The Importance of Capacity Management in the QVC Online Shopping Experience
QVC – a digital business

As an online retailer, QVC sells products through a variety of digital channels including television, social media, and multiple websites. Because of the engaging shopping experience and products offered, 93 percent of QVC shoppers are repeat customers.

QVC continues to strive to provide the best shopping experience for their savvy customers. To help with this, they invested in a capacity management practice that would ensure that QVC online services have the IT infrastructure resources needed to perform as their experienced shoppers expect while also optimizing the use of their IT infrastructure resources to manage IT costs.
A Highly Engaged Shopping Community

- **13M customers**
- **93% of sales come from repeat/reactivated customers**
- **7,360 brands sold worldwide**
- **370M homes reached**
- **14 television networks**
- **1B+ visits to 6 websites worldwide**
- **$8.8B in 2017 revenue**
- **191M units shipped**
- **7,360 brands sold worldwide**
- **800 products on-air each week in the US**
- **131M+ customer contacts**
- **130+ hours of live content daily (on average)**
- **130 on-air hosts/social mavens and over 8,000 on-air guests**

Distinctive Assortments of World-Class and Entrepreneurial Brands and Products
Delivering an exceptional customer experience

As a digital business, customer experience is at the core of QVC’s business success. The goal of the IT organization is to deliver a customer experience that exceeds expectations at an optimal cost to QVC. To that end, the capacity management team was formed in June 2016 and BMC’s TrueSight Capacity Optimization solution was selected by the team.

The capacity management team works with a variety of internal clients:

- **Infrastructure teams.** The infrastructure teams rely on the capacity management team for helping them optimize resource usage and insuring they are maximizing infrastructure investment. They also work with the infrastructure team to determine if application performance problems are due to resource constraints.

- **Application teams.** As applications change, the capacity team models resource needs to support the application changes and ensure performance SLAs are maintained. A variety of analytical models are created, allowing the application teams to determine the best fit based on service requirements.

- **Architects.** As new projects are defined, the capacity management team works with the enterprise architects and infrastructure team to size the compute, storage and network resources needed.

- **VP and directors.** The capacity management team provides reports on the status of IT resources to management. For example, machines being retired, resource capacity being reclaimed, performance and cost modeling.
The role of capacity management

To support these internal clients and QVC business goals, the capacity management team must be able to reliably and consistently answer questions about infrastructure resources that support the QVC digital business.

- What activity impacts infrastructure?
- How much user volume can be supported?
- How many API calls can be supported?
- What is the impact of new workloads?
- Do we need to buy new infrastructure resources, or can we optimize existing infrastructure?
- How much infrastructure capacity are we really using or wasting?
- How close are we to a saturation condition that will begin affecting performance?
- What is the capacity usage level at which service performance will become affected?

To answer these questions, the QVC capacity team established metrics and a process that would support their decision making for infrastructure usage and purchases.
Continuous analysis and recommendations for resource optimization

Optimizing resources includes increasing or decreasing capacity. The goal is to define an optimal size and configuration for a resource (such as a VM configuration), that is, not overallocated yet supports the changes in workloads, so business service or customer experience are not interrupted.

QVC approached optimization from 3 perspectives

- Minimize unplanned expenditures and capacity related outages
- Establish framework for capacity discussions, agree on ‘artifacts’ to exchange on a regular basis
- Centralize data from numerous sources and ensure it is normalized and viewable on equal terms

**Desired End-Result:** Provide the right capacity needed at the right time
Managing infrastructure capacity at multiple levels

Understanding the interactions and dependencies of the infrastructure that is supporting a service means looking at multiple levels and perspectives of infrastructure usage.

- Individual components and resources
- Service verticals
- Multiple services for a business group

This allowed QVC to evaluate infrastructure needs in the context of their business – not just IT.
Capacity Management Levels

**GROUP OF SYSTEMS**

Given the resources and services:
- **How** are budget and future plan affected?
- **When** will it happen again?
- **Where** is the trend headed?
* (Formal readout to sub-div or dept.)

**SYSTEM LEVEL DATA**

What happened?
Where? When?
How does it compare to a tear, month, week ago?

**SERVICE CAPACITY MANAGEMENT**

**MANY SERVICES**

Given the resources and services:
- **How** are budget and future plan affected?
- **When** will it happen again?
- **Where** is the trend headed?
* (Formal readout to sub-div or dept.)

**BUSINESS CAPACITY MANAGEMENT**

**End-to-End Service View "Verticals"**

- Firewall
- Load Balancer
- Windows Web Servers
- UNIX
- DB2
- Storage
- VMWare
- Mainframe (z/OS)
- Windows
- Network
- Storage
- UNIX
- VMWare

**SYSTEM OR DEVICES DATA**

- CPU, memory, I/O, bandwidth, etc.
- Mainframe (z/OS)
- Network
- UNIX
- Windows
- Storage
- VMWare
Reclaiming and adjusting capacity

One of the fastest ways for QVC to reduce infrastructure costs was by reclaiming compute and storage resources. Identifying idle resources and oversized resources that can be retired or reclaimed was a quick win. QVC looks at resources by owner and by a more narrowly defined view of a specific application group.

In addition, QVC evaluated compute and storage resources to determine if they were properly sized based on 6 to 12-month usage patterns.
Detecting anomalies with proactive analytics

QVC needed to understand changes in their transaction volumes and application workloads to ensure that the right resources were allocated. This is a grey area that has nothing to do with rightsizing or identifying idle systems.

QVC used TrueSight Capacity Optimization to automate detection of unusual changes – both anomalous increases and decreases in activity.

By being able to proactively detect changes in activity, the capacity management team has averted service slowdowns or failures that affect customer experience.

The following tables show actual system data of when a CPU or memory average for the last 7 days increased by more than 50% compared to the average for the 100 days preceding that period. The VMs that have a red bard in Relative Increase column are resources that have had an unexpected change in usage.
Anomalous CPU and Memory Increase

<table>
<thead>
<tr>
<th>VM</th>
<th>CPU Avg - 90 Days</th>
<th>CPU Avg - 7 Days</th>
<th>Relative Increase</th>
<th>Cluster</th>
<th>Desc</th>
</tr>
</thead>
<tbody>
<tr>
<td>VM A</td>
<td>36.7%</td>
<td>100%</td>
<td>172.3%</td>
<td>Cluster A</td>
<td>Provisioned by VMware vCAC</td>
</tr>
<tr>
<td>VM B</td>
<td>11%</td>
<td>63.1%</td>
<td>474.5%</td>
<td>Cluster B</td>
<td>Purpose: West Chester Plane</td>
</tr>
<tr>
<td>VM C</td>
<td>6.7%</td>
<td>18%</td>
<td>166.5%</td>
<td>Cluster B</td>
<td>Function: AEM Business Are</td>
</tr>
<tr>
<td>VM D</td>
<td>6.6%</td>
<td>11.7%</td>
<td>79.1%</td>
<td>Cluster C</td>
<td>vglch021 QA tomcat/apache</td>
</tr>
<tr>
<td>VM E</td>
<td>2.8%</td>
<td>46.6%</td>
<td>1,503%</td>
<td>Cluster D</td>
<td>Customer Credit Card</td>
</tr>
<tr>
<td>VM F</td>
<td>63.7%</td>
<td>99.7%</td>
<td>66.4%</td>
<td>Cluster D</td>
<td>Customer Credit Card</td>
</tr>
<tr>
<td>VM G</td>
<td>5%</td>
<td>8%</td>
<td>59.7%</td>
<td>Cluster A</td>
<td>HP Functional Tools, Prod S</td>
</tr>
<tr>
<td>VM H</td>
<td>7.6%</td>
<td>11.4%</td>
<td>51.1%</td>
<td>Cluster A</td>
<td>Function: Satellite 5 Bust</td>
</tr>
<tr>
<td>VM I</td>
<td>3.6%</td>
<td>6%</td>
<td>64.2%</td>
<td>Cluster B</td>
<td>Function:Ocen test Business</td>
</tr>
<tr>
<td>VM J</td>
<td>1%</td>
<td>1.6%</td>
<td>55.7%</td>
<td>Cluster C</td>
<td>Perf - Mobile CMS Auth 2 of 2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VM</th>
<th>MEM Avg - 90 Days</th>
<th>MEM Avg - 7 Days</th>
<th>Relative Increase</th>
<th>Cluster</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VM A</td>
<td>12.4%</td>
<td>23.2%</td>
<td>87.7%</td>
<td>Cluster A</td>
<td>Provisioned by VMware vCAC</td>
</tr>
<tr>
<td>VM B</td>
<td>5.6%</td>
<td>8.6%</td>
<td>53.6%</td>
<td>Cluster B</td>
<td>Purpose: Cyberation App De</td>
</tr>
<tr>
<td>VM C</td>
<td>11.3%</td>
<td>21.6%</td>
<td>91.5%</td>
<td>Cluster B</td>
<td>Function: Endeca Business</td>
</tr>
<tr>
<td>VM D</td>
<td>19.6%</td>
<td>41.9%</td>
<td>114.4%</td>
<td>Cluster C</td>
<td>Purpose: NOTES-STAGE Test</td>
</tr>
<tr>
<td>VM E</td>
<td>3.3%</td>
<td>5.7%</td>
<td>71.4%</td>
<td>Cluster D</td>
<td>Purpose: Pipkns Test Ser</td>
</tr>
<tr>
<td>VM F</td>
<td>32.1%</td>
<td>50.5%</td>
<td>67.2%</td>
<td>Cluster D</td>
<td>QA - Manhattan App</td>
</tr>
<tr>
<td>VM G</td>
<td>10.9%</td>
<td>22%</td>
<td>101.1%</td>
<td>Cluster A</td>
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<tr>
<td>VM H</td>
<td>11.9%</td>
<td>19.4%</td>
<td>63.1%</td>
<td>Cluster A</td>
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</tr>
<tr>
<td>VM I</td>
<td>11.7%</td>
<td>18.1%</td>
<td>64.4%</td>
<td>Cluster B</td>
<td>Purpose: eCommerce Server E</td>
</tr>
<tr>
<td>VM J</td>
<td>4.7%</td>
<td>8.6%</td>
<td>83.3%</td>
<td>Cluster C</td>
<td>Function: Customer Finance</td>
</tr>
</tbody>
</table>
Modeling Critical Customer Facing Applications

Like any digital business, QVC has critical customer facing applications and services that are directly tied to revenue and customer retention. Because of the financial impact that these applications have on the business, cost is not a factor when allocating infrastructure resources.

The goal for these critical applications is to ensure they have the compute, storage and network resources to stay up and running without interruption or slowdowns. This requires correlating the forecasted business growth metrics (KPIs) to resource needs.

When doing this analysis, it is important to properly

- Determine maximum sustainable growth based on Active/Active or Active/Passive needs
- Identify important windows of time to base your correlation analysis on
- Create logical groupings of systems to that are related to the business service
- Collect detailed business driver data from a variety of sources (via Splunk, or other tools)
Modeling for Demand Growth

This is an example of transaction growth modeled against CPU usage. The result is that 120,000 transactions (web visits) can be handled by an application server before it begins impacting performance and the customer experiences a slow response time for the web application.

As a result of this model, there are a few actions that can be taken to prepare for the growth expected for this web service.

- 'Tweak the knobs' of the model to use averages or peaks, amount of anticipated growth based on new feature performance tests, in addition to existing load and organic growth/forecast
- Provide a sizing recommendation ‘artifact’ to the application teams and users
- Possibly engage business and architects if the current design pushes against a limit that cannot be addressed.
QVC Results

QVC was able to reduce costs and eliminate application performance problems by establishing a dedicated team, processes, and measurements, and using TrueSight Capacity Optimization to automate the deep analysis, recommendations, and reporting required for successful capacity and cost optimization.

- Deferred cost of approximately $1M+ over a 9-month period.
- 300+ VMs retired (considered idle or unused)
- 1000+ VMs right-sized

- Identify systems that need resource changes. QVC has already adjusted 500 systems and identified changes for another 150 systems, improving application experience and averting potential outages.

- Proactively identify undesirable trends or sudden changes in behavior eliminating related outages. The capacity management team was able to uncover 50 instances of configuration and software bugs that would have resulted in outages.

- Established a platform for shared insights with Capacity Management, Development, Infrastructure, and Performance Engineering teams that facilitates quick decision making.

- Created a centralized data repository and standardized methodology with common terminology that is shared across all business units.
About TrueSight Capacity Optimization

QVC’s capacity management is powered by TrueSight Capacity Optimization. TrueSight Capacity Optimization aligns IT resources with service demands and business priorities, resulting in on-time service delivery and optimized costs.

**Capacity management teams can use TrueSight Capacity Optimization to:**

- Reserve and schedule IT infrastructure resources so applications can be released on time
- Forecast and model changes in demand to proactively adjust IT resources as needed
- Optimize the use of on premises infrastructure resources and cloud services
- Plan for on-premises and multi-cloud infrastructure resources and budget
- Keep stakeholders informed of the state of their applications and services through dashboards and reports

**More information**

[www.bmc.com/capacity](http://www.bmc.com/capacity)

- TSCO Overview Video
- TSCO Online Interactive Trial
About the author

**Omar Farooq** is the lead capacity manager at QVC. He is responsible for working with the various IT stakeholders to provide determine what infrastructure is needed to run and operate the QVC digital services and business applications.

Omar has held a variety of roles in IT during his career, including software engineer, enterprise architect, and program manager. Omar is a graduate of Temple University where he received a Bachelor of Science in Computer Science.
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