Magento Enterprise Edition White Paper

Methods and Best Practices for High Performance eCommerce

Magento™ Enterprise Edition

Introduced in 2009, the Magento Enterprise Edition subscription is the leading enterprise-grade, feature-rich eCommerce platform built on Open Source technology. The Magento Enterprise Edition subscription provides online merchants with unprecedented flexibility and control over the presentation, content and functionality of their eCommerce channel, giving merchants the power to create sites that provide an unrivaled and rich online shopping experience for their customers.

The Magento Enterprise Edition is an open system designed to be flexible, completely scalable and configurable, easily tailored to merchants' unique technical and business requirements and restraints. However, much like all flexible enterprise-grade software, custom configurations can often result in a number of places where incorrect configuration or insufficient resources can adversely affect performance.

In this Technical Whitepaper we provide an overview of architecture and design considerations, optimization guidelines and performance tuning tips for Magento Enterprise Edition as well as for the underlying hosting environment in an effort to provide best practices for maximizing Magento Enterprise Edition performance.

General Considerations

When getting ready to deploy and configure Magento Enterprise Edition, there are some general technical environment components that must be taken into consideration to create an optimized Magento Enterprise Edition setup. These range from physical hardware selection and network throughput, to the underlying Open Source stack, which are key underpinnings which help drive Magento Enterprise Edition, and Magento Enterprise Edition's own configuration components.

When trying to achieve the optimal setup, please take the following into consideration:

Environment Components:

- Hardware:

  With a large amount of concurrent users the sufficient amount of RAM is highly critical to handle all incoming connections. Faster, modern systems with multi-core CPUs, high front side bus speeds and fast hard drives, preferably at 7200RPM and above, will generally speed up the entire application.

- Network:

  Insufficient network I/O throughput and latencies in the internal network can significantly impact performance of a multi-server setup. Outbound connection latency may hurt the customers browsing the store frontend.

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- Software:

  Magento Enterprise Edition is a PHP application that runs on theLAMP stack. Therefore, current, up-to-date and well-configured versions of the Linux Kernel, Apache, MySQL and PHP will provide better performance results. Proper configuration of the web-server, the database server and PHP itself is required in order to achieve optimal performance results.

Magento Enterprise Edition Configuration Components:

- Proper cache backend
- Handling sessions with fast storage
- Directory structure optimization
- Flat frontend catalog
- Magento Enterprise Edition cron scripts
- Rebuilding indexes
- Admin panel separation
- Proper search type selection
- Frontend layout complexity
- Number of HTTP requests on the page
- Using parallel connections

Performance Testing Methodology

Testing and metrics are crucial components of measuring and reflecting performance under any given setup. Tests have been conducted showing the benefit of optimizing different configurations and setups. The tests were executed in a cloud environment so that both the tests and results should be easily reproduced in the same type of environment. However, it should be noted that all tests will provide much better results on physical, dedicated servers. A benchmark of two physical environments is provided as well, towards the end of the document.
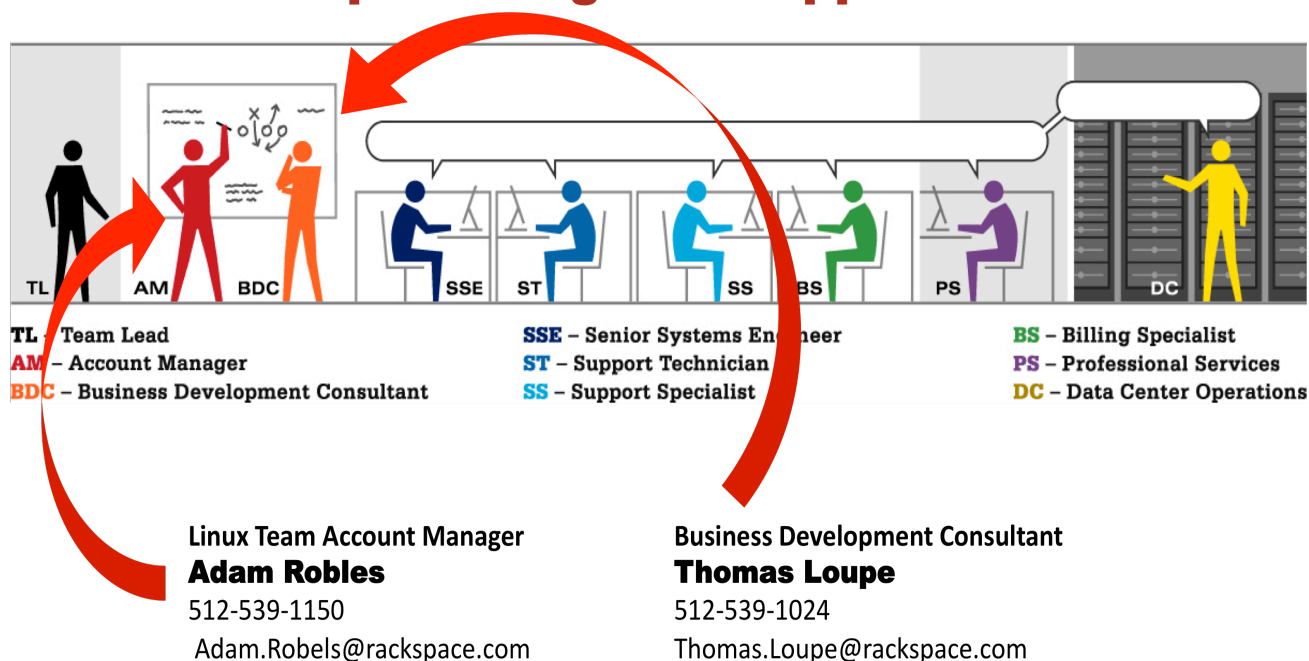
The tests were run on Rackspace Cloud Servers - www.rackspacecloud.com. Every instance is based on the CentOS 5.3 x86_64image provided by the cloud service with the latest updates installed. PHP and MySQL were installed from the Remi repository - rpms.famillecollet.com. Apache and MySQL configuration files are included in Appendices A through C. The tests were run against three Magento Enterprise Edition installations of different catalog sizes (Magento Enterprise Edition with default sample data of ~100 SKUs, 10,000 SKUs and 80,000 SKUs catalogs).

Tests measured both the homepage and an average customer session activity where applicable. Average customer session activity consists of a series of URL's, which can be found in Appendix E.

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The graphs included in this document were run on 3 Magento Enterprise Edition installations of the different catalog sizes detailed above, noted as Magento Enterprise Edition sample data (sd), Magento Enterprise Edition with 10,000 products (10k) and Magento Enterprise Edition with 80,000 products (80k). Each test was executed with 10, 20, 50 and 100 concurrent connections. The figures show both the main page performance and the average performance on abstract customer sessions on the site. Please check the 'Performance Testing' section for more details on tools and techniques used.

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Database Configuration

Proper MySQL configuration is one of the most important aspects of configuring any Magento Enterprise Edition environment. Optimizing theMySQL configuration can provide up to a 70% performance boost. An incorrect configuration may result in the web-server spending more time in idle loops waiting to retrieve data from the database.

As an additional note, the default MySQL installation, even in later versions, is configured to use far less resources than average hardware can provide.

Let's quickly go through the most important directives in the MySQL configuration file, my.cnf, and their recommended values.

The formulas that can be used for all the calculations can be found in the template file bundled within a MySQL distribution package.

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- Available Memory

Magento Enterprise Edition uses InnoDB as its primary table storage engine type. InnoDB, unlike MyISAM, can use the in-memory buffer pool to cache table indexes and data. Less disk I/O is needed to get data from hard drives when the value of the in-memory buffer pool is set higher. A general recommendation is to set this parameter up to 80% of the available RAM for a dedicated database server. In cases where both the web-server and the database are running on the same machine, it is recommended to split the entire memory pool into two parts, each having its own primary assigned portion (e.g. on a single server with 6 GB RAM installed it can be split to have 2-2.5 GB used by MySQL,with the rest left for the web server).

The key parameter in this section is **innodb_buffer_pool_size**, which should be set to use as much available memory as possible:

Server Type	innodb_buffer_pool_size
combined web and DB server, 6 GB RAM	2-3 GB
dedicated database server, 6 GB RAM	5 GB
dedicated database server,12 GB RAM	10 GB

- Multi-threading

Today's industry standard servers typically have more than 1 CPU installed, with 2 or more cores each. The InnoDB engine can effectively use multiple threads to serve more concurrent connections. **innodb_thread_concurrency** should be set to a value equal or greater than 8, even for a single CPU.The recommended value is calculated with the following equation:

2 * [numberofCPUs] + 2

thread_cache_size allows for the caching ofa client's threads when a client disconnects, and to reuse them when new connections are created. The recommended value is from 8 to 64, and depends on your **max_connections** number. **thread_concurrency** can be simply calculated as [number of CPUs] * multiplier . The multiplier value is between 2 and 4 and should be determined by testing the different values and benchmarking for the best results in your environment.

- Built-in Caching

table_cache is the number of tables that can be simultaneously opened by MySQL. A value of 1024 will be sufficient for most, if not all, Magento Enterprise Edition sites.

Having the query cache enabled may result in significant speed improvements when you have a large amount of identical queries, which is the case for any eCommerce

application frontend. The recommended values for a Magento Enterprise Edition database server are **query_cache_size** 64M and **query_cache_limit** 2M

- Buffers

  A sort buffer is used for optimization of sorting in ORDER BY and GROUP BY queries. 8M is the recommended value for a Magento Enterprise Edition database.

- Slow queries logging

  Logging slow queries might be useful for debugging purposes, but it should be disabled in production use.

- InnoDB storage

  The InnoDB engine works with a single data storage file, which usually grows in time. It's a good idea to have its initial state configured to be at least twice as large as the Magento Enterprise Edition database size, and **innodb_autoextend_increment** should be set to a fairly high value in order to avoid frequent data file extending operations.

  InnoDB supports transactional operations by using transaction log files. Transaction log files are generally configured in groups of 2. The bigger the size of the transaction log file, the less often it performs I/O operations on primary storage files. However more time will be required to restore a database in the event it would be necessary.

  Do not use multiple InnoDB table spaces unless you are sure you know the benefits in your particular hardware setup.

Web Server Configuration

The most commonly used Apache configuration provides PHP support with mod_php. This Apache configuration loads a large number of modules. However, most of these modules are not necessary in order to run Magento Enterprise Edition. This becomes more relevant in a multi-server setup, where different tasks can be split on different nodes and each node has to be configured to perform its specific task the best.

The minimum required list of Apache modules is:

- **mod_expires** – generates content expiration and cache control headers
- **mod_deflate** - compresses content before it is delivered to the client
- **mod_mime** - associates the requested file with its type and behavior
- **mod_dir**–serves directory index files
- **mod_rewrite**–is used to support Search Engine Friendly URL's
- **mod_authz_host**–is required to limit access to specific files

- **mod_authz_user**–might be required in a staging environment to setup password authentication, but on a live site it is not necessary

Note: If you are running any other web application(s) on the same server, please consult which Apache modules are required by the application(s).

With all unused Apache modules disabled by commenting out the corresponding '**LoadModule**' lines in httpd.conf, it is possible to cut memory consumed by Apache, which will allow more concurrent connections to be handled with the same amount of RAM.

Another important component is setting an optimal number of running Apache processes. The best method is to create the required number of Apache processes when the web server is started. This number should be calculated by measuring the memory amount consumed by Apache under the maximum load. This is currently the best threading method as **mpm_worker** cannot be safely used with PHP, and the process of forking every new Apache child in **mod_prefork** mode is an expensive operation.

Also note that **ServerLimit** and **MaxClients** values should be specified explicitly to prevent running out of physical memory and going into a swap file, causing a severe breakdown of web-server performance. **MaxRequestsPerChild** can be set to default value (4000).

Under a heavy load keeping persistent connections becomes disadvantageous, thus the **KeepAliv ze** directive should always be set to off.

mod_deflate allows to compress the content before sending it to the browser. Magento Enterprise Edition's **.htaccess** file already includes the necessary settings to enable the compression. Please make sure to uncomment this section in order to decrease the page load time.

Additionally, you can take advantage of eliminating directory structure scans for **.htaccess** files by moving all **.htaccess** directives into appropriate **<Directory>** sections of the main **httpd.conf** file.

In order to reduce the I/O throughput on Apache web-nodes in a multi-server setup, it is advisable to use a load balancer capable of handling all of the logging activity, instead of having the activity handled by Apache backends.
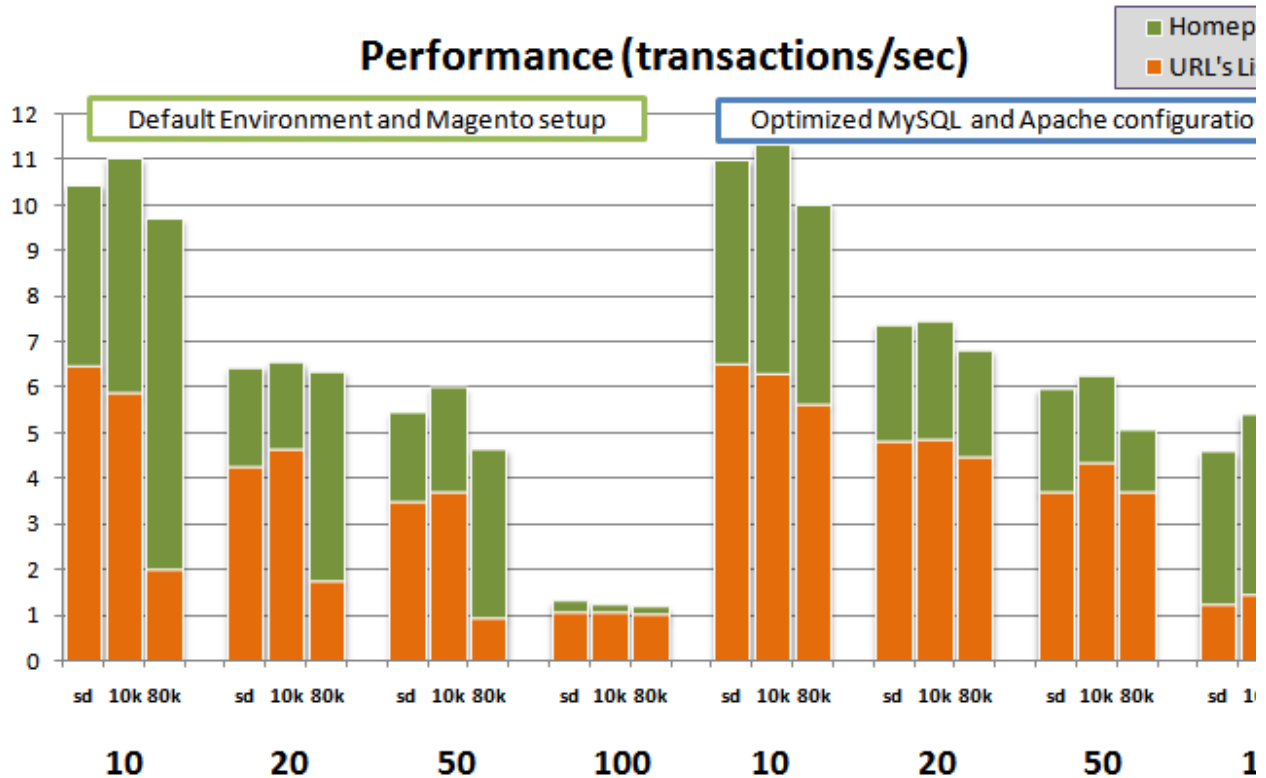
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Figure 1: Default Environment and Magento Enterprise Edition setup vs. Optimized MySQL and Apache configuration

Conclusion: An optimized MySQL and Apache configuration shows 55-70% performance increases on dynamic pages (that is most of the pages in the URL's list). The homepage results are less affected as the default Magento Enterprise Edition setup has cache enabled by default and caches make fewer queries to the database on hitting the homepage. Default Apache and

MySQL configuration is not able to handle higher concurrencies (100 concurrent sessions) resulting in the results for that concurrency varying a lot between tests.

Accelerating PHP

PHP is an interpreted scripting language. The process of running a PHP script includes a few steps - reading a script file from the hard drive, parsing and compiling bytecode, and finally running that bytecode.

Realpath cache configuration

Optimization of file I/O is not only limited to using faster hard drives. It is also highly recommended to increase the default **realpath_cache_size** and **realpath_cache_ttl** values in php.ini settings. Based on our tests the recommended values are**realpath_cache_size=32k** and**realpath_cache_ttl=7200** on production servers.

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Bytecode caching

The process of reading PHP scripts from disk and compiling them can be eliminated by enabling PHP accelerators. PHP accelerators cache compiled bytecode, resulting in less file and system I/O. Well known PHP accelerators eAccelerator and APC are tested and fully compatible with Magento Enterprise Edition. Their built-in shared memory can also be used as Magento Enterprise Edition cache storage, which will be covered later in this document.

php.ini configuration

To reduce the memory usage and speed up PHP performance you can enable in **php.ini** only the minimum set of PHP extensions required to run Magento Enterprise Edition. The necessary extensions are:

- **PDO_MySQL**
- **simplexml**
- **mcrypt**
- **hash**
- **GD**
- **DOM**
- **iconv2**
- **SOAP (if the MagentoWebservices API is to be used)**

Note: If you are running any other PHP application(s) on the same server, please consult which PHP extensions required by the application(s).
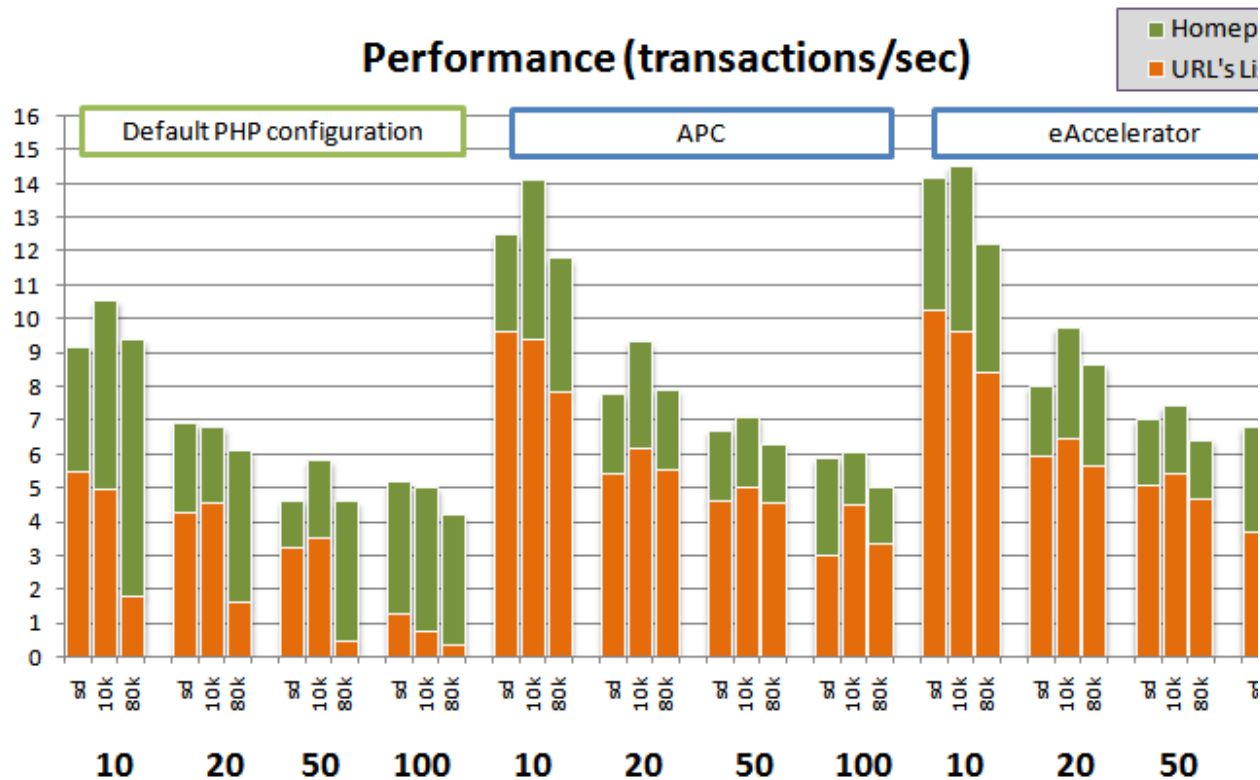
Performance (transactions/sec)

Figure 2: Default setup vs.eAccelerator vs. APC

Conclusion: Adding a PHP accelerator provides a performance boost from 42% on simple pages (homepage) to 500-600% when different PHP-files are used (URL's list). APC accelerator provides good results, but from our tests eAccelerator is 15-20% more efficient.

Caching in Magento Enterprise Edition

Magento Enterprise Edition is able to cache frequently-used data utilizing different cache backends.

When installing Magento Enterprise Edition the filesystem is set to be used as the cache backend by default. Using a cache backend will always improve the performance of Magento Enterprise Edition, and while the filesystem cache is the most reliable storage with unlimited size, it will not provide the best performance.

Magento Enterprise Edition v.1.3.2 can also work with the following cache backends that provide better performance than the filesystem cache backend:

- **APC** - a bytecode cache for PHP, andalso provides a shared memory storage for application data
- **eAccelerator** - a PHP accelerator that can also cache dynamic content
- **memcached** - a distributed, high-performance caching system

Please make sure that if you are using APC, eAccelerator or memcached, you configure them with enough memory to include all cache data, otherwise they may purge required cache hierarchy structures and break the cache.
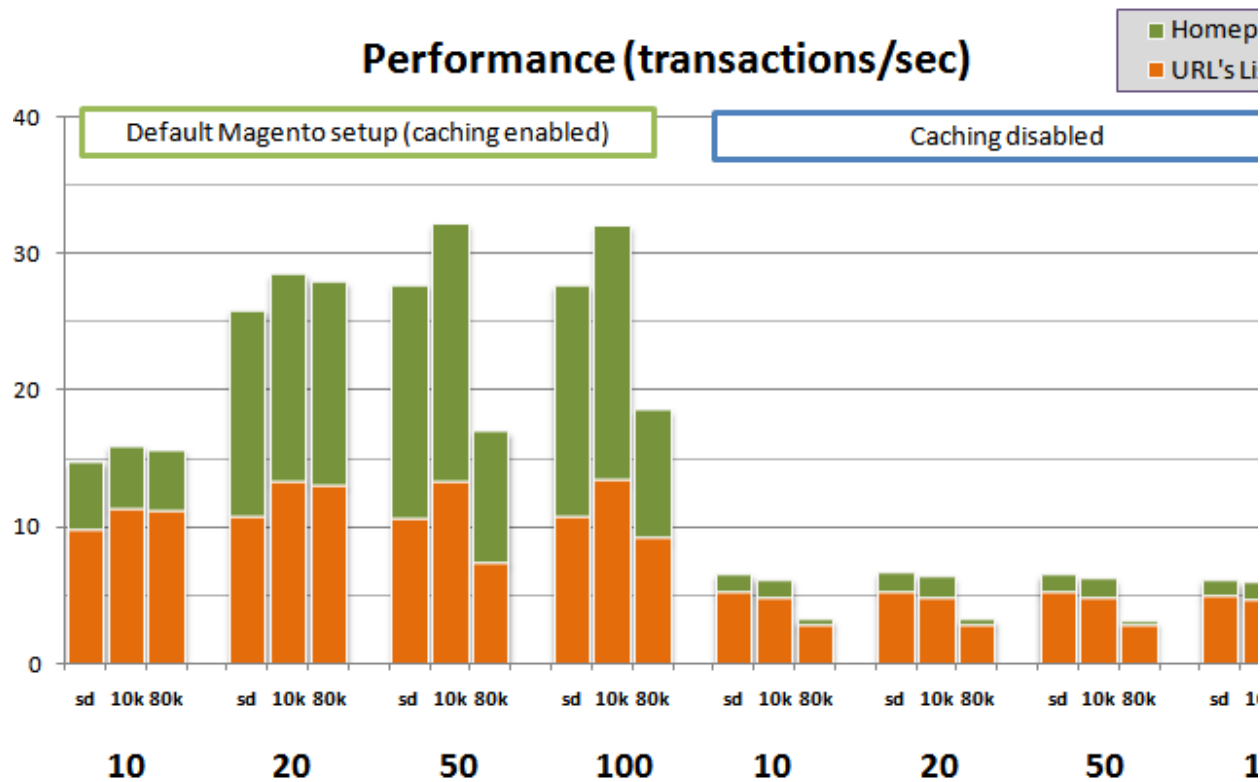

Figure 3: Caching enabled vs. Caching disabled

Conclusion: It may be required to disable the built-in Magento Enterprise Edition cache (that is enabled after installation by default) during active development, but please make sure that caching is enabled on production sites as disabled cache makes the store frontend 5-6 times slower and less responsive under load.
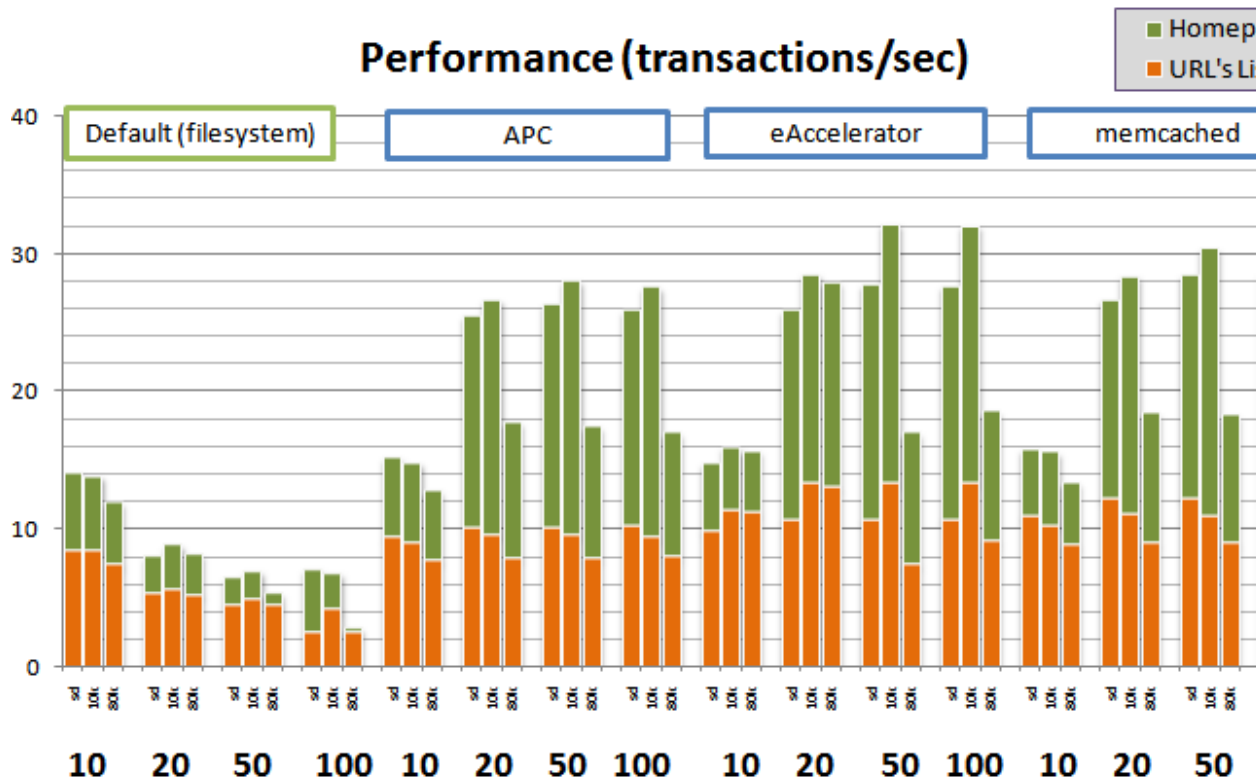
Figure 4: Cache backends: APC vs.eAccelerator vs. memcached vs. filesystem.

Conclusion: The APC cache backend improves the results, which are 2-3 times better than the default filesystem cache backend. The memcached cache backend shows 10-15% better results than APC. And from our tests the eAccelerator cache backend shows the best results which are 5-10% faster than memcached.

Handling Sessions

Magento Enterprise Edition uses PHP sessions to store customer session data.

The default method is to use filesystem storage, which works well if you are using a single web-server. Its performance can be improved by configuring a **tmpfs** in-memory partition to avoid extra hard drive I/O activity.

In a clustered environment with multiple web-servers, the first option for handling sessions is to use a load-balancer capable of associating client requests to specific web-nodes based on client IP or client cookies. If you are in a clustered environment and not using a load-balancer capable of the above, it is necessary to share the session data between all the web-servers. Magento Enterprise Edition supports two additional session storage types that can be used in this case.

Storing session data in the database (though it is fully supported) is not recommended as it puts

an additional load on the main database, and therefore requires a separate DB server to handle multiple connections efficiently under load in most cases.

memcached session storage is free of these disadvantages. **memcached** service can be run on one of the cluster servers to provide fast session storage for all web-nodes of the cluster. **memcached** session storage doesn't show any performance improvements when used in a single-server configuration though, because of extra overhead processing compared to raw filesystem session files.
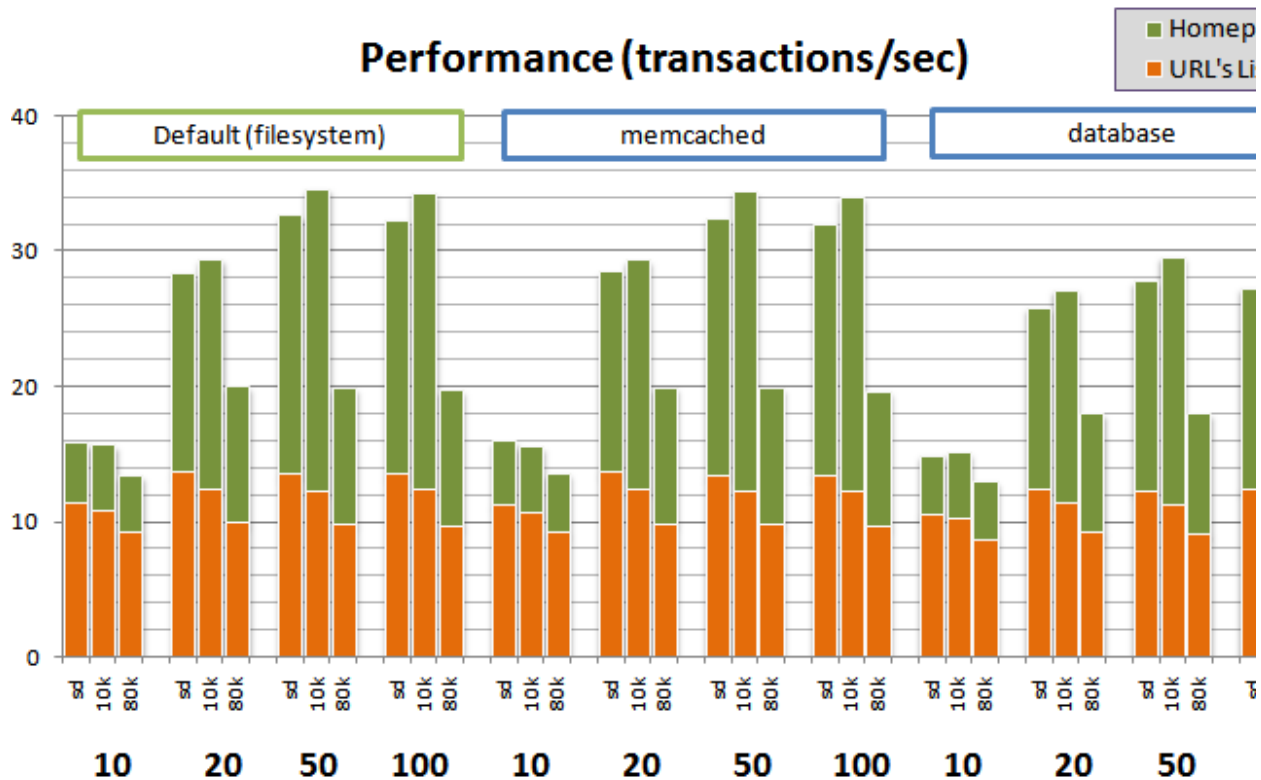

Figure 5: Session storage on single server: filesystem vs. database vs. memcached.

Conclusion: The default filesystem storage shows the best results on a single-server setup. The memcached session storage shows slightly different results (1-2% worse) and it can be considered an option in a clustered environment with a simple load-balancer setup. The database session storage should be used only in a clustered environment and only if the memcached storage cannot be used for some reason.

Directory Structure Optimization

Optimizing directory structure can also help fine tune Magento Enterprise Edition performance. It is highly recommended to use the Zend Framework distribution bundled within Magento Enterprise Edition as it is tweaked to significantly reduce the number of system calls required to

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locate a file in the directory structure. This is accomplished by commenting out all extra **require_once** directives within the configuration file. The additional **require_once** calls are not required because Magento Enterprise Edition implements its own **autoload** function that handles all necessary file requests on demand. Recent Magento Enterprise Edition versions (since version 1.3.x) include the Magento Enterprise Edition Compilation Module (**Mage_Compiler**) which provides extra optimization by placing all the files in one directory and combines the most used classes in a few single files.
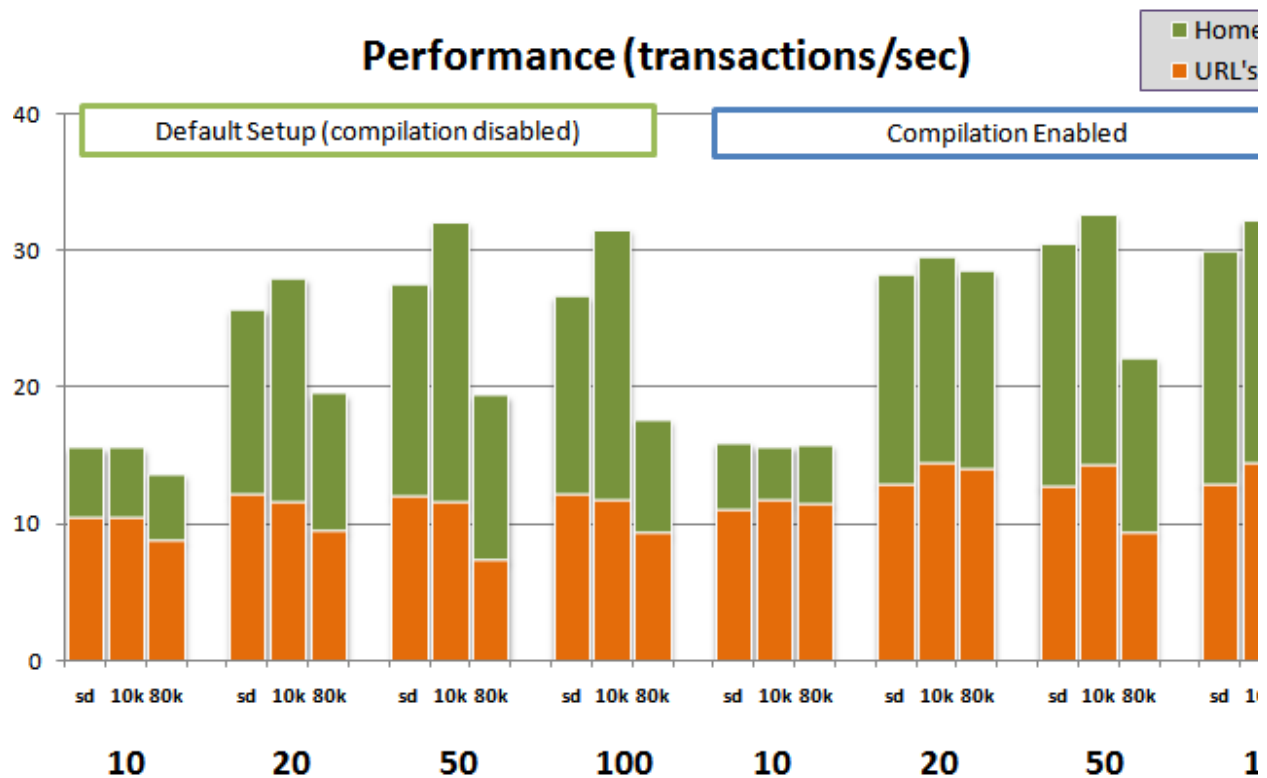

Figure 6: Compilation enabled vs. Compilation disabled

Conclusion: Enabling Magento Enterprise Edition Compilation Module provides a 10-15% additional performance boost.

Flat Frontend Catalog

Starting in Magento Enterprise Edition 1.3.x the Flat Frontend Catalog module was introduced. The Flat Frontend Catalog module maintains an additional set of database tables to store catalog data in a linear format, with extra indexes that facilitate executing database queries on the frontend catalog pages.

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Flat Frontend Catalog structures were implemented for both category and product data. Flat Categories are recommended for any Magento Enterprise Edition installation for improved performance, whereas the Flat Products is designed and recommended for catalogs that have over 1,000 SKU's.

To enable one or both, first go to your administrator panel and navigate to **System → Cache Management**. Under Catalog click on the **Rebuild** button next to **Rebuild Flat Catalog Category** or **Rebuild Flat Catalog Product**. Note: If only Flat Catalog Categories are used there is no need to rebuild the Flat Catalog Product.

Navigate to System → Configuration, click on **Catalog** and select the **Frontend** tab. Choose **Yes** next to the appropriate selection of either **Use Flat Catalog Category** or **Use Flat Catalog Product**.

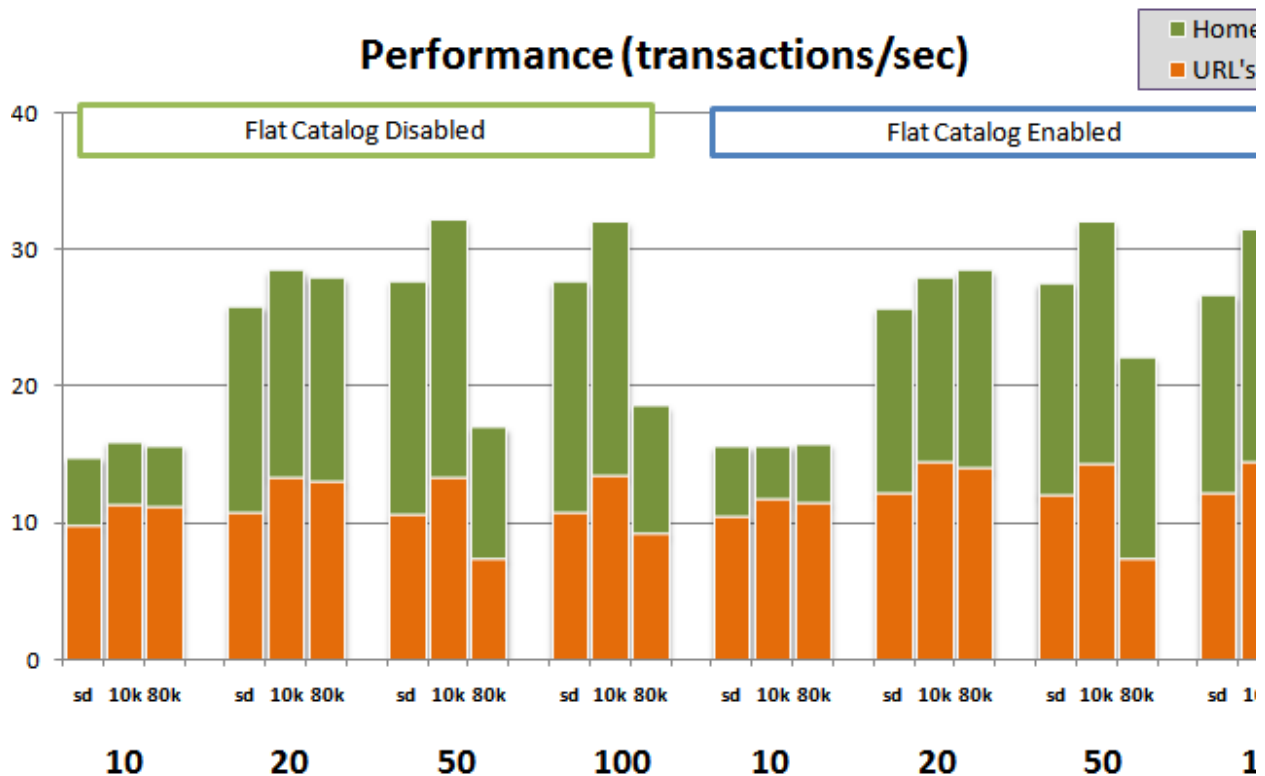*Note: If you want to use only Flat Category there is no need to enable Flat Product.*

Figure 7: Flat catalog Enabled vs. Disabled

Conclusion: Enabling the Flat Catalog module does not add much to the homepage test results as the default homepage does not contain product listing information and the categories menu is efficiently cached by default. However, when it comes to browsing the frontend catalog the performance gain is around 2-3% on smaller catalogs and reaches 8-10% on larger catalogs with complex category structures and large numbers of products.

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Magento Enterprise Edition 'cron' Scripts

There are some activities in Magento Enterprise Edition that are required to be scheduled with cron. For example, catalog price rules generate price indexes for 3 days in advance when a rule is applied from the admin panel, and in order to make the rules not expire in 3 days they have to be refreshed by Magento Enterprise Edition cron scripts on a daily basis. There are also other scheduled tasks in Magento Enterprise Edition, and it is important to not configure all of them to run at the same time, as it may overload the master database.

*Note on Scheduled Backups:

It is a general best practice to backup important data on servers daily. Though it's not under the Magento Enterprise Edition scope, please make sure that system backups are running on your server at a time when the number of active customers and load on the servers is minimal.

Rebuilding Indexes

The process of rebuilding Magento Enterprise Edition index tables (e.g. layered navigation indexes or catalog price rules index) is a resource intensive operation. Please do not rebuild the indexes during the period of highest customer activity. The Magento Enterprise Edition Enterprise Edition includes content staging functionality that can be used to schedule necessary catalog updates at an appropriate time.

In future Magento Enterprise Edition versions there will be the option to use a separate database to calculate indexes data in order to not affect the performance of the store.

Admin Panel Separation

Admin panel operations are in general more resource consuming than the frontend activities. Often they require increasing PHP memory limits or having extra extensions compiled into PHP. Therefore, having a dedicated admin server can help make admin panel operation faster while not impacting the frontend configuration and performance. The separation can be done by specifying different base URL's on a global level, and for frontend websites and stores. Each separate domain name can then be served by a separate server.

Proper Search Type Selection

Magento Enterprise Edition supports 3 search types that can be selected in configuration – LIKE, FULLTEXT, and their combination. FULLTEXT search is known to be faster and puts less load on the database.

Frontend Layout Complexity

The Magento Enterprise Edition page generation process implies building block object hierarchy specified by a frontend theme layout. Fewer block son a page will require less time to instantiate block objects.

Default Magento Enterprise Edition themes were designed to represent all the Magento Enterprise Edition features, thus introducing a large number of small blocks in most pages. A specific store will benefit from a custom built theme facilitating useable customer experience while taking into account business and product specifics.

Proper design theme customization, simplifying the layout structure and combining small blocks, can make page generation time 4-5% faster than a complex layout with a lot of blocks on the page.

Number of HTTP Requests Per Page

In order to improve page load and processing time it's important to reduce the number of HTTP requests per page. Magento Enterprise Edition allows for combining multiple JavaScript files and stylesheets into a smaller number of files. This is fully under the control of a theme developer through the flexible system of theme layouts, instead of directly including JavaScript files from within the templates.

This is an example of the proper way to reduce the number of JavaScript file includes:

```
<reference name="head">
<action method="addJs"><script>custom_js/gallery.js</script></action>
<action method="addJs"><script>custom_js/intro.js</script></action>
</reference>
```

The example layout file above will combine those 2 scripts in a single file that will be added to the page with one request to **js/index.php?c=auto&f=,custom_js/gallery.js,custom_js/intro.js**.

Using Parallel Connections

Browsers can load page elements in parallel. Specifying different domains in the Magento Enterprise Edition configuration (under **System → Configuration → Web**) for media, skin and JavaScript URLs will help to speed the page rendering time in the browser, as most browsers are limiting the number of downloads to 2-4 parallel threads per domain name.

Base URL	http://www.domain.com/
Base Link URL	http://www.domain.com/
Base Skin URL	http://static.domain.com/skin/
Base Media URL	http://media.domain.com/media/

Other web page design recommendations are out of this document scope. You can find the detailed list of website design best practices at the Yahoo Developer Network at http://developer.yahoo.com/performance/rules.html

Media and Static Content Delivery

Though Apache is a fast and reliable web-server, there are other web-server options that are known to serve static content and media files more efficiently, consuming less memory and CPU time.

Widely used are nginx, lighttpd and tinyhttpd. These are multiplexing web-servers, which don't have built-in scripting languages support, but can handle thousands of simultaneous connections per server.

Additional Performance Gains

Static content delivery can be improved using a caching reverse proxy, such as Squid, or an HTTP accelerator like Varnish. A reverse proxy can locally cache content received from Apache to reduce the load on the Apache backends.

Another way to reduce your server load and to get smaller network latencies is using a content delivery networks (CDN). Most CDN's support pushing media content through a simple API and can be integrated with the Magento Enterprise Edition backend quite easily.

Scalability

Magento Enterprise Edition is designed to utilize benefits of running a multi-server setup in a clustered environment. Web-nodes are not limited to be of exactly the same type. There might be different nodes performing different tasks (frontend servers, static content and media servers and a separate admin panel server).

Scaling DB nodes

Magento Enterprise Edition works with a database in a manner that easily allows separating database connections for read and write activities. Each particular module can use its own connections if needed, which is fully customizable and can be easily set in **app/etc/local.xml**.

The following configuration snippet shows how to setup 2 separate connections to master and slave DB servers:

```
<config>
<global>
<resources>
<default_setup>
<connection>
<host><![CDATA[master]]></host>
<username><![CDATA[writeuser]]></username>
<password><![CDATA[writeuserpwd]]></password>
<dbname><![CDATA[Magento Enterprise Edition]]></dbname>
<active>1</active>
</connection>
</default_setup>
<default_read>
<connection>
<use></use>
<host><![CDATA[slave]]></host>
<username><![CDATA[readuser]]></username>
<password><![CDATA[readuserpwd]]></password>
<dbname><![CDATA[Magento Enterprise Edition]]></dbname>
<model>mysql4</model>
<initStatements>SET NAMES utf8</initStatements>
<type>pdo_mysql</type>
<active>1</active>
</connection>
</default_read>
</resources>
</global>
<config>
```

Scaling web-nodes

Magento Enterprise Edition can be scaled over any number of additional web-servers, which will allow for the handling of more concurrent requests by simply introducing new web-nodes when the number of page views and visitors grow. When the number of visitors grows, doubling the number of web-nodes can provide up to 60-70% performance increase.

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Physical Servers

As mentioned in the introduction, the tests above were executed in a cloud environment to provide for easy reproducibility. However, as is expected, results show better performance on physical dedicated servers as shown below:
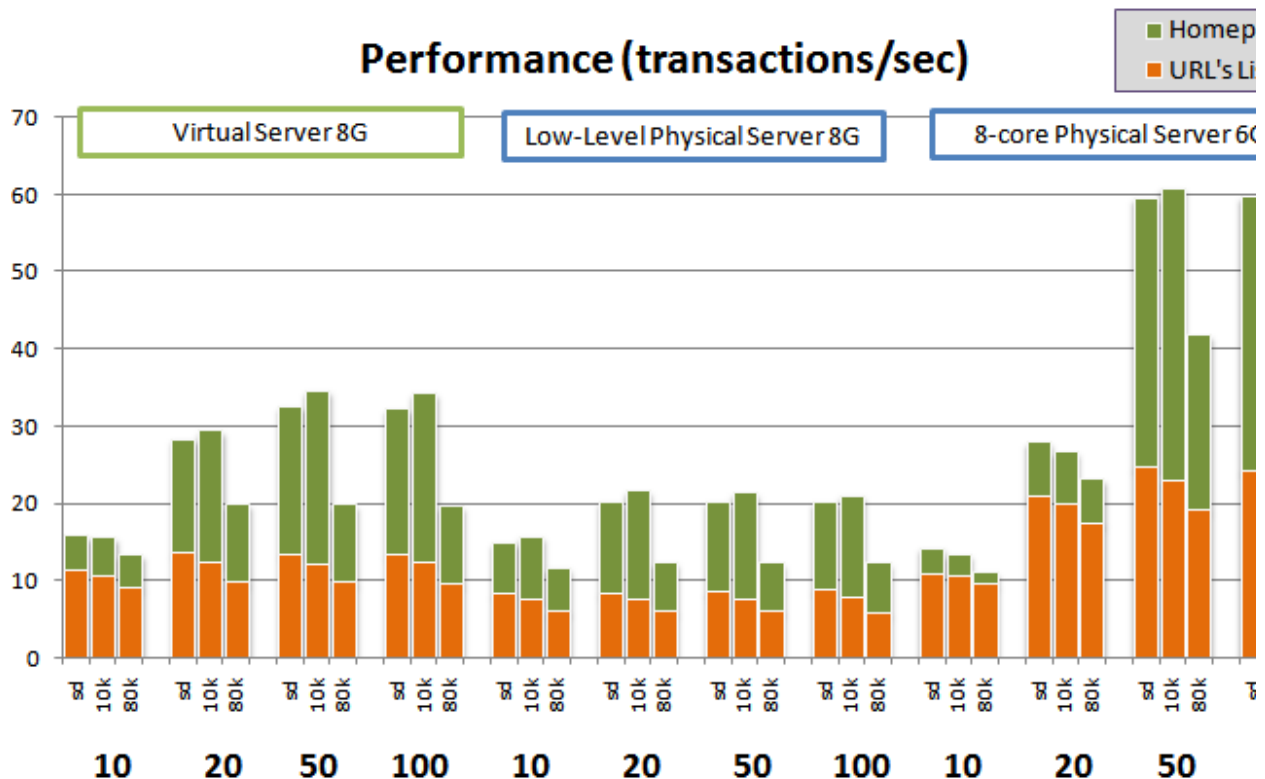

Figure 8: Cloud Server vs. Low-Level Server (2 cores, SATA HDD) vs. Modern Server (8-cores, SAS 15K, RAID10)

Conclusion: A low-level dual-core server with a single SATA hard-drive and 8GB RAM installed is able to handle about 20 trans/sec in homepage tests and 8-9 trans/sec during an average customer session. Adding more cores and faster hard-drives configured in a RAID array allows for the handling of more page requests (60 trans/sec on homepage and 24 trans/sec on customer session URL test) with hundreds of concurrent customer sessions which allows for the serving of more page views for more visitors. In our tests we were able to get the same requests per second with 400 concurrent sessions, but to keep page response time low one might consider adding another web node for serving such traffic.

Summary

As evident, there are significant benefits to paying attention to detail when planning, deploying and configuring your Magento Enterprise Edition setup. Considerations such as physical platform, network performance, stack configuration and fine-tuning as well as a suitable Magento Enterprise Edition installation all play important roles in ensuring you squeeze every ounce of performance possible out of your unique setup. Below is a review of some of the key lessons learned.

It's strongly recommended to optimized MySQL and Apache configuration which will provide a 55-70% performance increase, especially on dynamic pages. The default MySQL and Apache setup is configured to use far less resources than average hardware can provide. The default setup is not able to handle high numbers of concurrent customer sessions, making for unpredictable and sometimes erratic server load.

Adding a PHP accelerator is another important aspect of configuring your Magento Enterprise Edition environment. APC accelerator shows good results (42% increase on homepage and 500-600% increase on other pages). From our tests eAccelerator is even more efficient, showing a boost in performance an additional 15-20% better than APC.

Enabling caching on production sites is vital as a disabled cache can make the store frontend 5-6 times slower and less responsive under load.

When configuring Magento Enterprise Edition please consider switching from the default filesystem cache backend to a shared-memory (APC or eAccelerator) or memcached cache backend. The APC cache backend shows results which are 2-3 times better than the default filesystem cache backend. The memcached cache backend shows 10-15% better results than APC. And from our test the eAccelerator cache backend shows the best results.

In a single server setup there is no need to change the default filesystem session storage as it shows the best results. In a clustered environment, however, in cases where the load-balancer used is not capable of associating client requests to specific web-nodes based on client IP or client cookies, it might be required to use shared session storage (memcached or database). memcached session storage shows the results that are close to the default storage (1-2% worse). The database session storage should be used in a clustered environment only if memcached storage cannot be used for some reasons.

Installing the Magento Enterprise Edition Compilation Module and enabling compilation can give 10-15% additional performance boost.

For catalogs that have over 1,000 SKU's it is highly recommended to enable the Flat Catalog Products module. Flat Catalog products can provide an 8-10% performance increase. For improved performance the Flat Catalog Categories module is recommended for any Magento Enterprise Edition installation.

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All of these results can be improved even further utilizing modern multi-core CPUs and fast hard drives. A low-level dual-core server with a single SATA hard drive and 8GB RAM installed is able to handle about 20 trans/sec in homepage tests and 8-9 trans/sec during an average customer session. Adding more cores and faster hard drives configured in a RAID array allows for the handling of more page requests (60 trans/sec on homepage and 24 trans/sec during customer session) with hundreds of concurrent customer sessions which allows for the serving of more page views for more visitors.

The Magento Enterprise Edition subscription is the leading Open Source eCommerce platform built on solid technology which gives you the flexibility, configurability and performance you need to develop a unique online marketing and storefront channel. Attention to detail can go along way, and with a little bit of fine tuning, Magento Enterprise Edition's rock solid stability and well configured performance gives you the ultimate value when it comes to serving as many customers as richly and as cost-effectively as possible, while providing you with the edge necessary to differentiate yourself from and stay ahead of your competitors.

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Appendix A: Apache Web Server Configuration

```
ServerTokens OS
ServerRoot "/etc/httpd"
PidFile run/httpd.pid
Timeout 120
KeepAlive Off
MaxKeepAliveRequests 100
KeepAliveTimeout 15

StartServers      100
MinSpareServers   100
MaxSpareServers   150
ServerLimit       256
MaxClients        256
MaxRequestsPerChild  4000

Listen *:80

LoadModuleauthz_host_module modules/mod_authz_host.so
LoadModuleexpires_module modules/mod_expires.so
LoadModuledeflate_module modules/mod_deflate.so
LoadModulemime_module modules/mod_mime.so
LoadModuledir_module modules/mod_dir.so
LoadModulerewrite_module modules/mod_rewrite.so

LoadModulelog_config_module modules/mod_log_config.so


User apache
Group apache

ServerAdminroot@localhost
#ServerName www.example.com:80
UseCanonicalName Off

DocumentRoot "/var/www/html"
<Directory />
    Options FollowSymLinks
AllowOverride None
</Directory>
<Directory "/var/www/html">
    Options Indexes FollowSymLinks
AllowOverride All
    Order allow,deny
    Allow from all
</Directory>
AccessFileName .htaccess
<Files ~ "^\.ht">
    Order allow,deny
    Deny from all
</Files>

TypesConfig /etc/mime.types
DefaultType text/plain
<IfModulemod_mime_magic.c>
#    MIMEMagicFile /usr/share/magic.mime
MIMEMagicFile conf/magic
</IfModule>

HostnameLookups Off
ErrorLog logs/error_log
LogLevel warn
LogFormat "%h %l %u %t \"%r\" %>s %b \"%{Referer}i\" \"%{User-Agent}i\"" combined
LogFormat "%h %l %u %t \"%r\" %>s %b" common


LogFormat "%{Referer}i -> %U" referer
LogFormat "%{User-agent}i" agent
```

```
CustomLog logs/access_log combined

ServerSignature On
AddDefaultCharset UTF-8
AddType application/x-compress .Z
AddType application/x-gzip .gz .tgz

LoadModule php5_module modules/libphp5.so
AddHandler php5-script .php
AddType text/html .php
DirectoryIndexindex.php
```

Appendix B: MySQL Configuration

8 GB server that runs both Apache and MySQL:

```
max_connections = 1000
max_connect_errors = 10
table_cache = 1024
max_allowed_packet = 16M
max_heap_table_size = 64M
sort_buffer_size = 8M
join_buffer_size = 8M
thread_cache_size = 8
thread_concurrency = 8
query_cache_size = 64M
query_cache_limit = 2M
tmp_table_size = 64M
key_buffer_size = 32M
read_buffer_size = 2M
read_rnd_buffer_size = 16M
bulk_insert_buffer_size = 64M
myisam_sort_buffer_size = 128M
myisam_max_sort_file_size = 10G
myisam_max_extra_sort_file_size = 10G
myisam_repair_threads = 1
myisam_recover
innodb_additional_mem_pool_size = 16M
innodb_log_buffer_size = 8M
innodb_log_file_size = 512M
innodb_log_files_in_group = 2

innodb_buffer_pool_size = 3G
innodb_data_file_path = ibdata1:3G;ibdata2:1G:autoextend
innodb_autoextend_increment=512
```

Appendix C: PHP Configuration

```
# Required extensions
extension=bcmath.so
extension=curl.so
extension=dom.so
extension=gd.so
extension=mcrypt.so
extension=memcache.so
extension=mhash.so
extension=pdo.so
extension=pdo_mysql.so

# Not needed extensions from default setup
;;;extension=dbase.so
;;;extension=json.so
;;;extension=mysqli.so
;;;extension=mysql.so
;;;extension=pdo_sqlite.so
;;;extension=sqlite.so
;;;extension=wddx.so
;;;extension=xmlreader.so
;;;extension=xmlwriter.so
;;;extension=xsl.so
;;;extension=zip.so

# APC configuration specifics if it is used
extension=apc.so
apc.shm_size=256
apc.num_files_hint=10000
apc.user_entries_hint=10000
apc.max_file_size=5M

# eAccelerator configuration specifics if it is used
zend_extension="/usr/lib64/php/modules/eaccelerator.so"
eaccelerator.shm_size = "256"
```

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Appendix D: Software Versions Used

```
CentOS release 5.3 (Final)
Linux 2.6.24-23-xen SMP x86_64 GNU/Linux
mysqlVer 14.14 Distrib 5.1.36, for redhat-linux-gnu (x86_64) using readline 5.1
PHP 5.2.10
Apache/2.2.3
memcached 1.2.5
SIEGE 2.69
Magento Enterprise Edition 1.3.2.3
```

Appendix E: Tests Configuration

URL list for Magento Enterprise Edition with sample-data:

```
BASEURL=http://server.test/
$(BASEURL)
$(BASEURL)electronics/cell-phones.html
$(BASEURL)electronics/cell-phones.html?price=2%2C100
$(BASEURL)electronics/cell-phones.html?price=2%2C100&color=23
$(BASEURL)electronics/cell-phones/samsung-mm-a900m-ace.html
$(BASEURL)checkout/cart/add/product/20/
$(BASEURL)apparel.html
$(BASEURL)cn-clogs-beach-garden-clog.html
$(BASEURL)checkout/cart/
$(BASEURL)checkout/onepage/
$(BASEURL)catalogsearch/result/?q=ink&x=0&y=0
$(BASEURL)apparel.html?cat=17
$(BASEURL)apparel.html?price=1%2C100&cat=17
$(BASEURL)the-get-up-kids-band-camp-pullover-hoodie.html
$(BASEURL)checkout/cart/add/product/39/
$(BASEURL)apparel/shirts.html
```

URL list for Magento Enterprise Edition with 10.000 and 80.000 SKUs:

```
BASEURL=http://server.test/
$(BASEURL)
$(BASEURL)category-3.html
$(BASEURL)category-3.html?cat=28
$(BASEURL)category-3.html?cat=28&price=2%2C1000
$(BASEURL)category-3/pr15031-50.html
$(BASEURL)checkout/cart/add/product/2489/
$(BASEURL)category-273.html
$(BASEURL)category-273/100-190-b7h.html
$(BASEURL)checkout/cart/
$(BASEURL)checkout/onepage/
$(BASEURL)catalogsearch/result/?q=345&x=0&y=0
$(BASEURL)category-273.html?cat=427
$(BASEURL)category-273.html?cat=427&ab_host=303
$(BASEURL)category-273/r1256ap.html
$(BASEURL)checkout/cart/add/product/1354/
$(BASEURL)category-273/category-309.html
```

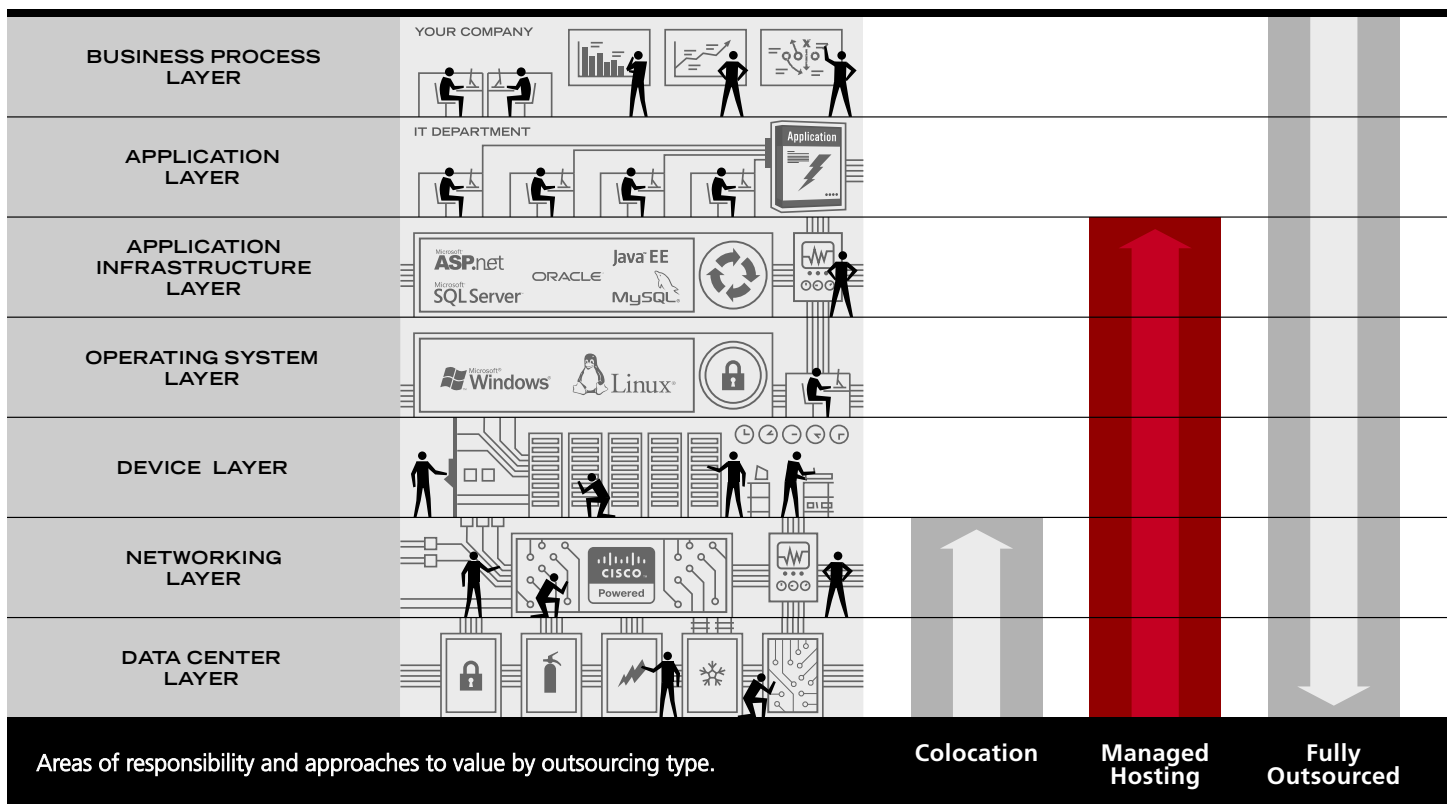# Appendix F: Magento Enterprise Edition Sample Databases

Please contact enterprise@varien.com for sample data and databases.

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MANAGED HOSTING
Dedicated Servers with Dedicated People Supporting Them

In a managed hosting environment, your provider owns and is responsible for the data center, network, devices, operating system and application infrastructure components, providing a stable operating environment for your applications. Your IT organization manages your applications and maintains full control over the operating system and application infrastructure.

Managed Hosting provides more value than colocation and dedicated hosting because it frees more of your IT personnel from mundane infrastructure related tasks, personnel that can now be reallocated to understanding and supporting your business more effectively. Managed Hosting also provides greater responsiveness than fully outsourced solutions because it emphasizes a flexible bottom-up approach to delivering value that puts you fully in control of your OS, application infrastructure and application. In addition, Rackspace® Hosting also delivers a number of key services designed to keep your applications secure, stable and responsive to your changing business needs.

		Colocation	Managed Hosting	Fully Outsourced
BUSINESS PROCESS LAYER	YOUR COMPANY			
APPLICATION LAYER	IT DEPARTMENT			
APPLICATION INFRASTRUCTURE LAYER	ASP.net ORACLE Java EE SQL Server MySQL			
OPERATING SYSTEM LAYER	Windows Linux			
DEVICE LAYER				
NETWORKING LAYER	CISCO Powered			
DATA CENTER LAYER				

Areas of responsibility and approaches to value by outsourcing type.

Scalability & Performance are key with eCommerce solutions. Magento has partnered with Rackspace to provide reliable and secure hosting solutions for Magento customers. **With every Magento deployment, Rackspace can perform configuration changes to Apache, PHP, and MySQL for maximizing performance as recommended by Varien, the Magento Company.** As Magento's Enterprise Hosting Partner, Rackspace will provide and manage the network and infrastructure, allowing merchants to take full advantage of the flexibility and control of this leading feature-rich eCommerce platform built on Open Source Technology.

For more information, please visit www.rackspace.com/magento

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