Linux, Apache, MySQL, Perl/PHP/Python (LAMP)

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KW Linux Users Group
Agenda

- Introduction
- What is LAMP?
- Linux, Apache, MySQL, PHP/Perl/Python
- Installation, Configuration
- Performance
- Alternatives
- Security
- Discussion
About Khalid

- 25 years in software development and consulting
- Sinclair ZX Spectrum, mainframe, then UNIX since 1987
- Linux discovered 1990, using it regularly since 1995, “LAMP” since 1999
- Open source developer, contributor since 2003
- Full time open source consulting
About 2bits.com

- Founded in 1999
- Drupal CMS/CMF since 2003
- Full time consulting
- Services
  - Drupal development
  - LAMP performance optimization and tuning
  - Server provisioning for performance and uptime
  - Manage huge sites for various clients
- http://2bits.com
What is LAMP?

- Application platform: operating system, web server, database and scripting language
- LAMP stands for: Linux, Apache, MySQL and Perl/PHP/Python
- 2000: Term coined in Germany
- 2001: Term popularized by O'Reilly (onlamp.com)
- Technology stack itself was in use before that (e.g. Slashdot)
LAMP Overview

- Linux
- Apache
- MySQL
- PHP, Perl, Python
- App Scripts
- Internet
Benefits

- Perhaps the most widely used open source stack
- Poster child for the FOSS movement
- Ubiquitous, yet not “visible”, unlike the desktop or cell phones
- Business cost savings (no licensing needed)
- Low entry barrier for developers
Who uses LAMP?

- Huge web sites
- Most of the top 20 sites, excluding Microsoft, Google and Chinese sites
- Examples:
  - Digg (Apache, PHP, MySQL)
  - Wikipedia (Apache, PHP, MySQL)
  - Yahoo (Apache, PHP, MySQL)
  - WordPress.com (PHP, MySQL)
  - Youtube (Apache)
Who else?

- Many other large sites
  - Facebook (Apache, PHP, other stuff)
  - Craigslist (Apache)
- Geeky large web sites
  - Slashdot (Apache, MySQL, perl)
  - Linux.com (Apache, PHP)
  - Drupal.org (Apache, PHP, MySQL)
Tip: HTTP Headers

- Curious about a site?
- Here is how to glean some info:
  - time wget -S -O /dev/null http://digg.com
- Shows HTTP Headers
  - Language used
  - Web server
Applications

- A very large number of applications are build on the LAMP stack
- Content Management Systems (CMS)
  - Drupal, Joomla, Wordpress
  - MediaWiki (Wikipedia)
- Frameworks
  - Symfony, Django
Installation

• Distro binaries
  – Far easier to install and maintain
  – Easier to apply security updates
  – Good for most cases

• Compiling from Source
  – Can customize further
    • e.g. Remove certain modules to save memory
    • Optimize for a given architecture
  – You take ownership of security patches and bug fixes
Distro install

- Debian/Ubuntu
  - Minimal install:
    **aptitude** install apache2 mysql-server php5 php5-mysql

- CentOS
  - Yum
Other options

- Ubuntu Server CD has an “install LAMP server” option.
- Appliances
  - Can run in a virtual machine
  - [http://www.turnkeylinux.org/](http://www.turnkeylinux.org/)
  - LAMP, MediaWiki, Drupal, Java, and much more
Linux
• Needs no introduction (this is the KWLUG!)
• Kernel + tools making up a distro
• Focus on server distros
  – Debian stable (Lenny)
  – Ubuntu Server edition LTS (8.04.2 Hardy Heron)
  – CentOS, free version of RedHat
• Seen LAMP running on Android phone, with Drupal on it!
Apache
Apache

- “A patchy server” -> “Apache”
- Free software
- Most widely used web server 47.12% June 2009 as per Netcraft
- Next most used server is Microsoft IIS (24.8%)
- Used to be higher, Microsoft “bought” market share in 2007
- Current stable version 2.2.8
Apache modes

- MPM Pre Fork
- MPM Worker
Apache pre-fork

- Each request is handled by a separate process
- Apache pre-forks a configurable number of processes, leaving spares around
- Incoming requests always have a handler for them, as long as the maximum is not reached
- Most common for PHP on VPS or dedicated, shared hosting more often CGI
- Configuration is important
  - Too low and you can get users complaining!
  - Too high and you get the server swapping!
Pre-fork configuration

- Parameters for many things

  StartServers    5
  MinSpareServers 5
  MaxSpareServers 10
  MaxClients      150
  MaxRequestsPerChild 0
Apache MPM Worker

- Threaded mode
- Each request is handled by a thread
- Much less memory usage
- Does not work with certain setups (e.g. PHP with mod_php)
Worker configuration

- Parameters for:
  - StartServers: 2
  - MaxClients: 150
  - MinSpareThreads: 25
  - MaxSpareThreads: 75
  - ThreadsPerChild: 25
  - MaxRequestsPerChild: 0
Tip: Worker + FastCGI

- Using Worker (threaded server) and FastCGI has the potential for memory savings
Modules

- Modular design
- Modules do various specific things
- Can be static (complied in) or shared (pluggable, implemented as a dynamic library)
- Can be disabled/enabled, reduce size
Modules

- **mod_rewrite**
  - manipulate URLs in various ways
  - e.g. Prettier URLs `example.com/index.php?q=something` becomes just `example.com/something`
  - Can be used it for mapping old content to new

- **mod_deflate**
  - compresses web pages, css, js to save bandwidth

- **mod_status**
  - statistics, number of requests, number of bytes, number of processes
MySQL

• Relational Database

• History
  – Initially there was mSQL
  – MySQL emulated MySQL
  – Was used for decision support (read heavy)
  – Offered it for free to hosting companies
  – More adoption, more growth
  – “Previous version GPL'd”, then full GPL
MySQL

- Pluggable “Engines”
- Commercial support
- Current stable version is 5.0.51
MyISAM Engine

- Non transactional engine
- Lightweight
- Fast!
- Table level locking
  - Bad for high traffic sites
- Indexes and data in separate files
InnoDB Engine

- Transactional engine
- Developed by InnoDB
- Row level locking
- Tablespaces (like Oracle), or one file per table
- Index and data stored in the same file
- Each table can be MyISAM or InnoDB
- More resource intensive
Tip: Convert to InnoDB

- InnoDB is better for not locking the whole table
- Better concurrency
- Simple to convert tables from MyISAM to InnoDB
  - `ALTER TABLE table1 Engine=InnoDB;
- Be careful with large tables though
  - Took 6 hours to complete for one client!
MySQL Advantages

- Easy to use and administer
- Supported by all languages and frameworks
- Small enough
- Powerful enough
- Upgrades are easy (data format remains the same)
Disadvantages

- Ignores statements that the engine does not support:
  - e.g. Non transactional engine (MyISAM) but using BEGIN TRANSACTION, ...etc.
- No sub second measurement
  - SHOW PROCESSLIST
  - 3rd Party patches have it (Percona)
MySQL future

• Oracle bought InnoDBBase, makes of InnoDB a few years ago
  – Perhaps to meddle/control MySQL?
• Sun bought MySQL in 2008 for $1B
• Sun is bought by Oracle in 2009
• MySQL founders have projects
  – Maria, Drizzle, OurDelta, ...etc.
• We can speculate all we want!
• MySQL is GPL!
Interpreter Modes

- CGI
- Inline
- FastCGI
Common Gateway Interface

- Oldest method of running dynamic stuff inside a web site (early to mid 90s?)

- Workflow:
  - Request comes in e.g. `/cgi-bin/something.cgi?param=value`
  - Web server forks a new process (`fork()` then `exec()`)
  - New process executes an interpreter (e.g. Perl)
  - A script is executed by the interpreter, with parameters passed
  - Passing back the result
  - Terminate the process
**CGI (cont'd)**

- **Advantages**
  - Provided a way to create dynamic web sites
  - Security (if setup correctly, interpreter process can run other than the web server user, with limited privileges)

- **Drawbacks**
  - Slow (because of the fork system call)
  - Wasteful on resources (fork is expensive)
  - Not suitable for large web sites (does not scale)
Inline (modules)

- Interpreter inside the Apache process
- PHP (mod_php)
- Perl (mod_perl)
- Python (mod_python)
Inline

Apache

Script interpreter (e.g. PHP)
FastCGI

- Similar to CGI
- Does not fork per request
- Instead, uses a socket to communicate with an existing process that holds the interpreter
- Instead of Apache being bloated with 100s of processes, we have fewer dynamic processes, a small pool to handle dynamic requests
- Apache has mod-fastcgi (questionable stability) and mod-fcgid (much more stable)
- Best of both worlds!
FastCGI (fcgid)

- Advantages
  - Significant memory savings!
  - Speed is very close to mod_php
  - Can be used with threaded server (MPM Worker)
  - Less connections to the database

- Drawbacks
  - Watch the timeouts (e.g. Large site with Drupal and cron)
PHP, Perl, Python
Scripting languages

- Interpreted, not compiled
  - Easy of develop
  - Easy to deploy
- Dynamic typing (integer vs string)
- Rich libraries
  - HTTP, file I/O, databases, string, math, arrays, XML, ...etc.)
Why not compiled?

- C, C++?
- Can be used, but more cumbersome
- Need to be compiled and linked to the web server
- Harder to develop, harder to deploy
- Some large sites do that
  - Amazon, eBay
  - Probably Google (very secretive)
PHP, Perl, Python

- PHP is popular and easy language, specifically for web development
- Python is a “better” language, but more generic.
- Perl a “worse” language, harder maintain, also not web specific
PHP

- Most widely used language on the web
- Current stable version is 5.2.4
- Can be run in many modes
  - CGI
    - Drawbacks
  - mod_php
  - FastCGI
mod_php

• Least problematic way of running PHP
• PHP is inside each and every Apache process
• Can be a tad faster than FastCGI
• Can also consume much more memory, since each Apache process has it, whether it is serving dynamic or static content
Apache's config

- MPM-Worker for a large site

```html
<IfModule mpm_worker_module>
  ServerLimit 500
  StartServers 10
  ThreadsPerChild 10
  MaxClients 600
  MinSpareThreads 30
  MaxSpareThreads 50
  MaxRequestsPerChild 3000
</IfModule>
```
PHP and fcgid

- First install fcgid
- `aptitude install libapache2-mod-fcgid`
- Configure as follows:

```xml
<IfModule mod_fcgid.c>
    AddHandler fcgid-script .fcgi .php
    DefaultInitEnv PHPRC "/etc/php5/cgi"
    FCGIWrapper /usr/bin/php-cgi .php
    MaxRequestsPerProcess 1500
    MaxProcessCount 50
    IPCCommTimeout 240
    IdleTimeout 240
</IfModule>
```
PHP op-code cache

- Op-code caches / Accelerators
- Reads, parses, and tokenizes scripts
- Stores the result in memory (op-code cache)
- Executes the code from the cache
- Significant resource savings for large sites
- APC
  - The “official” code cache from the PHP development team
  - Constantly tracks the latest PHP versions
  - Installed via PEAR/PECL repositories
eAccelerator

- Used to be the fastest and uses least memory
- No longer maintained
- Instabilities (segfaults, WSODs)
XCache

- Spin off from lighttpd web server
- Independent effort
- Maintained
- Debian/Ubuntu packages available
- Instabilities (segfaults, WSODs)
• mod_python
• FastCGI as well
Python Frameworks

• Zope, a framework
  – Grand daddy of all CMS
  – NATO uses it
• Plone CMS built on top of Zope
• Django framework
  – WashingtonPost
  – TorontoLife.com
• Pylons
• CherryPy framework
  - cuil.com
  - Turbogrears framework based on it
Perl

- Used to be popular as a web site language in the CGI days
- Still in use by some sites (Slashdot)
- mod_perl for embedding in Apache
- CMS based on Perl
  - Bricolage, popular for newspapers
  - WebGUI
  - Krang
  - Cyclone3
Speed and scaling

- Speed: faster serving of pages
- Scalability: ability to handle more concurrent requests
- Use a PHP op-code cache/accelerators
- Page caching
  - Static HTML (Squid, Varnish)
- Object caching
  - Memcached
- 2bits.com, for more performance presentations
Alternatives

Some components can be replaced for specific reasons
Operating System

- WAMP
  - LAMP on Windows
  - Several ready to install stacks out there
  - One download
  - Good, because it encourages developers to cross into open source
Operating Systems

- *BSD
  - FreeBSD seems to be a common alternative
- Mac OS/X
  - MAMP stacks exist
  - Mainly for development
Web servers

- **Lighttpd**
  - Nicknamed “lighty”
  - Fast and much less memory footprint
  - Memory leaks

- **Ngnix**
  - Same as lighty
  - Solves memory leaks
  - Still young, Russian documentation
  - Getting popular (shows on Netcraft)
Web servers

• Good for serving static content
  – All images on a separate server that has the alternate light weight web server
  – Or use Apache in a reverse proxy, front ended by the other web server on different ports

• All run PHP as FastCGI

• Lack certain features (e.g. URL rewriting, .htaccess, ...etc.)
Databases

• PostgreSQL
  – Very capable database
  – Community driven, not controlled by any company
  – Has transactional features by default
  – Not as easy to use as MySQL
  – Only recently incorporated replication
  – Upgrades mean export/import
Languages

- One language that has been gaining traction in recent years is Ruby
- Ruby on Rails a much touted (hyped?) platform
- Twitter was on RoR, now uses other technologies for messaging
  - Scala: a functional language that uses the Java Virtual Machine
Security

- Web applications will get remote probes all the time
  - Windows exploits
    - Worms targeting IIS and SQL Server (Code Red, SQL Slammer, Nimda, ...)
    - .DLL, vti, ...
    - Waste bandwidth and resources, but mostly harmless
  - Others are generic
  - Some are targeted to *NIX systems
    - Attempted logins via SSH
Types of exploits

- Cross Site Scripting (XSS): code injection from other sites, mainly Javascript
- Cross Site Request Forgery (CSRF): tricking you into actions when you are logged in
- Remote File inclusion, can lead to Trojan
- Never trust user input, sanitize it

Best practice

• Run ssh on a non standard port (e.g. 4023)
• Watch your logs
  – The logwatch package emails you daily with a summary
• Check CPU usage, a spike can mean a trojan
• Install only what is needed, as little as possible
  – Your app is PHP? Don't install mod_python
• Read a primer
  – e.g. http://drupal.org/writing-secure-code
Best practice

- Consider Apache's mod_security (web application firewall)
- PHP Suhosin hardening patch (enabled in Ubuntu by default)
- Stay informed
  - Subscribe to the security mailing list of your distro
  - If on Debian/Ubuntu, install apticron and get an email next day updates are available
Conclusion

- Success story for FOSS
- Powerful
- Capable
- Proven
- Low cost
Resources

- Wikipedia
- O'Reilly's ONLAMP http://www.onlamp.com
- Windows http://www.wampserver.com
Discussion

Questions?

Comments?