



## IBM i and the Paradox of Approximate Computing

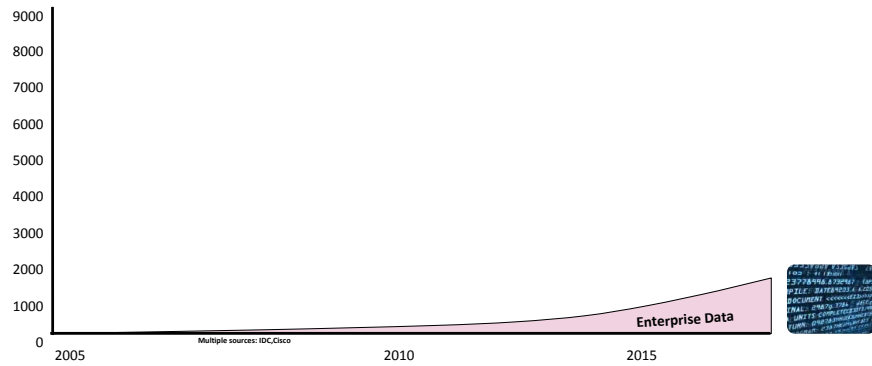
Alison Butterill  
WW Offering Manager,  
IBM i



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## Data is Growing, Changing

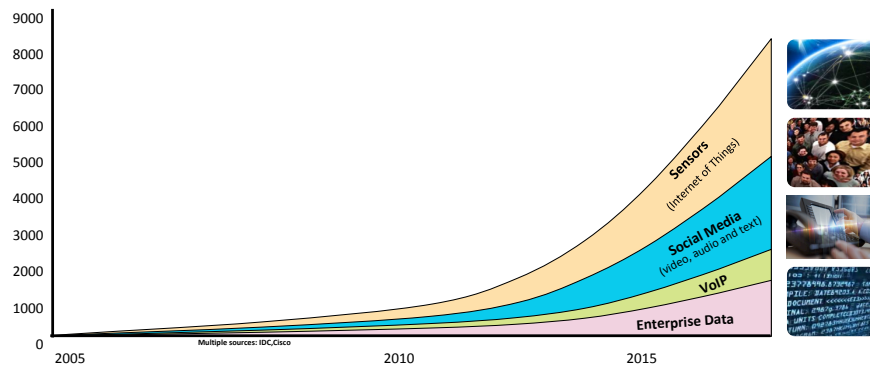


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## Data is Growing, Changing, Becoming Less Certain



Since 2015, 80% of all available data has been uncertain



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## Data Is Transforming Businesses



<p><b>Oil &amp; Gas</b> 80,000 sensors in a facility produce 15 petabytes of data</p>	<p><b>Public Safety</b> 520 terabytes of data are produced by New York City's surveillance cameras</p>
<p><b>Energy &amp; Utilities</b> 680m+ smart meters will produce</p>	<p><b>Healthcare</b> The equivalent of 300 million books of</p>

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## Digital Business means...



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## New Ways of Doing Business

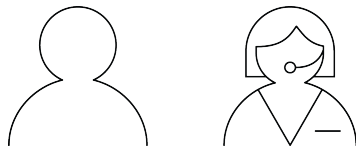


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## Customers are Shifting from Traditional Channels



**THEN**



Customer

**NOW**



Customer

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## Customers are Shifting from Traditional Channels



### Chat now with an IBM Representative

Hello, I am pleased to assist you in finding the right products and services to meet your needs. By accepting this invitation, we can chat directly in real time.

For technical or existing customer support questions, please visit the [IBM Support Portal](#) or the [IBM Global Directory](#).

[Start Chat](#)

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## New Ways of Doing Business



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## New Ways of Doing Business



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## Emerging World of Approximate Computing



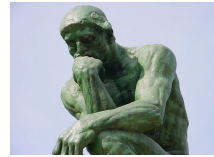
### Automate



One "RIGHT" Answer  
Payroll Calculation



### Understand



The "BEST" Answer  
Influencing a decision

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## What is Approximate Computing?



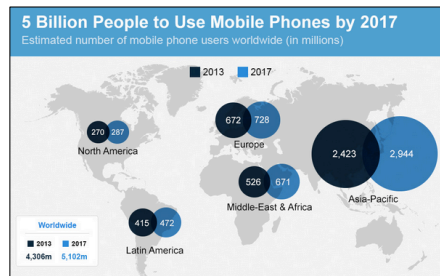
- Key requirements
  - approximation should only be in non-critical data
  - approximating critical data could lead to disastrous consequences
- Identifying the section(s) of an application that could be approximated
  - Need application programmer & application domain expert involved



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## What is Approximate Computing?

- Key requirements
  - approximation should only be in non-critical data
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  - Identifying the section(s) of an application that could be approximated
    - Need application programmer & application domain expert involved



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## Workloads in the Cognitive Era

Graph Analytics



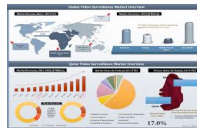
Security  
Fraud Detection  
Genome Analysis  
Social Network Analysis  
Knowledge Graphs

Machine Learning



Anomaly detection  
Robotics  
Predictive Analytics

Video Analytics



Multimodal Analysis

- Object recognition
- Complex video analytics
- Correlation and stitching

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When is good, good enough?

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When is good, good enough?

---



Is that a person?



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## When is good, good enough?

---



Is that a person?



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## When is good, good enough?

---



Is that Anne Marie?



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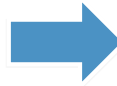
## ROI driving a new definition of insight



### DETERMINISTIC



100s of GBs of Data  
Noise Intolerant  
High Precision  
High Energy/Computation  
High Cost



### STOCHASTIC



10s of PBs of Data  
Noise tolerant  
Amenable to lower Precision  
Lower Energy/Computation  
Lower Cost

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## Cognitive Systems



- Cognitive computing simulates human thought processes in computerized model

Adaptive  
Interactive (Expert System)  
Natural Language Processing  
Iterative and Stateful  
Contextual  
Reasoning Capacity  
Machine Learning (AI)  
Fast (Real Time)  
Needs Big Data

Cognitive  
Computing

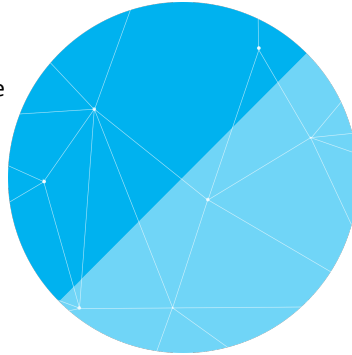


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## Cognitive systems = partnership of man and machine



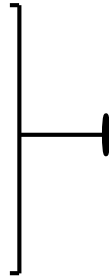
- Humans excel at:
- Common Sense
  - Morals
  - Imagination
  - Compassion
  - Abstraction
  - Dilemmas
  - Dreaming
  - Generalization



- Cognitive Systems excel at:
- Locating Knowledge
  - Pattern Identification
  - Natural Language
  - Machine Learning
  - Eliminates bias
  - Endless Capacity

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## Cognitive systems rely on data and information



Data, information, and expertise create the foundation.

**Examples include:**

- |                      |                              |
|----------------------|------------------------------|
| Analyst reports      | Forensic reports             |
| tweets               | Newspapers                   |
| Wire tap transcripts | Blogs                        |
| Battlefield docs     | Wiki                         |
| E-mails              | Court rulings                |
| Texts                | International crime database |
|                      | Stolen vehicle data          |
|                      | Missing persons data         |

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## AI/Deep Learning Strategy for Power



- Embrace and extend open source
- Add system-level optimizations - PowerAI and NVLink
- Build differentiated GPU-accelerated system solutions
- Enable through the Cloud



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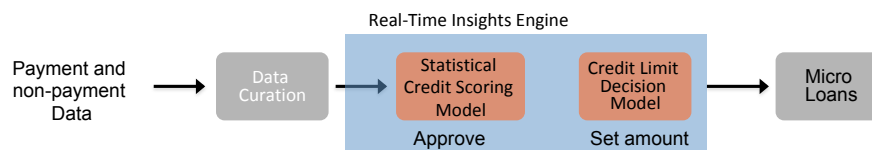
## Transforming Banking



East African bank reduces business risk with Cognitive Solution



- Statistical Credit Scoring Model
- Credit Limit Decision Model



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## Transforming Banking

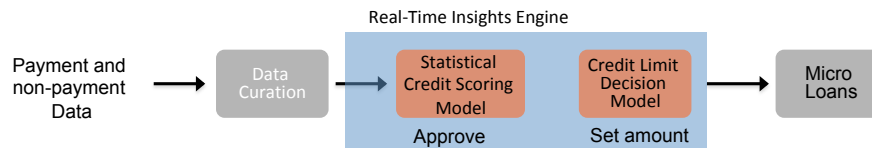


East African bank reduces business risk with Cognitive Solution



- Statistical Credit Scoring Model
- Credit Limit Decision Model

Approximate answer – influencing the decision



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## Machine Learning / Deep Learning



**MACHINE LEARNING**

The idea that some algorithms can tell you interesting things about your data without writing any custom code.

Instead of writing code, you feed data to the algorithm and it builds its own logic.

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## Deep Learning



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## Nest



## Siri and Alexa

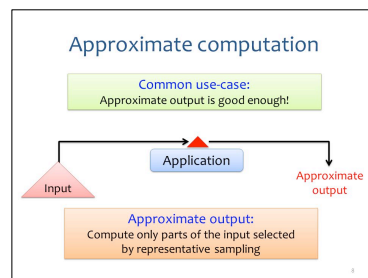


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## Many Aspects to Approximate Computing



- Approximate Circuits
  - Approximate logical circuits can reduce hardware overhead
- Approximate Storage
  - “Rounding” applied to numbers and data, dropping level of accuracy
- Software Approximation
  - Various algorithms can be invoked or ignored depending on the task being requested.
- Approximate Systems
  - Allow processor, memory, sensor and communication modules to approximate and thereby achieve better performance



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## Neural Networks



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## Tractable



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## Claims Triage



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## Let's talk about IBM i



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## Cognitive is Fueled by a different IT Infrastructure



Cognitive workloads are dramatically different than transactional computing



Cognitive is a race of speed to insight



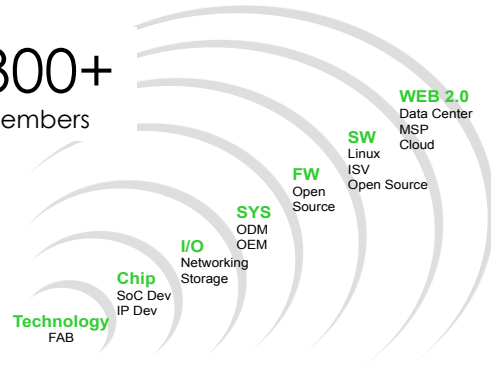
IT value to feed cognitive insights will no longer come solely from processors

# OpenPOWER Foundation: an Innovation Ecosystem



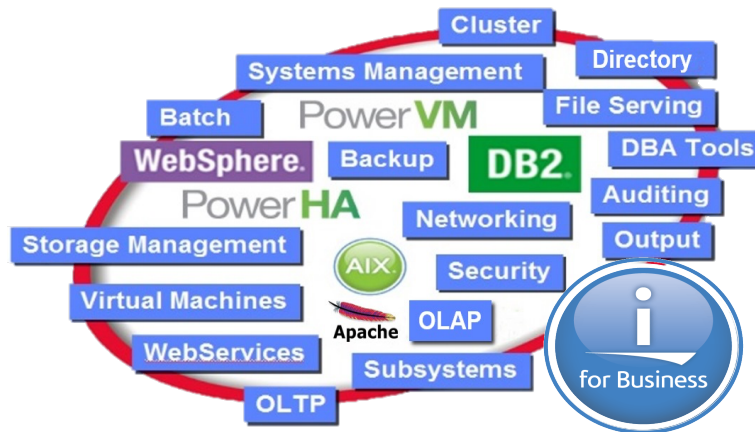
The OpenPOWER Foundation is an open ecosystem, using the POWER Architecture to serve the evolving needs of customers.

300+ members



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# IBM i – It's All in There



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## IBM i – it's always been about the Data



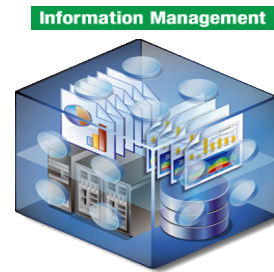
Integrated and optimized  
• for business computing

Integration  
• yields operational advantages

Open  
• for data access and interchange

Protected  
• with a trusted security model

Advanced



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## IBM i – it's all about the Data



Understand your history  
*Temporal*

- Learn from history
- Ask new kinds of questions
- Ensure intelligent security

Apply Analytics Directly  
*OLAP*

- Correlation
- Predictive analytics

Secure  
*Row Column Access Control*

- Permission based access
- Mask sensitive data
- ALL data access methods are controlled



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## Modern Interface?



```
SVADR002 6/27/14
NONICKL QPADEV1A7 SERVICE ADDRESS INQUIRY 10:26:58
Option: ADIQ Qualifier: 0000 ABBEY STREET
Service Address key 0045675 Street code 100 Status A
House Number 2 Street Name ABBEY STREET Apt #
Service Address 2 ABBEY STREET
City, State, Zip SAN FRANCISCO CA 94114
Postal Carrier 00000 Old Suffix #
Description
Units 1 Franchise Code SF0 County Code SF0
Map Area MIS Map Sub Area ABB Assessor Parcel # 3566 020
Pickup Restrictions (hham)
Garbage... Earliest Arrival 0000 Latest Arrival 0000
Recycling... Earliest Arrival 0000 Latest Arrival 0000
Organics... Earliest Arrival 0000 Latest Arrival 0000
Defaults
Account Type Bill Cycle Fran Schedule SF0 Day 4 (MTWTFSS) ---T---
Route 094 Block 10 Stop 30
1=End/return 2=Search Scrn 9/21=Tickets
```

## Mobile Devices are Pervasive



## The Cloud



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## IBM i Strategy



- **Power Solutions**
  - Delivering an integrated platform focused on leading industry applications
  - Engaging with partner ISVs & MSPs for flexible solutions delivery options
  - Enabling clients to transform their applications via mobile, cognitive, IoT
- **Open Platform for Choice**
  - IBM demonstrating commitment with major releases: IBM i 7.3 in 2016
  - Providing new capabilities between releases based on user feedback
  - Growing IBM i solutions options including open source languages and applications
- **The Integrated Promise of IBM i**
  - Deliver a simple, high value platform for business applications
  - Provide exceptional security and resiliency for critical business data
  - Leverage IBM systems, storage and software technologies

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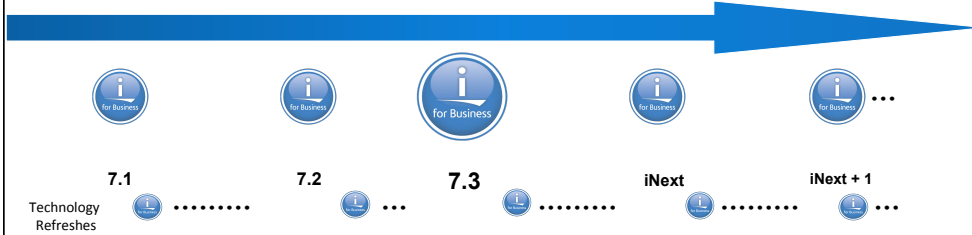
# IBM i Roadmap



2010

2014

2016



\*\* All statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

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# IBM i with the IBM Cloud - BlueMix and Watson



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# IBM BlueMix



### Bluemix Garage

Our experts bring together a unique blend of design thinking, lean and DevOps methodology to help you create exciting new ways to engage your customers.



### Enterprise application deployment

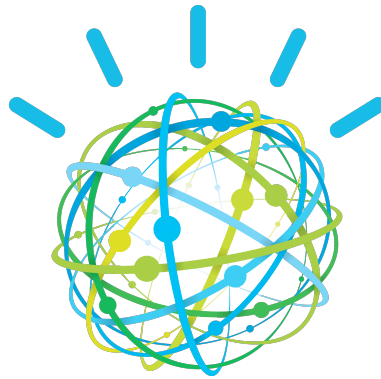
Work with IBM experts to host and manage enterprise applications such as SAP, SAP HANA and Oracle.



### Cloud expertise

Our experts have a deep combination of expertise across business, industry and technology and together we can chart forward a path to helping you modernize and transform enterprise IT.

# Watson = Cognitive and/or Approximate

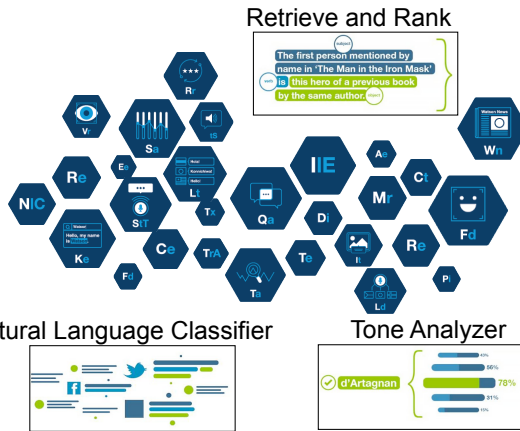


## Leverage Watson APIs to apply cognitive



### 50 underlying technologies

- |                         |                             |
|-------------------------|-----------------------------|
| Entity Extraction       | Language Translation        |
| Sentiment Analysis      | Natural Language Classifier |
| Emotion Analysis (Beta) | Personality insights        |
| Keyword Extraction      | Relationship Extraction     |
| Concept Tagging         | Retrieve and Rank           |
| Taxonomy Classification | Tone Analyzer               |
| Author Extraction       | Emotive Speech to Text      |
| Language Detection      | Text to Speech              |
| Text Extraction         | Face Detection              |
| Microformats Parsing    | Image Link Extraction       |
| Feed Detection          | Image Tagging               |
| Linked Data Support     | Text Detection              |
| Concept Expansion       | Visual Insights             |
| Concept Insights        | Visual Recognition          |
| Dialog                  | AlchemyData News            |
| Document Conversion     | Tradeoff Analytics          |



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## Human Understanding and Translation

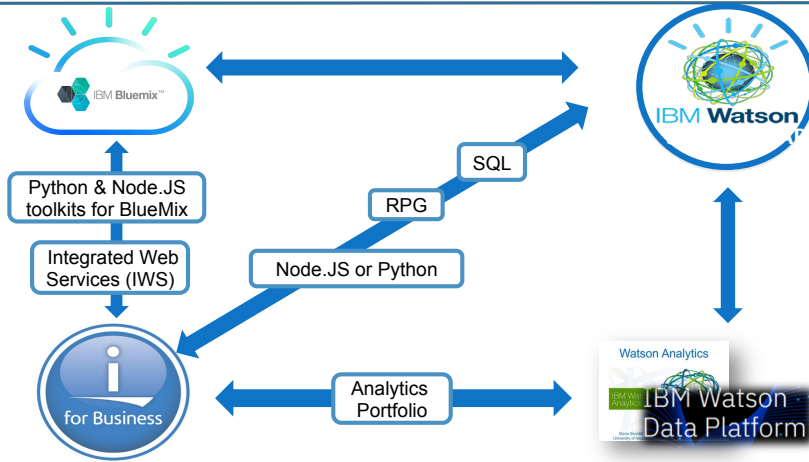


“Last Night I Shot an Elephant in My Pajamas”



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## Connecting IBM i to Watson



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## IBM i - Enabling solutions for your business



**IBM i Native Solutions**

**RPG**   **Cobol**   **Java**

**IBM DB2**

**APACHE**   **IBM i for Business**

**IBM Power Systems**

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# IBM i - Enabling solutions for your business



### IBM i Native Solutions

RPG Cobol Java

### Open Source on IBM i

php python

## IBM Power Systems

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# IBM i - Enabling solutions for your business



### IBM i Native Solutions

RPG Cobol Java

### Open Source on IBM i

php python

### Linux & AIX Solutions

*Expanded Linux ecosystem of solutions for CAMSS*

## IBM Power Systems

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# IBM i - Enabling solutions for your business



<b>IBM i Native Solutions</b> SAP, INFOR, SYNTAX, IBS, fiserv., Agilysys., DPS, CHRYSLER GUIDANCE, Friedman, DST, PFW, HARRIS, LWSI, solarsoft, Retailix, Hiper, kingston, N&N, Xperia, Jack Henry, SDS, HMS	<b>Open Source on IBM i</b> mantis, mambo,xoops, zen cart, dojo, WordPress, Drupal, FOCUS, phpbb, Joomla!, Magento, SUGARCRM	<b>IBM Bluemix™</b> IBM Watson
RPG, Cobol, Java	php, python	java, php, python
IBM, DB2.	IBM, DB2.	IBM, DB2., mongoDB, MariaDB
APACHE, i for Business	PASE	Linux
<b>IBM Power Systems</b>		

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# IBM i - Enabling solutions for your business



<b>IBM i Native Solutions</b> SAP, INFOR, SYNTAX, IBS, fiserv., Agilysys., DPS, COMPUTER GUIDANCE, Friedman, DST, PFW, HARRIS, LWSI, solarsoft, Retailix, Hiper, kingston, N&N, Xperia, Jack Henry, SDS, HMS	<b>Open Source on IBM i</b> mantis, mambo,xoops, zen cart, dojo, WordPress, Drupal, FOCUS, phpbb, Joomla!, Magento, SUGARCRM	<b>Linux Solutions</b> <i>Expanded Linux ecosystem of solutions for Cognitive and AI</i> IBM PowerAI
RPG, Cobol, Java	php, python	java, php, python
IBM, DB2.	IBM, DB2.	IBM, DB2., mongoDB, MariaDB
APACHE, i for Business	PASE	Linux
<b>IBM Power Systems</b>		

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## Into the Future



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## PowerAI: Get Started with Deep Learning



Package of Pre-Compiled Deep Learning Frameworks



Easy to install & get started with Enterprise-Class Support



Optimized for Performance To Take Advantage of NVLink

Delivering a differentiated High Performance Data Analytics Infrastructure

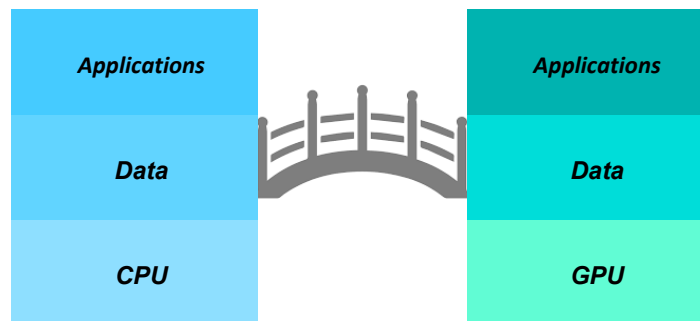
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## Example of Partnering X 2 - Nvidia GPU

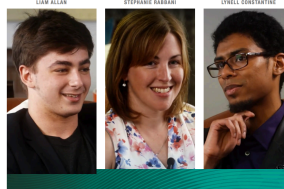
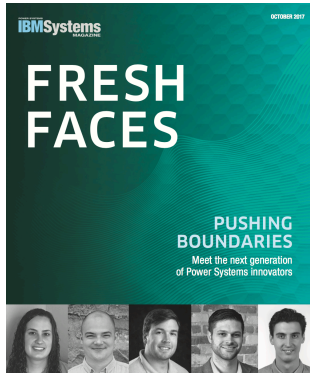


Platforms	Products	Developers	Corporate
AI and Deep Learning	DGX-1	Developer Program	NVIDIA Partner Network
Data Center	DRIVE PX	CUDA	NVIDIA Blog
NVIDIA GPU Cloud	GeForce GTX 10-Series	Training	Careers
Intelligent Machines	Virtual GPU	GPU Tech Conference	RSS Feeds
Self-Driving Cars	Jetson		Email Signup
GeForce Gaming	Quadro		Contact Us
SHIELD	SHIELD TV		Security
	Tesla		

## CPU Applications – GPU Applications



## Fresh Faces



### DEBUNKING 5 MYTHS ABOUT IBM i

Young people are embracing the modern platform  
and pushing it to new limits.



MAURITS  
HOOGLAND

TECHNICAL CONSULTANT  
EXTRAVAR B.V.



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## IBM i Priorities



- **Solutions for Today and the Future**
  - Focus on solutions integration with new technology
  - Invest in Db2 and language features for strategic solutions
  - Enable Mobile Device Support, Cognitive, AI and IoT
- **Systems On-Site or In the Cloud**
  - Exploit future POWER system technology
  - Deliver advanced virtualization of system & storage
  - Provide resiliency, availability & flexibility
- **Simple & Integrated, Secure & Available**
  - Simplify management of systems and high availability
  - Broaden storage area network integration
  - Extend industry-leading integrated security



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## Interconnected Devices: The Internet of Things



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## The Future is Here



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## What will you do with Approximate Computing?

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IBM i in the Age of Cognitive  
Computing

Alison Butterill  
WW Offering Manager,  
IBM i




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