What can PHP on IBM i do for you and your organization

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About Me

Open Source Software (OSS) Background

- Test team lead for original enablement of Linux on AS/400 in 2001
- Linux instructor as Adjunct Professor for University of MN in early 2000s
- RHCE certified
- LPIC level 1 & 2 certified
- Mirantis Openstack Professional certification
- Headed up OSS center of competency for the iSeries Technology Center (precursor to IBM Lab Services)
- Lead consultant on OSS team in IBM Lab Services

- 39 Years in the Industry
- Worked with multiple of *NIX variants including AT&T System V Release 3, DGUX, SUN/OS, Linux…
- Worked with many different hardware platforms including PDP 11/70, AT&T 3B2/400, MainFrame, AS/400, PC/XT, PC/AT,…
- Started out in development including Model 204, PL/1, Pascal, C
- Also worked with Database, Quality Assurance, Technical Sales Support, Customer Enablement
- IBM technical advocate for initial roll-out of PHP enablement on IBM i

- Still working on wife 1.0
- Have 3 Children
  - 2 Married Sons
  - 1 Daughter – never getting married!

Newest Edition to the team!!

Agenda

- Quick Overview of PHP
- PHP in the Marketplace
- Why PHP on IBM I
- Extending the Reach of DB2
- Leveraging existing ILE programs and resources
- Taking advantage of the LAMP ecosystem

Bonus Topics (Time Permitting):

- Why PHP v7
- Open Source on IBM i Update

What is PHP

- PHP is an easy to use, open source, platform independent scripting language
  - Designed for web application development
  - 4.5+ Million PHP Developers
- PHP is the leading scripting language deployed on the Internet

- Thousands of PHP applications are available
  - Web applications tied to databases
  - Content management
  - Wikis and Blogs

Check-Out:

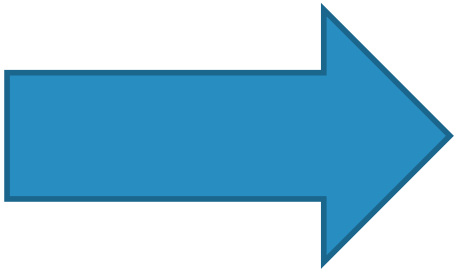
www.phpjunkyard.com/

www.phpfreaks.com/

```
<?php
 echo "Hello World!";
 echo "PHP is so easy!";
?>
```

Web Development/Deployment Stacks

L A M P
Linux Apache MySQL PHP



i A D P
IBM i Apache DB2 PHP

i A M P
IBM i Apache MySQL PHP

Mobile and Web Development

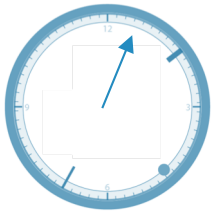
75%

attacks are on web applications

87%

developers experience delays in deployment

1 second



delay reduces conversion by 7%

40%

developers spend half their time on problem resolution

Enterprise PHP demands…

Fast resolution time and reduced PHP maintenance

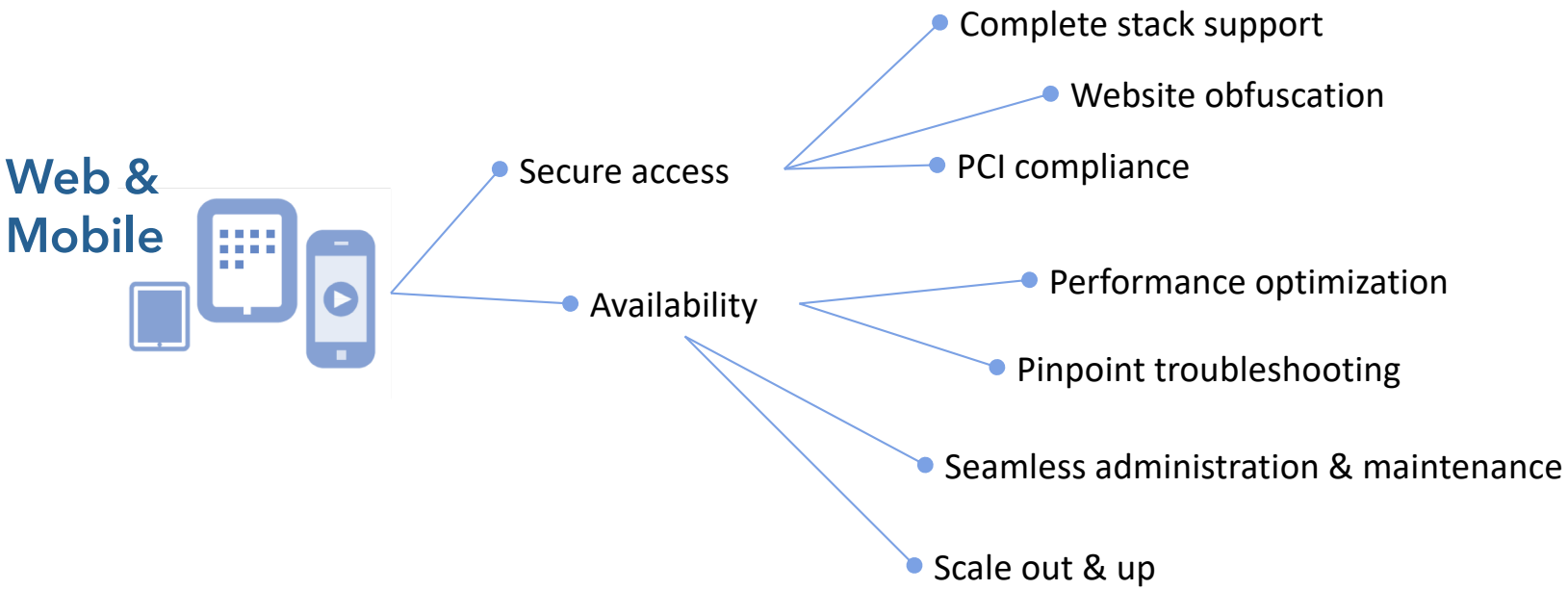
100% uptime and accelerated performance

Seamless scaling to meet ongoing and peak demands

Bulletproof, compliant web applications

Zend Portfolio

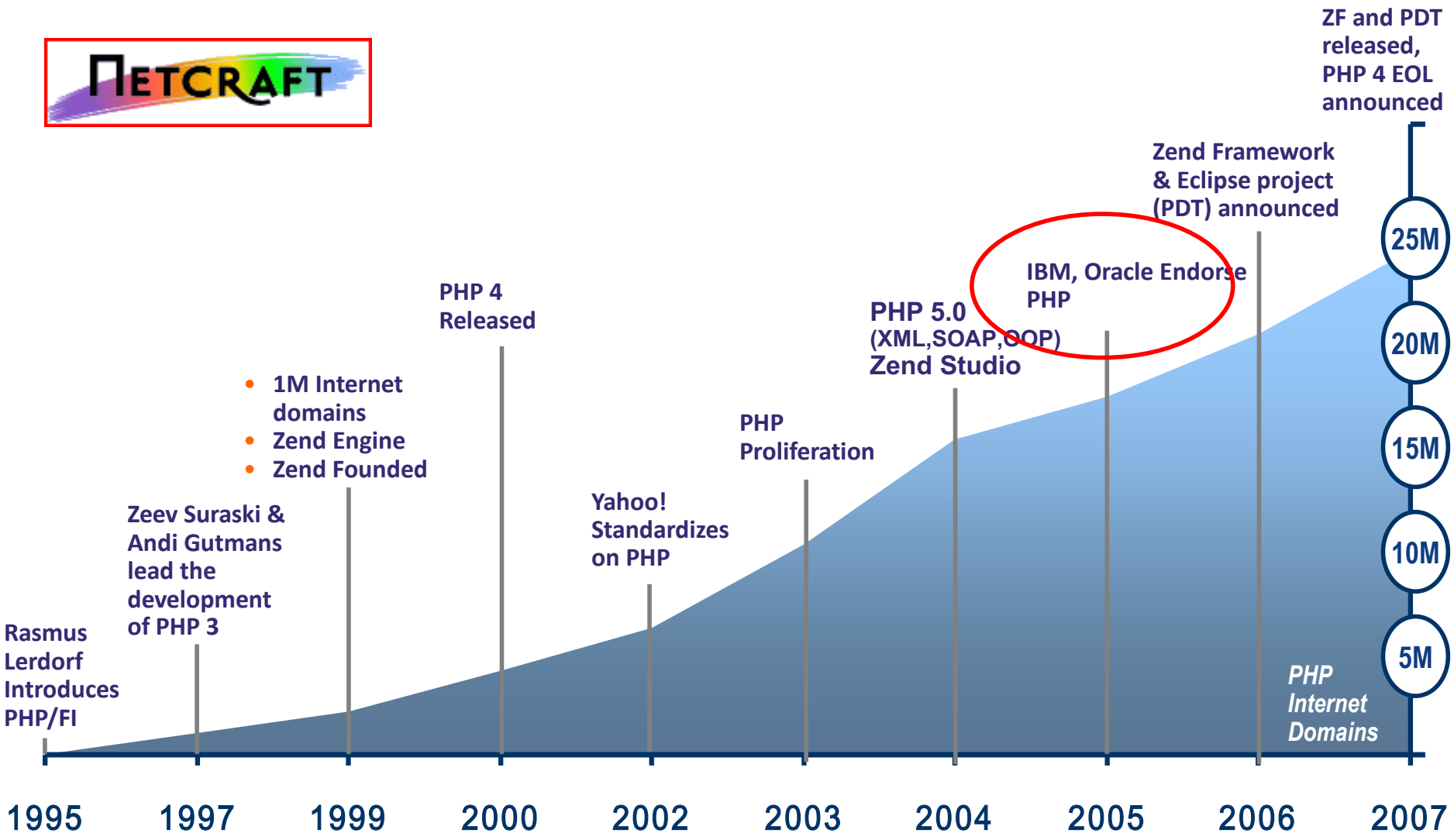
Comprehensive runtime for enterprise PHP



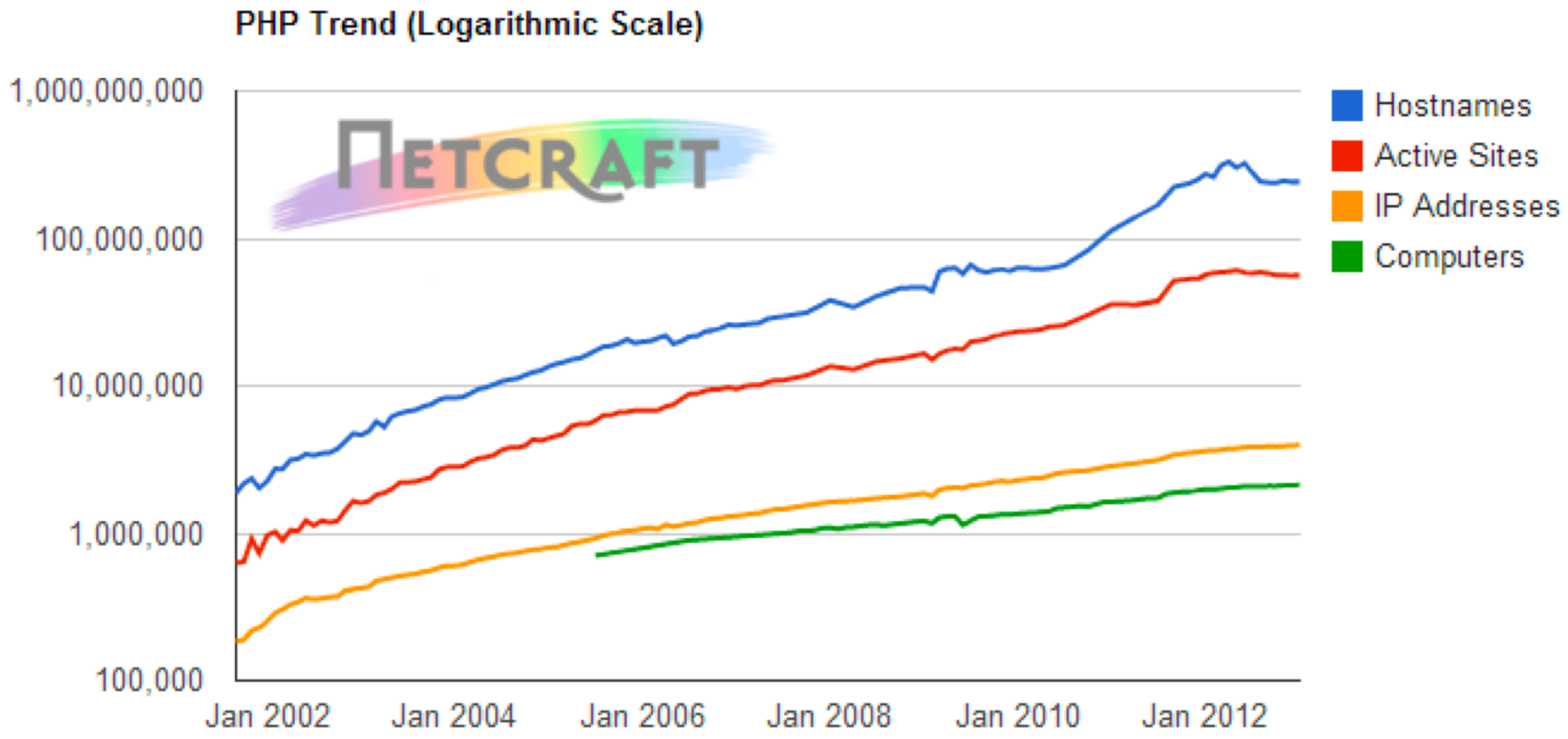
Secure | Manage | Build | Deploy

The Growth of PHP

Netcraft Article Jan 2013 says
244 Million sites+

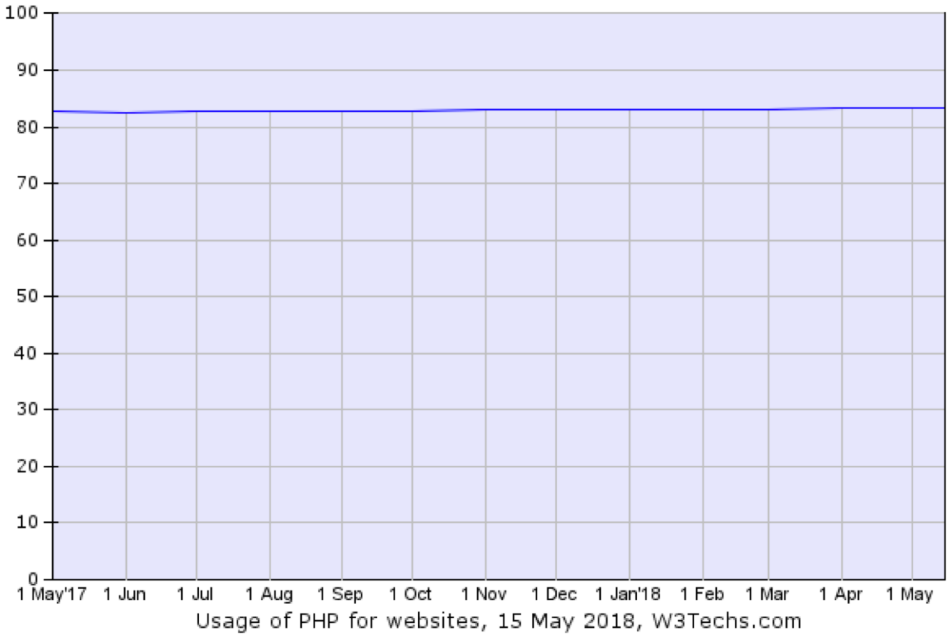


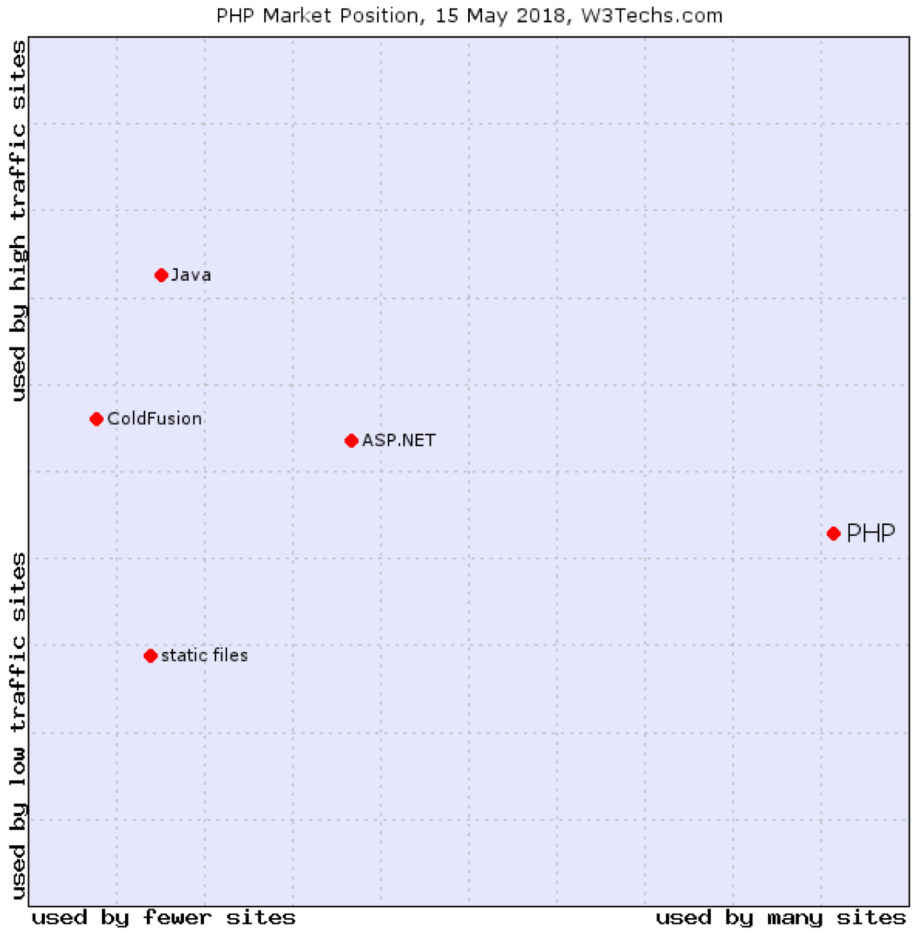
PHP Growth – another look



http://php.net/usage.php

PHP Usage





https://w3techs.com/technologies/details/pl-php/all/all

Drivers for PHP growth

- The ongoing Migration to Web Applications
  - When did you last install a desktop application?
  - Emerging generation of software services (**Web2.0**)
  - PHP is the leading web development platform
- Software buyers favor Open Source Software
  - OSS adoption driven by cost of ownership benefits, freedom from vendor lock in, and superior software quality
- PHP is the perfect Web Integration Platform
  - Best support for browser based rich client applications (Ajax)
  - Strong support for Web Services, XML & legacy systems
  - Powerful **SOA** capabilities enable new IT approaches (“mashable assets”) for reducing application backlogs
- PHP is backed by a very active community
  - ~ 1000 committers, ~ 4.5M developers (corporate/community)
  - Thousands of opensource projects and applications
  - Hundreds of thousands of commercial deployments
  - High profile PHP applications like Yahoo!, Flickr and YouTube
  - High profile ISV backing, IBM, Oracle, Microsoft, Adobe, etc.

Open Source Skills in High Demand

May 2018	May 2017	Change	Programming Language	Ratings	Change
1	1		Java	16.380%	+1.74%
2	2		C	14.000%	+7.00%
3	3		C++	7.668%	+2.92%
4	4		Python	5.192%	+1.64%
5	5		C#	4.402%	+0.95%
6	6		Visual Basic .NET	4.124%	+0.73%
7	9	^	PHP	3.321%	+0.63%
8	7	v	JavaScript	2.923%	-0.15%
9	-	^^	SQL	1.987%	+1.99%
10	11	^	Ruby	1.182%	-1.25%

Cobol #28
RPG #50

https://www.tiobe.com/tiobe-index/

Skills impact/benefit on IBM i shops

- Acquisition
  - Easy to find developers to write applications on your IBM I

- Utilization
  - Open Source technologies/languages provide opportunity for current staff to learn new skills

Popular sites using PHP

Web Technology Reports
https://w3techs.com/technologies/details/pl-php/all/all

Full ecosystem formed around PHP

Adoption of PHP on the IBM i

- IBM & Zend meet…
  - SystemiNetwork, COMMON, etc. identify need for scripting on IBM i.
    - Net.Data is good, but not strategic
  - Zend CEO and VP of Business Development come to COMMON
- IBM & Zend dance…
  - IBM and Zend strike a BP relationship
  - IBM helps Zend port PHP to IBM i
- The romance
  - Anticipate a few thousand downloads
  - Well past 11,000 unique registrations(nearly 400 monthly sustained)
  - Customer moves from intrigue to conviction
- Happily ever after…
  - Let's just say, both sides are quite pleased with where this is going
  - Competition is taking notice

Enterprise Proof Points – IBM i Customers!

Key Priorities articulated by CTOs, CIOs and VPs of Engineering

- Leverage investment in IBM i infrastructure
  - Expose DB2/400 data via the web
  - Webify green screen applications for end-users
- Maximize leverage of Power Systems computing power
  - Move Windows/Linux based PHP apps to IBM i
  - Deploy new web based applications
- Mitigate and minimize risk/cost of migrations
- Retool RPG programmers and access lower cost development resources to address business needs
- Leverage benefits of open-source technologies - create portable applications

Why PHP on IBM i?

Low Learning Curve

Easy Integration into
Heterogeneous Environments

Robust, Multi-Platform,
High-Performance, Scalable, Secure

Vibrant Community

Rapid
Innovation

Run an
Agile
Business

Proven
Deployment

Why PHP on i?

Leverage Existing Infrastructure to Develop & Run Dynamic Web Applications Easily

- Powerful , Flexible, & Fastest Growing Web Development Language
- Native on IBM i/OS
- Backing & Support of IBM
- Controlled/Driven by PHP Community
- Easy to Use & Fast to Deploy
- Supports Heterogeneous Environments
- Powerful Integration Capabilities

Application Modernization
Use PHP to web-enable green screen applications, utilizing existing data & business logic without rewriting application

Access RPG Programs & Data as Web Services
Package programs and data as web services and make available to other web applications

Consolidate Data in DB2/400
Move PHP applications that are running on Windows or Linux that access data in DB2 to run in IBM i/OS to speed up or reduce complexity of the applications

Access DB2/400 Data via Browser
Easily access and interact with DB2/400 data using a standard web browser

New/Packaged Web Application on IBM i/OS
Create new applications with PHP on IBM i/OS or leverage thousands of existing Open Sources applications

What are IBM i Customer's Doing with PHP

1. **Consolidation:** Move PHP applications that are running on Windows or Linux that access data in DB2 to run in IBM i to speed up or reduce complexity of the applications.

2. **Modernization:** Use PHP to web-enable green screen applications.

3. **New application development:** Create new applications with PHP on IBM i including applications for the intranet, reporting, websites, and extranets.

4. **Leveraging PHP portfolio:** Run commercial or opensource PHP applications on IBM i.

Why Modernization?

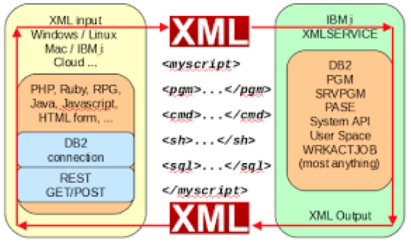
- Organizations face increased costs for maintaining legacy applications
- Pool of RPG programmers is shrinking – making it harder to hire and maintain staff

> 44% of respondents to a recent survey indicate IBM I skills as a top concern
> https://www.helpsystems.com/resources/guides/ibm-i-marketplace-survey-results

- Important to choose modernization tools that are compatible with RPG and the RPG community
  - Easy to learn
  - Integration points with existing applications and data
  - Provide for growth – example: mobile

IBM addresses modernization with every new version

- FastCGI
  - Allows fast connection from HTTP server to backend PASE environment
  - Instrumental in PHP performance
- ILE Object Toolkit
  - Allows connects from various languages (PHP, Python, perl, ruby, etc) to ILE objects and IBM I native artifacts
- SQL Connector
  - Easily integrated way to transfer data to and from DBF2 for i leveraging SQL.



PHPs Popularity Explained

- 82% of the world's websites use PHP (w3techsystems.com, 2016)
- 22% of IBM i organizations use PHP (HelpSystems, 2016)

- PHP provides an ease of entry in both development and deployment
- PHP provides excellent performance and scalability
  - And this improved significantly with v7 of the language

- Use existing staff / attract new talent

Extending the Reach of DB2

Capabilities/Benefits of DB2 Access

- Reach a larger audience/users/stake-holders through web access
- Provide new/rich interfaces for your data
  - Web
  - Mobile

- Gain new insights
  - Federate/join DB2 data with other data sources

Use Cases

Use Case: Extend reach of DB2 data to the web

Solution: Leverage PHP's 50+ DB2 language extensions to embed DB2 data access inside of HTML. Keep in mind that since PHP is a server-side scripting language the IBM i security aspects of the data access will be enforced

Use Case: Provide access to DB2 resident data to mobile applications

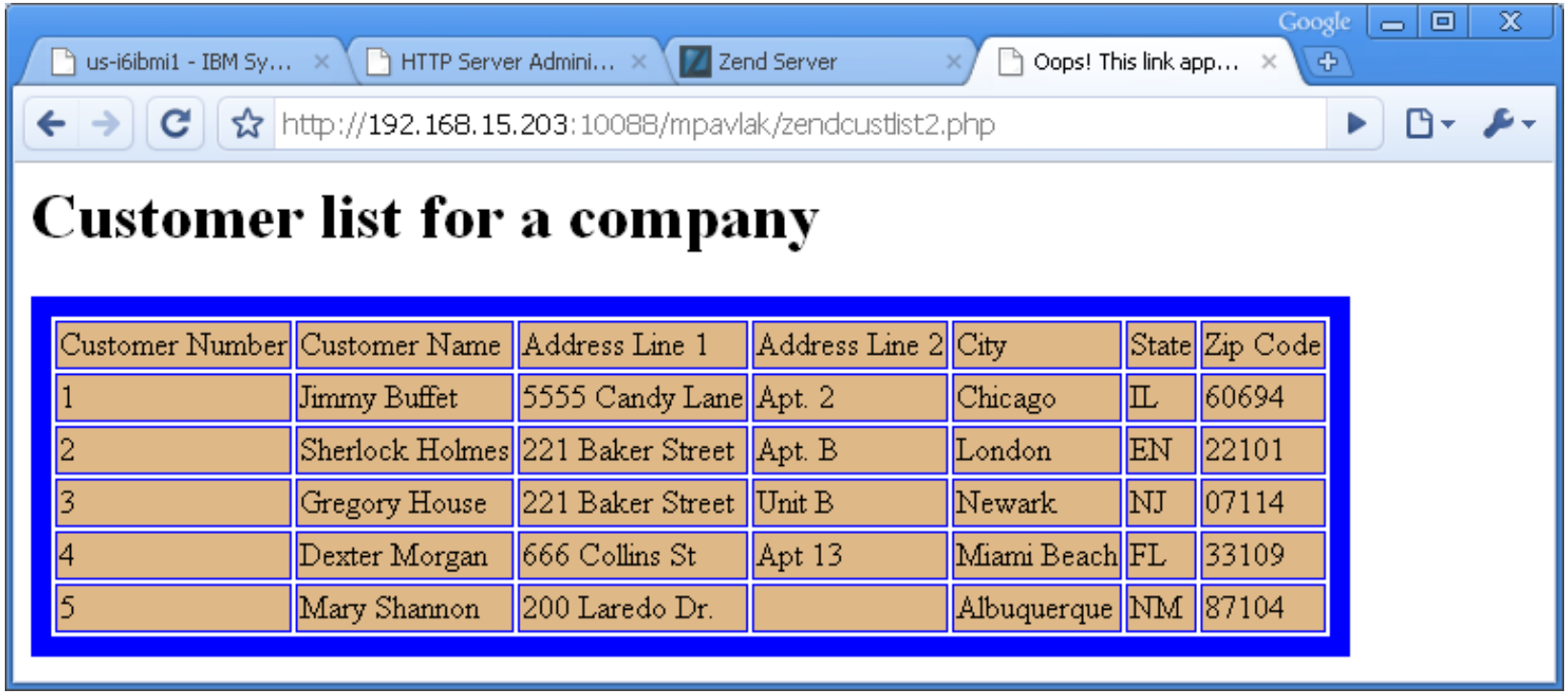
Solution: Take advantage of PHPs rich mobile application development support to create responsive web applications. Client-side frameworks such as Twitter Bootstrap can be used to provide standard HTML and CSS for designing of the user interface to work on smartphones and tablets.

Use Case: Develop applications against multiple data sources

Solution: Use PHP's support for multiple data sources (such as MySQL/MariaDB, SQL Server, and DB2) to logically process through or join data records from the various data sources.

Basic file listing script

- Connect to DB2 i
- Select records from a DB2 table
- Load the records in an HTML table
- Display the output.



Connection to DB2 for i

- Need three things:
  - System
  - User ID
  - Password

Note: If your data sets have *PUBLIC access, no user or password is required

```
// Standard DB connection to DB2...
$conn = "*LOCAL"; $name = "";$pwd = "";

$i5link = db2_connect($conn, $name, $pwd);
if (!$i5link)
echo 'Connection failed: '.db2_stmt_error().' : '.db2_stmt_errormsg();

$sql = "SELECT * from zenddata.customer";

$stmt = db2_exec($i5link,$sql)
 or die("Failed query:".db2_stmt_error().":".db2_stmt_errormsg());

?>
```

Reading data…

Loop through record set

```
<h1> Customer list for a company</h1>
<TABLE BORDER="10" BORDERCOLOR="blue"><TBODY BGCOLOR="DEB887">
<TR><TD>Customer Number</TD><TD>Customer Name</TD><TD>Address Line 1</TD>
<TD>Address Line 2</TD><TD>City</TD><TD>State</TD><TD>Zip Code</TD></TR>

<?php

while($row=db2_fetch_array($stmt)){
list( $CUSTOMER_NUMBER, $CUSTOMER_NAME, $CUSTOMER_ADDRESS_LINE1,
$CUSTOMER_ADDRESS_LINE2, $CUSTOMER_CITY, $CUSTOMER_STATE,
$CUSTOMER_ZIP)= $row;

echo(“ <TR><TD> $CUSTOMER_NUMBER </TD><TD> $CUSTOMER_NAME </TD>
<TD> $CUSTOMER_ADDRESS_LINE1 </TD><TD>$CUSTOMER_ADDRESS_LINE2 </TD>
<TD> $CUSTOMER_CITY</TD><TD> $CUSTOMER_STATE </TD>
<TD> $CUSTOMER_ZIP </TD></TR> ");
}
echo ‘ </table> ';
db2_close($i5link);

?>
```

Leveraging existing ILE programs and resources

It's all about the toolkit!

Capabilities/Benefits of ILE Access

- Leverage existing business logic – no need to re-write
- Provide new interfaces for existing data objects and artifacts

Use Case: Need to convert an existing RPG application to run in web browsers.

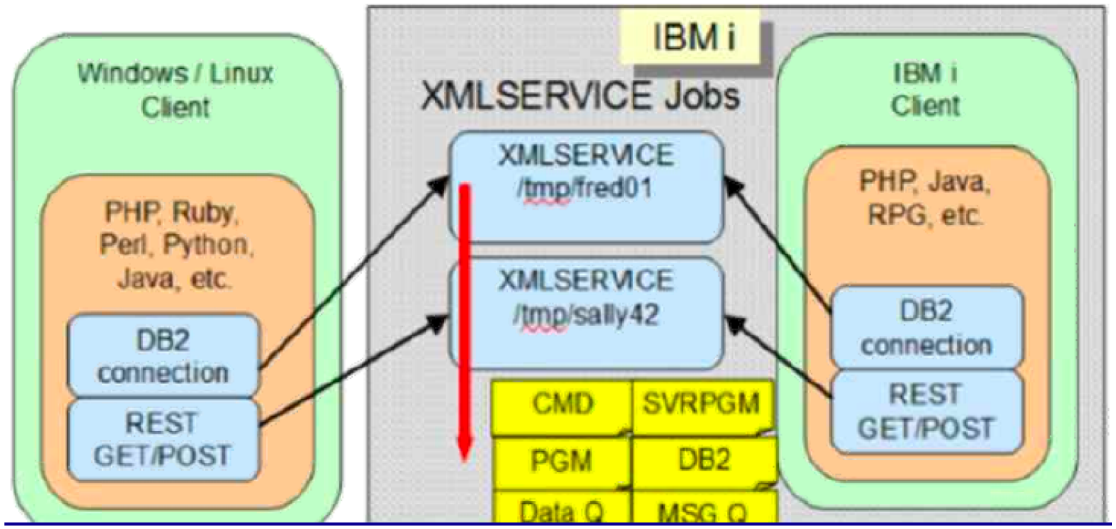
Solution: When using PHP as the "vehicle" to "convert" the application it's unlikely that 100% of the application will have to be rewritten. With PHP, the existing RPG code can be encapsulated into smaller programs or service programs containing modules. The programs and modules can be easily called using the ILE Toolkit.

Use Case: Leverage complex pricing routine written in RPG in a new web presence

Solution: Extract code from existing application and create an API in RPG. The resulting API can then be called from the PHP script thereby leveraging the investment in the existing application while using PHP to concentrate on the user interaction portion of the desired solution.

What is the Toolkit?

- Set of classes that access IBM i native artifacts
  - All program objects
    - RPG, COBOL, CL, etc.
- Others
  - Command processor
    Data Queues
  - Spooled File
  - More…
- Access naturally from PHP code.
  - No SPs required
- Easy to use



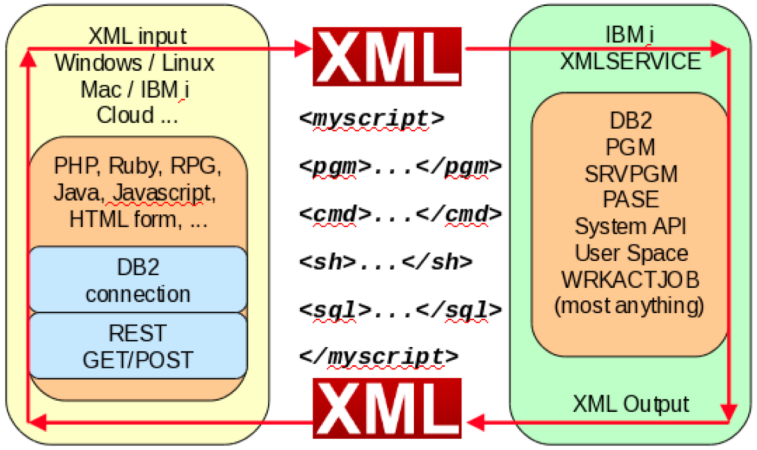
Two Parts

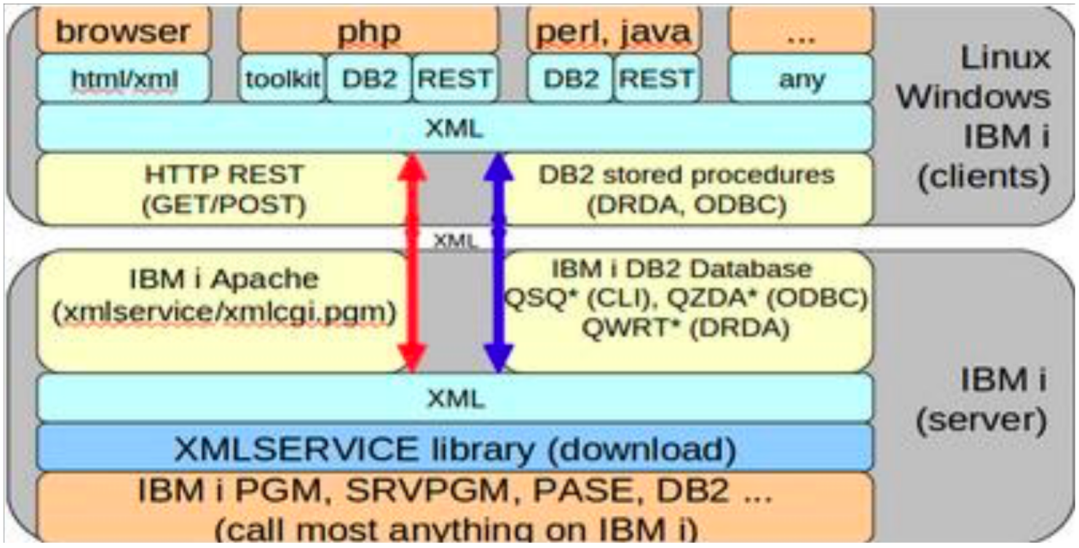
- XML Service
  - Developed by IBM and contributed to the community as open source
  - Made up of RPG, CL and DB2 stored procedures (SQL)
- Toolkit (the PHP side)
  - Series of classes that "wrap" the calls to the ILE Toolkit
  - All PHP but Object Oriented (but easy to learn and use)
  - Zend built the PHP wrapper
  - No OO training required to use them

http://yips.idevcloud.com/wiki/index.php/XMLService/XMLService

XML Service

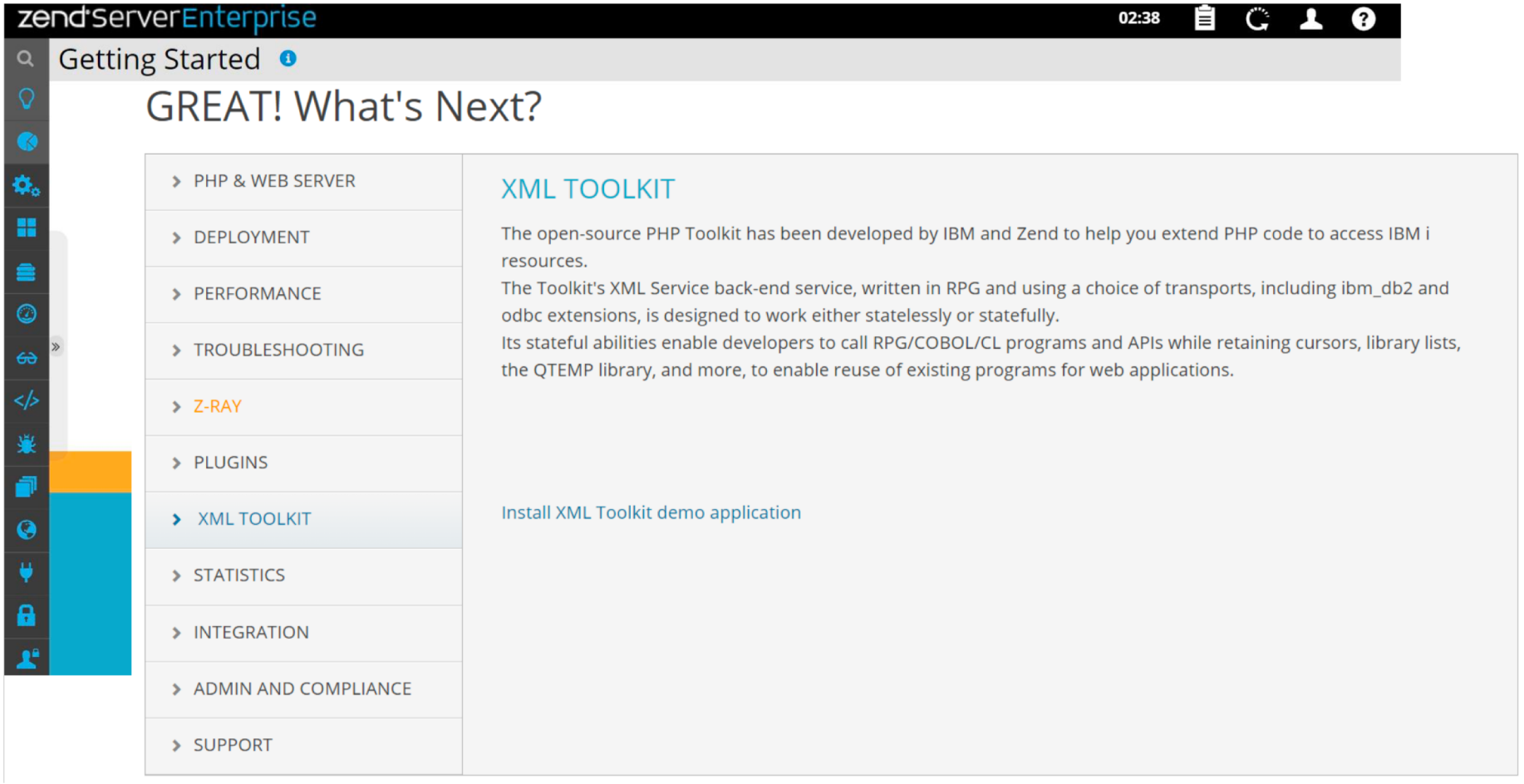
- Cross platform
- Language agnostic
- Basic plumbing for all open source languages



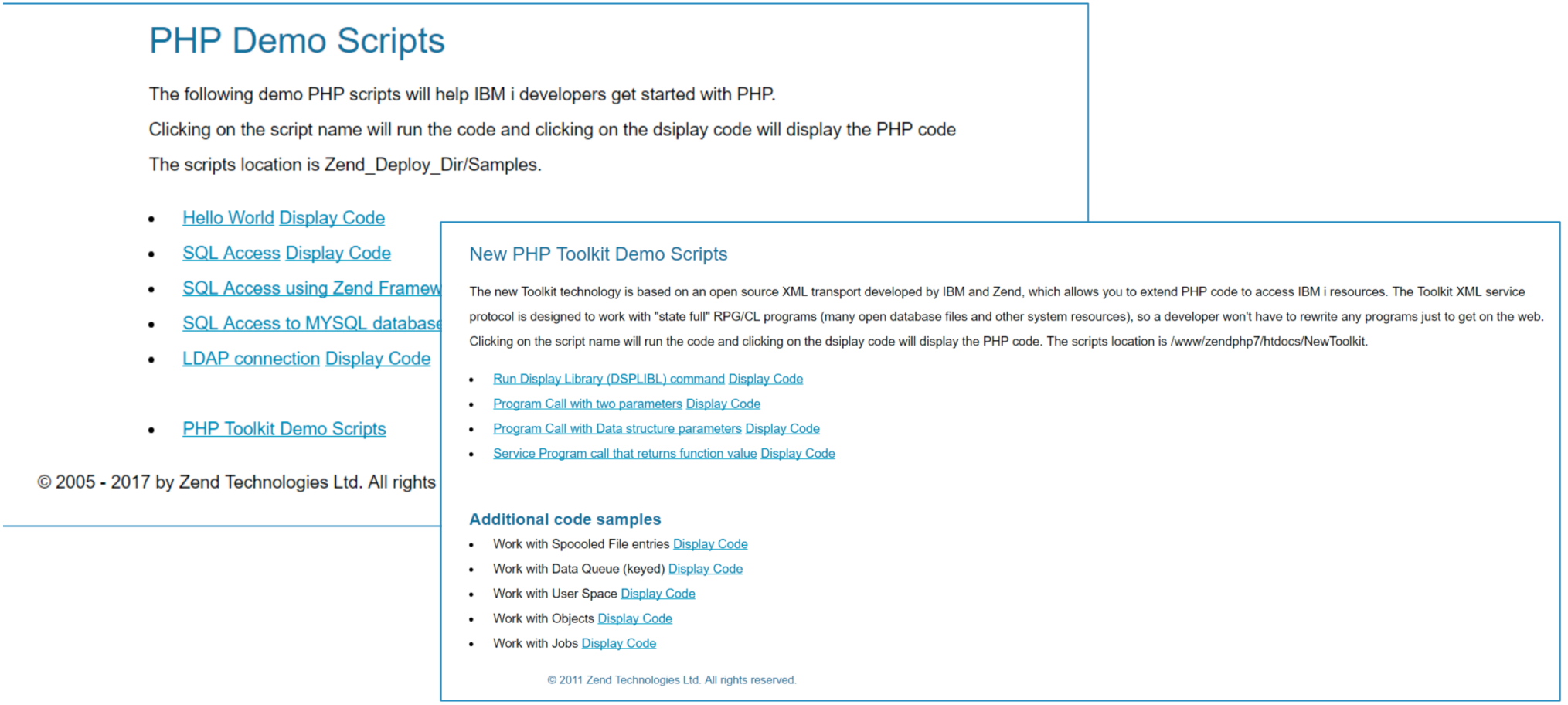


Take advantage of the samples!

- Take all the defaults and only enter the path
  - I use "samples"



Demo Scripts (samples)



PHP Demo Scripts

The following demo PHP scripts will help IBM i developers get started with PHP.

Clicking on the script name will run the code and clicking on the dsiplay code will display the PHP code

The scripts location is Zend_Deploy_Dir/Samples.

- Hello World Display Code
- SQL Access Display Code
- SQL Access using Zend Framew
- SQL Access to MYSQL database
- LDAP connection Display Code
- PHP Toolkit Demo Scripts

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New PHP Toolkit Demo Scripts

The new Toolkit technology is based on an open source XML transport developed by IBM and Zend, which allows you to extend PHP code to access IBM i resources. The Toolkit XML service protocol is designed to work with "state full" RPG/CL programs (many open database files and other system resources), so a developer won't have to rewrite any programs just to get on the web. Clicking on the script name will run the code and clicking on the dsiplay code will display the PHP code. The scripts location is /www/zendphp7/htdocs/NewToolkit.

- Run Display Library (DSPLIBL) command Display Code
- Program Call with two parameters Display Code
- Program Call with Data structure parameters Display Code
- Service Program call that returns function value Display Code

Additional code samples

- Work with Spoooled File entries Display Code
- Work with Data Queue (keyed) Display Code
- Work with User Space Display Code
- Work with Objects Display Code
- Work with Jobs Display Code

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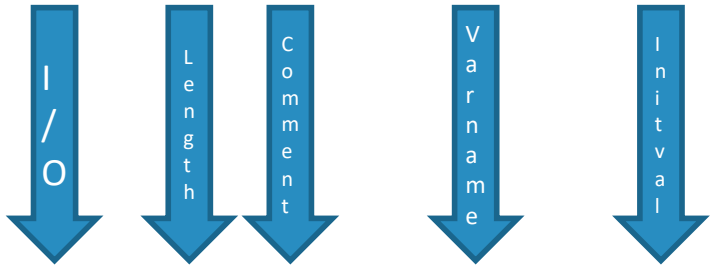
Display the code

```
<?php
 /*
RPG program parameters definition
                PLIST
                PARM                    CODE            10
                PARM                    NAME            10

 */

include_once 'authorization.php';
include_once zend_deployment_library_path('PHP Toolkit for IBMI i') . DIRECTORY_SEPARATOR . 'ToolkitService.php';
include_once 'helpshow.php';

//The ToolkitService connection method/function uses either IBM_DB2(default)or ODBC extensions to connect
//to IBM i server. In order to switch to ODBC connection assign an "odbc' value to the $extension varibale
//and make sure that the ODBC extension is enabled in the PHP.INI file.
//The ODBC extension usage in ToolkitService is preferable in 2 tier environment: Zend Server running in Windows/Linux
//and accessing database and/or programs in IBM i server


try {
    $ToolkitServiceObj = ToolkitService::getInstance($db, $user, $pass);
    }

    catch (Exception $e)
    {
        echo  $e->getMessage(), "\n";
        exit();
    }


$ToolkitServiceObj->setToolkitServiceParams(array('InternalKey'=>"/tmp/$user"));
$code =  $_POST ['code'];
$desc = ' ';
```

The Program Call

- Set parameters based on function
  - Call program
  - Output results




```
37 $param[] = $ToolkitServiceObj->AddParameterChar('both', 10,'CODE', 'CODE', $code);
38 $param[] = $ToolkitServiceObj->AddParameterChar('both', 10,'DESC', 'DESC', $desc);
39
40 $result = $ToolkitServiceObj->PgmCall("COMMONPGM", "ZENDSVR", $param, null, null);
41
42 if($result){
43   showTable( $result['io_param']);
44 }
45 else
46     echo "Execution failed.";
```

Toolkit – it's about more than just calling RPG

- CL Commands
  - $conn->CLCommand('my command');
  - $conn->CLInteractiveCOmmand('DSP… command');
  - $conn->CLCommandWithOutput('RTV… command');

Taking advantage of the LAMP ecosystem

LAMP - Background

- Business are retrieving data from their systems of record – the ERP, SCM, CRM applications that have long run the business – and delivering it through systems of engagement

- The de facto standard for building systems of engagement is the LAMP stack
  - Linux as the operating system
  - Apache as the web server
  - MySQL or MariaDB as the database
  - PHP as the development language

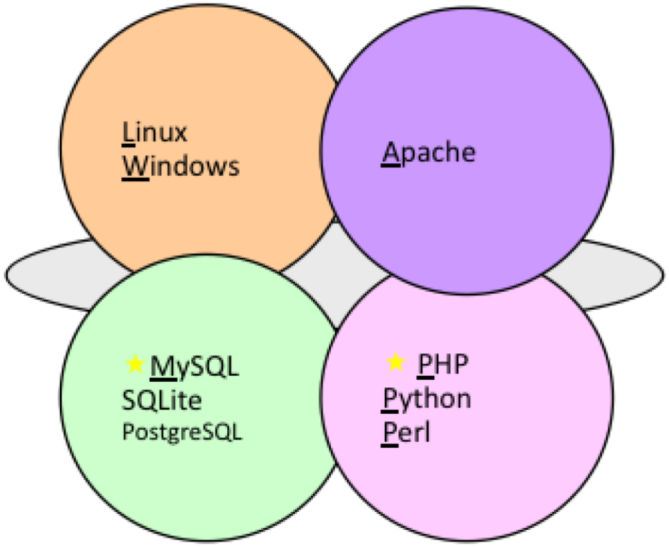
- Dominate solutions built on the LAMP stack include ecommerce, content management, and analytics

- LAMP solutions have grown to support many business critical systems of engagement, where more powerful, scalable, and reliable hardware (and operating systems) are required

Capabilities/Benefits of LAMP Applications

- Leverage deep ecosystem of open source applications in a variety of areas including
  - Customer Relationship Management (CRM)
  - Enterprise Resource Management (ERP)
  - eCommerce
  - Content Management Systems (CMS)
  - Blogging
  - Portals
  - etc.

What is LAMP?



- L ➔ Linux
- A ➔ Apache Web Server
- M ➔ MySQL / MariaDB
- P ➔ PHP | Perl | Python

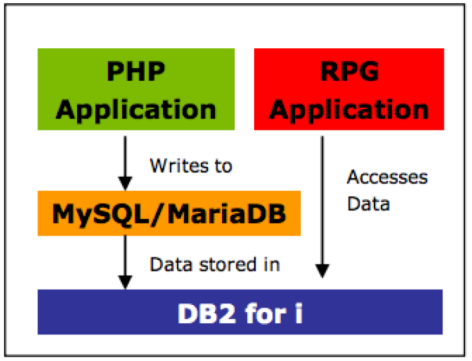
- Open-source software stack with strong focus on:
  - Affordability – Perceived zero or low cost
  - Ease of development, ease of use
  - Community
  - Building solutions. Large body of single-click install & auto-configure solutions and libraries

IBM i – enabled for Open Source Solutions

- Industry standard technologies, such as PHP, Apache, and MySQL/MariaDB all run on IBM I
  - These technologies enable web solutions like Jenkins and WordPress to run natively on the platform.
- These applications can be easily deployed and leveraged

DB2 Storage Engine for MySQL and MariaDB

- Supports open source applications (i.e., LAMP-based) while simplifying data management
  - Applications written to MySQL or MariaDB can store their data in DB2 without any code change
  - One database to manage, backup, and protect
  - RPG applications, DB2 Web Query have access to MySQL/MariaDB generated data.
- PHP, Apache, and MySQL/MariaDB enable 1000s of applications on IBM I including:
  - CRM, ecommerce, Portals, Wikis, blogs, etc



IBMi

Apache

MySQL

PHP

Finding Open Source Applications

Category	URL	Description
Customer Relationship Management (CRM)	http://www.crmsearch.com/top-10-open-source-crm-systems.php	Provides a list of 10 Popular CRM applications
Enterprise Resource Planning (ERP)	https://en.wikipedia.org/wiki/List_of_ERP_software_packages	Provides a list (with links) of popular ERP applications
Content Management System (CMS)	https://www.makeuseof.com/tag/10-popular-content-management-systems-online/	Provides a list of 10 Popular CMS applications
General	http://directory.fsf.org	Provides lists of "free" software in various categories
General	https://opensourcesoftwaredirectory.com/	Provides a list with links of 739 applications in the open source space.
General	https://alternativeto.net/software/open-source-software-directory/	Provides links to various lists of open source software solutions

General Process for Installation of Open Community Web Applications

- **Step 1**: Requires prior installation of
  - MySQL
  - Zend Core (PHP and Apache)
- **Step 2**: Download the application to your PC
- **Step 3**: Use a zip utility to unzip the application tar file
- **Step 4**: Copy the tar file (resulting from previous step) into the IFS (normally into the /www/zendphp7/htdocs directory)

General Process for Installation of Open Community Web Applications

- **Step 5**: Enter the PASE environment

  CALL QP2TERM | QSH | ssh into system

- **Step 6**: Navigate to the directory where the uploaded file resides

- **Step 7**: Expand the archive file:

  jar xvf application.tar

Not a typo! In PASE use the jar command to extract the contents of a tar file

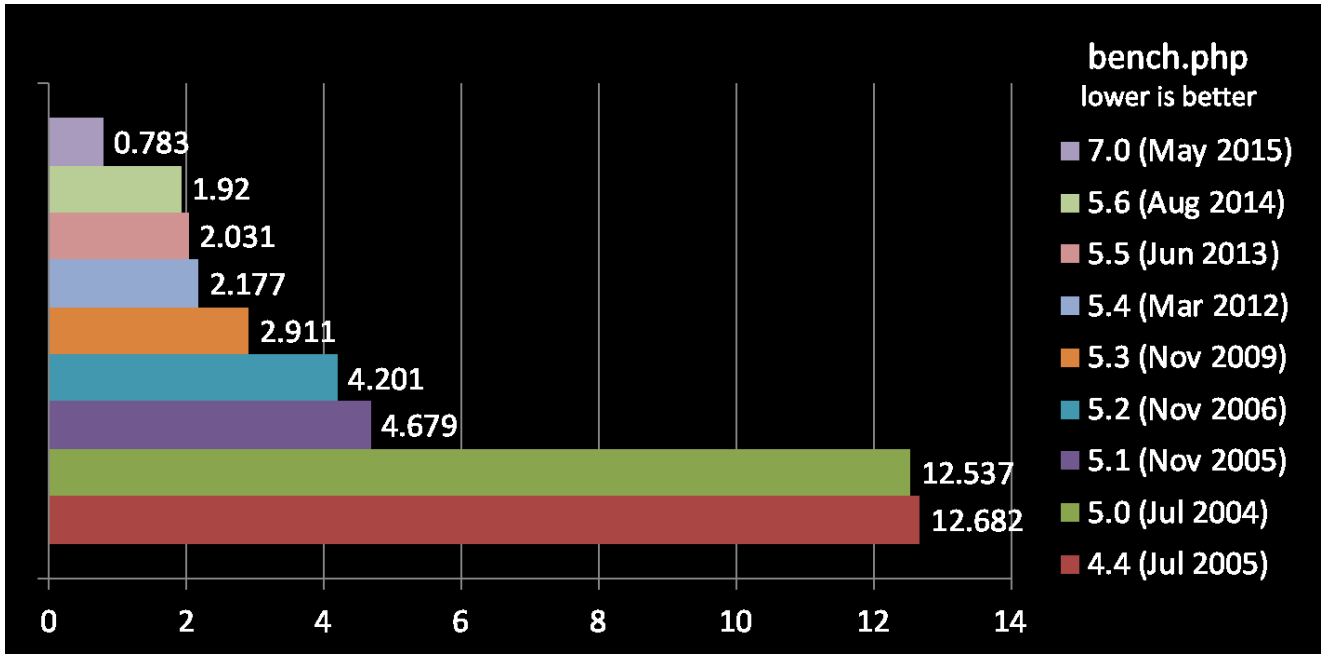
- **Step 8**: Point a web-browser to the application setup/configuration program:

  http://<IBM i>:10090/application

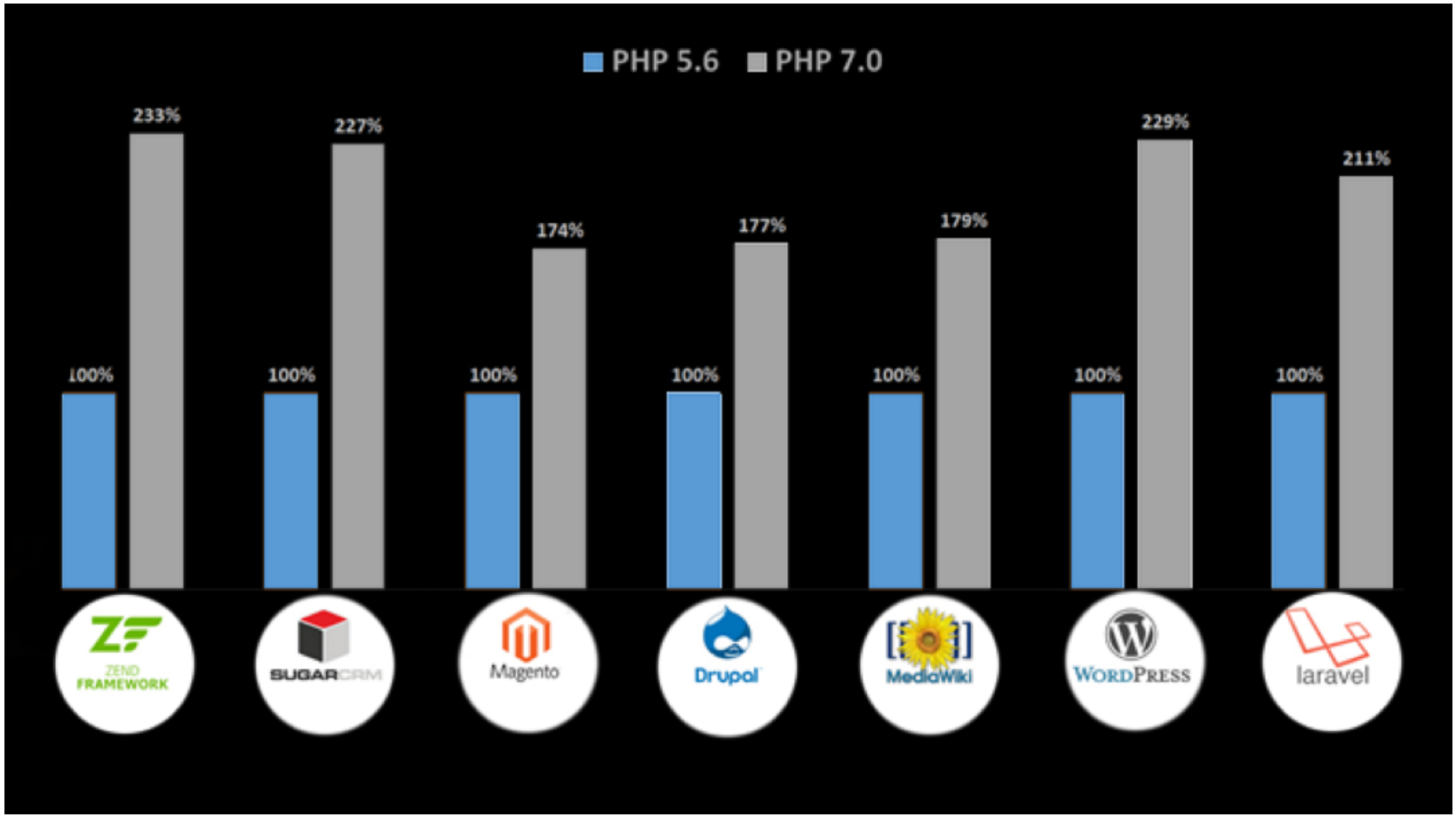
Bonus #1 – Why PHP v7

Significant Performance Gains

- Optimizations to the Zend Engine significantly enhances performance
- Performance gains ranging from 20-70% have been seen in real-world applications
  - No application code changes required!

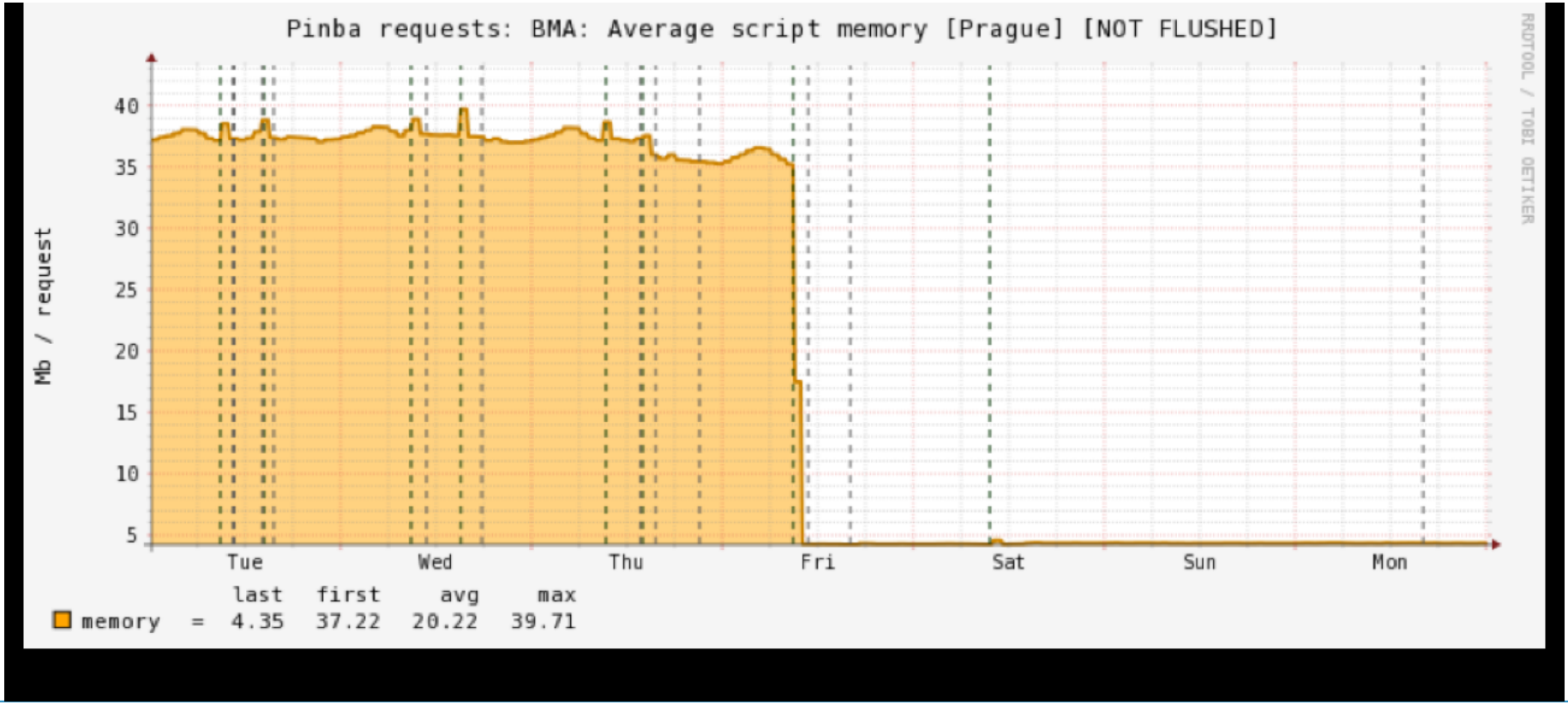


These benchmarks show a roughly 2x performance gain between PHP 78 and PHP 5.6 using real-world application performance.

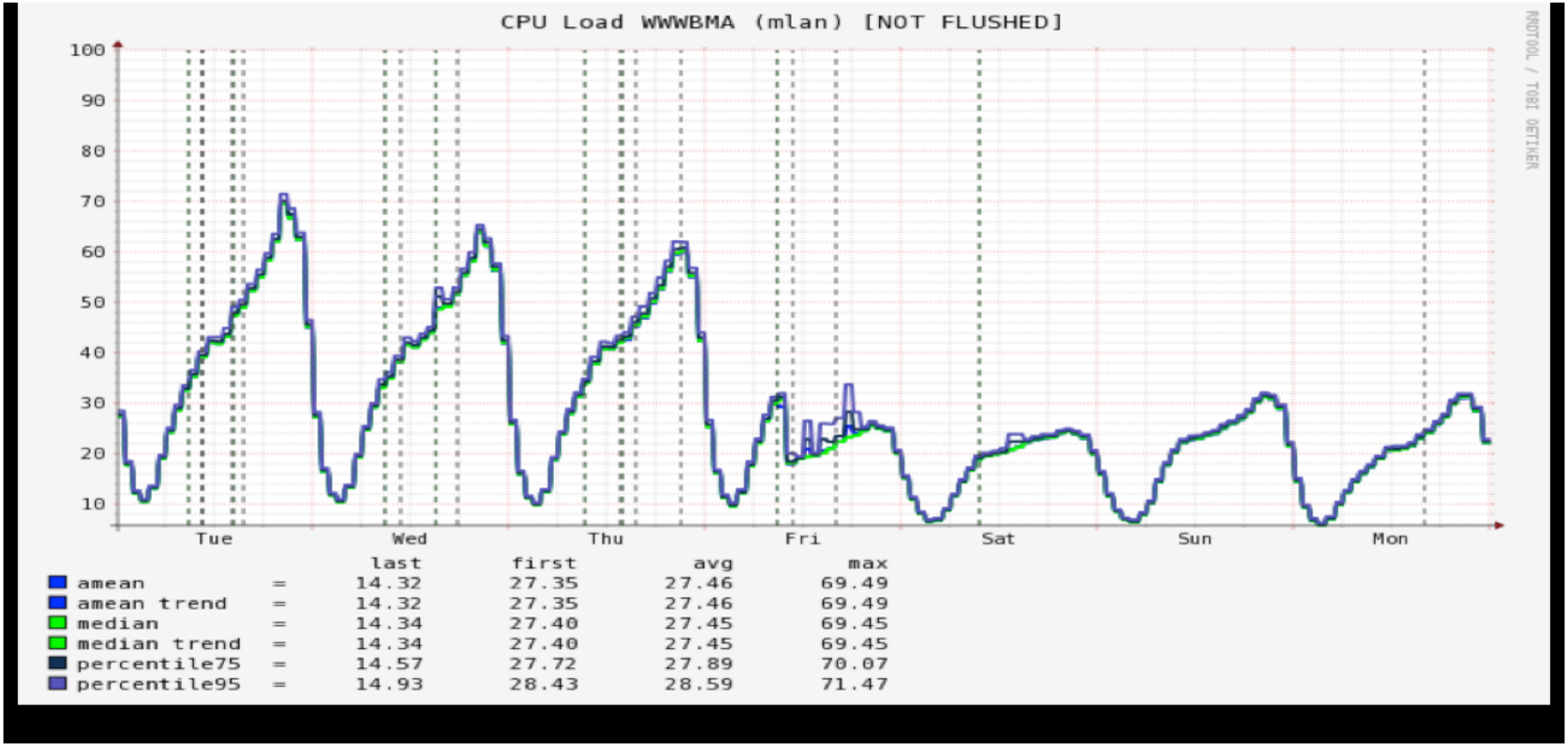


Reduced Memory Footprint

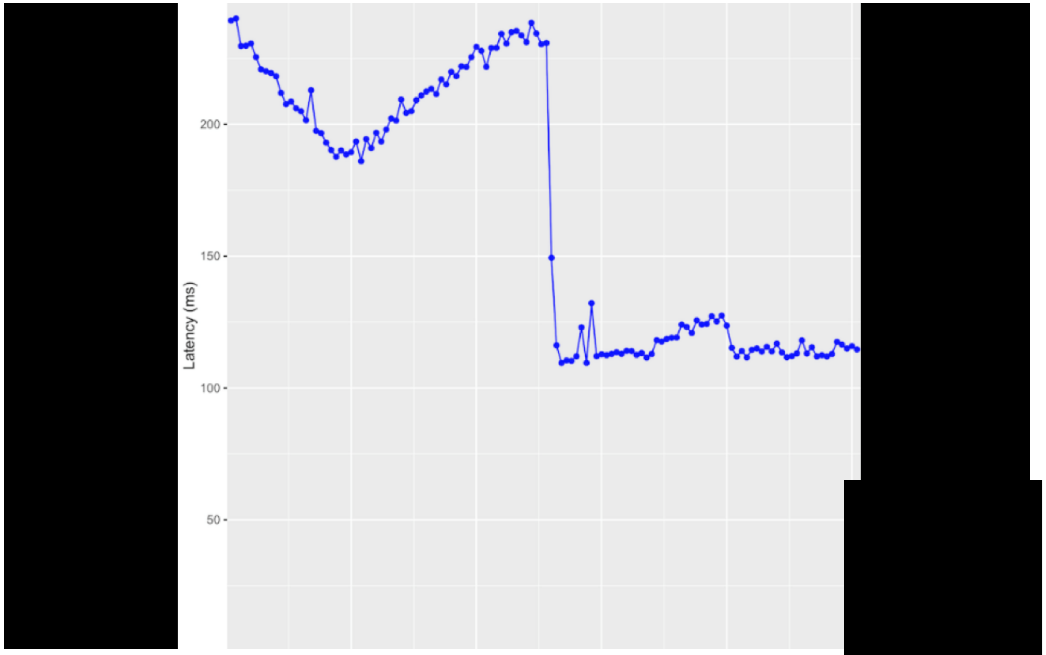
Badoo estimates $1m+ and $100K/yr savings on their Application Server in part due to the memory footprint gains with version 7 of PHP



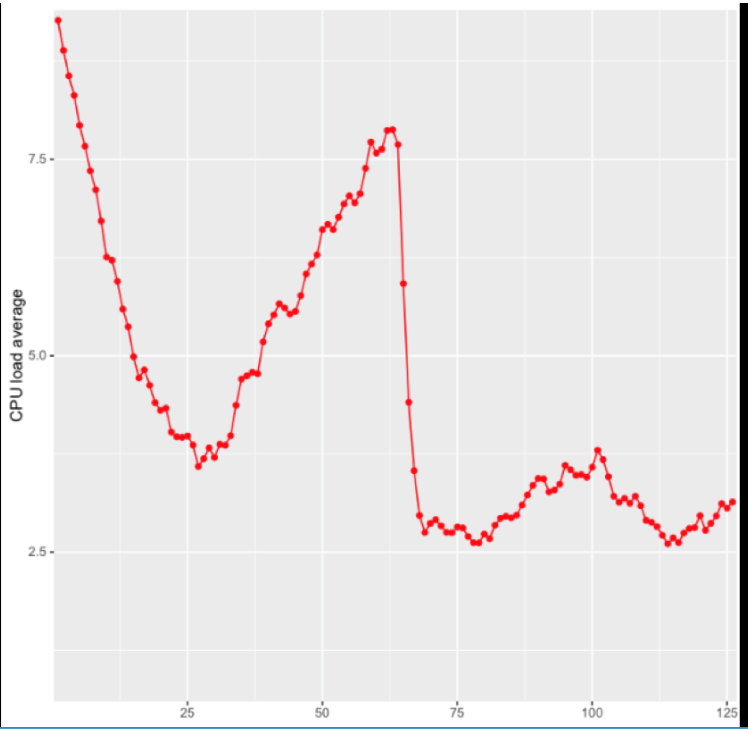
Reduced CPU Load



Reduced CPU Load

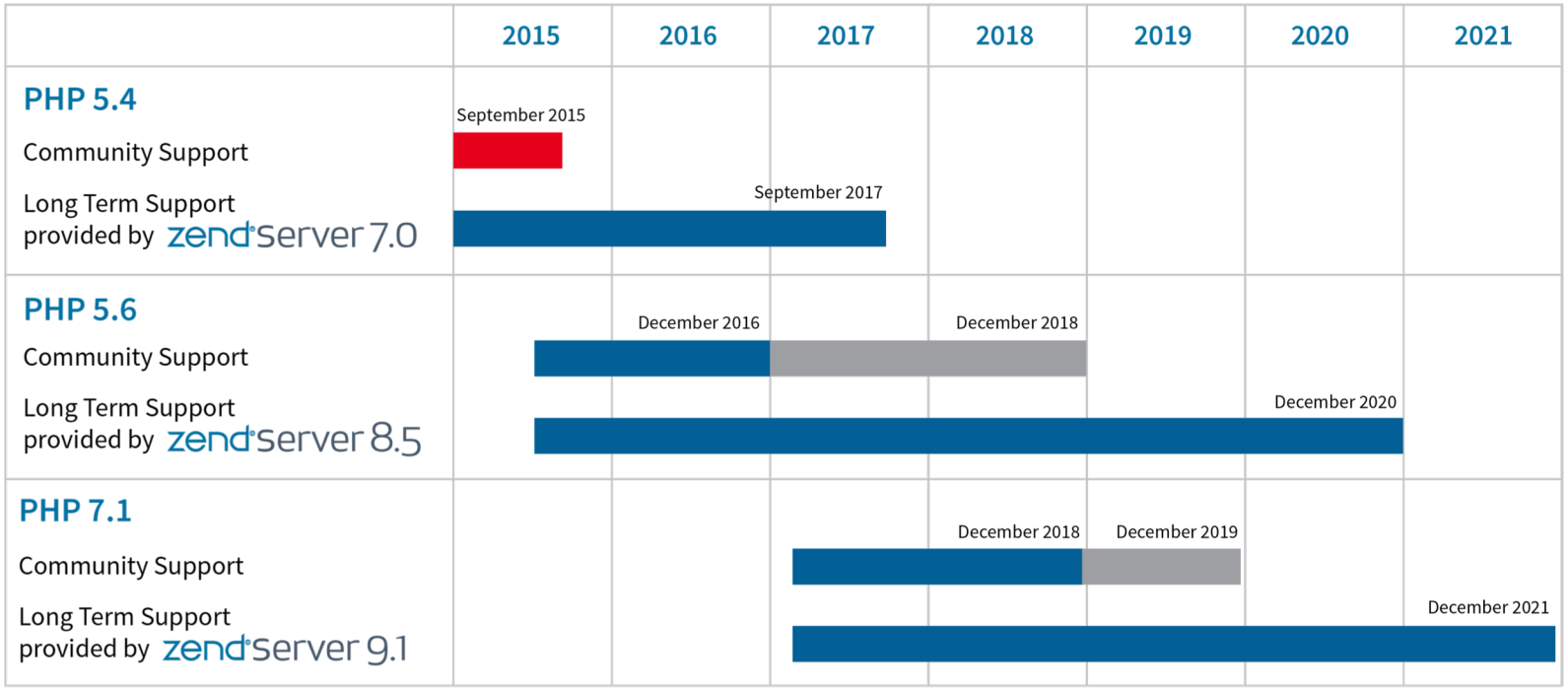


Tumblr indicates that their servers are serving pages twice as fast and that they are doing it with half the amount of CPU resources.



Long Term Support

- Running a version of PHP earlier than 5.6 puts your site at risk:
  - Security breaches
  - Bugs/defects
  - Breaks



*We encourage all PHP users to move to PHP 5.6 or 7.1 for longer community and Zend Support.

Bug fixes and security updates

Security updates only

Community security fixes no longer available

New Features

- Scalar Type Declarations
- Return Type Declarations
- Void Return Type
- Null Coalesce Operator
- Spaceship Operator
- Array Constants
- Exceptions in the Engine
- Session Options
- Easy Userland CSPRNG (Cryptographically Secure Pseudo-Random Number Generator)
- Group Use Declarations
- Filtered Unserialize()

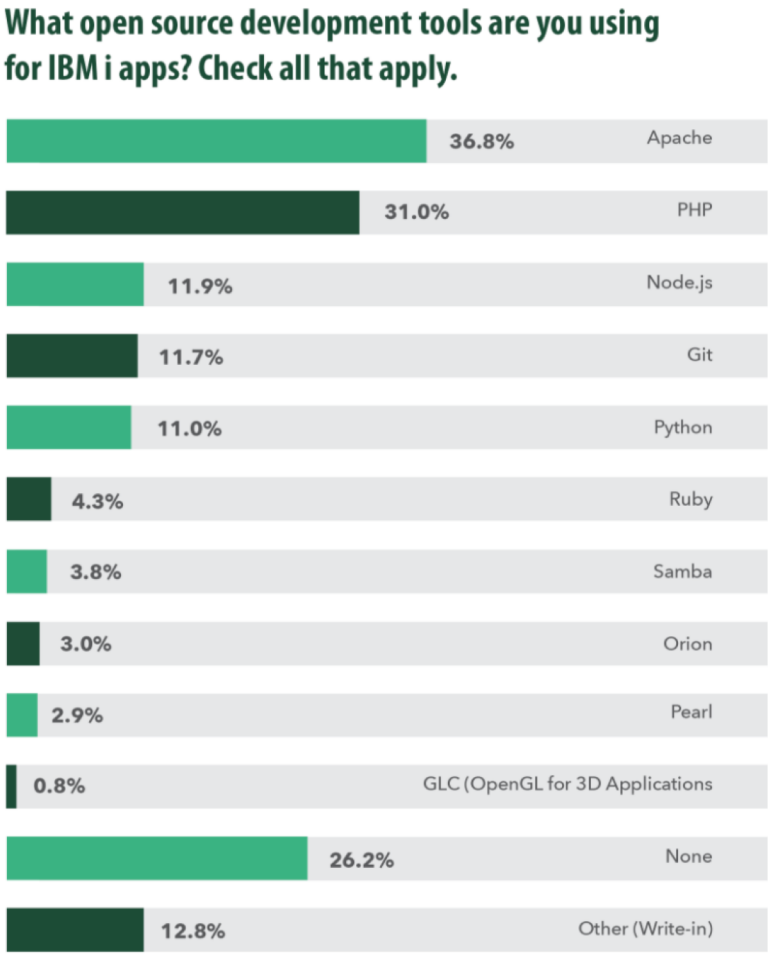
Bonus #2 – Open Source on IBM i Update

Open Source Solutions on IBM i

Legacy Offerings	5733OPS	Integration	Community
Apache OpenSSL OpenSSH JTOpen etc	Python Node.JS Git Orion etc.	XMLService Language Toolkits IBM I Services (SQL) etc.	Many i OSS projects Active collaboration Blogs, articles etc.

Is Open Source Strategic

"…the real story is in the adoption of additional development languages, especially open source tools. Nearly 75% of survey respondents are using open source development tools on IBM i."



https://www.helpsystems.com/resources/guides/ibm-i-marketplace-survey-results

The Web is driven by Open Source

- Languages
  - PHP
  - Python
  - Ruby
  - Javascript
- Packages
  - JSON / XML
  - Swagger API framework
  - SOAP libraries
  - Web frameworks
- Application Framework/Servers
  - Apache Tomcat / TomEE
  - Jboss EAP
  - Greenfish
  - Rails
  - Epxress.js
  - Salis.js
  - Django
  - Bottle
  - Flask
- HTTP Servers
  - Apache HTTP Server
  - nginx
  - Eclipse Jetty

RPM Pile Overview

- IBM has released a beta of an RPM pile that provides the packages from 5733-OPS (and a lot more) in a RPM-based repository
- This allows for installation of open source packages in a Linux-like fashion with PASE
- Currently the packages are in beta form and can be installed on IBM i 7.2 and newer
- The RPM pile contains many packages including:
  - Node.js version 8
  - Python 3.6
  - The 'less' utility
  - git
  - The 'updated' and 'locate' utilities
  - GCC 6.3.0 and other development tools
  - GNU Nano
  - Others…

Leverage the Community!

- Node Package Manager (npm) – package manager for Javascript (considered the world's largest repository of packages

  650,000 packages

- Preferred Installer for Python (pip/pip3) – package management system to install and manage software packages written in Python

  125,000 packages

- Yellowdog Updater, Modified (yum) – package management system to install/manage RPM packages

```
$ npm install jshint
jshint@2.5.11 node_modules/jshint
├── strip-json-comments@1.0.2
├── underscore@1.6.0
├── exit@0.1.2
├── console-browserify@1.1.0 (date-now@0.1.4)
├── minimatch@1.0.0 (sigmund@1.0.0, lru-cache@2.5.0)
├── shelljs@0.3.0
├── cli@0.6.5 (glob@3.2.11)
└── htmlparser2@3.8.2 (domelementtype@1.1.3, domutils@1.5.0, entities@1.0.0,
domhandler@2.3.0, readable-stream@1.1.13)
$ ls node_modules/
jshint
$ ls node_modules/jshint/
README.md  bin  data  dist  node_modules  package.json  src
$ ls node_modules/jshint/node_modules/
cli  exit  minimatch  strip-json-comments  console-browserify  htmlparser2
shelljs  underscore
```

```
$ pip install xlswriter
Downloading/unpacking xlswriter
  Downloading Xlswriter-0.7.3-py2..
Installing collected pacakges:
xlswriter
Successfully installed xlswriter
Cleanup up…
$
```

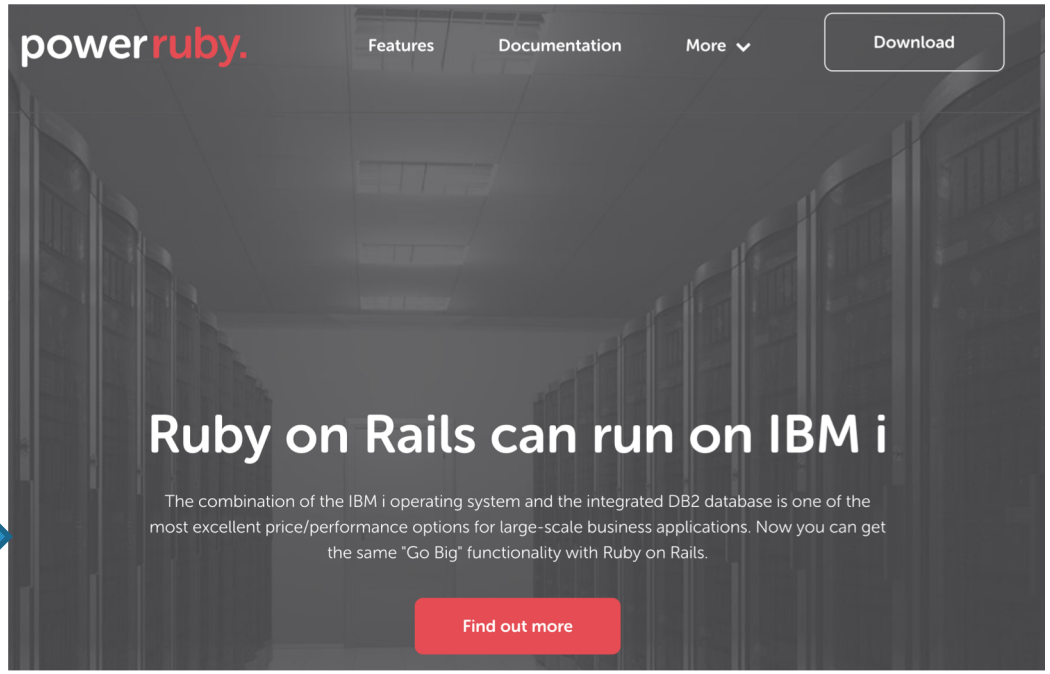
```
# yum list packages
ibm
                | 1.5 kB  00:00
ibm/primary
                |  86 kB  00:00
ibm
                             223/223
Error: No matching Packages to list
bash-4.4# yum list available
Available Packages
autoconf.noarch
2.69-1                          ibm
automake.noarch
1.15-1                          ibm
bison.ppc64
3.0.4-1                         ibm
bzip2.ppc64
1.0.6-5                         ibm
```

Ruby on Rails

- Ruby is a dynamic, open source programming language with a focus on simplicity and productivity.
- Ruby is a general-purpose scripting language
- Ruby runs in the PASE environment
- Ruby can be used for web applications, graphing libraries, picture recognition engines, threaded database servers as well as low-level system utilities.
  - Another typical use is for developing database-backed web applications according to the Model-View Control (MVC) pattern

PowerRuby is a commercially supported port of the Ruby programming language and the Ruby on Rails Web application framework for IBM i.

https://powerruby.com



Ruby Overview

- Ruby is the programming language used to manipulate the framework
- Rails is the framework that provides the necessary infrastructure
- Rail is written in Ruby
- Ruby is considered by some to be more powerful than Perl, and more OO than Python

Ruby Features

- Ruby is an interpreted language (No compile strep)
- Ruby is an Object Oriented Language
- Every is an object (no primitives)
- Ruby draws from Perl, Smalltalk, and Lisp

```
class HelloWorld
 def initialize(name)
     @name = name.capitalize
  end
  def sayHi
     puts "Hello #{@name}!"
  end
end
hello = HelloWorld.new("World")
hello.sayHi
```

Python

- Popular scripting language
- Started out as a teaching language
- Based on Object Oriented concepts and paradigms
- Supports/encourages rapid development + large systems
- Code is not hard to read, write, and maintain

Python Uses

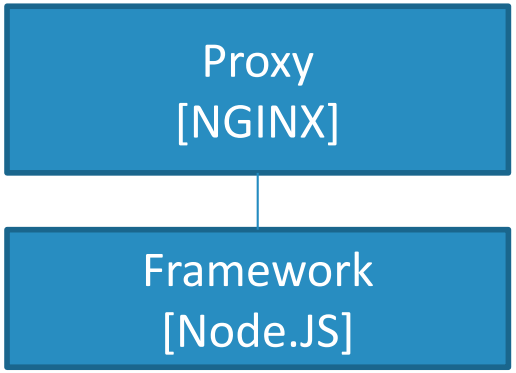
- Shell tools
  - System admin tools, command line programs
- Extension-language work
- Rapid prototyping and development
- Language-based modules
  - Instead of special-purpose parsers
- Graphical user interfaces
- Database access
- Distributed programming
- Internet scripting

```
#!/usr/local/bin/python
# import systems module
import sys
marker = '::::::'
for name in sys.argv[1:]:
  input = open(name, 'r')
        print marker + name
  print input.read()
```

Node.js

- Node.js facilitates the running of server-side Javascript
- Node is designed to build scalable network applications
- Node.js supports high-performance web transactions by handling many connections concurrently.

- Along with Nginx, serverless nodes can now be implemented on IBM i



git

- Git provides Source Code Control / Version Control
- Version control is a system that keeps records of all changes
- Enables collaborative development
- Enables auditing – knowing who did what and when
- Facilitates rolling back changes to a previous state

Orion

- Some refer to Orion as an IDE on the cloud
- Browser-based open tools integration platform
  - Focused on developing for the web, on the web
  - Focus on web developers working on client-side JavaScript, CSS, and HTML
- Orion is a set of server and client-side components/code that when brought together make up an extensible browser-based development platform.
- Supports integration with Git, as well as shell access, site definition, dealing with various tasks, etc.

Nginx

- Pronounced at "Engine X"
- Open Source web and reverse proxy server
- High-performance HTTP, HTTPS, SMTP, iMAP, and POP3 server
- Supports load balancing and HTTP caching
- Architecture is asynchronous and event-driven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