



Future of Open Source on IBM i

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Agenda

- Some of the latest news
- General philosophical predictions
- Language futures
- Stuff that may be coming
- Major themes

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Some of the Latest News



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.NET Available on IBM i!!

- Mono has been ported to IBM i!!
- Community Effort
- Available via third-party RPM repository

https://bitbucket.org/ibmi/opensource/src/master/docs/yum/3RD_PARTY_REPOS.md



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Easy install with yum!

```
-bash-4.4$ yum list mono\*
Available Packages
mono-complete.ppc64                5.21.0.500-0
mono-core.ppc64                    5.21.0.500-0
mono-data.ppc64                    5.21.0.500-0
mono-data-db2.ppc64                5.21.0.500-0
mono-data-oracle.ppc64             5.21.0.500-0
mono-data-sqlite.ppc64             5.21.0.500-0
mono-devel.ppc64                   5.21.0.500-0
mono-extras.ppc64                 5.21.0.500-0
mono-mvc.ppc64                     5.21.0.500-0
mono-nunit.ppc64                   5.21.0.500-0
mono-reactive.ppc64                5.21.0.500-0
mono-wcf.ppc64                     5.21.0.500-0
mono-web.ppc64                     5.21.0.500-0
mono-winforms.ppc64                5.21.0.500-0
mono-winxcore.ppc64                5.21.0.500-0
monodoc-core.ppc64                 5.21.0.500-0
```

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Machine Learning enabled on IBM i

- RPM enablement
- Python enablement
- BLAS enablement
- Db2 connection
- Most famous ML packages available
 - Numpy, Pandas for data processing
 - Scipy, Scikit Learn for ML and scientific analysis
 - ipython, interactive python language support
 - nltk, natural language toolkit for natural language ML process.
 - matplotlib, jupyter notebook for visual/interactive ML/data analysis

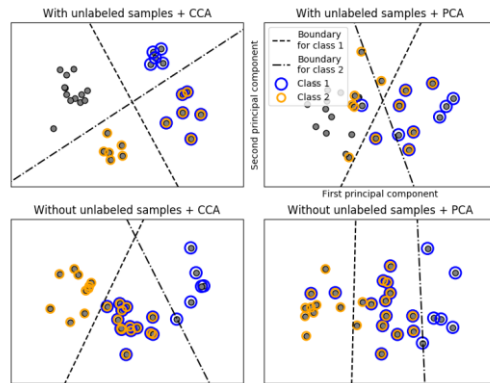


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Demo-scikit-learn

- multi-label classification.
 - Each sample has 20 features
 - We try to use Support Vector Machine (SVM) based on the chosen features(2 features selected) by canonical correlation analysis (CCA) or principal component analysis (PCA), which make it easier for us to show on plot.



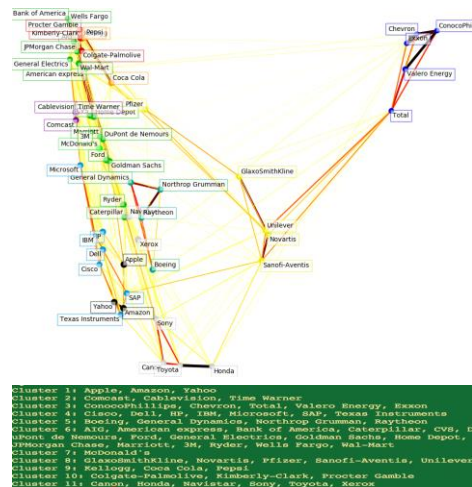
refs: https://scikit-learn.org/stable/auto_examples/plot_multilabel.html#sphx-glr-auto-examples-plot-multilabel-py

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Demo-scikit-learn

- visualizing the stock market structure.
 - try to get the stock open/close prices for some companies as training data.
 - Using the GraphLassoCV to train the data.
 - Using the trained model's covariance matrix to calculate the classes and labels.
 - Giving out the clusters output based on assigned labels.
 - Meanwhile, visualizing the results into a 2d plane.



refs: https://scikit-learn.org/stable/auto_examples/applications/plot_stock_market.html#sphx-glr-auto-examples-applications-plot-stock-market-py


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R: a new programming language on IBM i!

- Great for:
 - Data analysis
 - Statistical computing
 - Data mining
 - Big Data
- Ranked #7 by IEEE
<https://spectrum.ieee.org/at-work/innovation/the-2018-top-programming-languages>



Language Rank	Types	Spectrum Ranking
1. Python	🌐 🖥️ 📱	100.0
2. C++	📱 🖥️ 📱	99.7
3. Java	🌐 📱 🖥️	97.5
4. C	📱 🖥️ 📱	96.7
5. C#	🌐 📱 🖥️	89.4
6. PHP	🌐	84.9
7. R	🖥️	82.9
8. JavaScript	🌐 📱	82.6

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vim

- Popular terminal-based editor

```

SELECT
    REMOTE_ADDRESS as RemoteAddr, REMOTE_PORT as RmtPort, REMOTE_PORT_NAME as RmtPortName,
    LOCAL_ADDRESS, LOCAL_PORT as Port, LOCAL_PORT_NAME as PortName,
    CONNECTION_TYPE as TYPE,
    TRIM(AUTHORIZATION_NAME) AS AUTH_NAME, JOB_NAME, SLIC_TASK_NAME
FROM QSYS2.NETSTAT_JOB_INFO
{0} -- WHERE CLAUSE
ORDER BY LOCAL_PORT, LOCAL_ADDRESS, REMOTE_PORT, REMOTE_ADDRESS
...

sql = sql.format("WHERE LOCAL_PORT = ?") if args.port is not None else sql.format('')
params = (args.port,) if args.port is not None else None
if args.limit is not None:
    sql += "\n LIMIT {0}".format(args.limit)
if args.offset is not None:
    sql += "\n OFFSET {0}".format(args.offset)

cur.execute(sql, params)
# One advantage to using a spec-compliant driver is that it works well with many Python modules, like
# tabulate().
# which understands what to do with a standard cursor object. https://pypi.python.org/pypi/tabulate
print(tabulate(cur, 'keys'))
cur.close()

except:

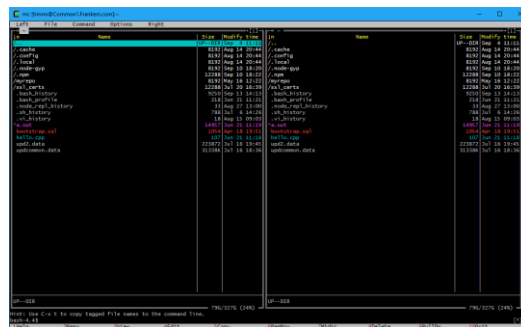
```

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Midnight Commander

- Two-pane file manager
- Abilities include:
 - FTP access
 - Compare files
 - Compare directories
 - Edit files
 - Move, copy, delete, etc
 - Subshell
 - Scroll wheel
 - Mouse
 - Directory side-by-side and tree views
 - See and modify file info
 - Tons more!!



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ActiveMQ

- Open source message broker (Java-based)
- Supported protocols:
 - OpenWire
 - STOMP
 - MQTT
 - AMQP
 - REST
 - WebSockets

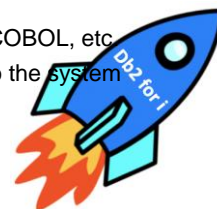


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Node.js connectivity libraries

- idb-connector v1.x
 - Direct API access to Db2
 - Standard JavaScript (callback-based) conventions
- idb-pconnector v1.x
 - Built around idb-connector
 - Promises-based API set (aligns with new language standards)
 - Includes connection pooling (avoids many common pitfalls)
- itoolkit
 - Allows Node.js to integrate with RPG, Db2, CL, COBOL, etc
 - ****NEW in v1.x**** Can use SSH or ODBC to talk to the system
- Sequelize Dialect
 - Db2 via the popular Node.js ORM



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Loopback support

- Easily create REST APIs with a nonular Node.js framework

The screenshot displays the Loopback CLI interface. On the left, a table lists columns for a model, including 'id', 'personId', and 'title'. On the right, a list of REST API endpoints is shown, such as 'GET /books/{id}/exists', 'POST /books/{id}/replace', and 'GET /books/count'. A large blue arrow points from the CLI interface to the right, indicating the flow of data or the generation of the API endpoints.

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Loopback

```

Enter an empty property name when done.
Property name: Name
Property type: string
Required? yes
Default value[leave blank for none]:

Let's add another employee property.
Enter an empty property name when done.
Property name: EmployeeID
Property type: number
Required? yes
Default value[leave blank for none]:

Let's add another employee property.
Enter an empty property name when done.
Property name: startDate
Property type: date
Required? yes
Default value[leave blank for none]:

Let's add another employee property.
Enter an empty property name when done.
Property name:
[markirishoc6133424434 loopback-test]$
  
```

The screenshot displays the Loopback CLI interface for an 'employee' model. On the left, a table lists columns for the model, including 'id', 'Employees', and 'startDate'. On the right, a list of REST API endpoints is shown, such as 'GET /Employees', 'POST /Employees', and 'GET /Employees/count'. A large blue arrow points from the CLI interface to the right, indicating the flow of data or the generation of the API endpoints.

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Loopback

Response Content Type application/json

Parameters

Parameter	Value	Description	Parameter Type	Data Type
id	4	Model id	path	string
filter		Filter defining fields and include - must be a JSON-encoded string ({"something":"value"})	query	string

[Try it out!](#) [Hide Response](#)

Curl

```
curl -X GET --header 'Accept: application/json' 'http://0.0.0.0:3000/api/books/4'
```

Request URL

```
http://0.0.0.0:3000/api/books/4
```

Response Body

```
{
  "title": "Journey to the Center of the Processor",
  "isbn": 1726308311,
  "id": 4,
  "personId": 0
}
```

Response Code

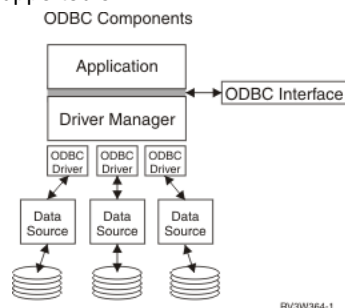
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ODBC Driver

- IBM i Access ODBC driver now supported on:

- Windows
- Linux
- IBM i



- Why ODBC on IBM i?
 - Develop on Windows/Linux, deploy on IBM i
 - Use standard ODBC libraries from various languages (PHP, Python, Node.js, Ruby, R, etc)

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Disclaimers



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Disclaimer #1

- Even business architects don't know the future!



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Disclaimer #2

- I'm not officially announcing anything today!
- This presentation represents personal predictions. These predictions neither imply nor expressly state any IBM commitment.

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General Philosophical predictions



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Open Source Support: the past (adoption inhibitor)

- 5733-OPS: **No support**
- RPM pile: **Community support**
- A few community “integration pieces”: IBM community support
- Zend Server, PowerRuby, many others: vendor support
- Most open source frameworks and other packages: **Community support**

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With a continuously evolving product list, we can support virtually your entire ecosystem

389DirectoryServer	CephFS	GNU sed	Maven	Python
ActiveMQ	Chef	GNU Wget	MongoDB	QEMU
Ansible	CoreOS	Grafana	MySQL	R
Apache Ant	Couchbase	Graylog	Nagios	Rabbit MQ
Apache Camel	CVS: Concurrent Versions System	gVim	Nagios Plugin	Redis
Apache Cassandra	Debian - x86 & Power only	HAProxy	Nginx	Relax and Recover (ReaR)
Apache CouchDB	DHCP (ISC DHCP)	Hibernate	Nmap	rsync
Apache Derby	Docker Engine	HornetQ	Node.js	Samba
Apache HttpServer	Docker Registry	iptables	OpenJDK	SELinux
Apache Maven	Docker Swarm	Java	OpenLDAP	Sendmail
Apache ServiceMix	Drupal	Jenkins	OpenSSL	Spring
Apache Solr	Elasticsearch (ELK)	Joomla!	OpenVPN	Subversion
Apache Spark	FluentD	Kafka	oVirt	SugarCRM
Apache Tomcat	Galera	Kibana	Perl	Vim
ApacheCXF	Gawk	Kubernetes	PhantomJS	vsftpd
Apigility	Git	KVM	PHP	WildFly
Artifactory	GitLab	lighttpd	Postfix	Wireshark
Atomic OS	GlassFish - 9x5 only	Logrotate	PostgreSQL	WordPress
BIND	Gluster / GlusterFS	Logstash (ELK)	Prometheus	Zookeeper
Celometer	GNU Make	Isof	Puppet	
CentOS	GNU Privacy Guard	MariaDB	PuTTY	

Support is available for Community editions only through this offering. Enterprise editions are not supported

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More than just Break / Fix



80% of OSS support issues stem from either a lack of product knowledge, or something in the environment outside of the package ¹

80%

IBM Cloud Open Source Support includes diagnostics & virtually unlimited assistance with a wide variety of usage & how-to questions

TSS can be a resource for your development team....at any stage of the SDLC!



Interoperability Issues

- Product compatibility and interoperability questions
- Discuss interdependencies between OSS packages



Installation & Configuration

- Answer specific installation questions for documented functions
- Provide available configuration samples



Short Duration OSS Guidance

- We can provide advice on which OSS packages may be optimized or best suited for your solution



Community Engagement

- Rogue Wave & IBM participate in a wide variety of community projects and leverage as a resource



Our Solution Approach

- Our breadth of expertise allows us to take a holistic approach and provide support for the solution stack
- Review problems from a systems perspective



Additional Resources

- Our team can provide technical references to publications, such as redbooks or manuals and assist with interpretation of publications

¹ 2017 Open Source Support Report, Rogue Wave Software

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Significant supportables for IBM i

- Git
- Jenkins
- rsync
- Node.js
- Apache Tomcat
- Spring
- WordPress
- Python
- For more resources, see <http://ibm.biz/ibmi-oss-support>

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Prediction!

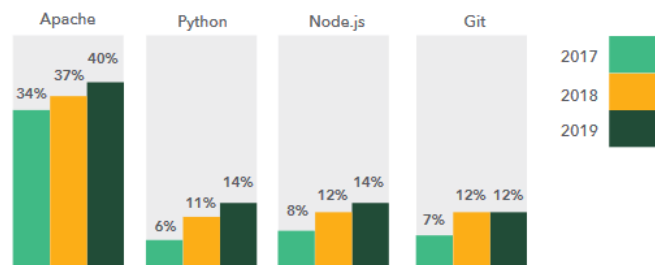
- More customers will leverage the IBM support offering
- This will be the new “MO” (mode of operation)

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Marketplace Survey Trends

Which open source development tools are you using for IBM i apps?



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

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Predictions!

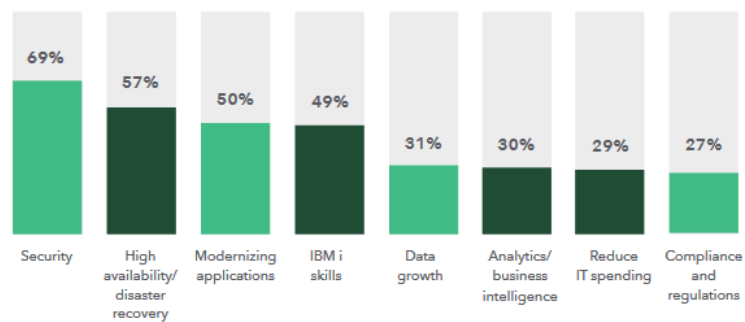
- Use of Python and Node.js will continue to grow
 - 16% each by 2020
- Continued interest in git will bleed into DevOps tools like Jenkins, Artifactory, GitHub/GitLab, etc.

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Marketplace Survey top concern?

What are your top concerns as you plan your IT environment?



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Prediction!

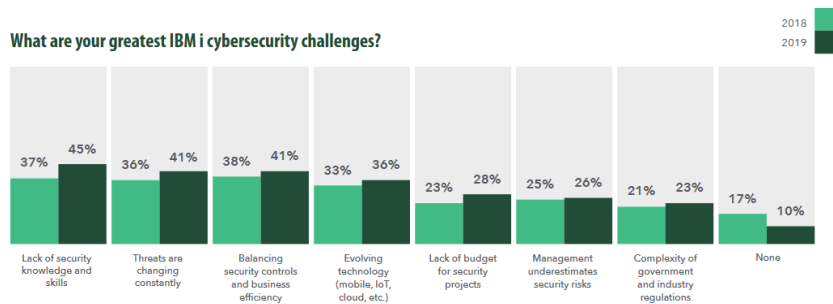
- More enterprises will be turning to open source to secure their data and applications
- More people will turn to PASE OSS for TLS connectivity
 - Industry-standard
 - More quickly updated

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Greatest cybersecurity challenges

What are your greatest IBM i cybersecurity challenges?



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Greatest cybersecurity challenges (top five)

- Lack of security knowledge and skills
- Threats are changing constantly
- Balancing Security Controls and Business Efficiency
- Evolving technology (mobile, IoT, cloud, etc)
- Lack of budget for security projects

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Greatest cybersecurity challenges (top five)

- Lack of security knowledge and skills
 - OSS brings “googlable” solutions
- Threats are changing constantly
 - OSS constantly evolves as new threats arise
- Balancing Security Controls and Business Efficiency
 - OSS brings cost-effectiveness with industry-standard technology
- Evolving technology (mobile, IoT, cloud, etc)
 - OSS thrives in all these areas and solutions already exist
- Lack of budget for security projects
 - OSS has multimillion-dollar investments from many companies

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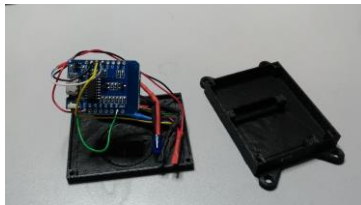
Prediction!!

- IoT from IBM i will be done for >60% of IBM i customers in the following industries:
 - Medical
 - Transportation/logistics/shipping
 - Manufacturing



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Temp and Light Sensor



<https://github.com/mhdawson/arduino-esp8266/tree/master/TempAndLightSensor>

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Consuming Sensor Data on IBM i (client-sensor.js)

```
const fs = require('fs');
const path = require('path');
const mqtt = require('mqtt');

// setup mqtt
let mqttOptions;
mqttOptions = {
  key: fs.readFileSync(path.join(__dirname, 'mqttclient', '/client.key')),
  cert: fs.readFileSync(path.join(__dirname, 'mqttclient', '/client.cert')),
  ca: fs.readFileSync(path.join(__dirname, 'mqttclient', '/ca.cert')),
  clientId: 'simple-client',
  checkServerIdentity: function() { return undefined },
  rejectUnauthorized: false,
  username: '',
  password: ''
}

const mqttClient = mqtt.connect('mqtts:common1.iinthecloud.com:8883', mqttOptions);
mqttClient.on('connect', () => {
  console.log('connected');
  mqttClient.subscribe('factory/1/light');
  mqttClient.subscribe('factory/1/temp');
  mqttClient.on('message', (topic, message) => {
    console.log('message received topic (' + topic + ') message (' + message.toString() + ')');
  });
});
```

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Consuming Sensor data on IBM i

The screenshot shows a web browser window with a SQL query editor and a results table. The query is a SELECT statement filtering for 'temp' and 'light' records from the 'JESSEGIOT.IOT_RECORDS' table. The results table displays columns for DEVICE, SENSORVALUE, and SENSORTIME, with multiple rows of data for 'factory/1/temp'.

```
1 -- description: Temperature
2 SELECT *
3 FROM JESSEGIOT.IOT_RECORDS
4 WHERE DEVICE LIKE '%temp'
5 ORDER BY SENSORTIME DESC
6 LIMIT 50;
7
8 -- description: Light
9 SELECT *
10 FROM JESSEGIOT.IOT_RECORDS
11 WHERE DEVICE LIKE '%light'
12 ORDER BY SENSORTIME DESC
13 LIMIT 50;
14
```

DEVICE	SENSORVALUE	SENSORTIME
factory/1/temp	24.75	2019-04-12 16:07:05.510507
factory/1/temp	24.75	2019-04-12 16:06:35.337323
factory/1/temp	24.75	2019-04-12 16:06:05.127732
factory/1/temp	24.75	2019-04-12 16:05:34.939690
factory/1/temp	24.75	2019-04-12 16:05:04.754581
factory/1/temp	24.75	2019-04-12 16:04:34.556798
factory/1/temp	24.75	2019-04-12 16:04:04.355322

Messages Global Variables and Special Registers

Connected to relational database host on common1.iinthecloud.com as TD446 - 060877QJ55RQ2DASQNET using JDBC configuration 'Common'

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Language Futures



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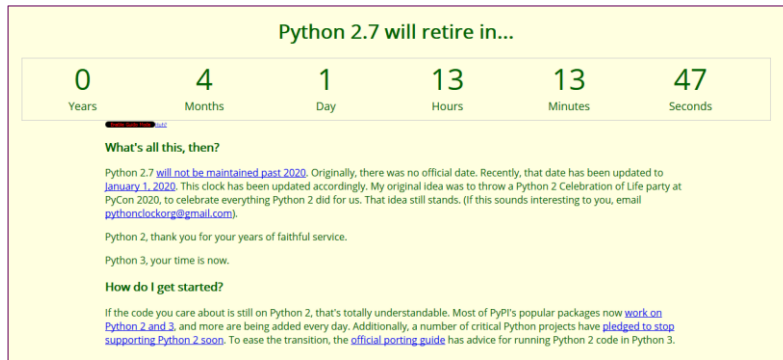


Language Futures (Python) with your guest, Mike Pavlak from Fresche



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pythonclock.org



FRESCH!

Python 3.8 (PEP569 - October 21, 2019) Python.org

- New features <https://docs.python.org/3.8/whatsnew/3.8.html>
 - ▢ PEP572-Walrus Operator `:=` for minimizing assignment gymnastics

In this example, the assignment expression helps avoid calling `len()` twice:

```
if (n := len(a)) > 10:
    print(f"List is too long ({n} elements, expected <= 10)")
```

- ▢ PEP570-Parameter syntax to lock in/out keyword or positional notation.
- ▢ PEP587-Python Init Configuration for better error reporting and control.

FRESCH!

PEP-572

- PEP == Python Enhancement Proposal
- BDFL == Benevolent Dictator for Life
 - ▢ Guido Van Rossum
 - ▢ Final design authority for the Python language
- 572 is a proposal for creating a way to assign to variables within an expression using the notation `NAME := expression`.
- There was a GREAT deal of passion, both for and against this enhancement...

<https://www.python.org/dev/peps/pep-0572/>

FRESCHÉ 43

PEP-572 examples

```
# Handle a matched regex
if (match := pattern.search(data)) is not None:
    # Do something with match

# A loop that can't be trivially rewritten using 2-arg iter()
while chunk := file.read(8192):
    process(chunk)

# Reuse a value that's expensive to compute
[y := f(x), y**2, y**3]
```

IT can make you smile ☺ 44

Python Civil War part 2: Age of Assignment

[python-committers] Transfer of power

Guido van Rossum [guido at python.org](mailto:guido@python.org)
Thu Jul 12 10:37:35 EDT 2018

- Previous message (by thread): [\[python-committers\] A different way to discuss](#)
- Next message (by thread): [\[python-committers\] Transfer of power](#)
- Messages sorted by: [\[date \]](#) [\[thread \]](#) [\[subject \]](#) [\[author \]](#)

Now that PEP 572 is done, I don't ever want to have to fight so hard for a PEP and find that so many people despise my decisions.

I would like to remove myself entirely from the decision process. I'll still be there for a while as an ordinary core dev, and I'll still be available to mentor people -- possibly more available. But I'm basically giving myself a permanent vacation from being BDFL, and you all will be on your own.

After all that's eventually going to happen regardless -- there's still that bus lurking around the corner, and I'm not getting younger... (I'll spare you the list of medical issues.)

I am not going to appoint a successor.

So what are you all going to do? Create a democracy? Anarchy? A dictatorship? A federation?

BDFL
?

"I'm tired, and need a very long break."

IT can make you smile ☺ 45

Is this a good thing?

- Without question, this is a good thing...
- Healthy for leadership to transition (think term limits?)
- PHP release managers
 - ▢ PHP 1 & 2 – Rasmus Lerdorf
 - ▢ PHP 3 & 4 – Zeev and Andy
 - ▢ PHP 5 – Ilia Alshanetsky
- Zend Framework
 - ▢ ZF1 – Walter
 - ▢ ZF2 & 3 Matthew O'Phinney
 - Component managers help

Release	Release Managers
PHP 5.6	Ferenc Kovacs tyrael@php.net Julien Pauli jpauli@php.net
PHP 7.0	Anatol Belski ab@php.net Ferenc Kovacs tyrael@php.net
PHP 7.1	Davey Shafik davey@php.net Joe Watkins krakjoe@php.net
PHP 7.2	Remi Collet remi@php.net Sara Golemon pollita@php.net
PHP 7.3	Christoph M. Becker cmb@php.net Stanislav Malyshev stas@php.net

Python 3.8 (PEP569 - October 21, 2019) Python.org

- New features <https://docs.python.org/3.8/whatsnew/3.8.html>

- ▣ f-strings support for self documenting expressions...

```
>>> user = 'eric_idle'
>>> member_since = date(1975, 7, 31)
>>> f'{user=} {member_since=}'
"user='eric_idle' member_since=datetime.date(1975, 7, 31)"
```

- ▣ PEP574-Pickle Protocol 5 - data can be transmitted separately from the main pickle stream, at the discretion of the communication layer.
 - ▣ Lots of optimizations...

FRESCH!

Python 3.8 (PEP569 - October 21, 2019) Python.org

- New module: importlib.metadata: for reading metadata from third-party packages.

```
>>> from importlib.metadata import version, requires, files
>>> version('requests')
'2.22.0'
>>> list(requires('requests'))
['chardet (<3.1.0,>=3.0.2)']
>>> list(files('requests'))[:5]
[PackagePath('requests-2.22.0.dist-info/INSTALLER'),
 PackagePath('requests-2.22.0.dist-info/LICENSE'),
 PackagePath('requests-2.22.0.dist-info/METADATA'),
 PackagePath('requests-2.22.0.dist-info/RECORD'),
 PackagePath('requests-2.22.0.dist-info/WHEEL')]
```

FRESCH!

Python 3.8 (PEP569-October 21, 2019) Python.org

o Improved modules:

Ast	Json.tool	Sys
Asyncio	Math	Tarfile
Builtins	Mmap	Threading
Collections	Multiprocessing	Tokenize
Ctypes	Os	Tkinter
Functools	Ncurses	Time
Datetime	Pickle	Typing
Gettext	Plistlib	Unicodedata
IDLE	Socket	Unittest
Inspect	Slex	Venv
IO	Shutil	Weakref
GC	Ssl	Xml
Gzip	Statistics	

FRESCHET

Python 3.9 (PEP596 - June 8, 2020) Python.org

- o New features: <https://docs.python.org/3.9/whatsnew/3.9.html>

Features for 3.9

Nothing yet, go write a PEP!

FRESCHET

Python 4 (rumored 2023)

- New features: who knows?
- Or maybe that will just be Python 3.10...

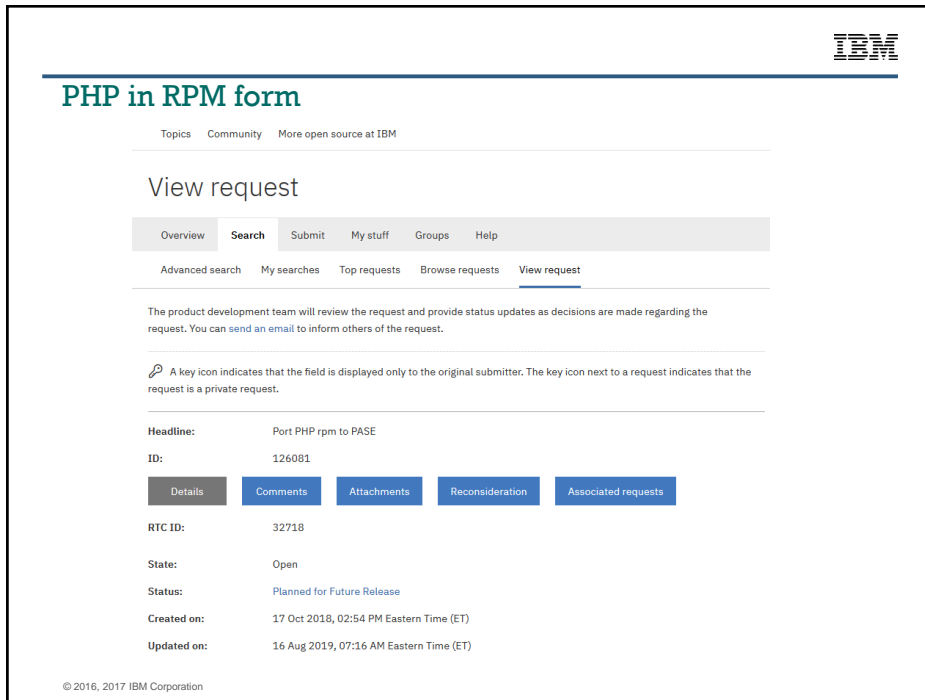
FRESCH!

IBM

Language Futures (PHP)



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The screenshot shows the 'View request' page for the 'PHP in RPM form'. The page has a header with the IBM logo and navigation links: Topics, Community, and More open source at IBM. Below the header, the title 'View request' is displayed. A navigation bar includes links: Overview, Search, Submit, My stuff, Groups, and Help. A secondary navigation bar includes: Advanced search, My searches, Top requests, Browse requests, and View request (which is the active page). The main content area contains a message from the product development team, a note about private requests, and a list of request details. The details include: Headline (Port PHP rpm to PASE), ID (126081), RTC ID (32718), State (Open), Status (Planned for Future Release), Created on (17 Oct 2018, 02:54 PM Eastern Time (ET)), and Updated on (16 Aug 2019, 07:16 AM Eastern Time (ET)). At the bottom, there is a copyright notice: © 2016, 2017 IBM Corporation.

IBM

PHP in RPM form

Topics Community More open source at IBM

View request

Overview Search Submit My stuff Groups Help

Advanced search My searches Top requests Browse requests View request

The product development team will review the request and provide status updates as decisions are made regarding the request. You can [send an email](#) to inform others of the request.

A key icon indicates that the field is displayed only to the original submitter. The key icon next to a request indicates that the request is a private request.

Headline: Port PHP rpm to PASE

ID: 126081

Details Comments Attachments Reconsideration Associated requests

RTC ID: 32718

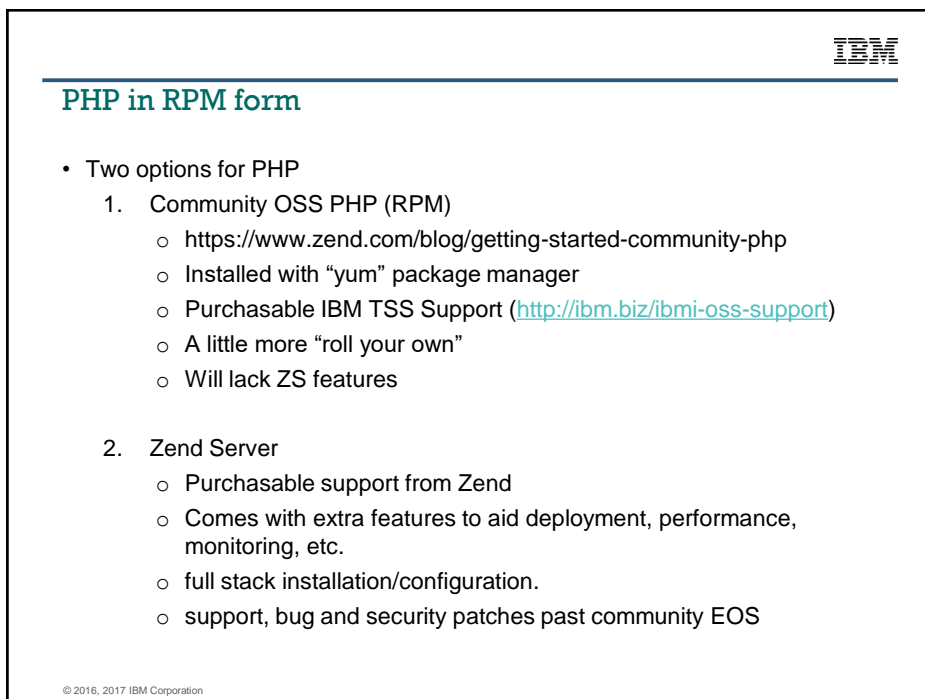
State: Open

Status: [Planned for Future Release](#)

Created on: 17 Oct 2018, 02:54 PM Eastern Time (ET)

Updated on: 16 Aug 2019, 07:16 AM Eastern Time (ET)

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The screenshot shows a presentation slide titled 'PHP in RPM form' with the IBM logo in the top right corner. The slide lists two options for PHP: 1. Community OSS PHP (RPM) and 2. Zend Server. Each option has a list of sub-points. At the bottom, there is a copyright notice: © 2016, 2017 IBM Corporation.

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PHP in RPM form

- Two options for PHP
 - Community OSS PHP (RPM)
 - <https://www.zend.com/blog/getting-started-community-php>
 - Installed with “yum” package manager
 - Purchasable IBM TSS Support (<http://ibm.biz/ibmi-oss-support>)
 - A little more “roll your own”
 - Will lack ZS features
 - Zend Server
 - Purchasable support from Zend
 - Comes with extra features to aid deployment, performance, monitoring, etc.
 - full stack installation/configuration.
 - support, bug and security patches past community EOS

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Language Futures (PHP 7.4) with your guest, Erwin Earley from Performe



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Foreign function Interface (FFI)

- Allows for loading of shared libraries (.DLL and .so), calling of C functions and accessing of C data structures in pure PHP.
- Implemented as a single class (FFI)

```
<?php
// create FFI object, loading libc and exporting function printf()
$ffi = FFI::cdef(
    "int printf(const char *format, ...);", // this is a regular C declaratio
n
    "libc.so.6");
// call C's printf()
$ffi->printf("Hello %s!\n", "world");
?>
```

Provided for ad-hoc interfacing with C functions and data structures. Does not render the classic PHP extension API obsolete..

output

Hello world!

<https://www.php.net/manual/en/book.ffi.php>

Array Spread Operator (aka Argument Unpacking)

- The spread operator (Argument Unpacking) introduced a syntax for unpacking arrays and traversables into argument lists
 - This is sometimes referred to as "splat operator", "scatter operator" or "spread operator")
- Version 7.4 of PHP adds this capability to array expressions

```
$array1 = [1, 2, 3];  
$array2 = [4, 5];  
  
$result = [0, ...$array1, ...$array2, 6, 7];  
// [ 0, 1, 2, 3, 4, 5, 6, 7
```

Numeric Literal Separator

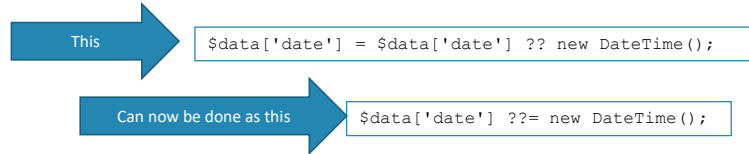
- PHP 7.4 allows the use of underscores to visually separate numeric values:

```
$unformattedNumber = 107925284.88;  
$formattedNumber = 107_925_284.88;
```

- The underscores are ignored by the PHP engine

Null coalescing assignment operator

- The null coalescing assignment operator is a shorthand for null coalescing operators:



Combining null coalescing with assignment

Preloading

- Preloading allows the server to load PHP files in memory on startup and have them permanently available for all subsequent requests
 - Without preloading, all files have to be loaded and linked on every request – especially costly when using frameworks

This performance improvement comes at a cost!

If the source of preloaded files are changed, the server has to be restarted

<https://stitcher.io/blog/preloading-in-php-74>

Other Features

Feature	Description
Arrow Functions	Also called "short closures" allow for less verbose one-liner functions <code>array_map(fn \$user) => \$user->id, \$users)</code>
Typed Properties	Class variables can be type hinted: Class A { public string \$name; public \$foo \$foo; }
Custom Object Serialization	Two new magic methods have been added: <code>__serialize</code> and <code>__unserialize</code>
Reflection for references	<code>ReflectionReference</code> class added which properly reflects references
Weak References	References to objects which don't prevent them from being destroyed
<code>mb_str_split()</code>	Provides same functionality as <code>str_split()</code> but on multi-byte strings
Password Hashing Registry	Changes made to how hashing libraries are used to make it easier for userland to use them. Function <code>password_algos()</code> added which returns list of all registered password algorithms.

Deprecations

Feature	Description
Left-associative ternary operator	Deprecation warning added for nested ternary statements. In PHP 8 this deprecation will be converted to a compile time error.
Exceptions allowed in <code>__toString</code>	Exceptions can now be thrown from <code>__toString</code>
Concatenation precedence	Deprecation warning added when encountering an unparenthesized expression containing a <code>.</code> before a <code>+</code> or <code>-</code> sign
<code>array_merge()</code>	Both <code>array_merge()</code> and <code>array_merge_recursive()</code> now allow for an empty parameter list.
Curly brackets for array and string access	The use of curly brackets for accessing array at string offsets has been deprecated.
Invalid array access notices	Previously array access on items like integers would return a null, as of 7.4 a notice is emitted.

Deprecations

Feature	Description
<code>proc_open()</code>	Can now execute programs without going through a shell by passing an array instead of a string for the command.
<code>strip_tags()</code>	Now supports use of an array
<code>ext-hash()</code>	Permanently available in all PHP installations.
<code>password_hash()</code>	Added argon2i and argon2id hashing support when PHP is compiled without libargon
PEAR not enabled by default	PEAR is no longer actively maintained so removed in default installations of PHP 7.4
Invalid array access notices	Previously array access on items like integers would return a null, as of 7.4 a notice is emitted.



Other predictions.....





Open Source Databases? (OSDBs)

- Examples include
 - Redis
 - PostgreSQL
 - MariaDB
 - MongoDB
- WHY????
 - Db2 for i is the world's best database!

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Open Source Databases? (OSDBs)

- Examples include
 - Redis
 - PostgreSQL
 - MariaDB
 - MongoDB
- WHY????
 - Enable new solutions!!

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Integration / connectivity

- ODBC
 - Expect adoption to rise
- Continued enhancements to ILE integration libraries
 - Successor to XMLService?
 - More transports? (already have ODBC, SSH)
- Enhanced security via OpenSSL, nss, nodejs upgrades
- Open Source LDAP and Kerberos solutions

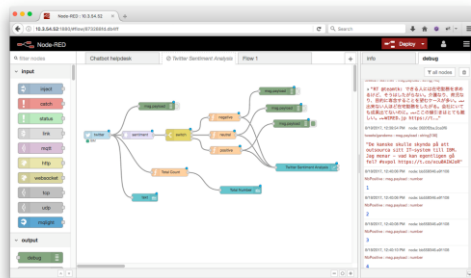
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Node-RED

- Created by IBM
- Low-code graphical way to write flow-based programs
- <https://developer.ibm.com/tutorials/i-running-node-red/>
- Nodes can be any building block that can receive and send messages. Examples include:

- Db2 for i queries
- IoT devices
- Web pages
- Web APIs
- Cloud services
- Dashboards

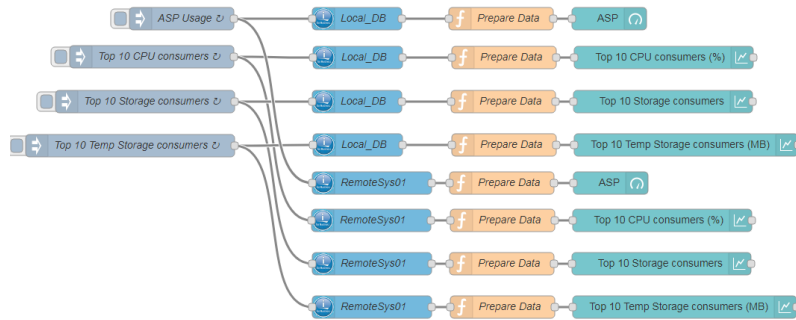


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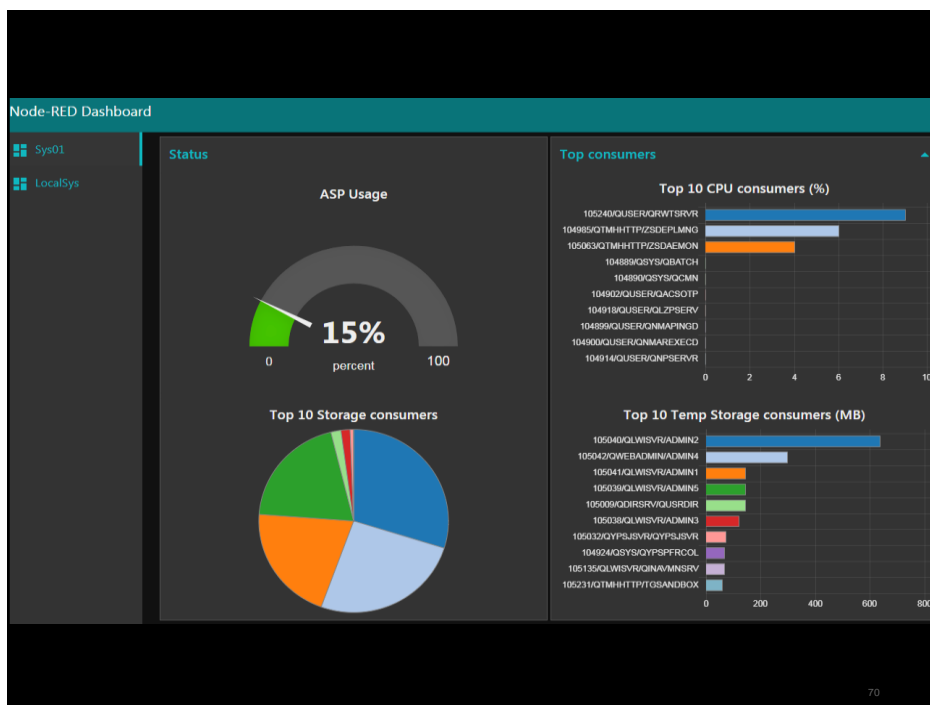


Node-RED

- We already have a Db2 node.....
 - More to come??



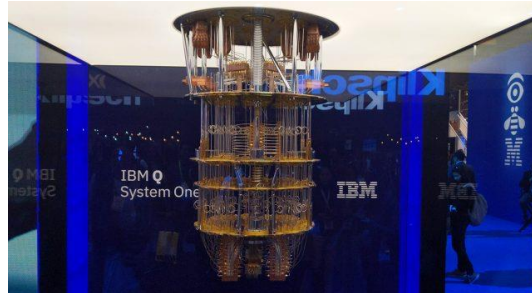
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Quantum Computing

- More quantum computing technologies to be available
- Already
 - qiskit-terra
 - qiskit-aer (some versions)



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IBM Continues Quantum Leadership

- From the IBM NewsRoom, Sept 18, 2019
<https://newsroom.ibm.com/2019-09-18-IBM-Opens-Quantum-Computation-Center-in-New-York-Brings-Worlds-Largest-Fleet-of-Quantum-Computing-Systems-Online-Unveils-New-53-Qubit-Quantum-System-for-Broad-Use>
- IBM (NYSE: IBM) announced the opening of the IBM Quantum Computation Center in New York State. The new center expands the world's largest fleet of quantum computing systems for commercial and research activity that exist beyond the confines of experimental lab environments.

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IBM Quantum Community – Some outdated (Sep) numbers

- **>150,000** registered users
- **nearly 80** commercial clients
- **>14 million** experiments through the cloud (since 2016)
- **>200** scientific papers.

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IBM Quantum Fleet – Some numbers

- five 20-qubit systems
- one 14-qubit system
- four 5-qubit systems.
- Five of the systems now have a Quantum Volume of 16 – a measure of the power of a quantum computer – demonstrating a new sustained performance milestone.
- Within a month: a new **53-qubit quantum computer**, the single largest universal quantum system made available for external access in the industry, to date.

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Popular ML Software on the IBM i (soon?)

- Scikit Learn
- TensorFlow
- Caffe
- Pytorch
- Theano
- Spark



theano

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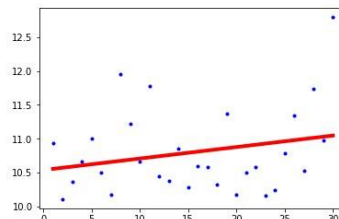
Jupyter Notebooks – Easier to use

```
In [51]: #implement a linear regression with Scikit-learn.

from sklearn.linear_model import LinearRegression

model = LinearRegression()
model.fit(xdata,ydata)
pred = model.predict(xdata)
#print("expect time:",(-model.intercept_/model.coef_)[0][0])
print("expect days to reach 40% CPU:",((40-model.intercept_)/model.coef_)[0][0])
plt.plot(xdata,ydata,"b.")
plt.plot(xdata,pred,'r',linewidth=4)
plt.show()
```

expect days to reach 40% CPU: 1740.8391



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Rising adoption of other AI technologies

- IBM Watson Portfolio
 - Watson Studio
 - Machine Learning
 - Machine Learning Accelerator
- PowerAI Vision
- H2O

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New Business Applications

- Specifically ERP, CRM
- I hear several are on IBMs radar.....
 - Some Node.js
 - Some PHP
 - Some Python...

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Major themes



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Major Themes of the Open Source Revolution

- Explosion of languages
 - C/C++
 - RPG
 - CL
 - Cobol
 - Perl
 - Ublu
 - Kotlin
 - Lua
 - Python
 - PHP
 - bash
 - Ruby
 - JavaScript (Node.js)



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Major Themes of the Open Source Revolution

- “Normalization” of IBM i Application Development
 - Familiar tools
 - Industry-standard technology
 - Industry-standard techniques
- More tools available
- More frameworks and configurations
- More solutions
- Unprecedented capabilities
- What can it do for you?



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About Me...

- Open source is an integral part of IBM i strategy

- Architect for open source:
Jesse Gorzinski

- Follow him on Twitter:
@IBMJesseG

- Read his "Open Your i" blog at
<http://ibm.biz/open-your-i>



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The "Take Home" thought

- Open Source is not a spectator sport!
 - Chat at <http://ibm.biz/ibmiooss-chat> (join at <http://ibm.biz/ibmiooss-chat-join>)



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The end!



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