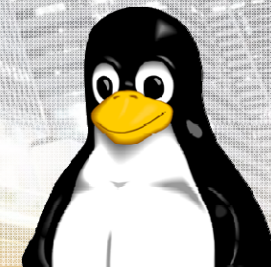# Cognitive Computing with IBM z Systems

Wilhelm Mild
Executive IT Architect
for Mobile, z Systems and Linux
IBM R&D Lab. Germany

The business environment is shifting…

Cloud

Mobile

Social

Internet of Things

…and a new era of computing is emerging

Cognitive Computing = Digital Business + Digital Intelligence

https://www.youtube.com/watch?v=AGYkk5wUKtA

Cognitive Computing with z Systems - video

https://www.youtube.com/watch?v=AGYkk5wUKtA
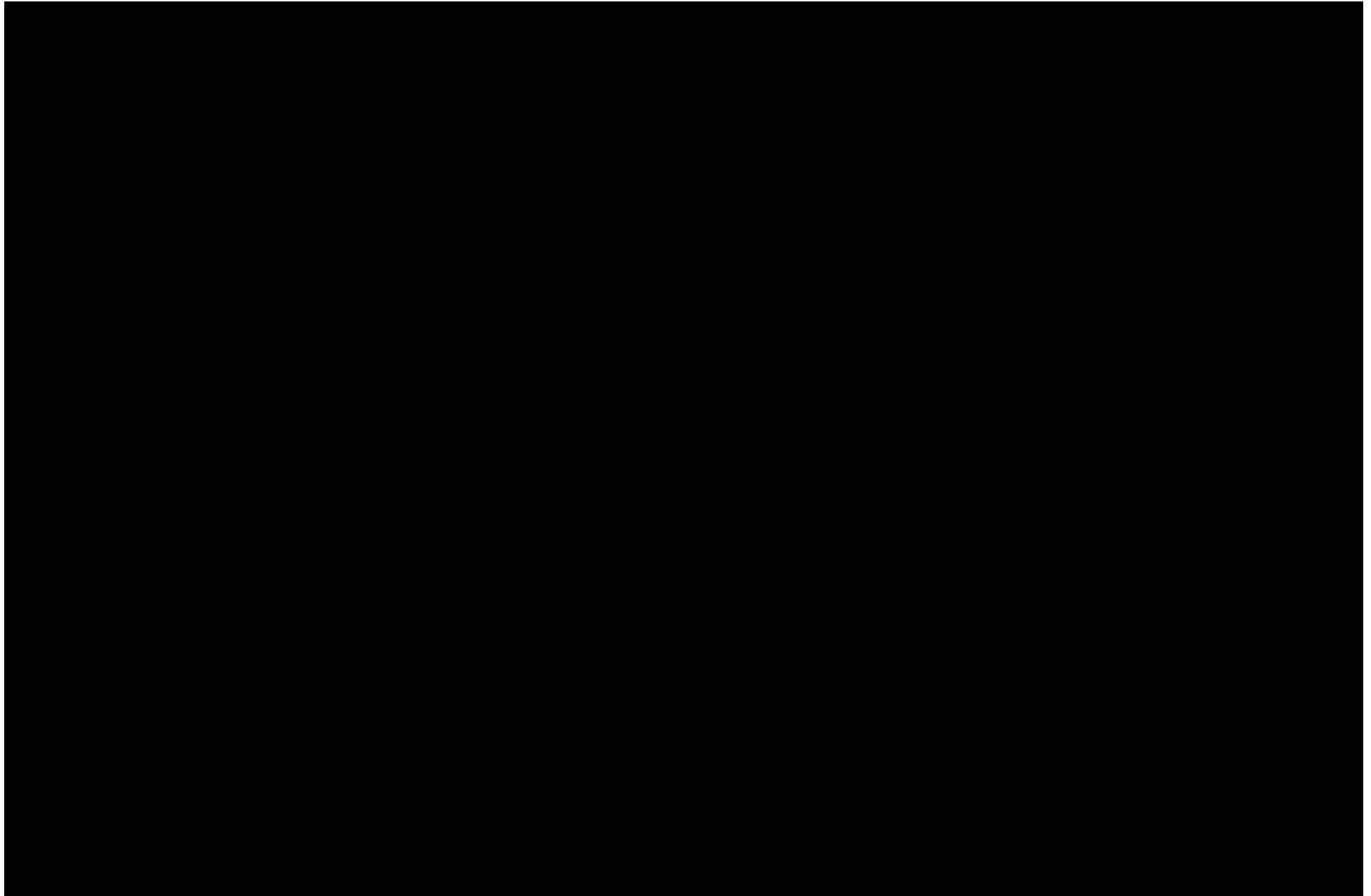
Was ist <u>Cognitive</u>?

Cognitive: Bewußter **Einsatz von mentalen Aktivitäten** (wie Verstehen, Schlussfolgern, Lernen und Erinnern)

Was ist <u>Cognitive Computing</u>?

Daten interpretieren & verstehen

Lernen & Anpassen

Entscheiden
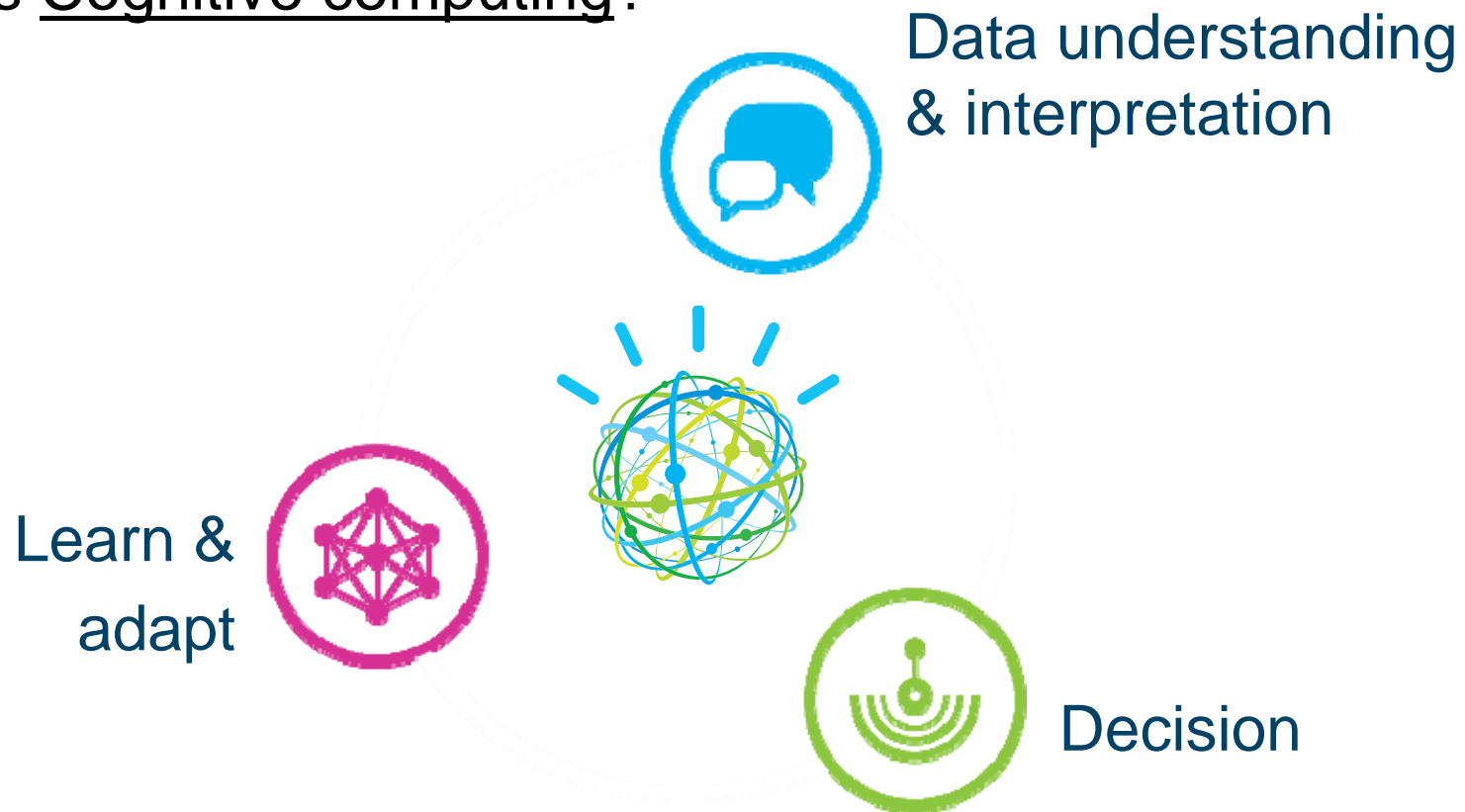
What is <u>Cognitive</u> ?

Cognitive: *Psychological processes involved in acquisition and understanding of knowledge, formation of beliefs and attitudes, and decision making and problem solving.*
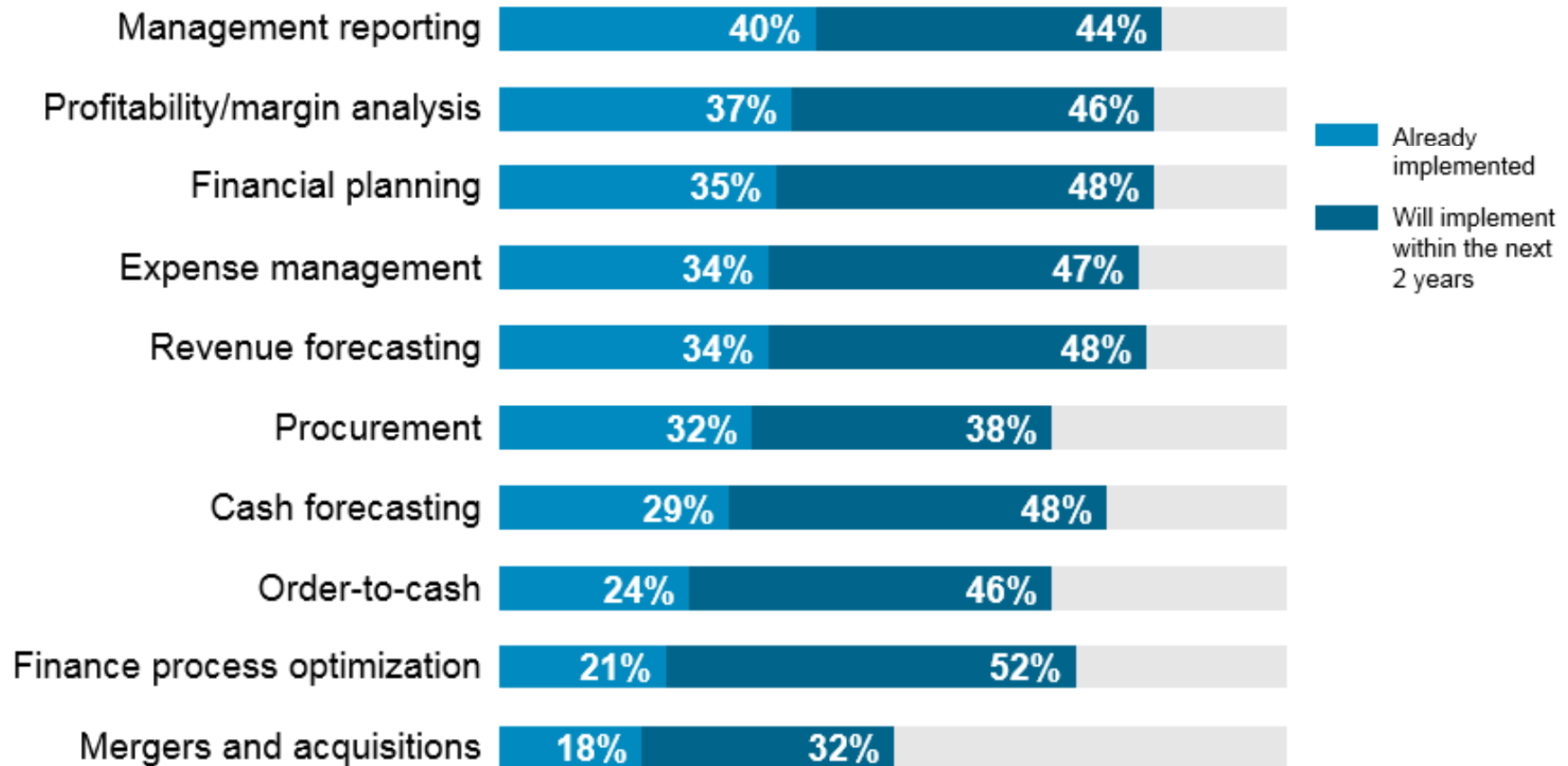
What is <u>Cognitive computing</u>?

Data understanding & interpretation

Learn & adapt

Decision

IBM Center for Applied Insights

http://ibmcai.com/

Adoption of analytics

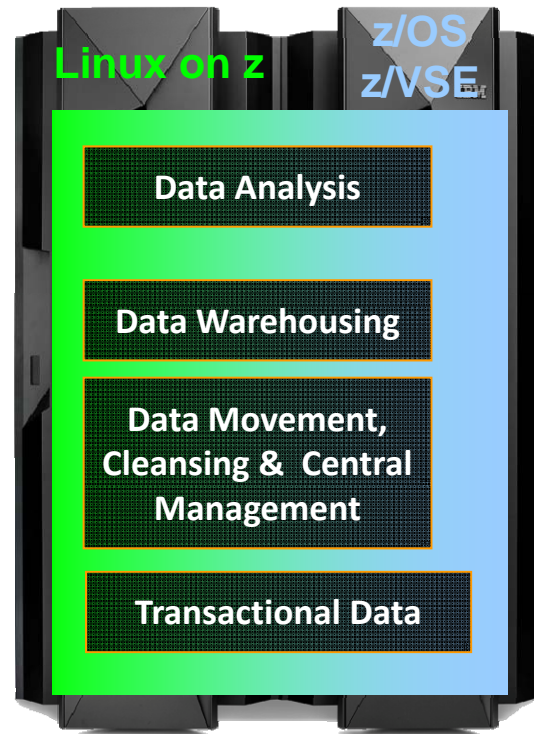|	Already implemented	Will implement within the next 2 years
Management reporting	40%	44%
Profitability/margin analysis	37%	46%
Financial planning	35%	48%
Expense management	34%	47%
Revenue forecasting	34%	48%
Procurement	32%	38%
Cash forecasting	29%	48%
Order-to-cash	24%	46%
Finance process optimization	21%	52%
Mergers and acquisitions	18%	32%

Source: IBM Center for Applied Insights survey of 337 Finance executives across industries, July 2015.

From transactional data to real-time Analytics and Cognitive consider end-to-end solutions and operational impacts

Real-time "integration of analytics and transaction processing" increases customer value with every interaction

- Deliver real-time insights at the point of impact

- Manage data lifecycle and governance

- Eliminate redundancy and avoid ETL

Linux on z

z/OS z/VSE

Data Analysis

Data Warehousing

Data Movement, Cleansing & Central Management

Transactional Data

IBM Software examples

- Cognos BI
- SPSS
- Query Management Facility

- DB2
- DB2 Analytics Accelerator
- InfoSphere® Warehouse

- InfoSphere Information Server
- InfoSphere Data Replication
- InfoSphere Master Data Mgmt

- DB2
- IMS, VSAM
- Non IBM, e.g. Oracle

"Cognos generates insightful reports and sophisticated dashboards, providing quick and accurate information to senior management. We are now adding more reporting functionality - on business revenue, credit data, loan risks, and so on - to make Cognos the complete decision-support system for Sicoob."
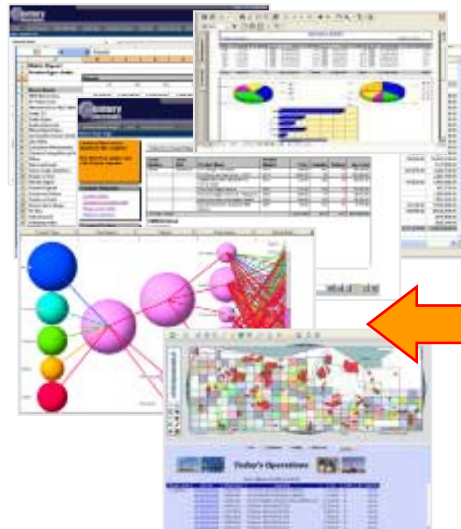
- Paulo Nassar,
IT Processing and Storage Infrastructure Manager, Sicoob

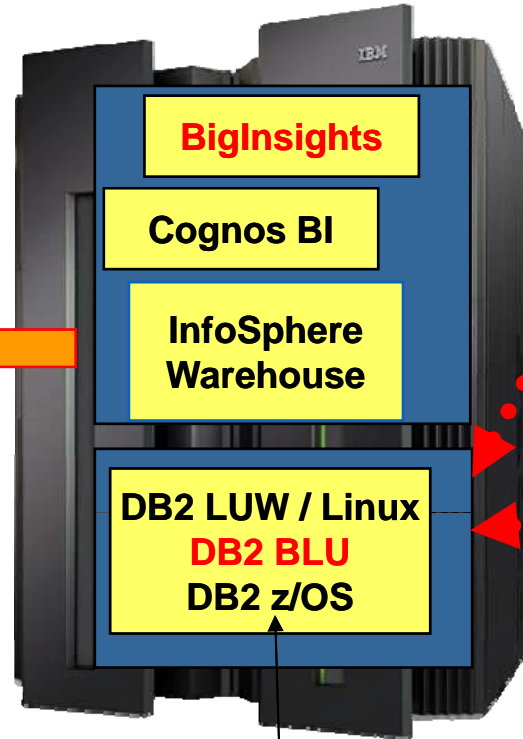IBM Cognos Business Intelligence and additional analytics software is running on Linux on z Systems

1) Data: From Database to Information Management

IBM

Building an end-to-end BI, Analytics and Real-time Fraud detection environment on z Systems
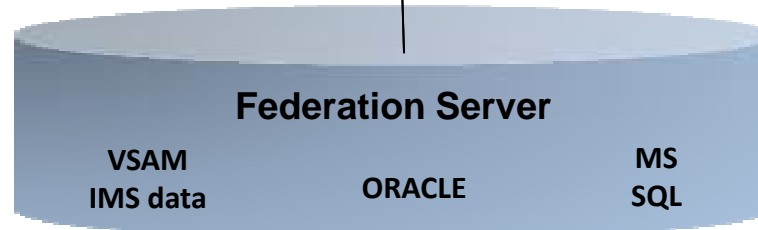
Linux on z Systems

z/VSE z/OS

DB2 Warehouse Database
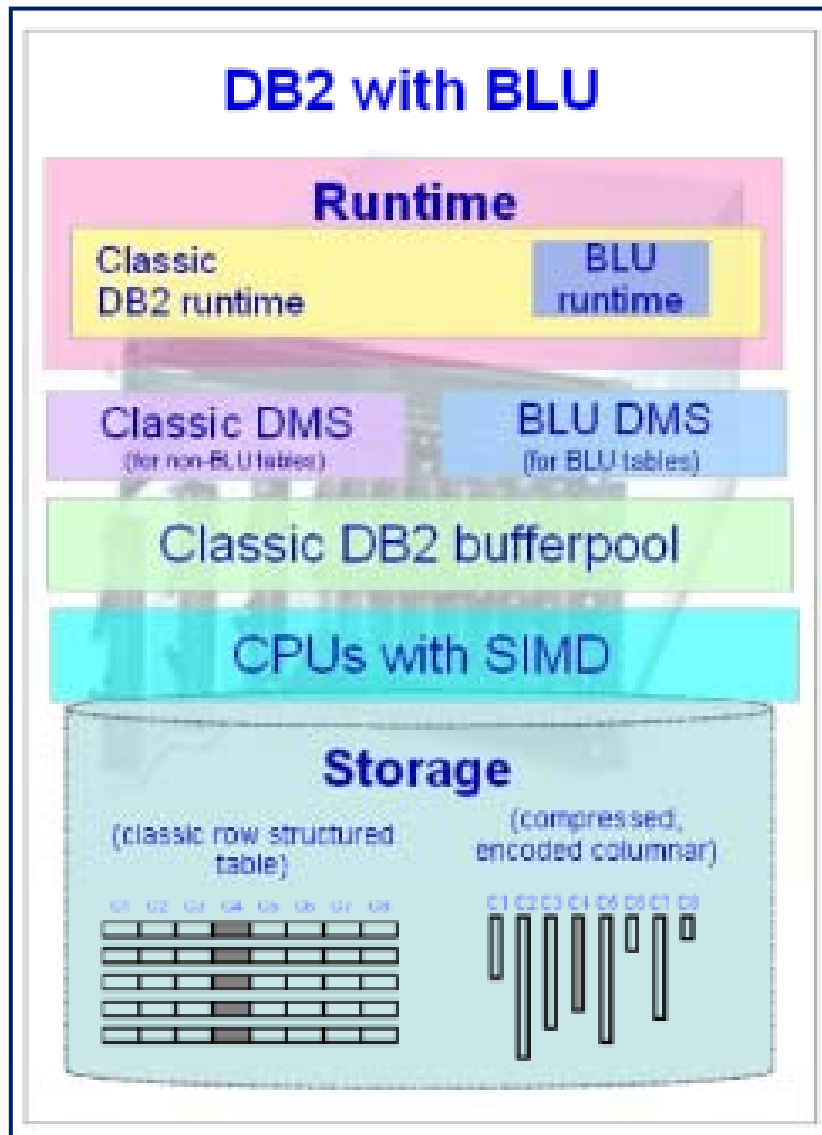
BigInsights

Cognos BI

InfoSphere Warehouse

DB2 LUW / Linux
DB2 BLU
DB2 z/OS

IBM TotalStorage / Flash

IBM DB2 Analytics Accelerator

Federation Server

VSAM
IMS data

ORACLE

MS
SQL

- *IBM Data Analytics Accelerator on z Systems*
- *BI solutions*
- **IBM BigInsights and Hadoop on z Systems**
- **DB2 BLU**

DB2 w/ BLU Acceleration for Linux on z Systems
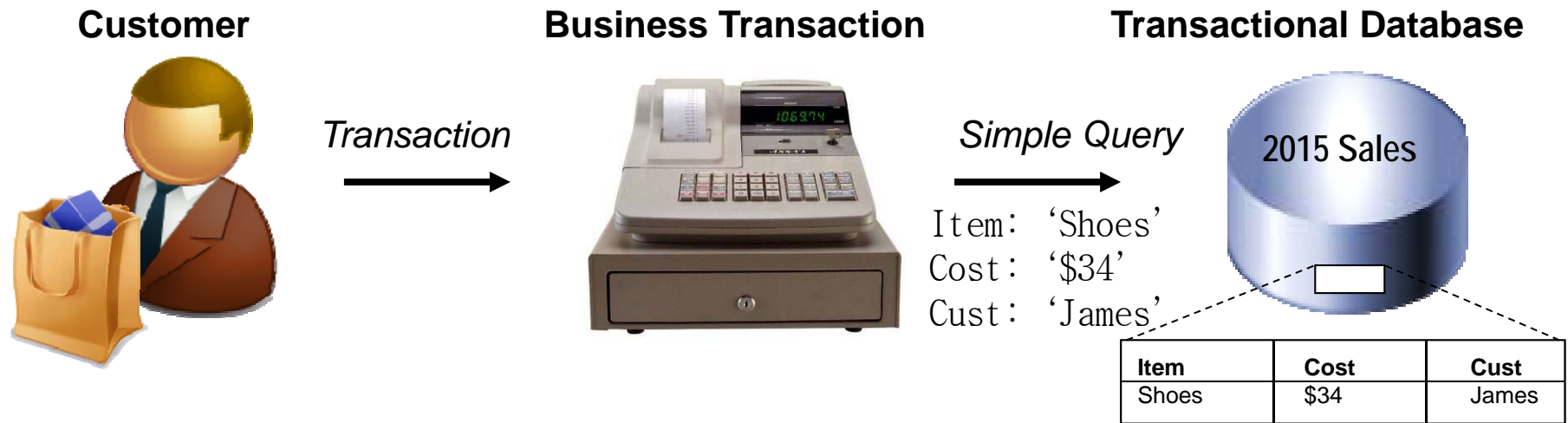**Super Simple. Super Fast.**

Solution

- DB2 with BLU Acceleration is the preferred solution for customers who would like to run analytics on z Systems Linux data

- Satisfy requirement for a columnar in-memory db

- Alternative of Linux on z Oracle installations

- Enhanced for distributed consolidations onto z Systems

2) Analytical:
From Transactional Workloads to Analytic Workloads
Two VERY different requirements for storing and processing data

Customer → *Transaction* → **Business Transaction** → *Simple Query* → **Transactional Database**

2015 Sales

```
Item: 'Shoes'
Cost: '$34'
Cust: 'James'
```

Item	Cost	Cust
Shoes	$34	James

Business Analyst → *Complex Query* → **Data Warehouse** → **BI Reports & Dashboards**

```
Sales & Profit for
Shoes & Belts
Year >= 2010
```

SALES
2015
2014
2013
2012
2011
2010
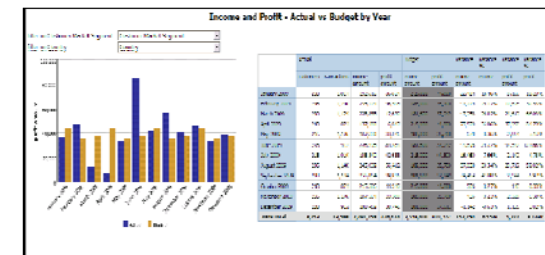
Business Analytics Solutions on z Systems

Business analytics capabilities

Cognos – Business Intelligence

SPSS – Predictive Analytics

TM1 – Performance Management
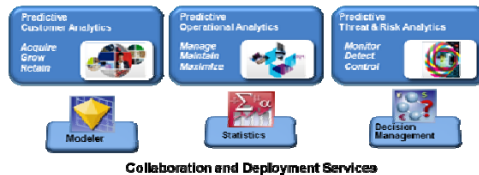
Hadoop - Investigative Analytics

Business outcomes/benefits

- Understand current & potential state
- Monitor results & fine-tune your business
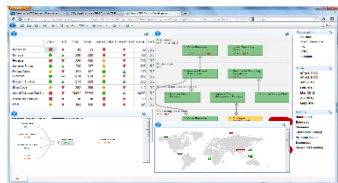- Inform strategy with a view into the future

- Predict customer segment & category affinity
- Market Basket Analysis to identify NBO
- Overlay browsing history onto purchase history to profile customers

- Reporting, analysis, operational & financial planning and consolidation
- Product profitability across customers, business & channels
- Sales Performance Management to improve efficiency in incentive compensation process

- Gain additional insights from LOGs, social media, streams, machine data, mass archives
- Understand and visualize the context of data in unstructured documents, LOGs and understand customer sentiment using **Hadoop**

Hadoop with Linux on z Systems:
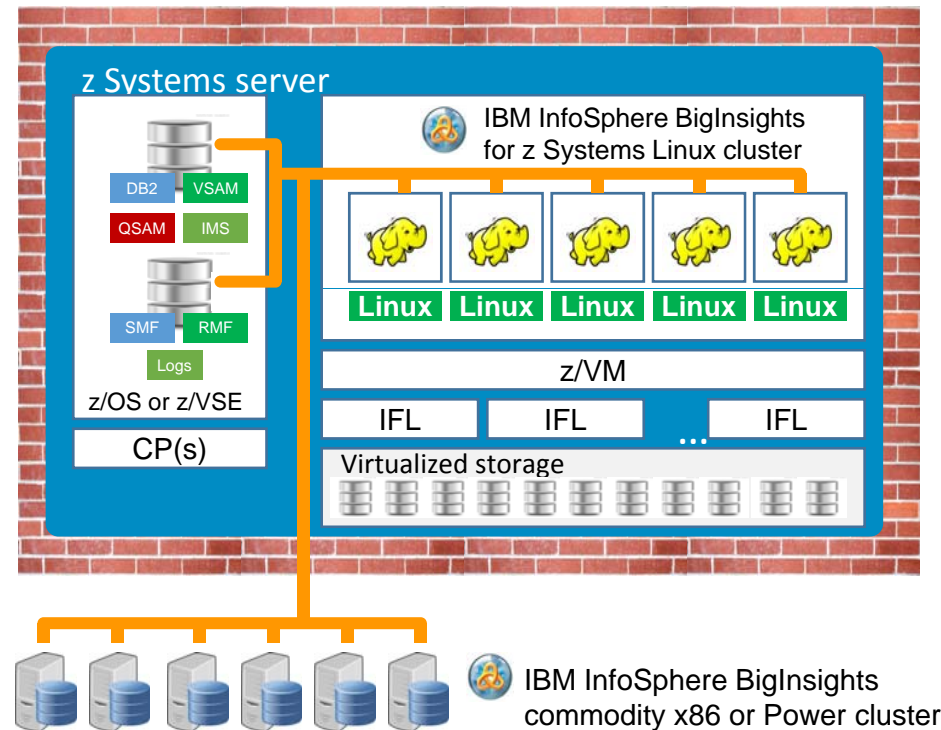## File System for parallel processing in Analytics

New ways of thinking, transformative economics

Apache™ Hadoop® is an open source software project that enables distributed processing of large data sets across different clusters

- Leverage the power of Hadoop on z Systems

- Drag-and-drop extracts from z Systems sources

- Protect sensitive data

- Faster application delivery

- Seamless interoperability

IBM InfoSphere® System z Connector for Hadoop

Fast and seamless data connectivity between a variety of mainframe data sources and IBM InfoSphere BigInsights

z Systems server

DB2 VSAM
QSAM IMS

SMF RMF
Logs
z/OS or z/VSE
CP(s)

IBM InfoSphere BigInsights for z Systems Linux cluster

Linux Linux Linux Linux Linux

z/VM

IFL IFL ... IFL

Virtualized storage

IBM InfoSphere BigInsights commodity x86 or Power cluster

Include NoSQL Data:
IBM Cloudant & IBM's Big Data Portfolio

IBM Cloudant

IBM is unique in having developed an **enterprise class big data and analytics platform that allows you to address the full spectrum of big data business challenges.** Cloudant provides another leading solution to the already market leading portfolio.

Cloudant – is **a NoSQL database platform** built for the cloud.
- on Linux on z Systems integration with IBM Big Data Products:

BigInsights is IBM's Hadoop platform for analytics
➢ Cloudant is complementary to BigInsights
➢ Data from Cloudant can be copied into BigInsights for analytics as part of the Watson Foundations zone based architecture

DB2 BLU is IBM's in-memory high performance relational database system (RDBMS) for analytics
➢ Cloudant is complementary to DB2 BLU
➢ Data from Cloudant can be loaded into DB2 BLU directly for analytics or via the BigInsights landing zone as part of Watson Foundations

http://www-01.ibm.com/software/data/cloudant/

Effective Analytics: Apache SPARK using Hadoop

http://hadoop.apache.org/

Search with Apache Solr   Search

Last Published: 10/31/2015 05:08:14

Welcome to Apache™ Hadoop®!

PDF

What Is Apache Hadoop?

The Apache™ Hadoop® project develops open-source software for reliable, scalable, distributed computing.

The Apache Hadoop software library is a framework that allows for the distributed processing of large data sets across clusters of computers using simple programming models. It is designed to scale up from single servers to thousands of machines, each offering local computation and storage. Rather than rely on hardware to deliver high-availability, the library itself is designed to detect and handle failures at the application layer, so delivering a highly-available service on top of a cluster of computers, each of which may be prone to failures.
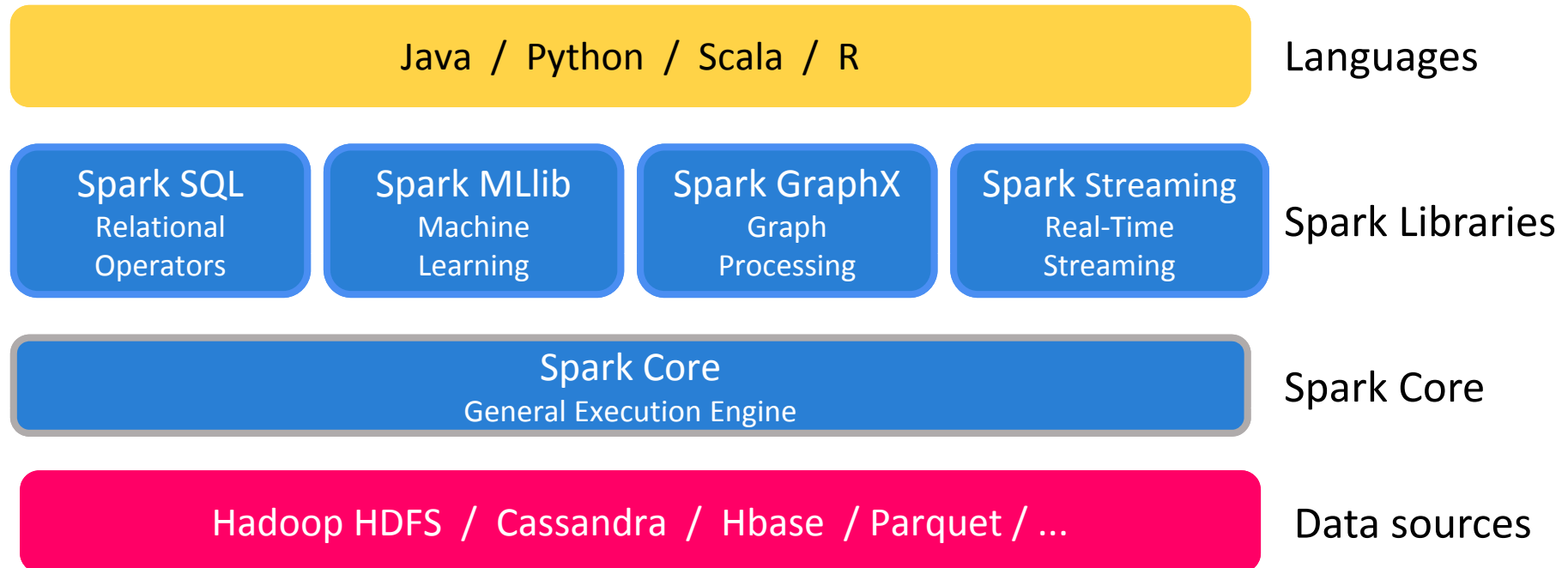
The project includes these modules:

- **Hadoop Common**: The common utilities that support the other Hadoop modules.
- **Hadoop Distributed File System (HDFS™)**: A distributed file system that provides high-throughput access to application data.
- **Hadoop YARN**: A framework for job scheduling and cluster resource management.
- **Hadoop MapReduce**: A YARN-based system for parallel processing of large data sets.

Other Hadoop-related projects at Apache include:

- **Ambari™**: A web-based tool for provisioning, managing, and monitoring Apache Hadoop clusters which includes support for Hadoop HDFS, Hadoop MapReduce, Hive, HCatalog, HBase, ZooKeeper, Oozie, Pig and Sqoop. Ambari also provides a dashboard for viewing cluster health such as heatmaps and ability to view MapReduce, Pig and Hive applications visually alongwith features to diagnose their performance characteristics in a user-friendly manner.
- **Avro™**: A data serialization system.
- **Cassandra™**: A scalable multi-master database with no single points of failure.
- **Chukwa™**: A data collection system for managing large distributed systems.
- **HBase™**: A scalable, distributed database that supports structured data storage for large tables.
- **Hive™**: A data warehouse infrastructure that provides data summarization and ad hoc querying.
- **Mahout™**: A Scalable machine learning and data mining library.
- **Pig™**: A high-level data-flow language and execution framework for parallel computation.
- **Spark™**: A fast and general compute engine for Hadoop data. Spark provides a simple and expressive programming model that supports a wide range of applications, including ETL, machine learning, stream processing, and graph computation.
- **Tez™**: A generalized data-flow programming framework, built on Hadoop YARN, which provides a powerful and flexible engine to execute an arbitrary DAG of tasks to process data for both batch and interactive use-cases. Tez is being adopted by Hive™, Pig™ and other frameworks in the Hadoop ecosystem, and also by other commercial software (e.g. ETL tools), to replace Hadoop™ MapReduce as the underlying execution engine.
- **ZooKeeper™**: A high-performance coordination service for distributed applications.

Apache Spark – compute engine for analytics

Java / Python / Scala / R	Languages

Spark SQL Relational Operators	**Spark MLlib** Machine Learning	**Spark GraphX** Graph Processing	**Spark Streaming** Real-Time Streaming	Spark Libraries

Spark Core General Execution Engine	Spark Core

Hadoop HDFS / Cassandra / Hbase / Parquet / ...	Data sources

Spark, was developed at U.C. **Berkeley's AMPLab in 2009**, part of Apache in 2010.
Spark is **best known for in-memory machine learning** through its MLlib component, but it also **supports graph, SQL, and streaming analysis with GraphX, Spark SQL**, and Spark Streaming, respectively.

IBM Commitment:
IBM Announces Major Commitment to Advance Analytics with Apache® Spark™

06/2015 Announcment
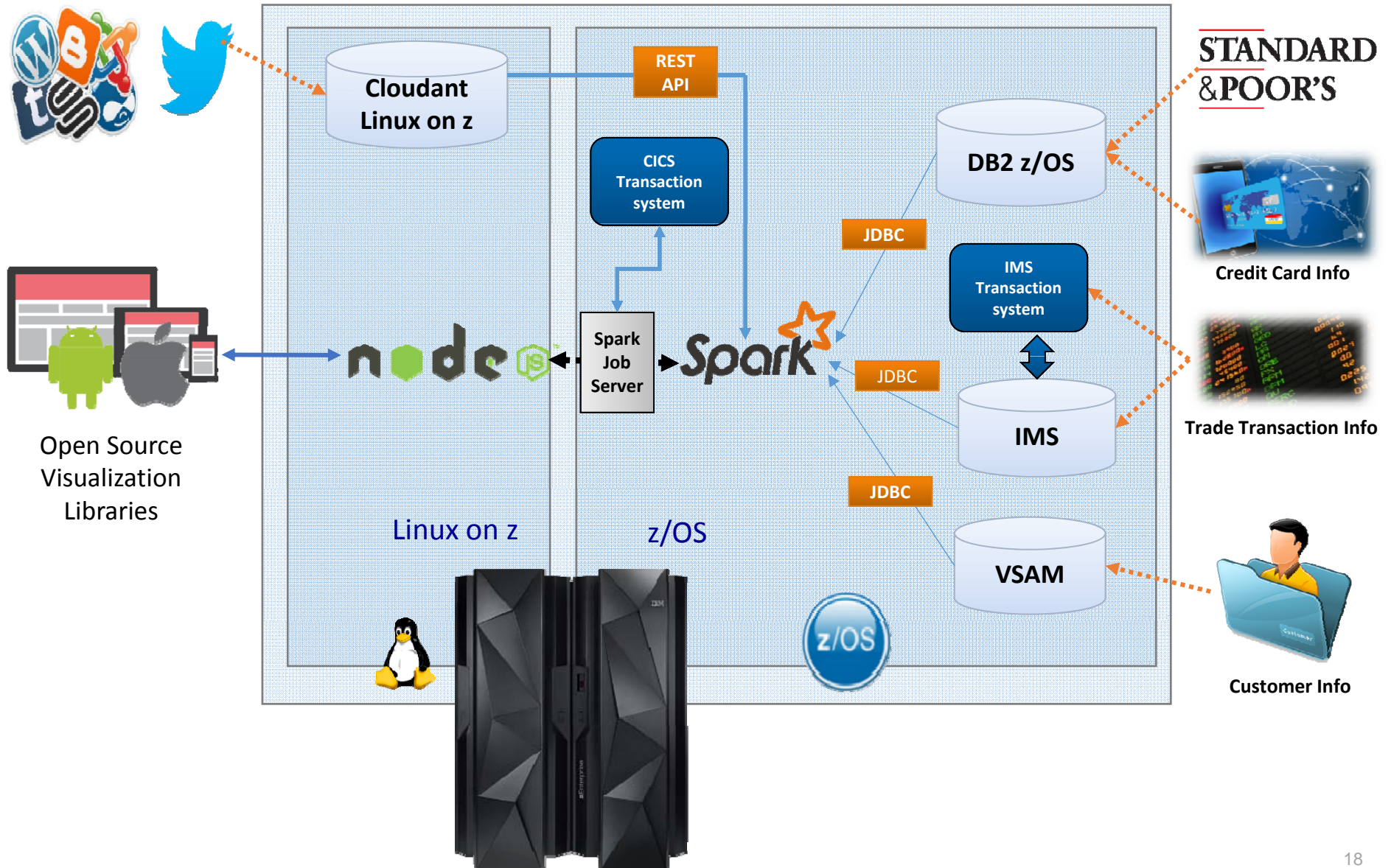
https://www-03.ibm.com/press/us/en/pressrelease/47107.wss

- At the core of this commitment, IBM plans to embed Spark into its industry-leading Analytics and Commerce platforms, and to offer Spark as a service on IBM Cloud.

www.smartercomputingblog.com/system-z/ibm-spark-mainframe/

- **Apache® Spark™** is an open-source computing framework with in-memory processing to speed **analytic applications up to 100 times faster** compared to technologies on the market today and enhance mission-critical applications with deep intelligence.

- The impact is being compared to that of Linux, Spark being a common framework for analytics just as Linux has been a common framework for computing.

- Linux and the mainframe have been a perfect match, and so it will be with **Spark** – for **z/OS** and **Linux on z Systems**.
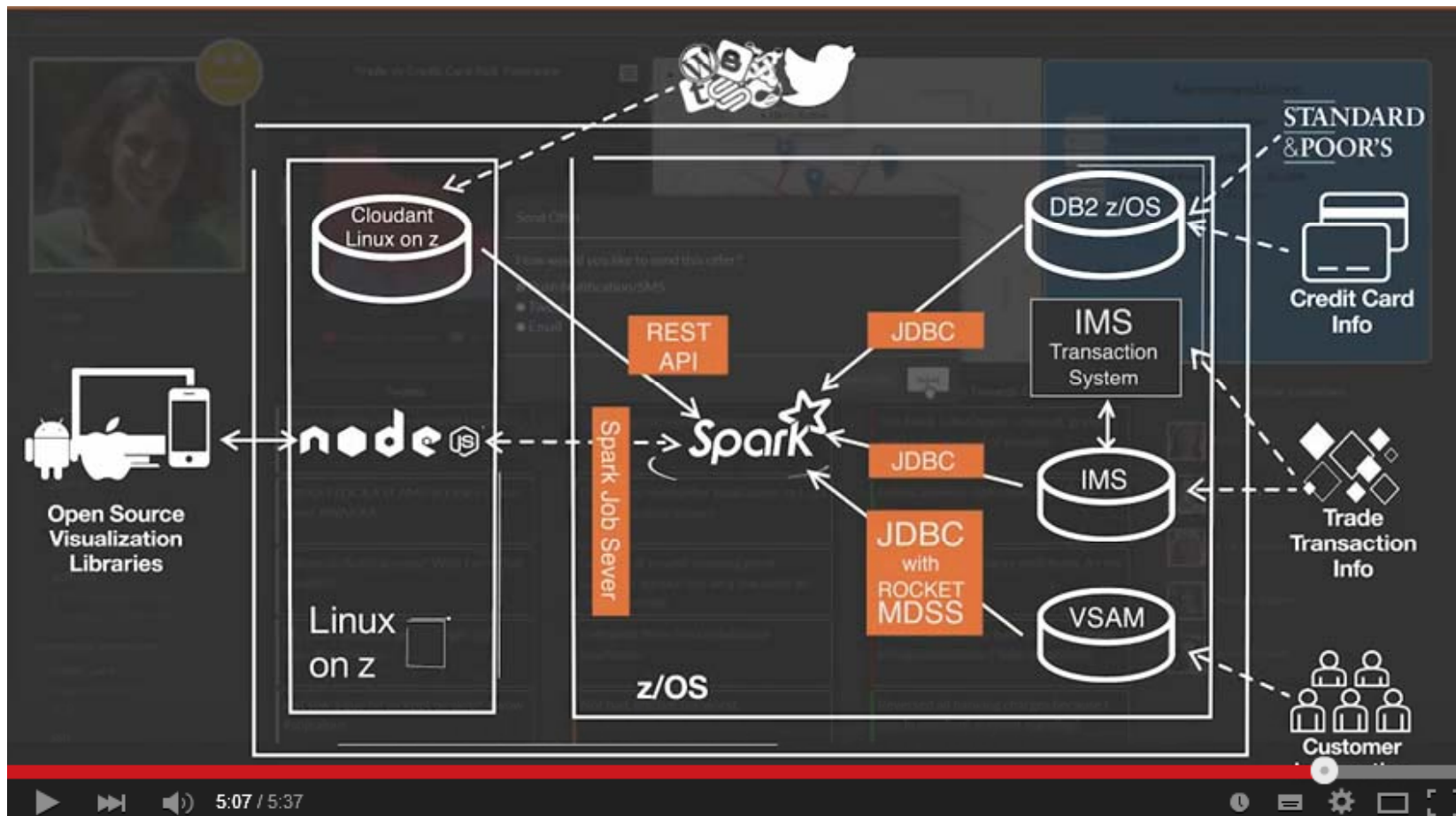
Spark z/OS Showcase: Reference Architecture

STANDARD &POOR'S

Credit Card Info

Trade Transaction Info

Customer Info

Cloudant Linux on z

REST API

CICS Transaction system

DB2 z/OS

JDBC

IMS Transaction system

Spark Job Server

Spark

JDBC

IMS

Open Source Visualization Libraries

Linux on z

z/OS

JDBC

VSAM

Digital Business with SPARK:
Spark Analytics on z Systems – the Technology Demo

https://www.youtube.com/watch?v=sDmWcuO5Rk8

Real time Analytics in combination with sentiment cloud data
– Performance
- with data in their original location

3) Cognitive Computing = Digital Business + Digital Intelligence

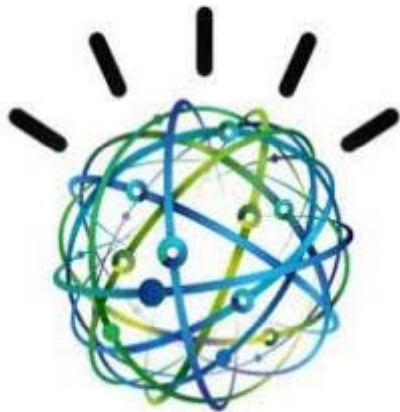## Watson technology – the Digital Intelligence for Cognitive Computing

- ➢ Watson is the first commercially available cognitive computing capability, representing a new era in computing.

- ➢ Watson analyzes high volumes of data and processes information more like a human than a computer
  - ➢ by understanding natural language,
  - ➢ generating hypotheses based on evidence,
  - ➢ learning as it goes

- ➢ IBM has created two business units:
  - ➢ Watson Group, established for the development and commercialization of cloud-delivered cognitive computing technologies
  - ➢ Watson Health to improve the ability of doctors, researchers and insurers
    - ➢ to surface new insights from the massive amount of personal health data being created daily to deliver personalized healthcare.

Positionierung: Watson und Cognitive Business

Was ist <u>Cognitive</u> **Business**?

Die neue IBM-Strategie und unser Standpunkt, wie die Welt durch *Cognitive Computing* verändert wird.
- durch Systeme, die verstehen, entscheiden und lernen können

Was ist <u>Watson</u>?
Der Markenname für Produkte, Lösungen und Services von IBM, die *Cognitive Computing* für das Business nutzen

Cognitive Computing Mehrwert
ergänzt herkömmliche Analysen und erzeugt nie gekannte Mehrwerte

Analytics

Cognitive Computing

- Für klar umrissene Problemstellungen

- Liefert präzise, definitive Anworten

- Verarbeitet Informationen mit klarer Bedeutung

- Formale Benutzerinteraktion mit Kommandos und Befehlen

- Für mehrdeutige Problemstellungen

- Liefert Antworten mit Unsicherheitsbereich

- Verarbeitet Informationen ohne bekannte Bedeutung

- Benutzerinteraktion mit natürlicher Sprache

Das Cognitive Portfolio
- überall wo Cognitive „draufsteht" ist Watson drin

Watson Branchenlösungen

X-Industry **Financial Services** **Healthcare / Life Sciences**

| Customer Care | Wealth Management | Risk Compliance | Oncology | Clinical Trial | Drug Discovery |

Ecosystem
Partner-Lösungen

Watson Produkte
Watson Explorer,
Watson Analytics

Watson-Lösungsframeworks
Watson Engagement Advisor,
Watson Discovery Advisor, Watson Policy Advisor,
Watson Decision Advisor

Watson Lösungsbausteine und –services
(Q&A API, User Modelling API, Watson Content Store ···)

Bluemix Services

Watson Developer Cloud

Anwendungsfälle für kognitive Systeme

- Gesundheitswesen
  - Pharmaforschung
- Handel
  - Einkaufberatung per Experten-App
- Finanzwirtschaft
  - Richtlinienberater (Policy)
- Öffentliche Verwaltung
  - System für polizeiliche Untersuchungen
- Fertigungsindustrie
  - Betriebsoptimierung

Quelle: IDC

Watson and user engagement

Cognitive experience with 'shopper' user interaction:

- More than structured Data
- Interpretation between the lines
- Different nuances
- Varying moods
- Sentiments
- Personal relations

WHERE WE STAND TODAY:

96%

of <u>unhappy</u> customers are not writing complaints

91%

of them <u>disappear</u> and will never return

Watson enables self-service Coffee shop to a new experience

25,000 tweets
analyzed per data set to reveal insight about what customers say over social media

Boosts sales
by analyzing purchasing trends and enabling targeted marketing promotions for vending machine customers

Improves satisfaction
by better understanding customers' tastes and aligning the business model to serve their preferences

Solution components

- IBM® Watson™ Analytics Personal Edition
- IBM Premier Business Partner EBI Solutions Limited

Business challenge: With **no onsite employees** to gather feedback, this coffeehouse in the United Kingdom needed to use data collected from vending machines to learn more about customer **preferences** and **habits** to drive revenue.

The transformation: The solution **combines vending machine data** with information such as **time**, **weather** and **social** media analytics. The company now **understands** customer behaviors and habits without having staff onsite. This insight helps it better set **prices**, predict **trends** and refine the in-store **experience** to boost sales

Company in Germany, discovers via Social Media analysis the bestseller of tomorrow

Creates new revenue streams with Germany's first social media sentiment analysis tool for book publishing

Increases market share by attracting new publishing customers while strengthening existing relationships

Optimizes business decisions that can now be based on demand forecasts driven by social media

Solution components

- IBM® Watson™ Content Analytics
- IBM Premier Business Partner PROFI Engineering Systems AG

Business challenge: Getting a better picture of **bestsellers** in **six months** or more in the future. The clues to tomorrow's hits are embedded in the **unstructured, user-generated social media content**.

The smarter solution: Media control can now continuously sift through content on over 100,000 websites — **reviews, blogs and other sources** rich in reader opinion—to create a mix of sentiment indexes. It's giving publishers an early, **under-the-radar glimpse** at likely future sales patterns that can mean the difference between **printing** too many or too few books. For media control, it means **a new revenue stream** and true source of **differentiation**.

Cancer therapy advisor for doctors in Thailand with Watson

From weeks to minutes
to provide treatment recommendations, now in just minutes compared to weeks

World-class experts'
treatment experience, current literature and international guidelines all inform the solution's recommendations

Expected to serve
more than 4,000 cancer patients with personalized cancer therapy over the next five years

Solution components
- IBM® Watson™ for Oncology
- IBM Global Business Services® – Business Consulting Services
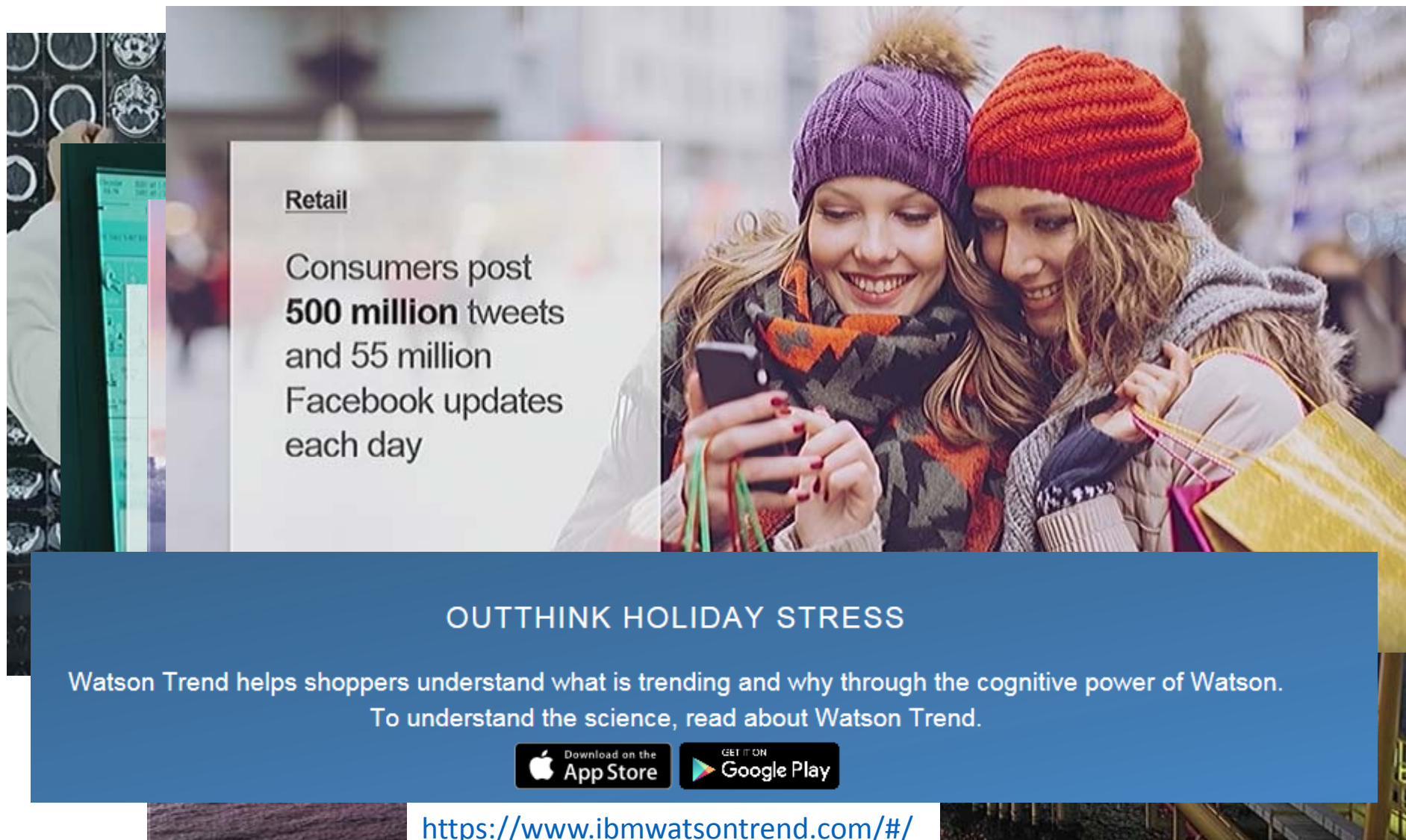
Business challenge: The **explosion of information** about cancer and its treatment makes treating patients with cancer increasingly **challenging**. The hospital is implementing a cognitive solution to **help patients** with cancer.

The transformation: The cognitive computing system provides the physician with important **comprehensive information** about each patient's **case** by analyzing the patient's data against **thousands of cases**, including information from 5,000 hours of **training** by oncologists at Memorial Sloan Kettering Cancer Center, 300 medical **journals**, 200 **textbooks** and 12 million pages of text.

Watson is not miming or replicating the brain

- 80 – 90% of todays data is dark data – not visible to computer systems
- Similar to dark material in space

Retail

Consumers post **500 million** tweets and 55 million Facebook updates each day

OUTTHINK HOLIDAY STRESS

Watson Trend helps shoppers understand what is trending and why through the cognitive power of Watson.
To understand the science, read about Watson Trend.

https://www.ibmwatsontrend.com/#/

Cognitive in industry - predictions

CONSIDER:

Cognitive systems can understand the world through sensing and interaction, **reason** using hypotheses and arguments and **learn** from experts and through data. Watson is the most advanced such system.

Today, businesses in
36
countries across.
17
industries are applying cognitive technologies.

78%
of **business and IT execs** believe successful business will **manage employees** alongside **intelligent machines.**

There are
350+
Watson ecosystem partner companies with
100
of those have taken their product to market.

On average there are
1.3B
Watson API calls a month and growing.

Among C-Suite executives familiar with cognitive computing:

96% in **insurance** intend to invest in cognitive capabilities.

84% in **healthcare** believe it will play a disruptive role in the industry, and 60% believe they lack the skilled professionals and technical experience to achieve it.

94% in **retail** intend to invest in cognitive capabilities.

89% in **telecommunications** believe it will have a critical impact on the future of their business.

Cognitive Business

IBM Launches Industry's First Consulting Practice Dedicated to Cognitive Business

Specialists in analytics and data science lead client journeys spanning cognitive banking, retail, supply chain and healthcare, among others

Select a topic or year

↓ News release   ↓ Contact(s) information

↓ Related XML feeds

Armonk, N.Y. - 06 Oct 2015: IBM (NYSE: IBM) today launched the industry's first consulting organization dedicated to helping clients realize the transformative value of cognitive business.

IBM Cognitive Business Solutions extends the exclusive cognitive leadership of IBM Watson and the company's established market leadership in business analytics. The new practice draws on the expertise of more than 2,000 consulting professionals spanning machine learning, advanced analytics, data science and development, supported by industry and change management specialists to accelerate client journeys to cognitive business.

Cognitive represents an entirely new model of computing that includes a range of technology innovations in analytics, natural language processing and machine learning. Industry analyst firm IDC predicts that by 2018, half of all consumers will interact regularly with services based on cognitive computing.

"Our work with clients across many industries shows that cognitive computing is the path to the next great set of possibilities for business," said Bridget van Kralingen, senior vice president, IBM Global Business Services. "Clients know they are collecting and analyzing more data than ever before, but 80 percent of all the available data -- images, voice, literature, chemical formulas, social expressions -- remains out of reach for traditional computing systems. We're scaling expertise to close that gap and help our clients become cognitive banks, retailers, automakers, insurers or healthcare providers."

A survey of more than 5,000 C-suite executives to be released this fall by IBM's Institute for Business Value (IBV) finds that executives from the highest-performing companies place significantly greater priority on cognitive capabilities than peers in market-following enterprises. Industry-specific IBV research shows that:

https://www-03.ibm.com/press/us/en/pressrelease/47785.wss

Cognitive with IBM Systems

IBM Systems

We build systems for clients designed for cognitive workloads.

Cognitive Business requires breakthroughs at every level of the enterprise IT foundation—from processors and computer design to storage, networking and the integration layer.

Cognitive workloads require a re-imagined infrastructure able to synthesize massive amounts of data drawn from an expansive technological ecosystem, including public, private and hybrid cloud as well as distributed devices and the Internet of Things. This gives enterprises new competitive advantages.

For example, a bank can reduce the time it takes to develop mobile apps by as much as sixty percent with the use of API Harmony—a cognitive technology that helps clients find the right APIs quickly.

Game-changing economics:
- Spectrum Storage with storage efficiency technologies
- LinuxONE with elastic pricing
- OpenPOWER technologies and Power Systems LC product line

http://ibm.biz/cognitive-bu-systems-pov

CTO perspective

Infrastructure tuned for the Cognitive Era

Integration

Convert to an API economy

With the industry's most robust API management integration platform, IBM helps companies innovate securely.

▶ Watch the video (01:18)

Data

Profit from data in near real-time

Quintillions of data bits are generated every day. IBM systems help companies take advantage with analytics services.

▶ Watch the video (01:17)

Operations

Anticipate the future

Earthquake-proof systems. Middleware that detects, automates and solves problems. Always-on operations.
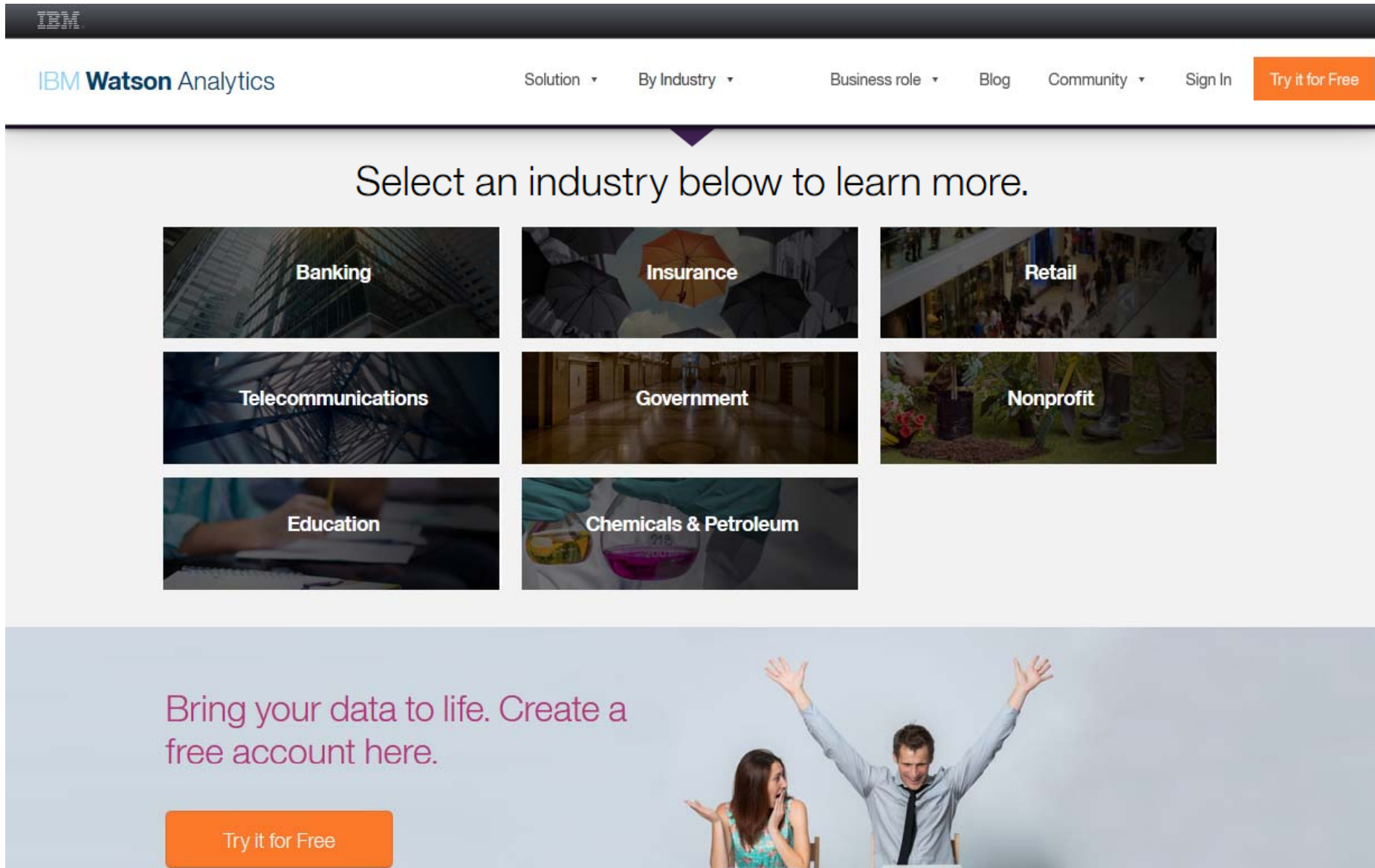
▶ Watch the video (01:08)

IT Infrastructure for Cognitive
http://www.ibm.com/it-infrastructure/us-en/?lnk=buit

Experience Watson analytics –made easy

http://www.ibm.com/analytics/watson-analytics/by-industry

Experience Watson analytics –made easy

http://www.ibm.com/analytics/watson-analytics/by-industry/insurance

Experience Watson analytics

http://www.ibm.com/analytics/watson-analytics/by-industry

Linux on IBM z13 and LinuxONE – Fit for Cognitive computing
An Enterprise grade Linux solution portfolio

Data and Analytics

IBM InfoSphere BigInsights

IBM DB2 BLU

SPARK

Cloud

Custom Patterns for Linux on z Systems

Cloudant

Mobile

Node.js

Internal Integration

141 High performance cores

Simultaneous multi-threading

10TB Memory

320 16 GB/sec Channels

2X Cache and I/O Bandwidth

Single instruction, multi data

Trusted Computing

Spectrum Scale (GPFS technology)

IBM zAware V2.0

Crypto Express5S

GDPS Virtual appliance

Openness and Pricing

OpenSource and KVM

Large memory

High scalability

Security

Outstanding Capacity

IBM z13

Questions?

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wilhelm.mild@de.ibm.com*

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