foreman
/var/log/foreman/*.log
  size=500M

Schedule in cron outside of normal logrotate rules
# Out of band logrotate for high volume logs
0  *  *  *  * /usr/sbin/logrotate /etc/logrotate.d/foreman > /dev/null 2>&1
0  0  *  *  * /usr/sbin/logrotate /etc/logrotate.d/httpd > /dev/null 2>&1

-- INSERT --
PULP CONCURRENCY
(Reduced Published Times)

PULP_CONCURRENCY=16
PULP_MAX_TASKS_PER_CHILD=2

-- INSERT --
Managing Satellite Clients at Scale
USING PUPPET TO AUTOMATE CLIENT SIDE OPERATIONS

PUPPET MODULES

PACKAGING

FILES

SERVICES
USING PUPPET ENTERPRISE TO ROLLOUT IN SCALE
MODIFIED PUPPET MODULE TO RUN MULTIPLE LINUX CLIENTS
HOW SCALE IMPACTED ROLLOUT

WHERE: Started in one location
WHAT: Touched 60,000 boxes
WHEN: Delivered on an aggressive timeline
HOW: Rolled out successfully
Operational Improvements
Walmart had challenges, but they turned them into efficiency gains with customization
Added automation to roll out to a huge number of clients, multiple locations, small team.
BUSINESS CHALLENGE
During client registration, Satellite defaults out of the box are not optimal for large scale, and they get maxed out.

Added randomization to even the distribution
BUSINESS CHALLENGE
Users need new content available faster.

Performed customizations to dramatically reduce publish times

<table>
<thead>
<tr>
<th>PUBLISH TIME (HOURS)</th>
<th>OVER TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initially impossible to publish all in one day (manually through the UI)</td>
<td>25</td>
</tr>
<tr>
<td>Scripted – still more than 24 hours because of capsule syncs</td>
<td>20</td>
</tr>
<tr>
<td>Added shared filesystem = 12 hour publish</td>
<td>15</td>
</tr>
<tr>
<td>Multi-threaded script = 4 hour publish</td>
<td>10</td>
</tr>
<tr>
<td>6.3 = 1.5 hour publish</td>
<td>5</td>
</tr>
<tr>
<td>© Wal-Mart Stores, Inc. 2018</td>
<td>0</td>
</tr>
</tbody>
</table>
BUSINESS CHALLENGE
Walmart needed version control. Template changes from one user changed the template for everyone.

Moved to fully version-controlled template process to improve workflow
BUSINESS CHALLENGE
Need visibility into the operational health of the infrastructure

METRICS

collectd > graphite > grafana
Ansible playbook to redeploy grafana dashboards

IMPORTANT METRICS TO COLLECT

- standard cpu/memory/disk/network
- foreman tasks active (per task type)
- foreman tasks per minute (per task type)
- katello event queue
- qpid queue depths
- dynflow plans
- dynflow orphaned execution plans
- pulp tasks running
- pulp tasks state
- pulp repo count
- postgres connections
- postgres query length
- apache processes
- passenger processes
- apache scoreboards
- capsule apache busy servers
SCALING SUCCESS

**Scalability**
Build capacity for IT of any size

**Collaboration**
Share your ideas and optimizations

**Infrastructure**
Create a reference architecture then customize

**Migration**
Know your environment and track key metrics
THANK YOU

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