

# Smarter Cities: Cognitive Computing in Government



# Unit objectives

**After completing this unit, you should be able to:**

- Learn the concept of smarter cities of cognitive computing in Government
- Gain knowledge on emerging cognitive computing
- Gain an insight into areas & future applications for cognitive computing

# Smarter cities: Cognitive computing in Government



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## WHAT IS A 'SMART CITY'?

A city equipped with basic infrastructure to give a decent quality of life, a clean and sustainable environment through application of some smart solutions



Figure: Smart city definition

Source: <https://images.app.goo.gl/xNMihEsXdnTfr2JE8>

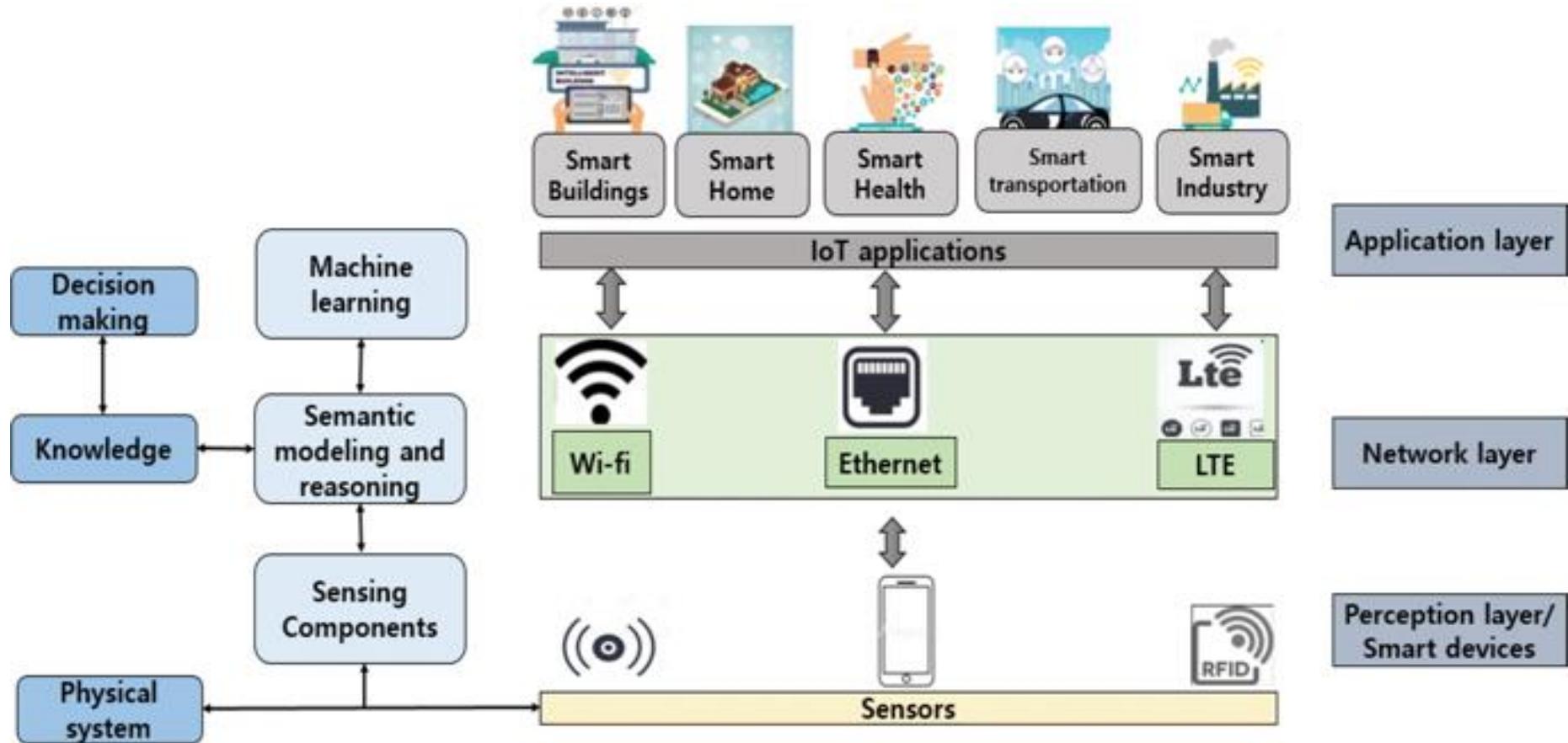


Figure: Foundations of cognitive computing for smarter cities

Source: <https://images.app.goo.gl/yEc4DDLzTCKMZcFG6>

# Features of smart city (1 of 2)

## Smart City Features

- Mixed land use in area-based developments
- Housing and inclusiveness
- Walk able localities
- Open spaces
- Variety of transport options
- Governance citizen-friendly and cost effective
- Identity to the city
- Smart Solutions

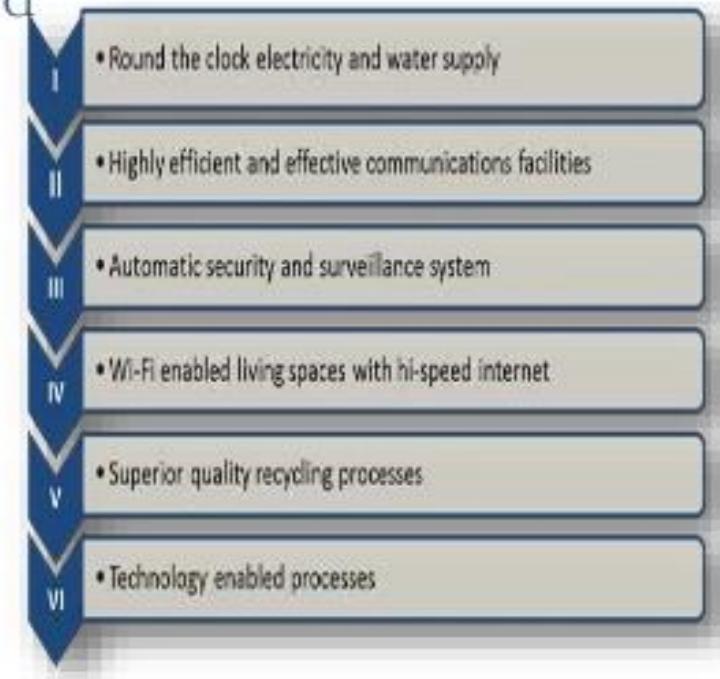


Figure: Smart city features

Source: <https://images.app.goo.gl/q7793ZH3CiezRqYH7>

# Features of smart city (2 of 4)

- Collecting Data for Planning

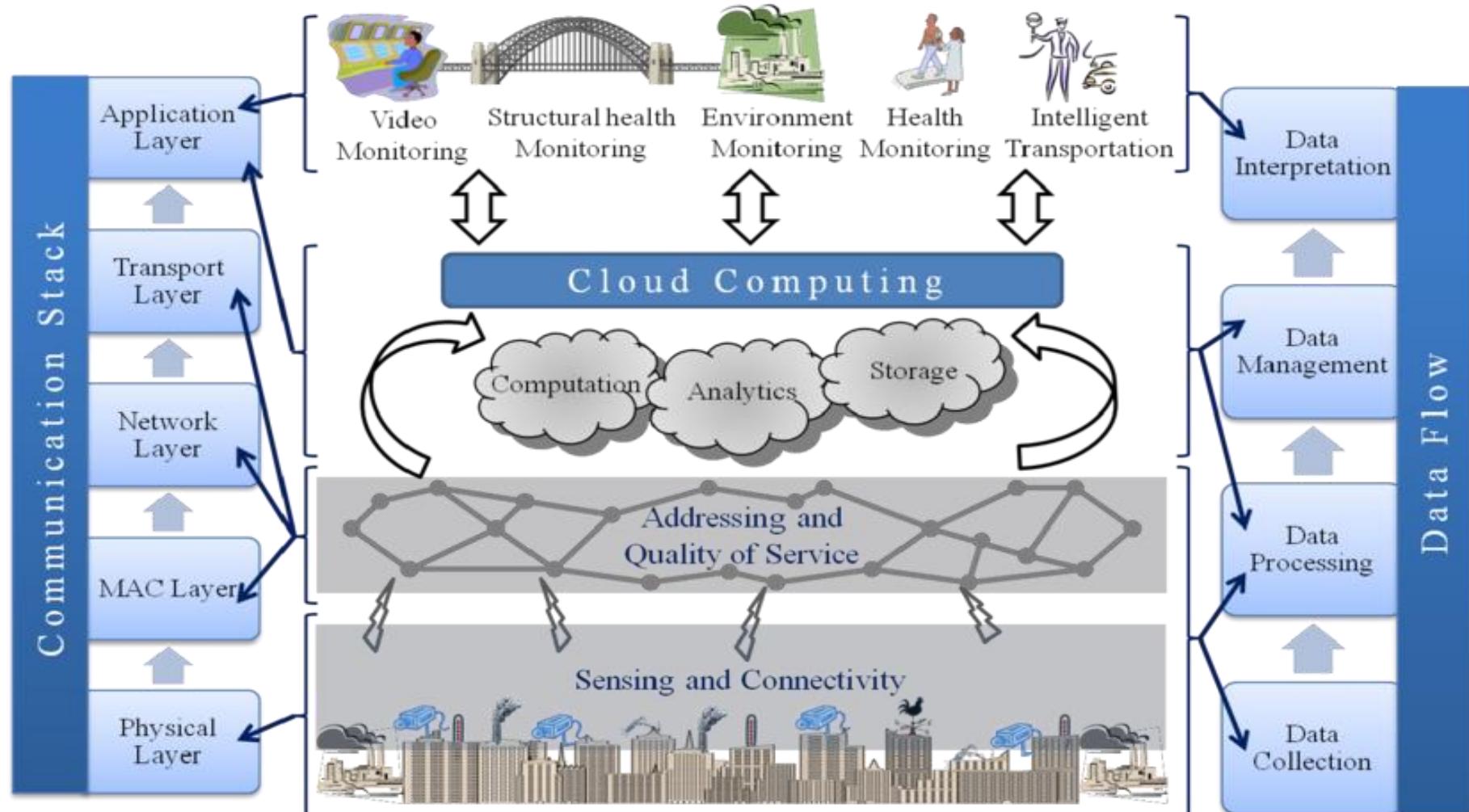


Figure: Data Collection for smart city

Source: <https://images.app.goo.gl/kxHyQv8ecgWLzYhq7>

# Features of smart city (2 of 2)

- Managing Security and Threats

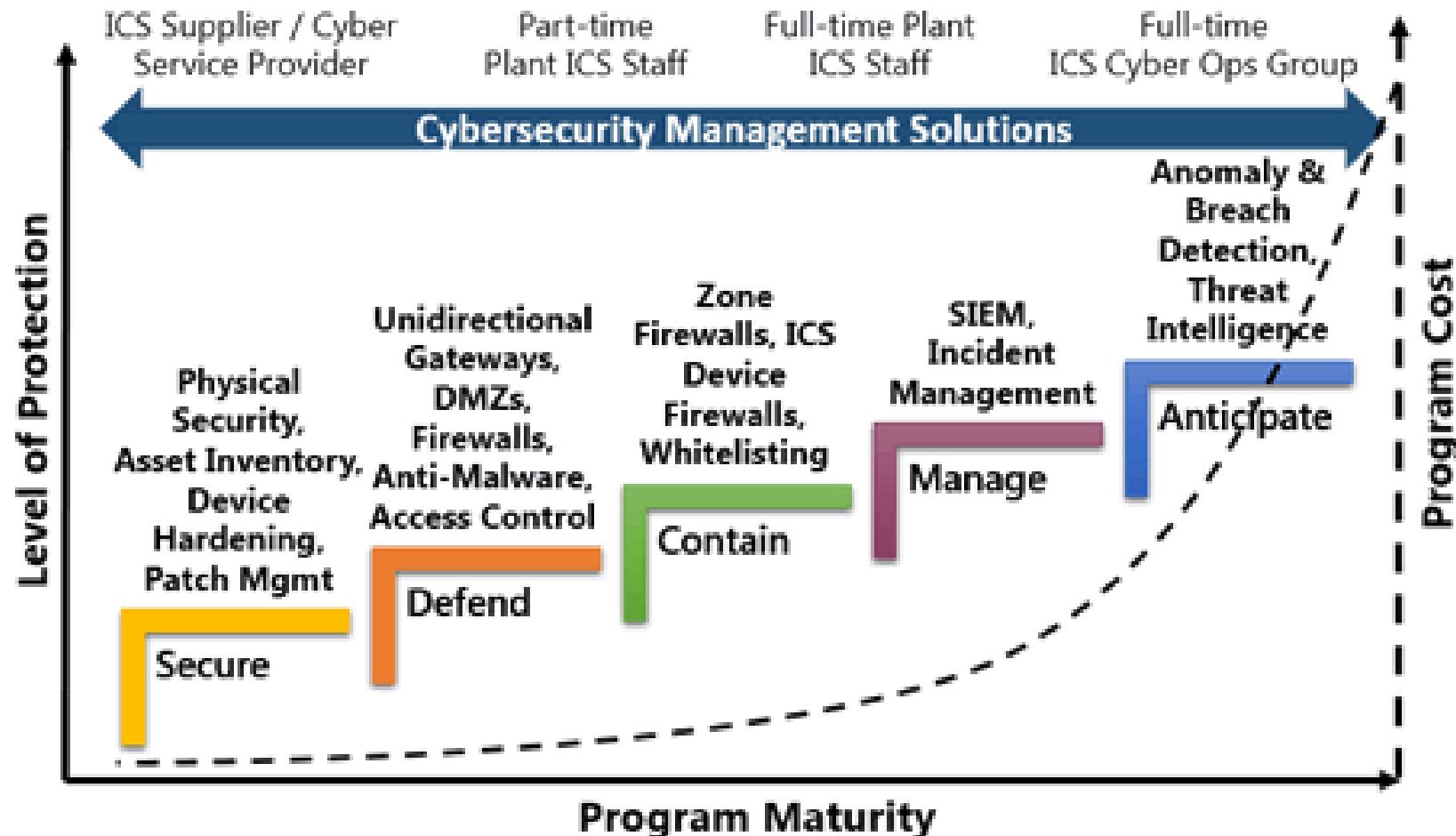


Figure : Security in smart city

Source : <https://images.app.goo.gl/AQvPB76U1NUXqaJR7>

# Features of smart city (4 of 4)

- Data Integration Across Government Departments

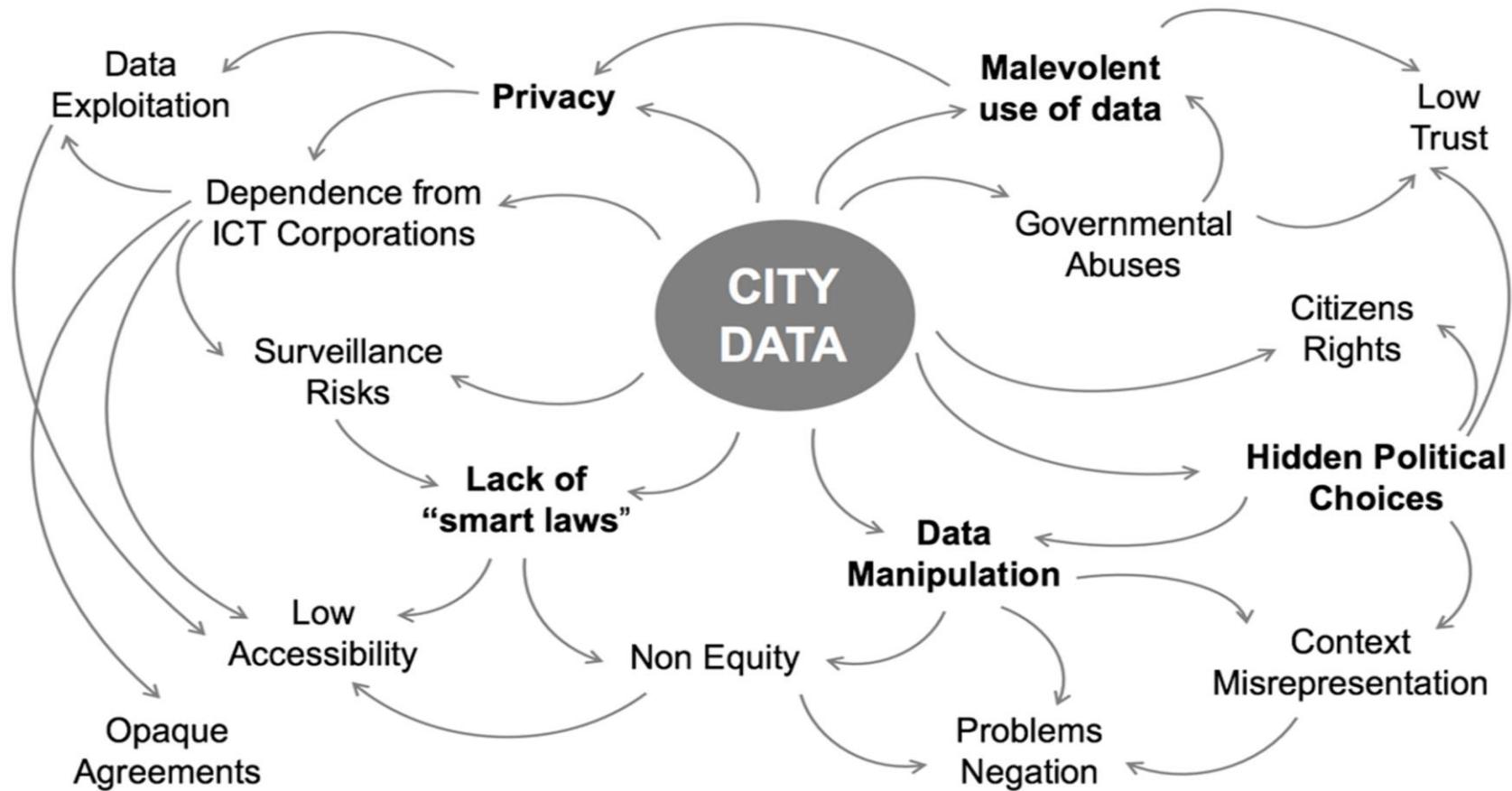


Figure: Data Integration for government department

Source: <https://images.app.goo.gl/A8svitxpdczUPmm28>

# The rise of the open data movement for smart city

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## Smart City Rising

### Connectivity



### Smart Mobility



### Energy Grid Management



### Parking



### Water Management



### Traffic And Navigation



### Environmental Sensors



### Public Safety



### Urban Planning



CBINSIGHTS

Figure: Open Data movement for smart city

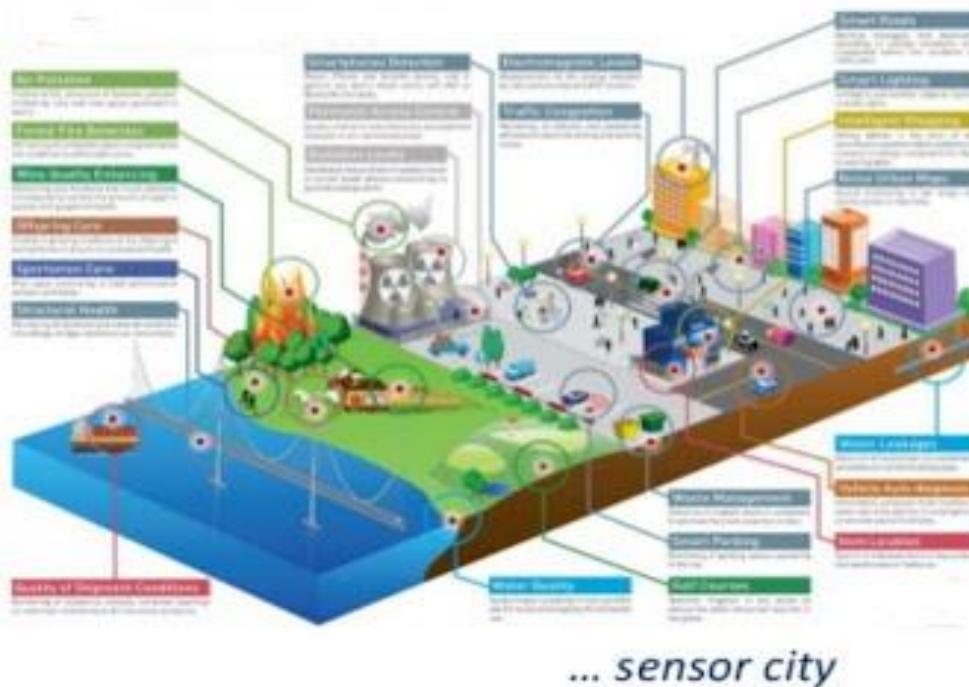
Source: <https://images.app.goo.gl/UFWKjw3igK4F4SM7>

# The internet of everything and smarter cities



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## *Perspectives of a Smart City*



### Sensors for

- Air pollution
- Fire detection
- Water quality
- Smart parking
- Traffic congestion
- Waste management
- Golf course conditions

Figure: IOT and Smart city

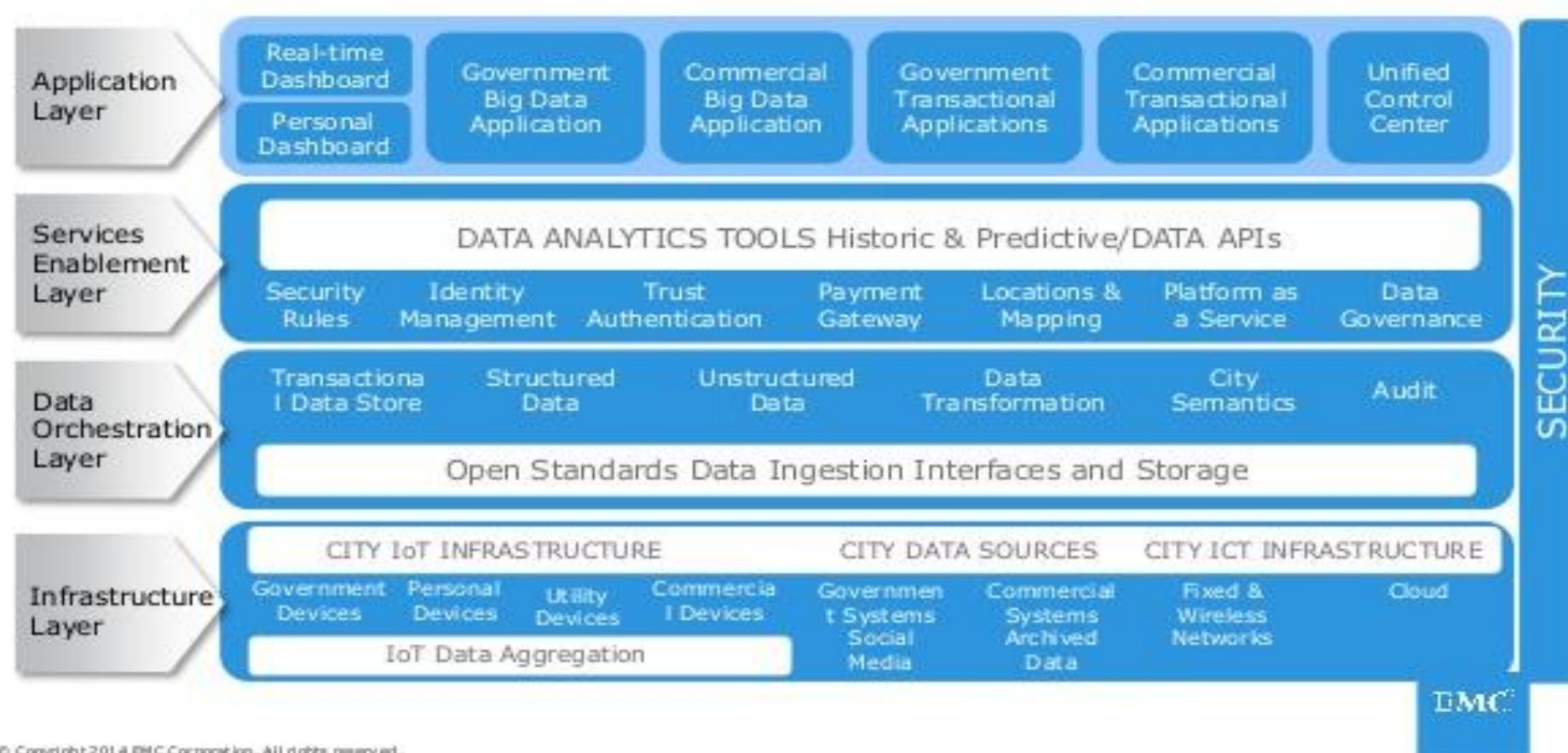
Source: <https://images.app.goo.gl/UE6kw4BFUYpsKAFv5>

# Understanding the ownership and value of data



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## Smart City Platform requirements



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Figure: Smart city platform requirements  
Source: <https://images.app.goo.gl/BhLERV3ZFUGqyW87A>

# Cities are adopting smarter technology today for major functions



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Significant funding is required to build sufficient technology base, develop applications and promote public usage



**INTELLIGENCE LAYER**  
supporting enhanced decision making

**Adoption:** Changes in behavior



**Applications:** Data analysis capabilities and applications



**Technology base:** Network of connected devices and sensors, open data portals

SOURCE: McKinsey Global Institute. Report 'Smart cities: Digital solutions for a more livable future'.

Figure: Major function for smart city operations

Source: <https://images.app.goo.gl/eYmBQ45C2N2McAc29>

# Managing law enforcement issues cognitively (1 of 2)



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- Law enforcement is a term for the activities of some members of government who act in an organized manner to enforce the law by discovering, deterring, rehabilitating, or punishing people who violate the rules and norms governing that society.
- Although the term encompasses police, courts, and corrections, it is most frequently applied to those who directly engage in patrols or surveillance to dissuade and discover criminal activity, and those who investigate crimes and apprehend offenders, a task typically carried out by the police, sheriff or another law enforcement organization.
- Although law enforcement may be most concerned with the prevention and punishment of crimes, organizations exist to discourage a wide variety of non-criminal violations of rules and norms, effected through the imposition of less severe consequences. There are also different units in different police departments, including “Undercover”, “Detective”, “CID”, “Gang Task Force”, “Drug Task Force”, "Custody Enforcement" , this varies from jurisdiction to jurisdiction.

# Managing law enforcement issues cognitively (2 of 3)



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- The Problem of Correlating Crime Data

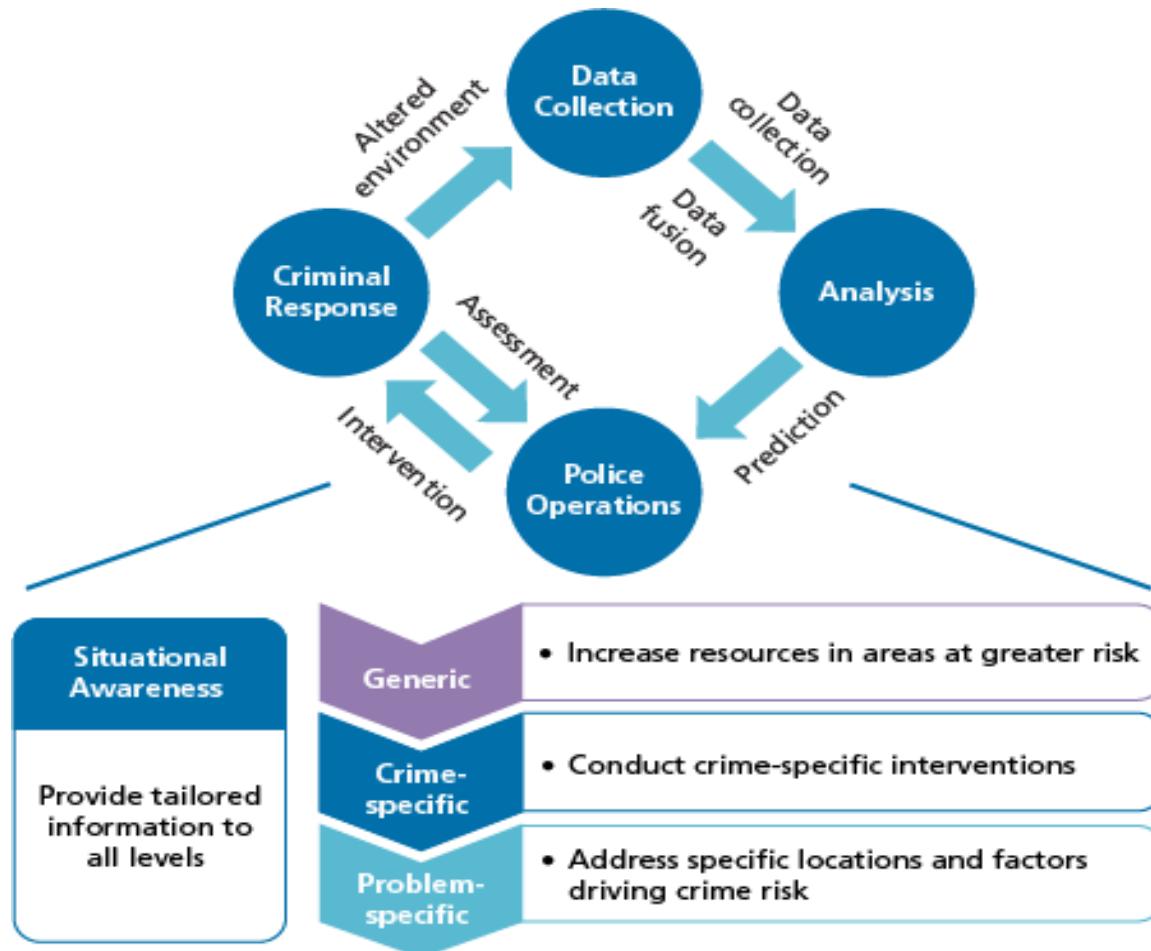


Figure: Crime data analysis

Source: <https://images.app.goo.gl/bN5HNtvz9gZUy1Bk7>

# Managing law enforcement issues cognitively (2 of 2)



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- The COPLink Project

## COPLINK project in the press

**The New York Times, November 2, 2002**  
COPLINK assisted in DC sniper investigation

**ABC News April 15, 2003**  
Google for Cops: Coplink software helps police search for cyber clues to bust criminals

**Newsweek Magazine, March 3, 2003**  
A computerized way for police to coordinate crime databases

**Washington Post, March 6, 2008**  
National dragnet is a click away!  
COPLINK in use in 1,600 police agencies in US!



**A**

Figure: COPLink Project

Source: <https://images.app.goo.gl/tFMWJyNSaappywDi9>

# Control of smart energy: From design to execution

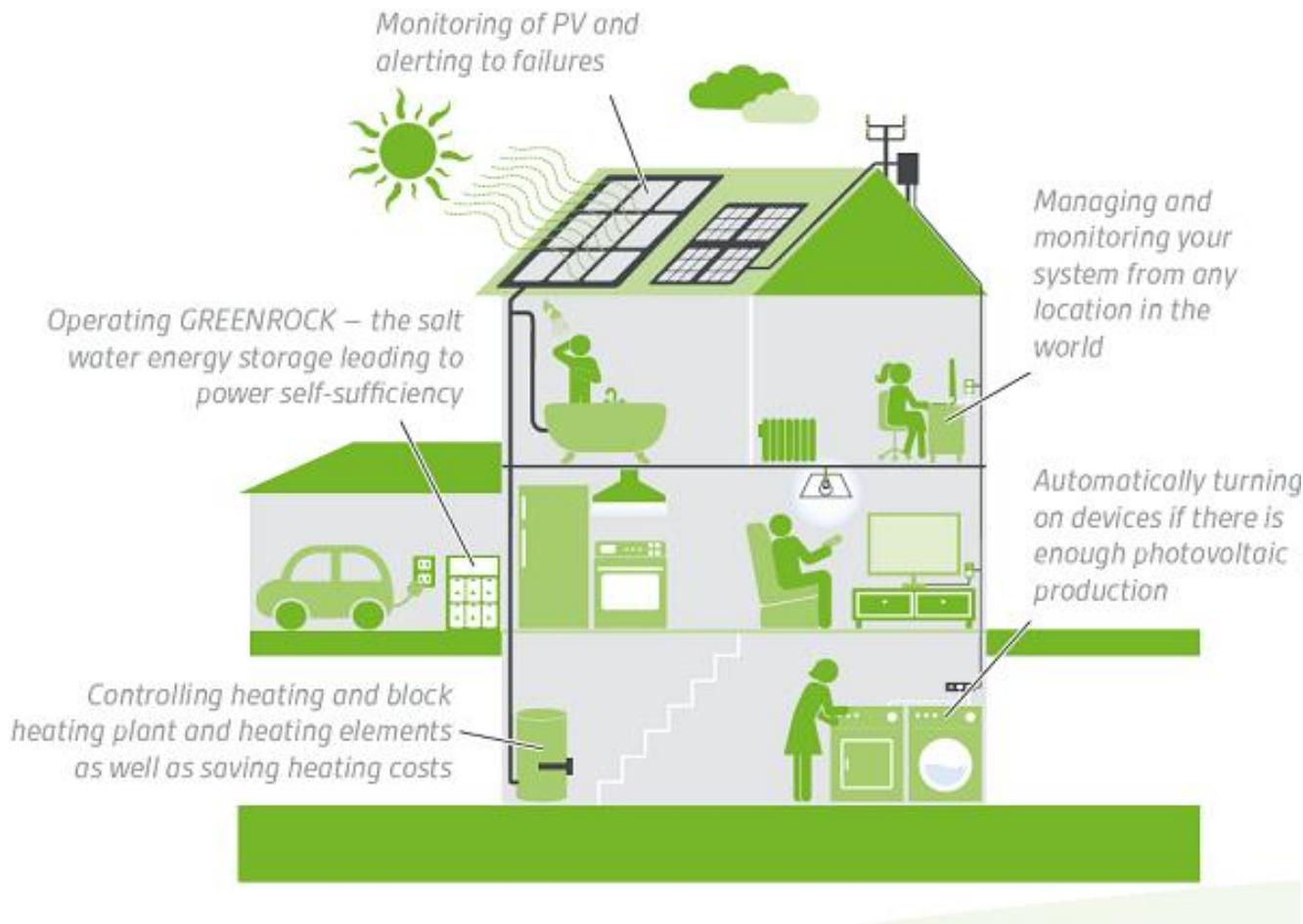


Figure: Smart energy Management

Source: <https://images.app.goo.gl/Jocxf9Njd7DTiBYc7>

# The problem of integrating regional utilities management



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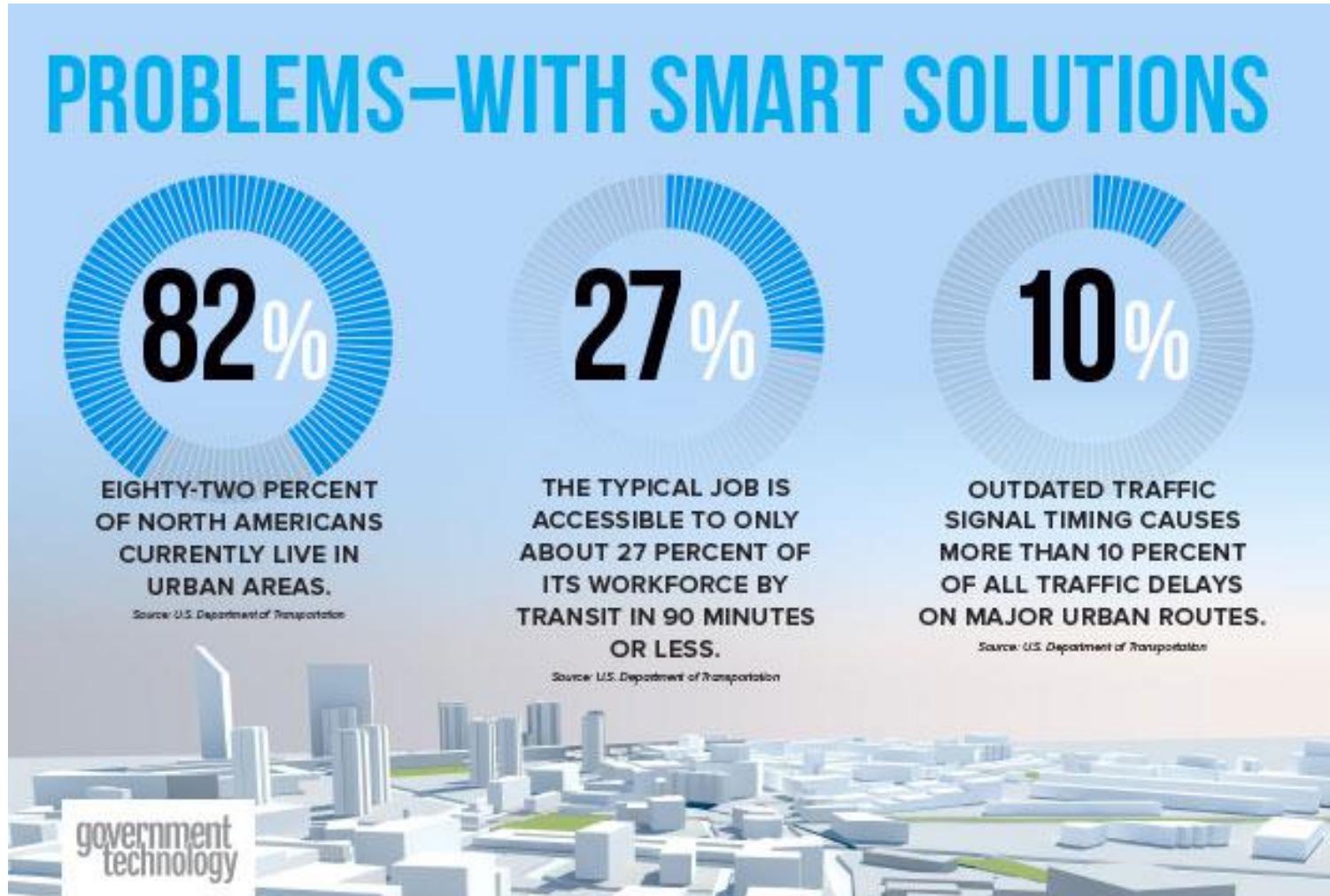


Figure: Problems with smart solutions  
Source: <https://images.app.goo.gl/cpSbPPJSqfFiKRZR6>

# The area energy management solutions project



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## Indian Smart City Solutions

- Application of Smart Solutions will enable cities to use technology, information and data to improve infrastructure and services. Three point Strategy:
- Retrofitting** : make the existing area more efficient and liveable
- Redevelopment**: replacement of the existing built-up environment and enable co-creation of a new layout with enhanced infrastructure using mixed land use and increased density.
- Greenfield** : Innovation driven projects



Figure: Smart city solutions

Source: <https://images.app.goo.gl/v7EgUJXyVb6tUTaF8>

# The cognitive computing opportunity

**Cognitive computing:** the combination of humans, machine learning, and predictive modeling.

**Vision:** ingest and analyze many data types to provide insights for improved outcomes.

**Enabling the opportunity for perpetual optimization.**

**Cognitive computing leverages tools such as:**

- Natural language processing
- Visualization
- Data ingestion and analysis from: text, images, IoT data from smart devices, sensors, wearables, social media
- Predictive data analytics

Figure: Cognitive Opportunity

Source: <https://images.app.goo.gl/mjqijuvkAN9nXYig9>

# Self evaluation: Exercise 23

- To continue with the training, after learning the various steps involved in cognitive analytics and Watson machine learning, it is instructed to utilize the concepts of cognitive machine learning algorithms to perform the following activity.
- You are instructed to write the following activities using Python code.
- Exercise 23: Quora Topic Modeling

# Protecting the power grid with Machine Learning



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- The Problem of Identifying Threats from New Patterns

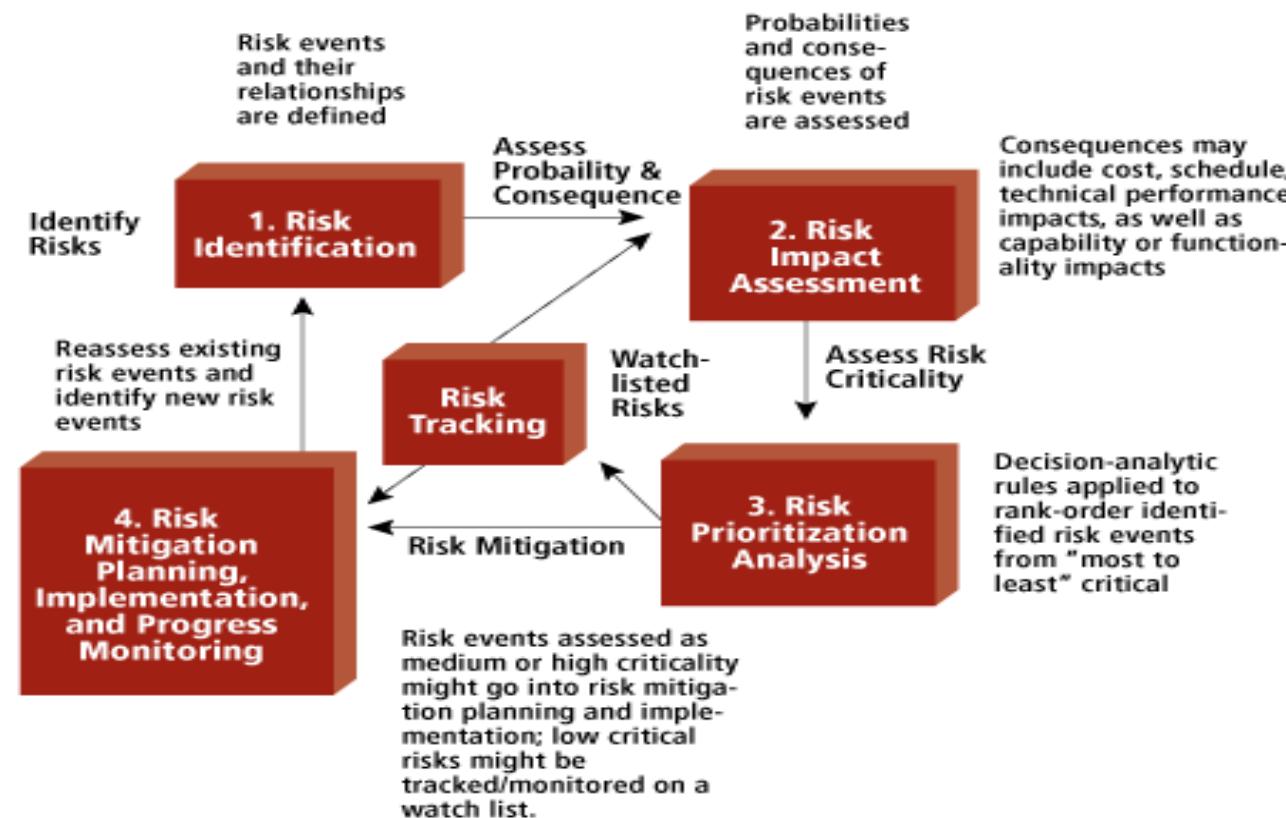
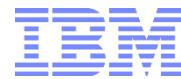


Figure: Risk Identification

Source: <https://images.app.goo.gl/DgVkkUgrfXGXu42L8>

# Protecting the power grid with machine learning



IBM ICE (Innovation Centre for Education)

- The Grid Cybersecurity Analytics Project

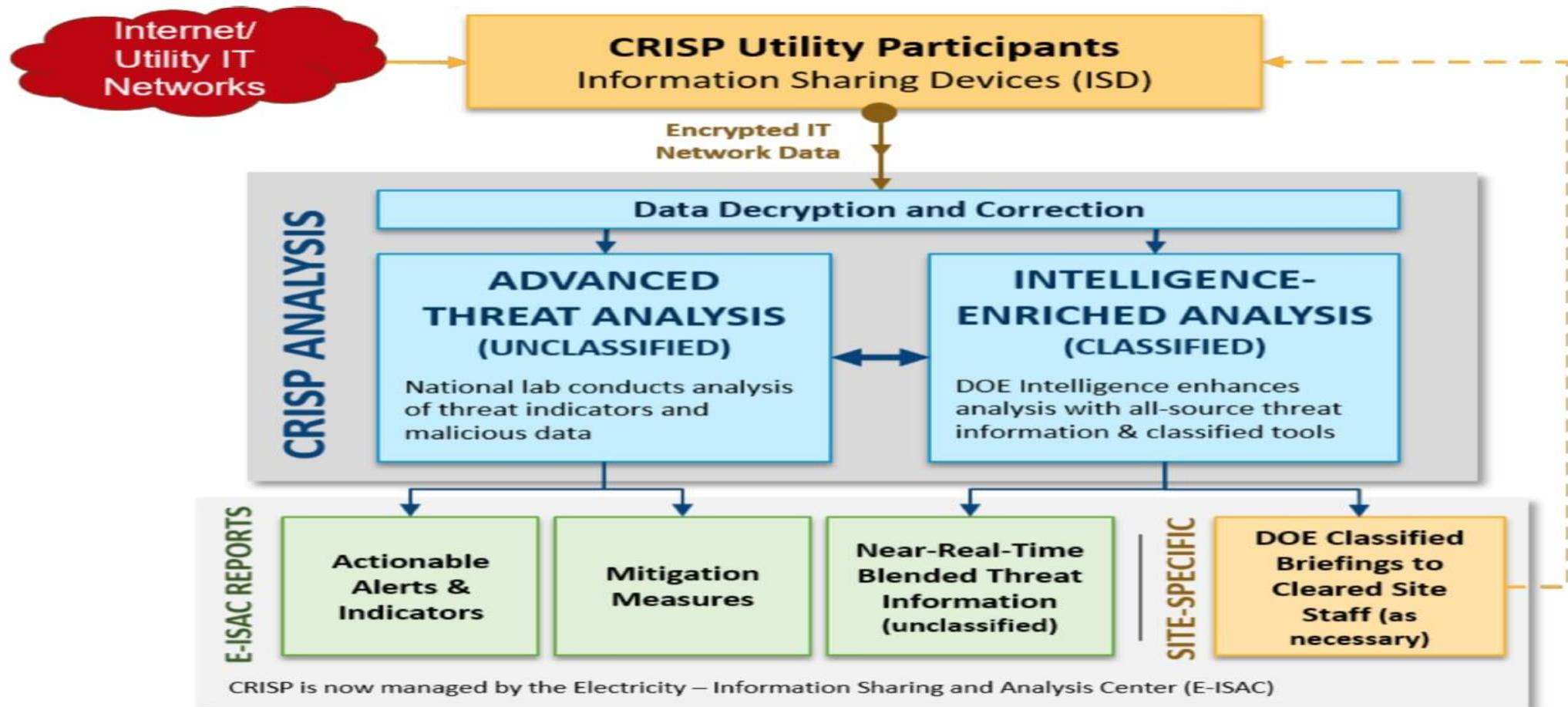


Figure: Cybersecurity Analytics project  
Source: <https://images.app.goo.gl/CwyxMYZ4RzdTPjvd7>

# Protecting the power grid with Machine Learning (4 of 4)



IBM ICE (Innovation Centre for Education)

- The Cognitive Computing Opportunity

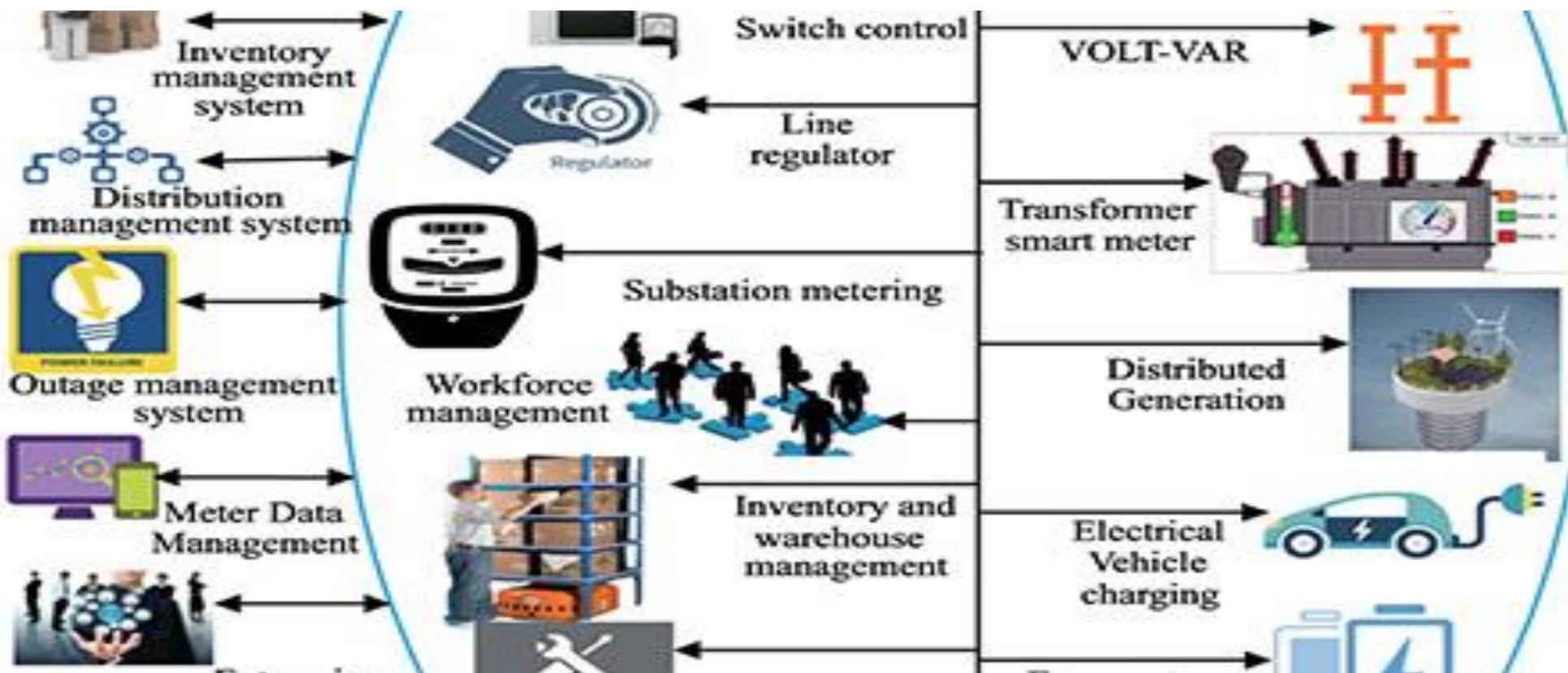


Figure: Power grid cognitive model

Source: <https://images.app.goo.gl/EV7fZhpCe6LsvMXU7>

# Improving public health with cognitive

## How can interoperability improve digital medicine?

### AI and Big Data

- provide algorithms with clear data structure and semantics
- ensure validity of analysis results
- create trust in digital technologies

### Medical Communication

- enable easy information retrieval
- avoid medical errors caused by communication barriers
- reduce documentation burden
- empower patients

### Research

- improve the use of real-world data (e.g. for large-scale observational studies)
- create new research hypotheses (with data mining and AI)
- enable remote development of analysis scripts

### International Cooperation

- pool data across organizations (e.g. rare diseases, precision medicine)
- tackle global public health issues (e.g. infection control, epidemics)
- provide global access to new technologies

Figure: AI with Healthcare

Source: <https://images.app.goo.gl/zWHQ5Fq1diDajquPA>

# Smarter approaches to preventative healthcare (1 of 2)



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At the center of smarter healthcare is an increasingly more personalized experience, focused on the *wellness* of the individual.



One result is higher satisfaction for consumers and service providers.

Figure: Smarter Approaches to Preventative Healthcare

Source: <https://images.app.goo.gl/7NgtEY6vF1jsL5Tz9>

# Smarter approaches to preventative healthcare (2 of 2)



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- The Town Health Station Project

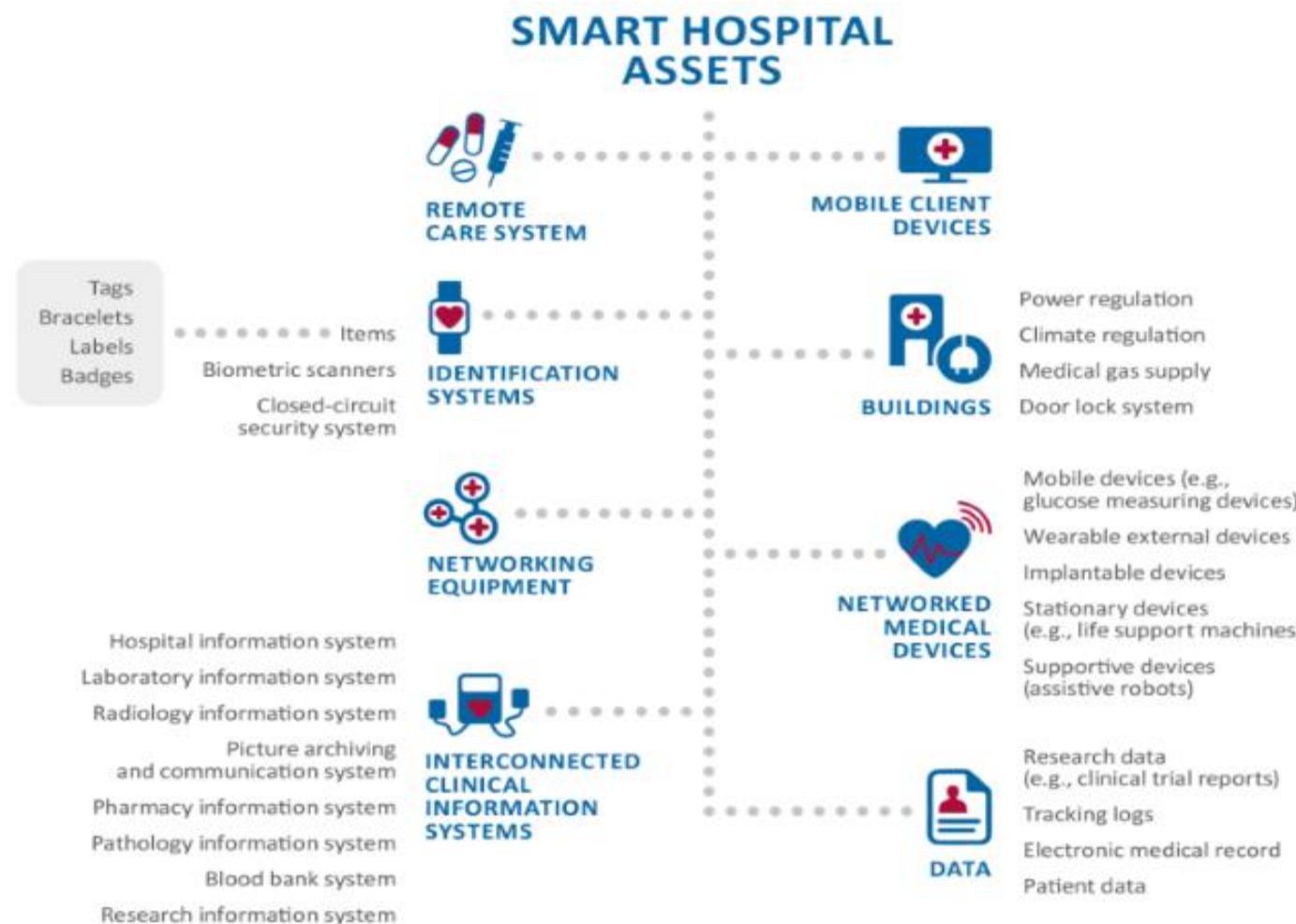


Figure: Smart Hospital

Source: <https://bit.ly/3fLR4dc>

# Smarter approaches to preventative healthcare (3 of 3)



IBM ICE (Innovation Centre for Education)

- The Cognitive Computing Opportunity

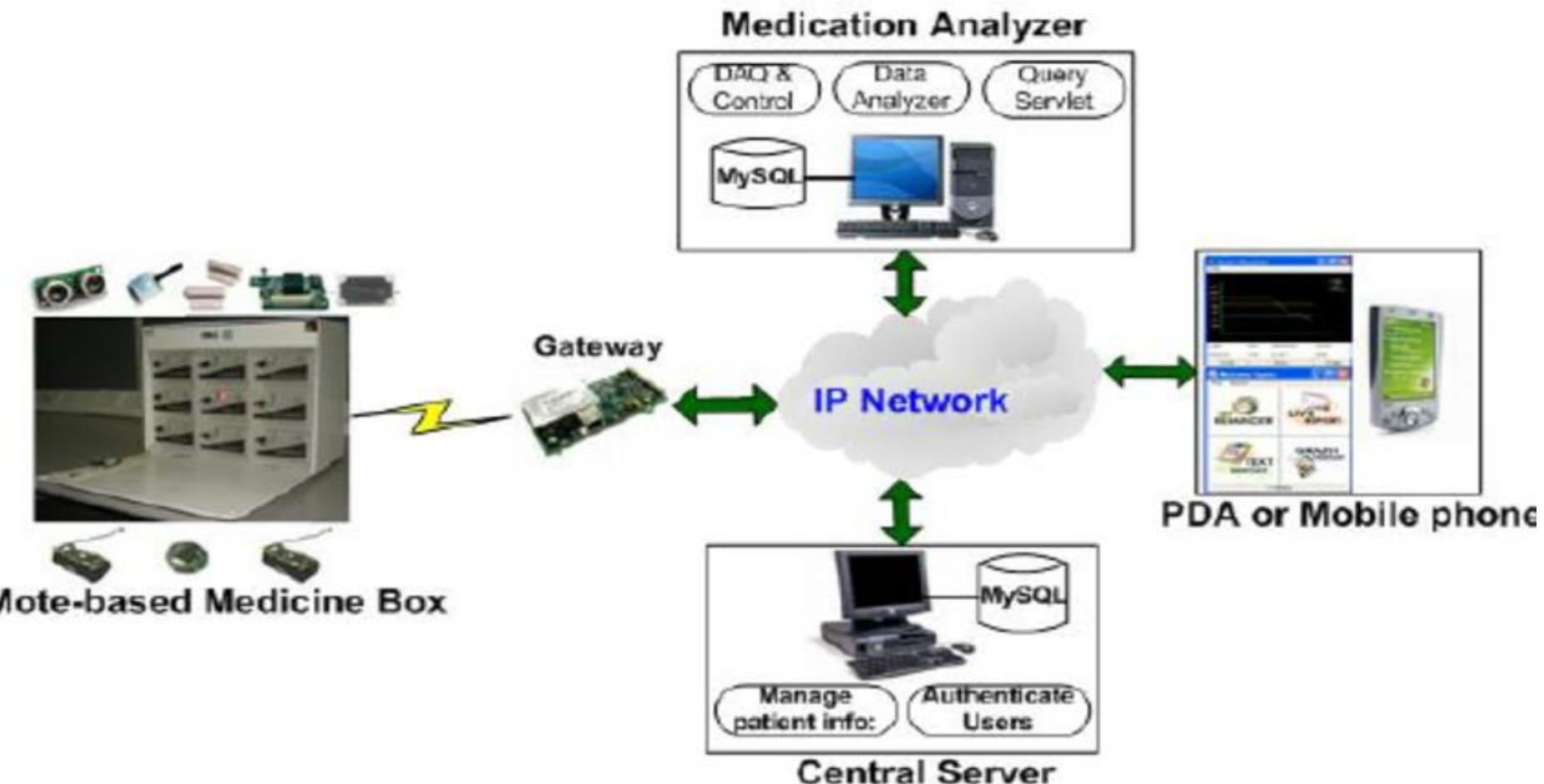


Figure: Smart Medicine

Source: <https://images.app.goo.gl/RXyxHepNzNEyxCkS9>

# Building a smarter transportation infrastructure

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Figure: Smart Transportation

Source: <https://images.app.goo.gl/zHgg1T1L8nNNiw2X6>

# Building a smarter transportation infrastructure (2 of 4)



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- Managing Traffic in Growing Cities

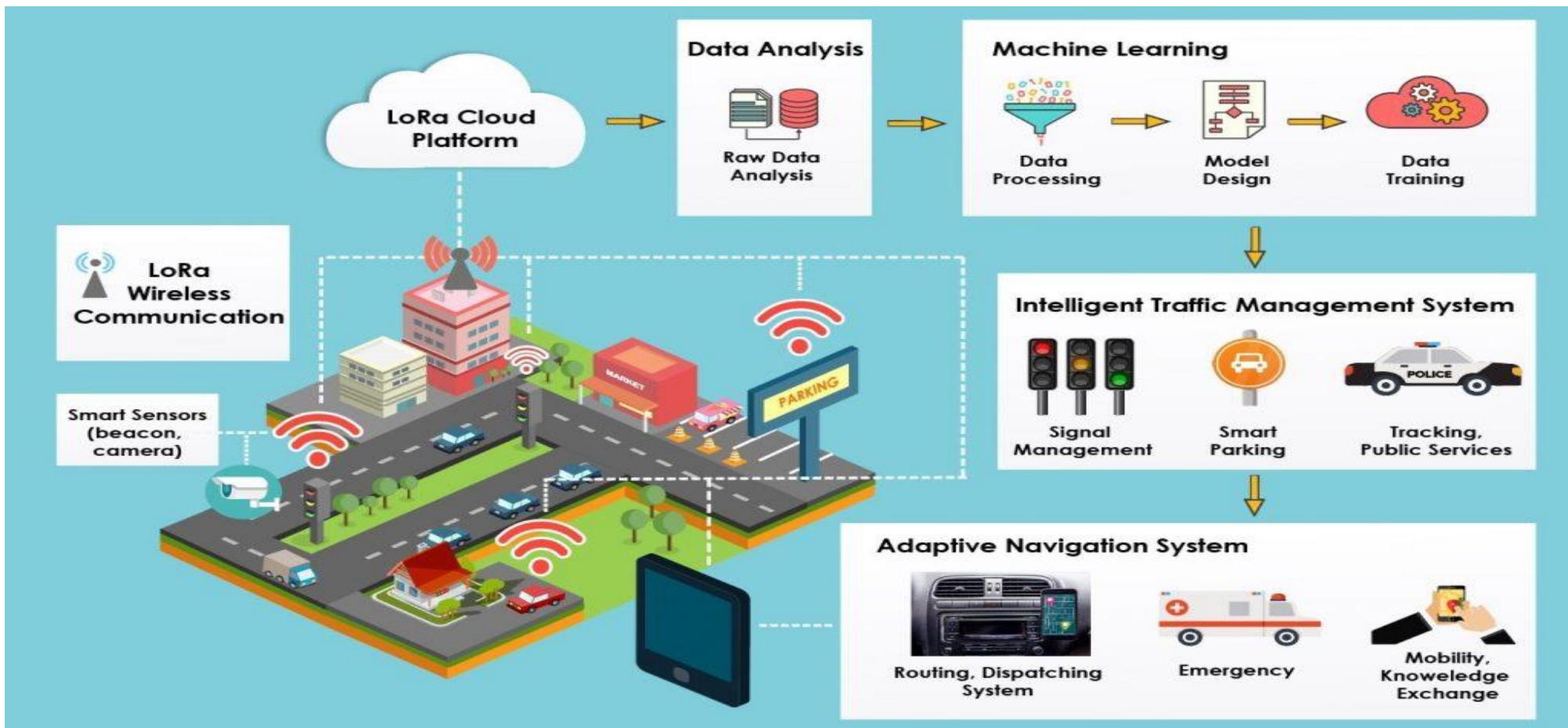


Figure: Smart Traffic

Source: <https://images.app.goo.gl/Dihd1W7YH5uBmKvq9>

# Self evaluation: Exercise 24

- To continue with the training, after learning the various steps involved in cognitive analytics and Watson machine learning, it is instructed to utilize the concepts of cognitive machine learning algorithms to perform the following activity.
- You are instructed to write the following activities using Python code.
- Exercise 24: Natural Language Processing.

# Building a smarter transportation infrastructure (4 of 4)



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- The Cognitive Computing Opportunity

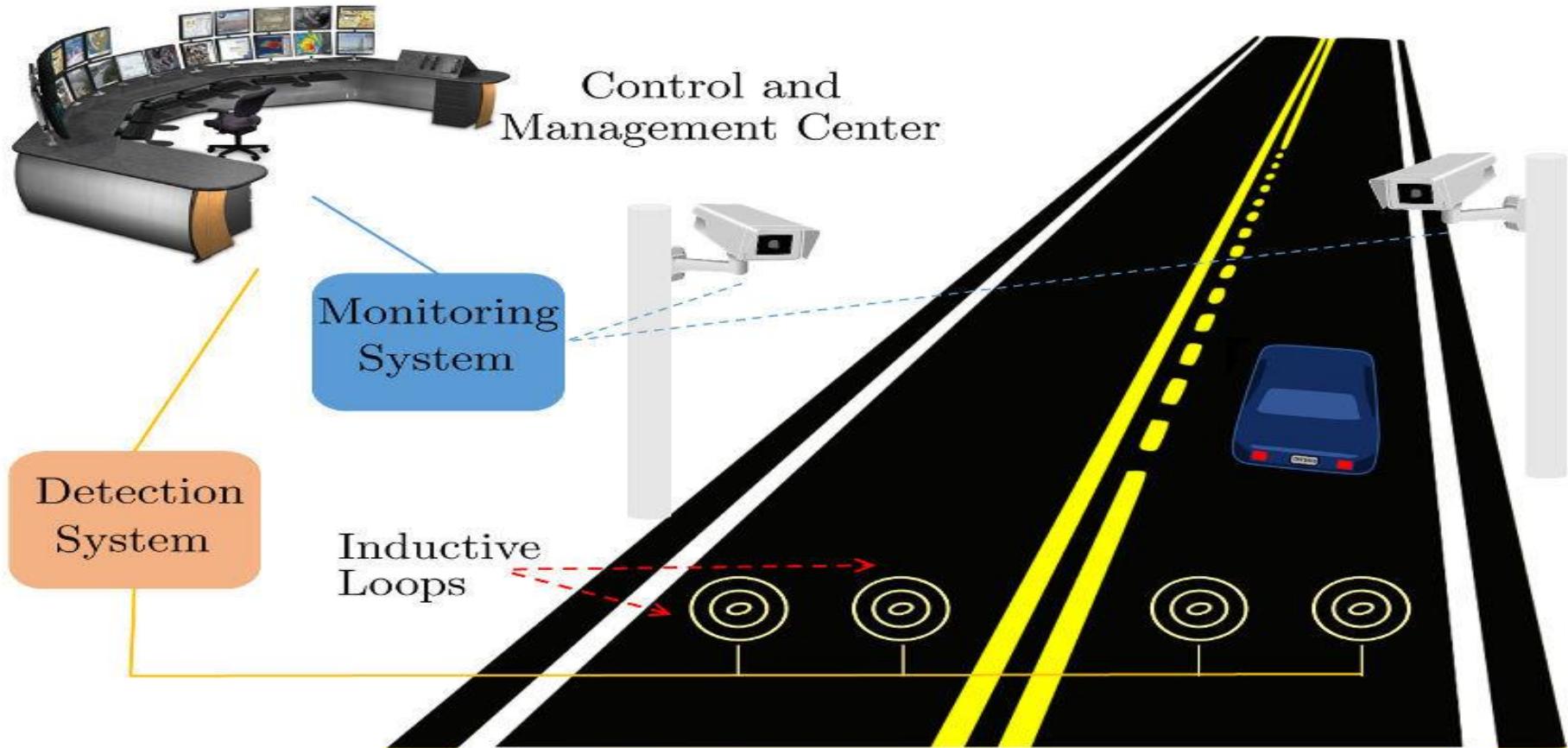


Figure: Smart Traffic Management

Source: <https://images.app.goo.gl/6y8Yg7oYC7HzH1kv7>

# Using analytics to close the workforce skills gap



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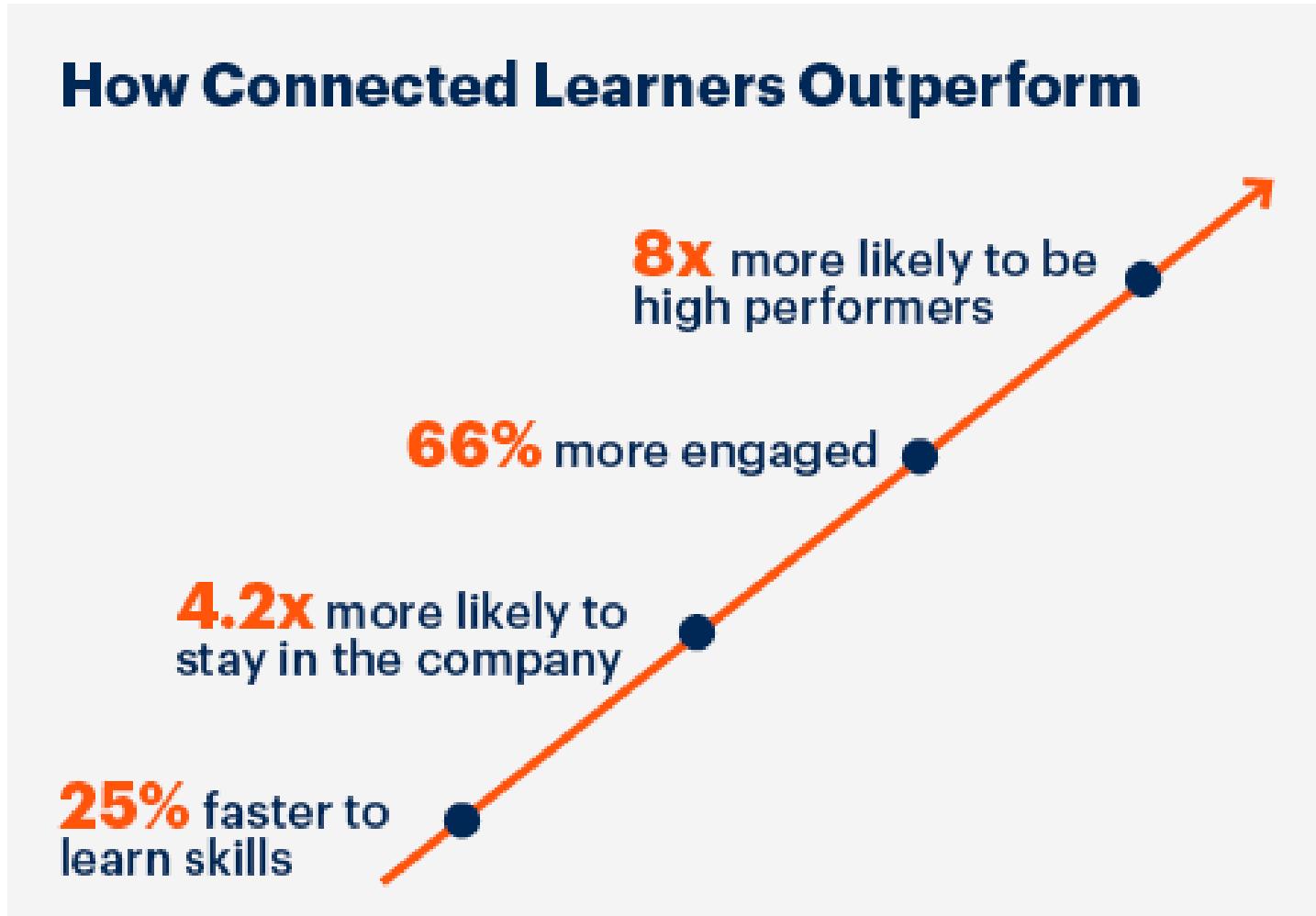


Figure: Using Analytics to Close the Workforce Skills Gap

Source: <https://images.app.goo.gl/qt5Auja9jAiAxXS78>

# Identifying emerging skills requirements and just-in-time training



IBM ICE (Innovation Centre for Education)

strategy+business

## 6 steps to upskilling your people

1

Analyze the situation and define the initiative.



2

Design a skills plan.



3

Assess and advise individual employees.



4

Match jobs and engage workers.



5

Select training and providers.



6

Administer the project and monitor results.



Figure: Emerging Skills Requirements and Just-in-Time Training

Source: <https://images.app.goo.gl/3PJSfUb4zrc8CrfX6>

# The Digital On-Ramps (DOR) project

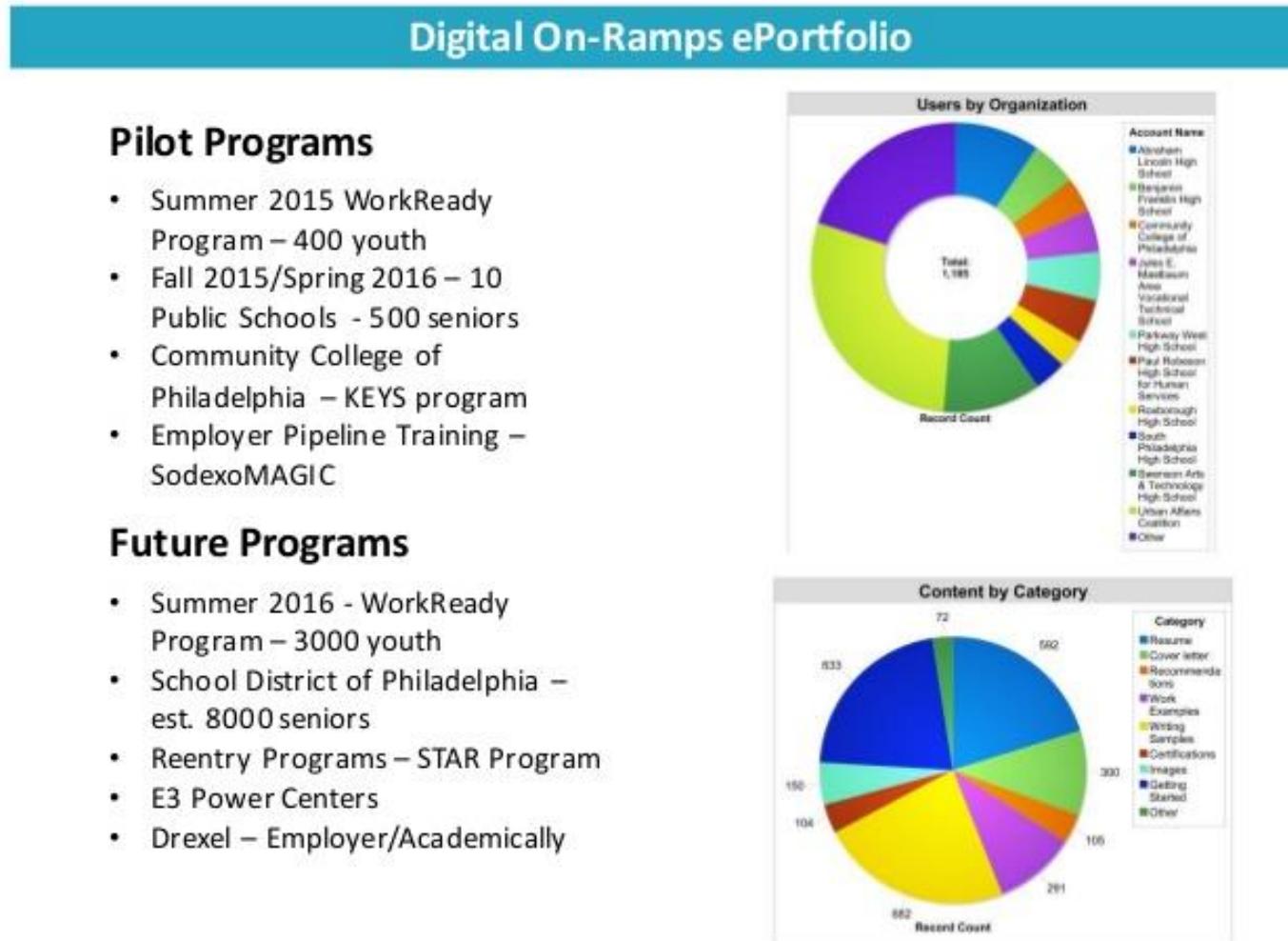


Figure: DOR Project

Source: <https://images.app.goo.gl/EakdGYMNrBhspbSy5>

# Creating a cognitive community infrastructure



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Example: model homes

Up to now:

Actual homes are put on display.



"I want to see a greater variety of actual homes."  
"I want to modify the interior design."

AI: artificial intelligence

Target world: Provides VR catalogs via an edge infrastructure

Other examples: car dealerships, sales calls, showrooms, events, etc.

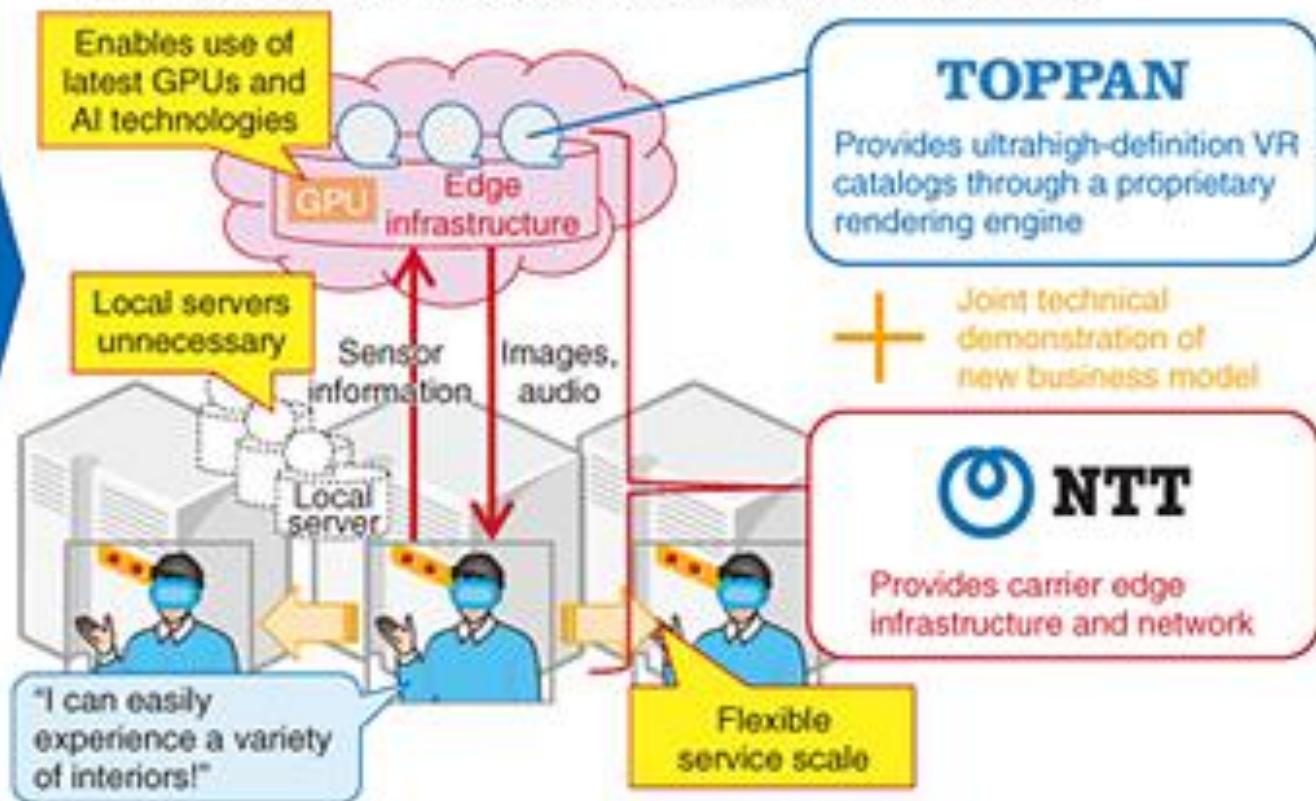


Figure: Cognitive computing Infra

Source: <https://images.app.goo.gl/uCS24hmL7BZztZZB7>

# The next phase of cognitive cities

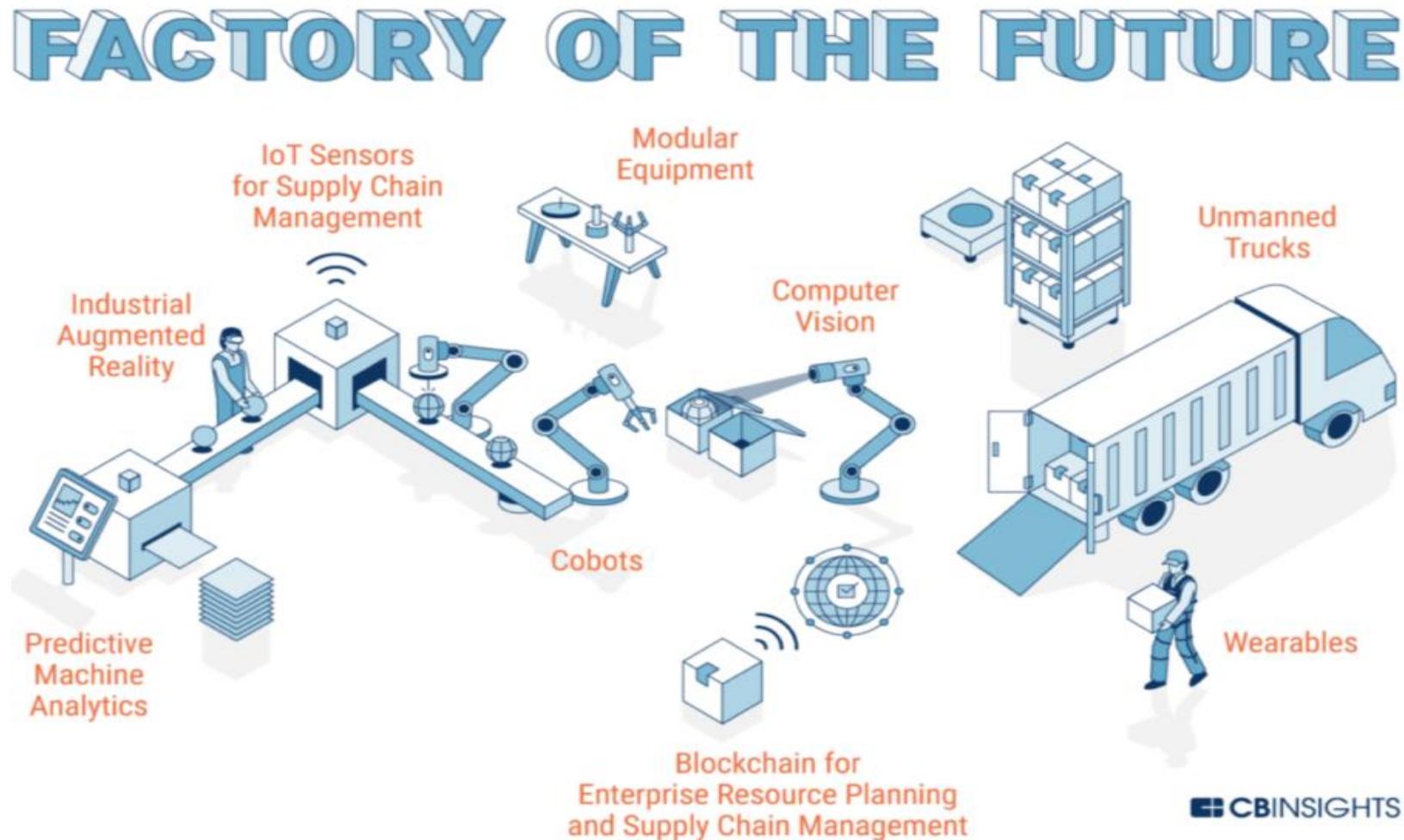


Figure: Future of cognitive city

Source: <https://images.app.goo.gl/yvFJqrRfCUT2kzLa8>

# RETAIL ANALYTICS — TECHNOLOGY —

MERCHANTS ARE REINVENTING THEIR SUPPLY CHAINS WITH UPDATES THAT ENABLE AUTOMATED, REAL-TIME INVENTORY VISIBILITY VIA IoT, SUCH AS RFID. THIS CAN BOOST INVENTORY ACCURACY LEVELS TO AS HIGH AS **95% ↑**

**73%** of retailers rate managing **Big Data** as important or business critical.

## BUSINESS INTELLIGENCE INVESTMENTS BY 2021



Figure: Cognitive in Retail Industry

Source: <https://images.app.goo.gl/hqwZvtibS8e5afeA7>

# Travel

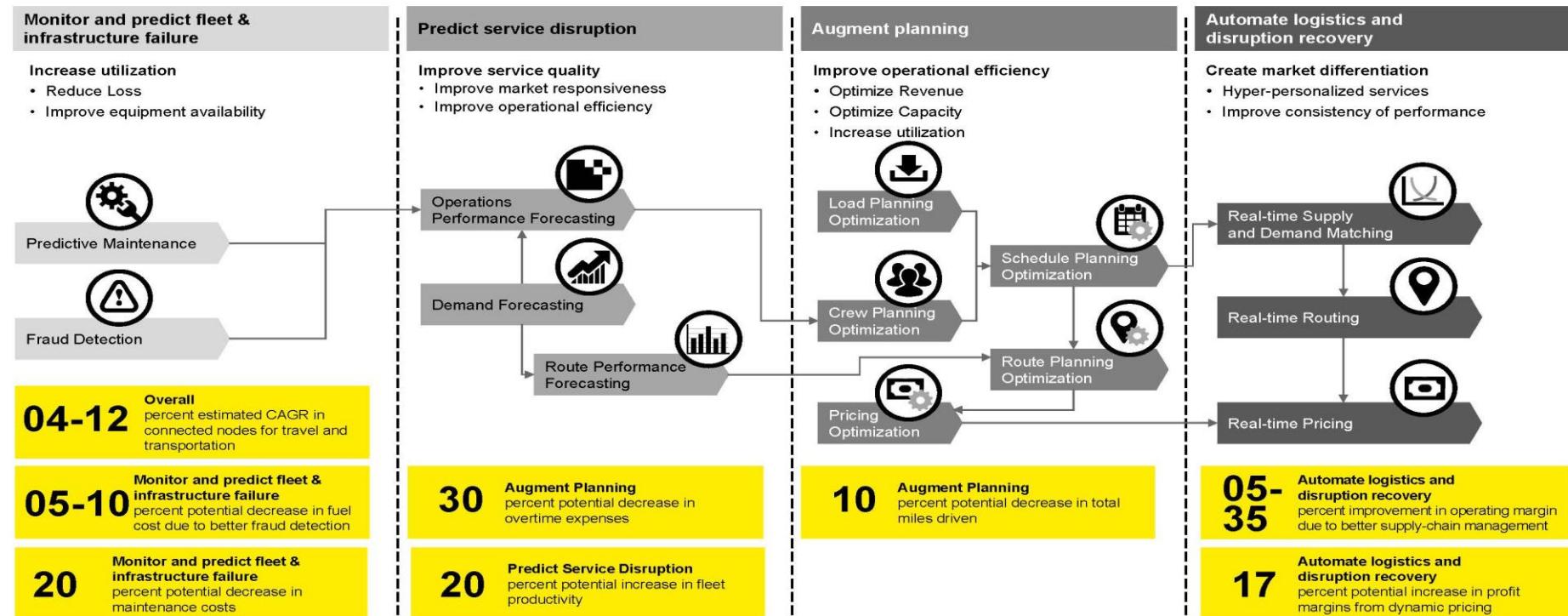


Figure: Travel with cognitive computing

Source: <https://images.app.goo.gl/nh3Ph5eAjp7vQ4cr5>

# Transportation and logistics

## Applied Industrialized AI – Travel and Transportation



This material is based on research by:

"Big Data: 20 Mind-Boggling Facts Everyone Must Read," Forbes, 2015.

"The Digital Universe In 2020: Big Data, Bigger Digital Shadows, and Biggest Growth in the Far East," EMC, 2012.

"The age of analytics: Competing in a data-driven world," McKinsey Global Institute, 2016.

"Save Lives, Time and Money with Fleet Telematics Solutions," Sprint Business, 2017.

Fraud Matters. Fleet Management Weekly. Last Accessed 8/25/2017.

"Big data: The next frontier for innovation, competition, and productivity," McKinsey Global Institute. 2011. Freight & Logistic Services Pricing Strategies, Chron, 2017.

### Figure: AI in Transport

Source: <https://images.app.goo.gl/u7iCP7hoQvx9sP4r6>

# Telecommunications

- Internet service Provider (ISP)

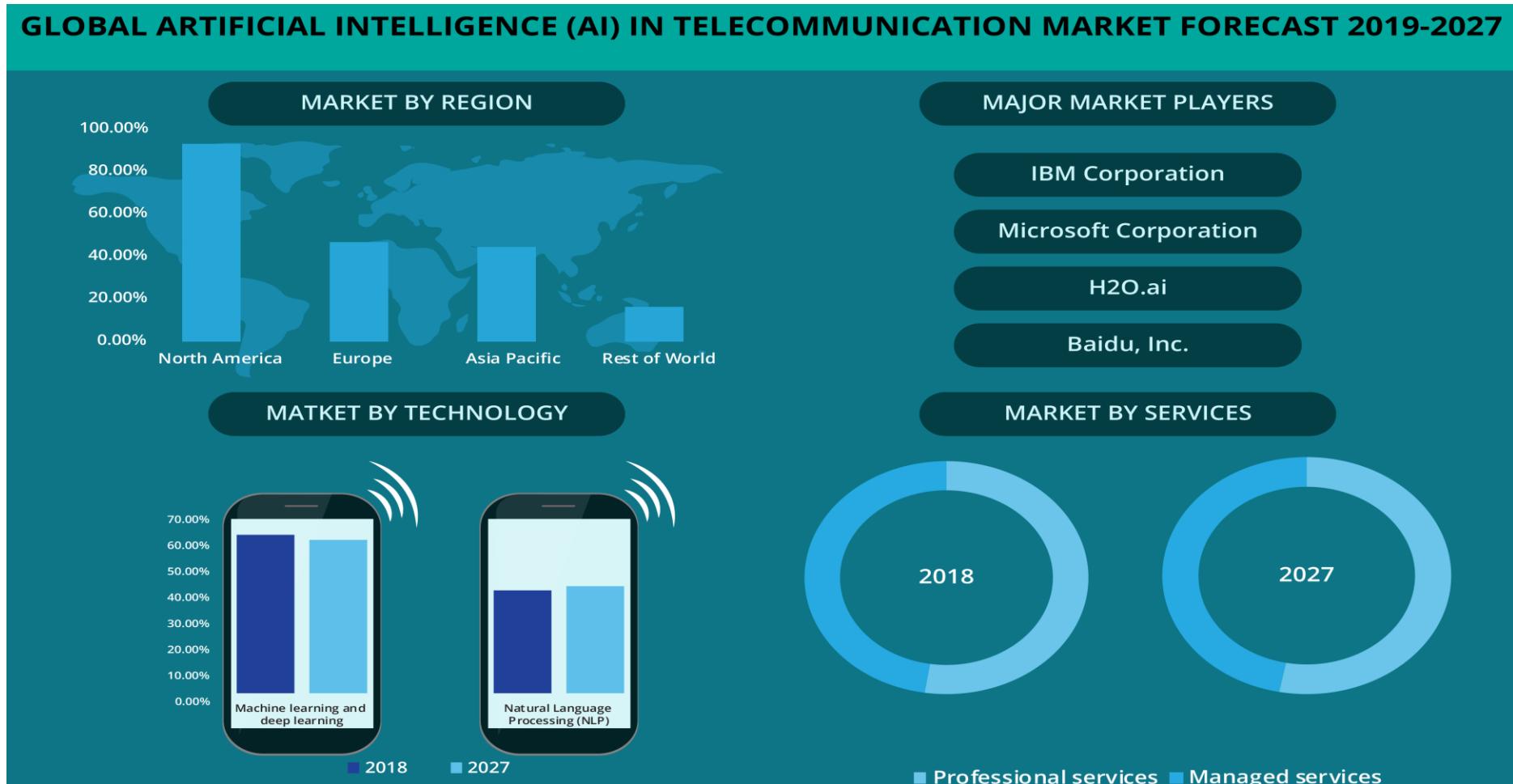


Figure: Cognitive in Telecom

Source: <https://images.app.goo.gl/qZ3YqgjJ9bG7529U9>

# Security and threat detection

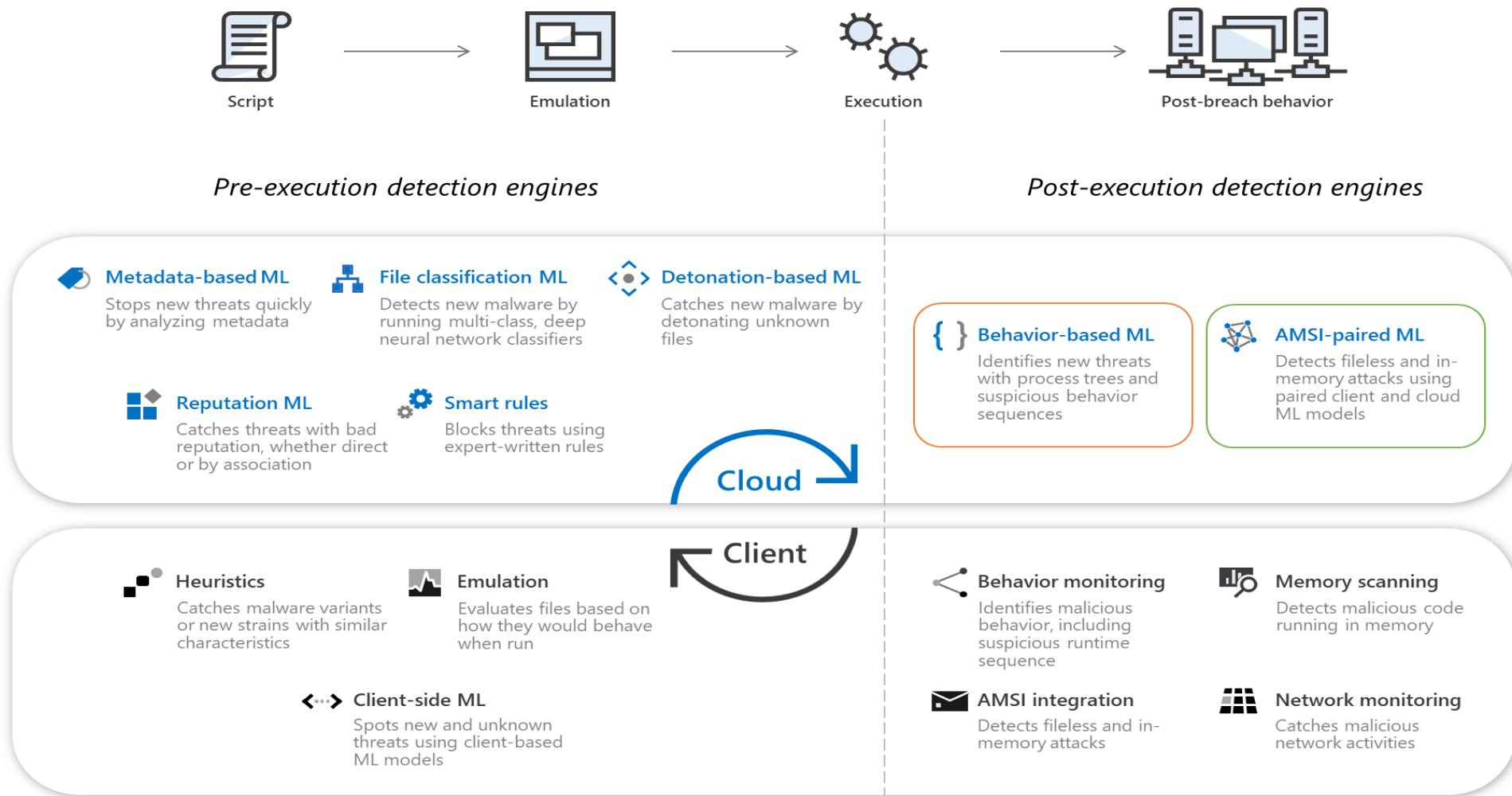


Figure: Security and Threat Detection in cognitive computing  
Source: <https://images.app.goo.gl/tLz9r7Aw7ttwZ9m1A>

# Other areas that are impacted by a cognitive approach



IBM ICE (Innovation Centre for Education)

## SINGAPORE'S APPROACH TO AI

### AI-ENABLED ECONOMY

#### Frontier Developments

Outpace competitiveness through innovative AI use



**Key sectors with strategic economic impact and global standing**

#### Addressing Disruption due to AI

Transform sectors and jobs to cognitive, higher-VA activities



**Sectors with higher risks of disruption**

#### Leveling up AI use across economy

Ensure sectors are up-to-date in AI adoption



**All businesses**

### SUPPORTED BY VIBRANT AI ECOSYSTEM

- Good international AI companies anchored in SG
- Hi-value homegrown AI companies



- Globally-recognized R&D capabilities in niche areas of strengths



- Hub for competitive AI talent equipped with critical skillsets to address AI opportunities



- Strengthening hyperscale computing capability
- Hub for data-driven activities to facilitate access to datasets within and beyond Singapore
- Trusted environment with progressive regulations that balance between protection and innovation



Figure: Singapore based AI and cognitive Approach

Source: <https://images.app.goo.gl/rPT9hvpuAFn2uxx9>

# Solutions in other areas (1 of 2)

- Financial services

## COGNITIVE COMPUTING IN FINANCE

**Analyzing unstructured data from different sources to perform detailed customer analysis**

**Providing better customer service through conversationally adept chatbots**

**Ensuring the balance between security and convenience with smarter access management**

Figure: Financial services

# Solutions in other areas (2 of 2)

- Legal applications

Support lawyers to conduct due diligence and investigation

Further insights and "shortcuts" through analytics

Automation of creative processes in legal work (including certain writing)

Figure: AI's existing legal applications

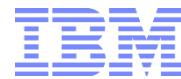
# Solutions in other areas (3 of 3)

- **AI in Law: Business Applications**

Basis on Business evaluation and legal proposals, existing AI requests seem to fall into six key categories:

- Due Diligence – AI tools allow litigators to detect context information to carry out due diligence. In this section we agreed to include a study of contracts, legal analysis and online discovery.
- Technology prediction – The results of litigation prevention are produced by AI software.
- Legal analytics – lawyers will make use of previous jurisprudence data points, rate of profit/loss, and a judicial context for patterns and trends.
- Document automation – Software models are being used by law firms to create completed documents using input data.
- IP (Intellectual property) –. AI applications always guide lawyers to analyze broad IP portfolios and to know the substance
- E-billing – Lawyers' working hours would be calculated automatically.

# Future applications for cognitive computing



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## The ICT Industry's 3rd Platform From IT to Business Productivity

- Paradigm shift
- Every 20–25 years
- Winners and losers
- Impact on vendors and channel
- By 2020: 40% of revenue from 3rd Platform



Figure: Cognitive computing future Applications

Source: <https://images.app.goo.gl/DnM7VZGqetngT2gk6>

# Requirements for the next generation (1 of 2)

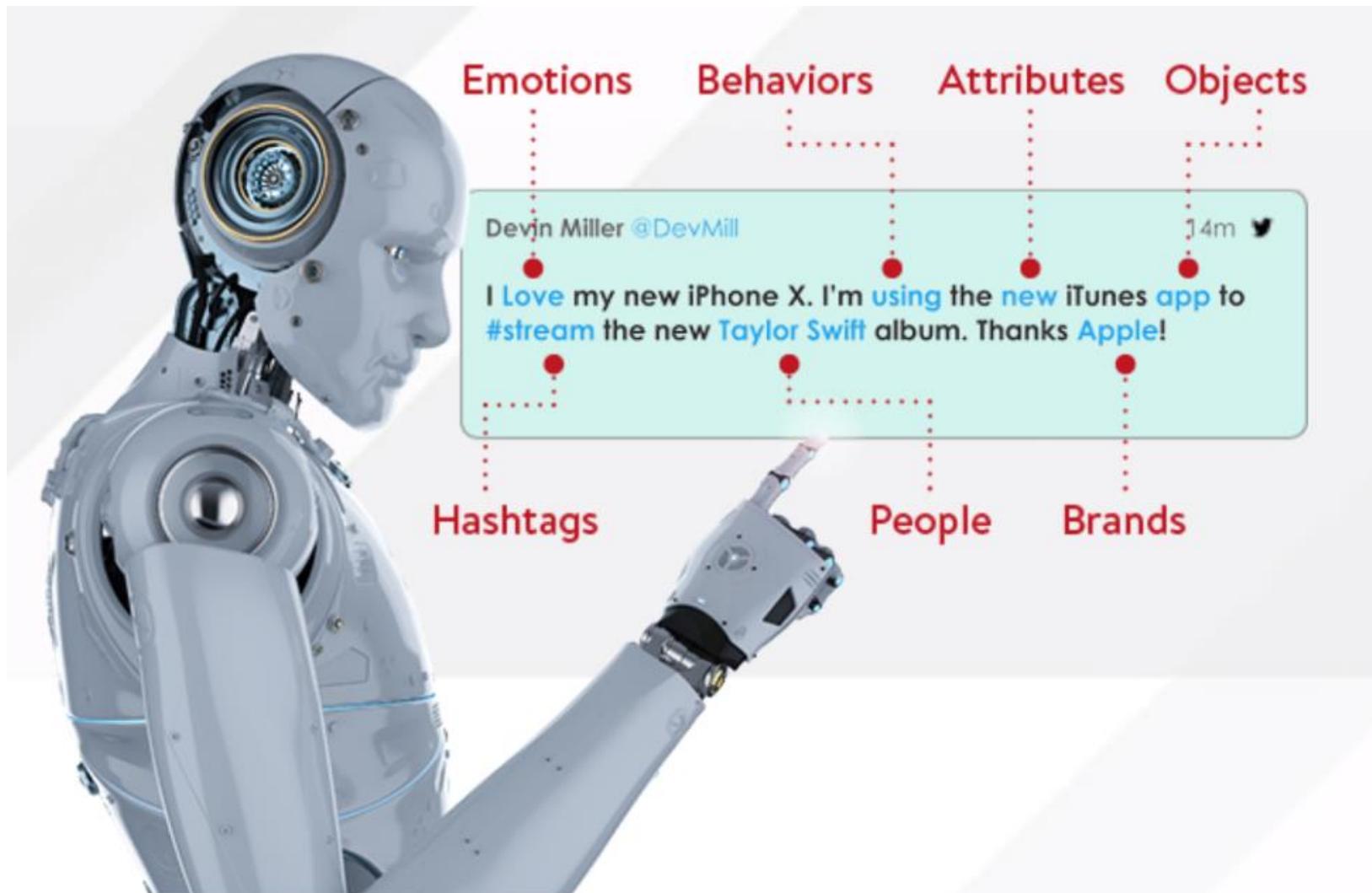


Figure : Next Generation AI model  
Source: <https://images.app.goo.gl/sh5sC6US8deR4DFBA>

# Requirements for the next generation (2 of 2)



IBM ICE (Innovation Centre for Education)

- Leveraging Cognitive Computing to Improve Predictability

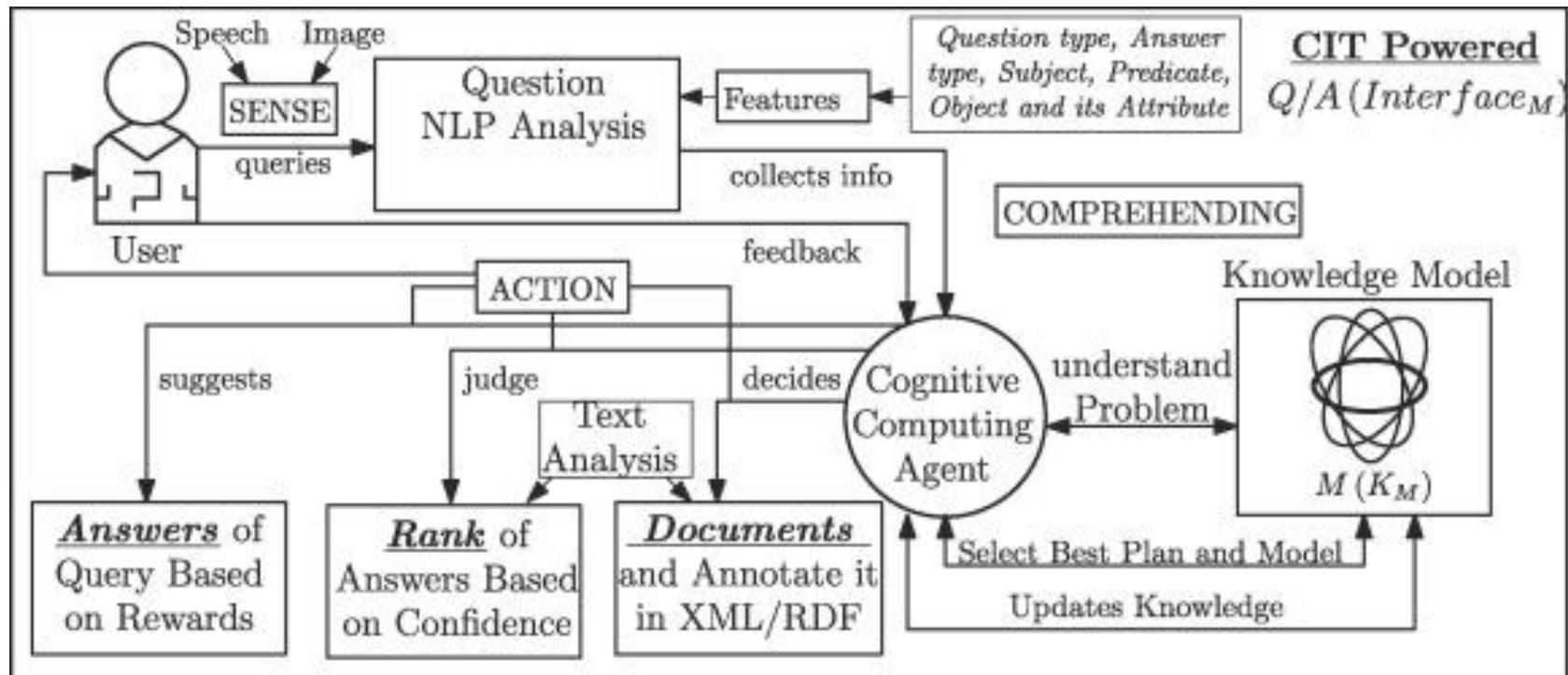


Figure: Cognitive analytics for productivity

Source: <https://images.app.goo.gl/gH3GvZrsZsgrz8Fv7>

# Requirements for the next generation (3 of 3)

- **The New Life Cycle for Knowledge Management**

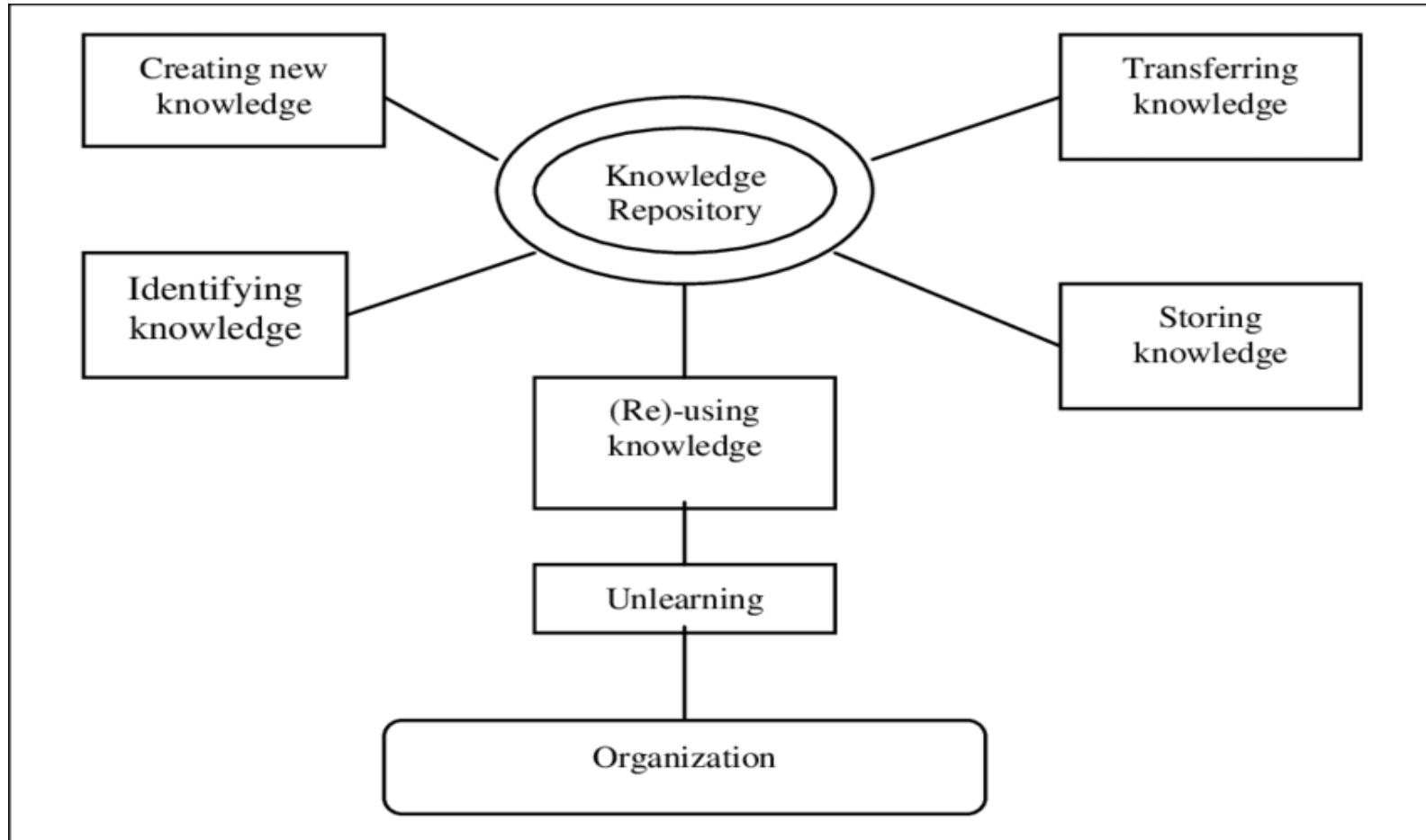


Figure: The life cycle of knowledge management

Source: <https://images.app.goo.gl/WYG5Yw8Lyb1816ZBA>

# Self evaluation: Exercise 23

- To continue with the training, after learning the various steps involved in cognitive analytics and Watson machine learning, it is instructed to utilize the concepts of cognitive machine learning algorithms to perform the following activity.
- You are instructed to write the following activities using Python code.
- Exercise 23: Quora Topic Modeling

# What is knowledge management? (1 of 2)

- What is Knowledge Management?
  - Knowledge Management (KM): Is the over-arching umbrella that comprises the strategies and practices an organization uses to discover, create, capture, document, categorize, classify, protect, secure, file, obsolete destroy and renew knowledge.
  - Includes external processes to identify, reference, adopt, share, archive and maintain knowledge assets.
  - Focuses on transferring know-how that involves retrieving, exchanging, accessing, and disseminating understanding

# What is knowledge management? (2 of 2)

## Knowledge Management Lifecycle

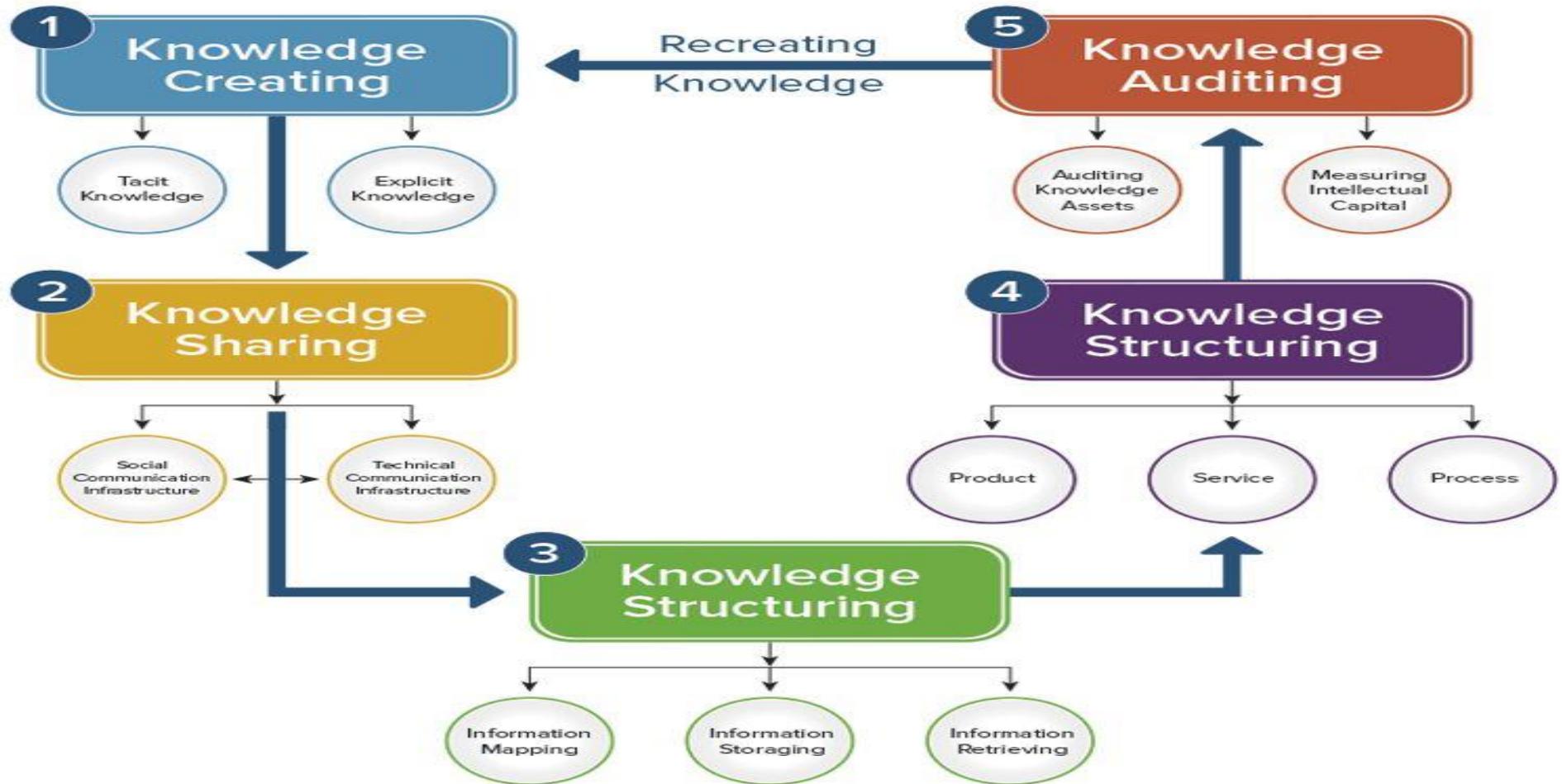


Figure: Knowledge Management life cycle

Source: <https://images.app.goo.gl/KzBnNXCPpNYND4ktb7>

# What is knowledge management? (3 of 3)

- Use cases for customer support and knowledge management

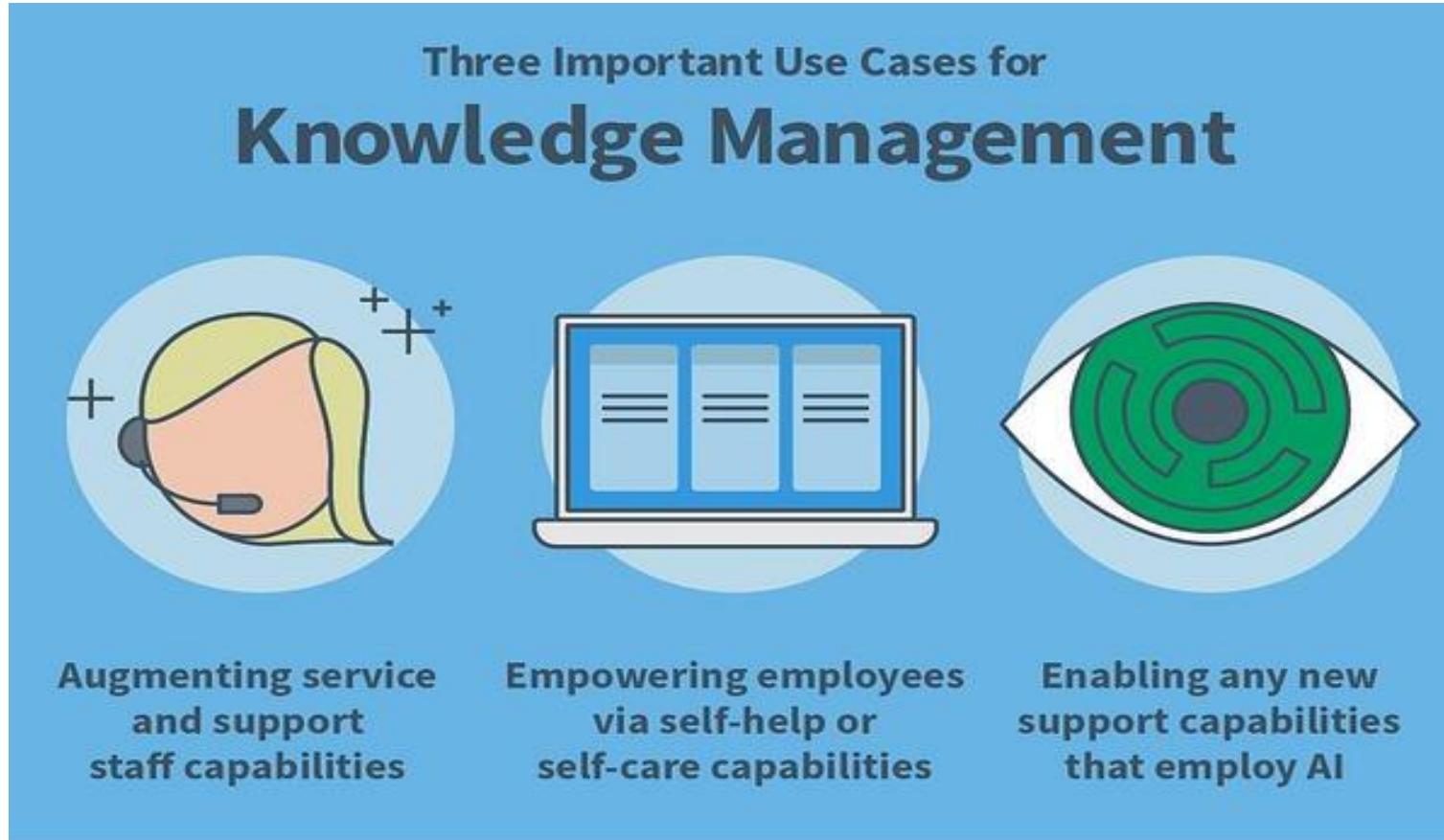


Figure: customer support and knowledge management

Source: <https://images.app.goo.gl/rhhTYYzWcBMtdMYr7>

# Requirements for the next generation (1 of 2)

- Creating Intuitive Human-to-Machine Interfaces

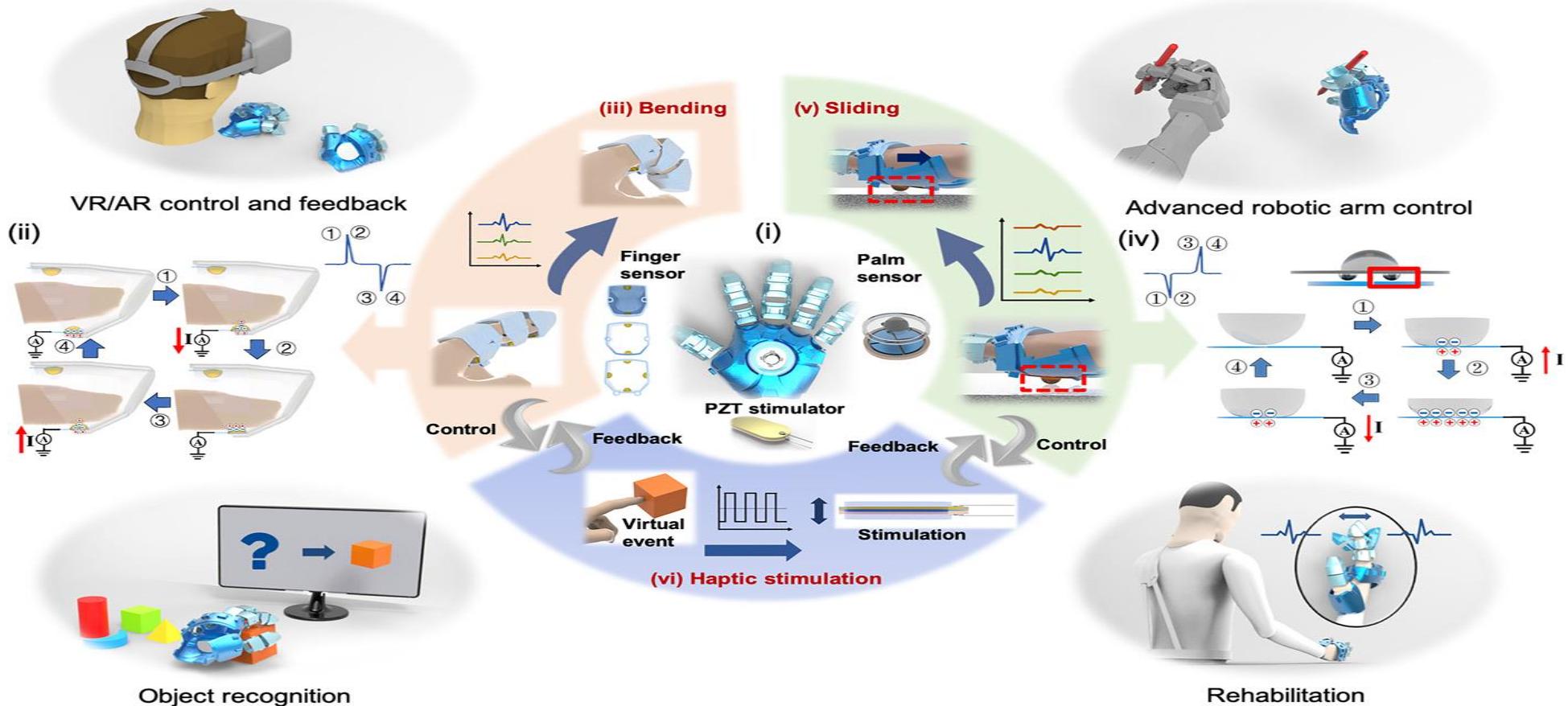


Figure: Human to Machine Interface  
Source: <https://images.app.goo.gl/sFcN6on4SbFKV9w29>

# Requirements for the next generation (2 of 2)



IBM ICE (Innovation Centre for Education)

- Requirements to Increase the Packaging of Best Practices

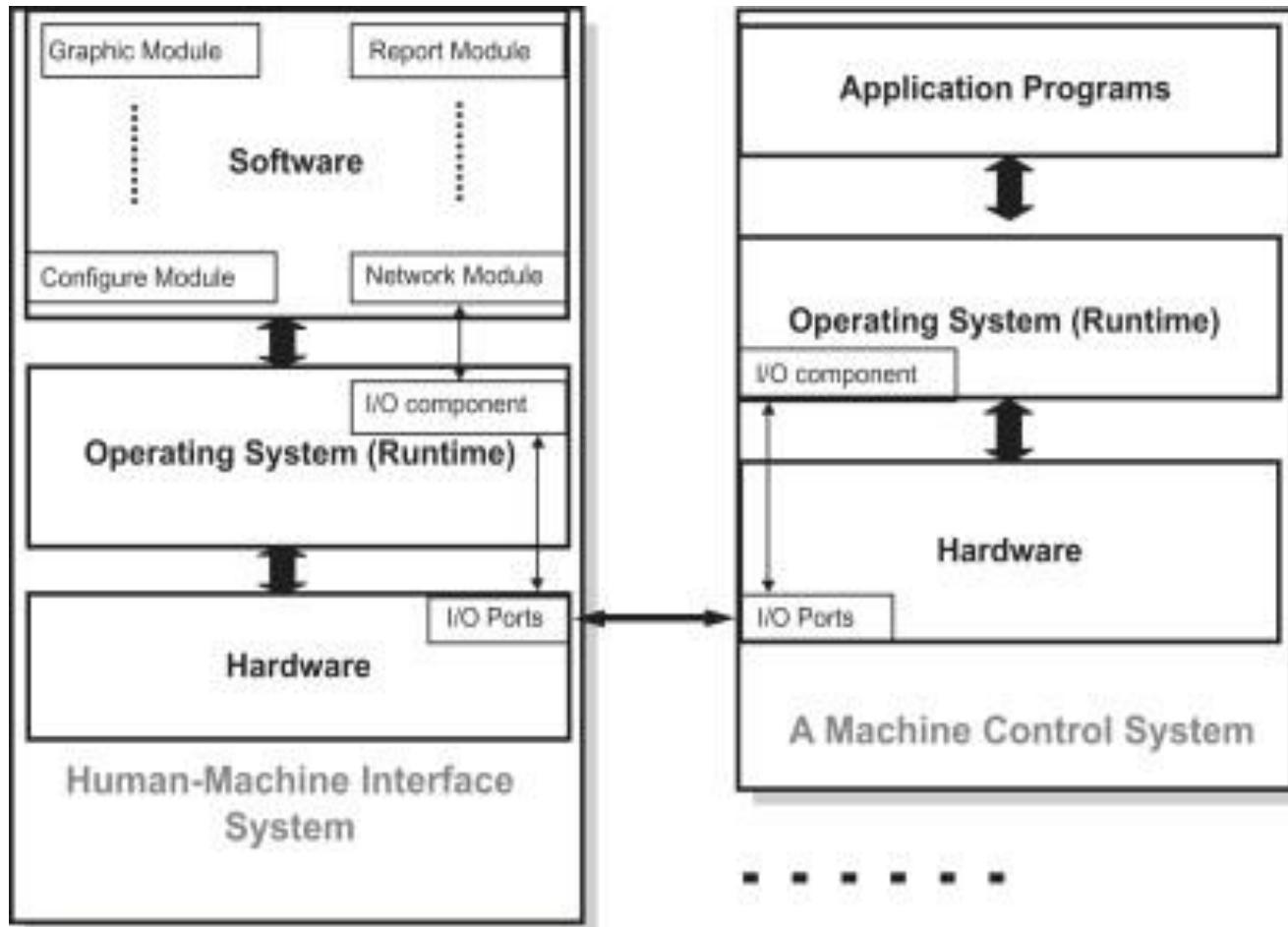


Figure: HMI for next generation model

Source: <https://images.app.goo.gl/Naf2q24BMHq5YGPKA>

# Technical advancements that will change the future of cognitive computing (1 of 2)



IBM ICE (Innovation Centre for Education)

- What the Future Will Look Like

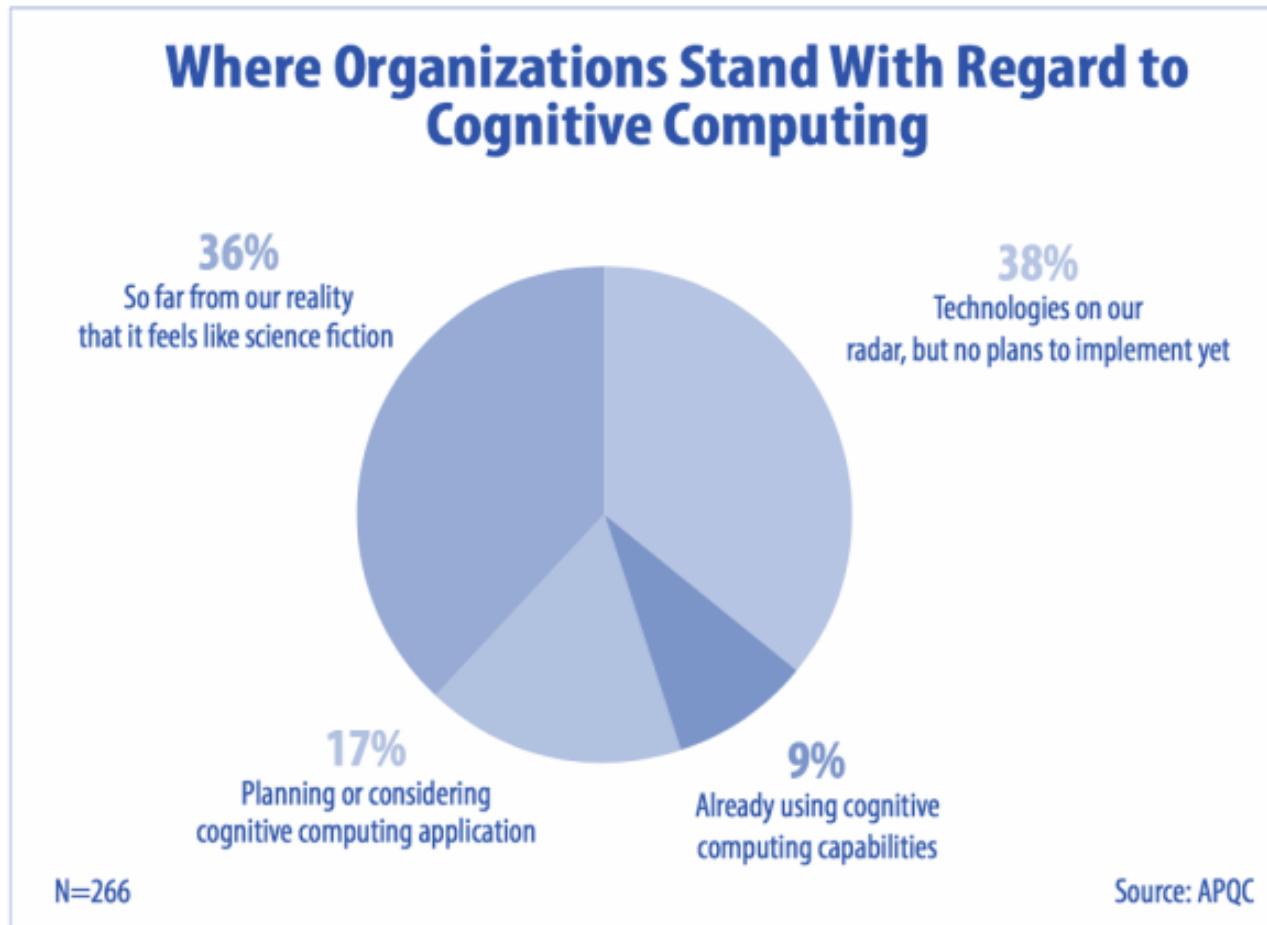
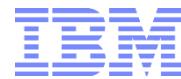


Figure: Organization with cognitive model

Source: <https://images.app.goo.gl/7q6h4zGdifgspo2r5>

# Technical advancements that will change the future of cognitive computing (2 of 2)



IBM ICE (Innovation Centre for Education)

- **The Next Five Years**

The Cognitive Era is not prediction of a future time period, it has already begun

"The numbers in the new AI field are staggering: more than 2,300 startups (a comprehensive list can be found here) have been founded; venture capitalists are investing billions of dollars."

[Forrester](#)

"IDC expects the overall market to grow significantly in the 2015–2019 forecast period, at a CAGR of approaching 35%." [IDC](#)

"Smart machines are not future fantasy; they are commercially available. According to Gartner's analysis of external sources, more than \$10 billion have already been purchased through more than 2,500 technology companies." [Gartner](#)

Frost & Sullivan: [Future Applications of Cognitive Intelligence](#)

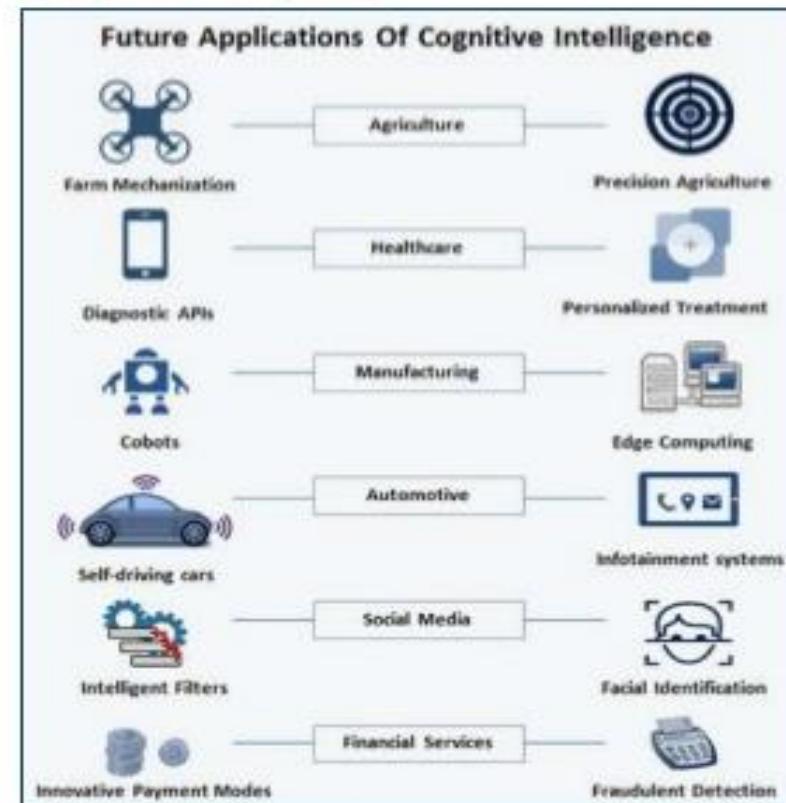
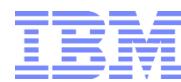


Figure: Cognitive future

Source: <https://images.app.goo.gl/kpeUcXqYeYhcveM27>

# Technical advancements that will change the future of cognitive computing (3 of 3)

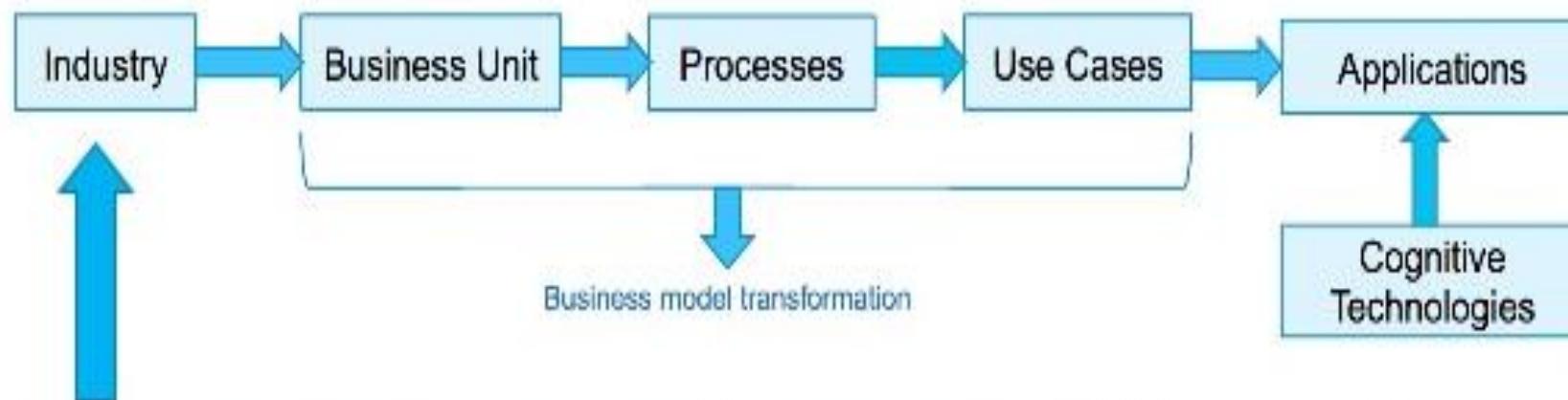


IBM ICE (Innovation Centre for Education)

- Looking at the Long Term

## Cognitive Patterns Emerging at Multiple Levels

Cognitive computing has matured enough for patterns to emerge in how they are being developed and applied



Cognitive technology will also lead to industry transformation, e.g. in healthcare

Figure: Cognitive pattern at multiple levels

Source: <https://images.app.goo.gl/9qAiKApaep6zmSHr6>



## Business solution innovations

are packages of platform technology that work together to enable new ways of understanding and engaging with customers across their life cycle.

- Customer analytics
- Digital experience solutions
- Customer-driven design
- Internet of Things

## Emerging technology is enabling innovation at the platform level:



### Interaction platforms innovations

enable firms to interact with customers, employees, and partners in natural, engaging, and constantly connected new ways.

- Next-generation connectivity
- Wearable technology
- Natural computer interfaces



### Digital delivery and aggregation platform innovations

enable firms to execute intelligent processes and deliver relevant insights by exploiting all the underlying data.

- Real-time data sourcing and delivery
- Advanced analytics
- Digital identity management
- Software acceleration platforms and tools



### Infrastructure and context platforms innovations

enable firms to manage all the processes and data needed to understand and exploit customer context and adapt to constantly changing markets and customer preferences.

- Advanced silicon devices
- Software-defined infrastructure
- Cloud integration
- Big data management

Figure: Emerging Innovations

# Deep QA and hypothesis generation (1 of 2)



IBM ICE (Innovation Centre for Education)

## DeepQA: the technology & architecture behind Watson

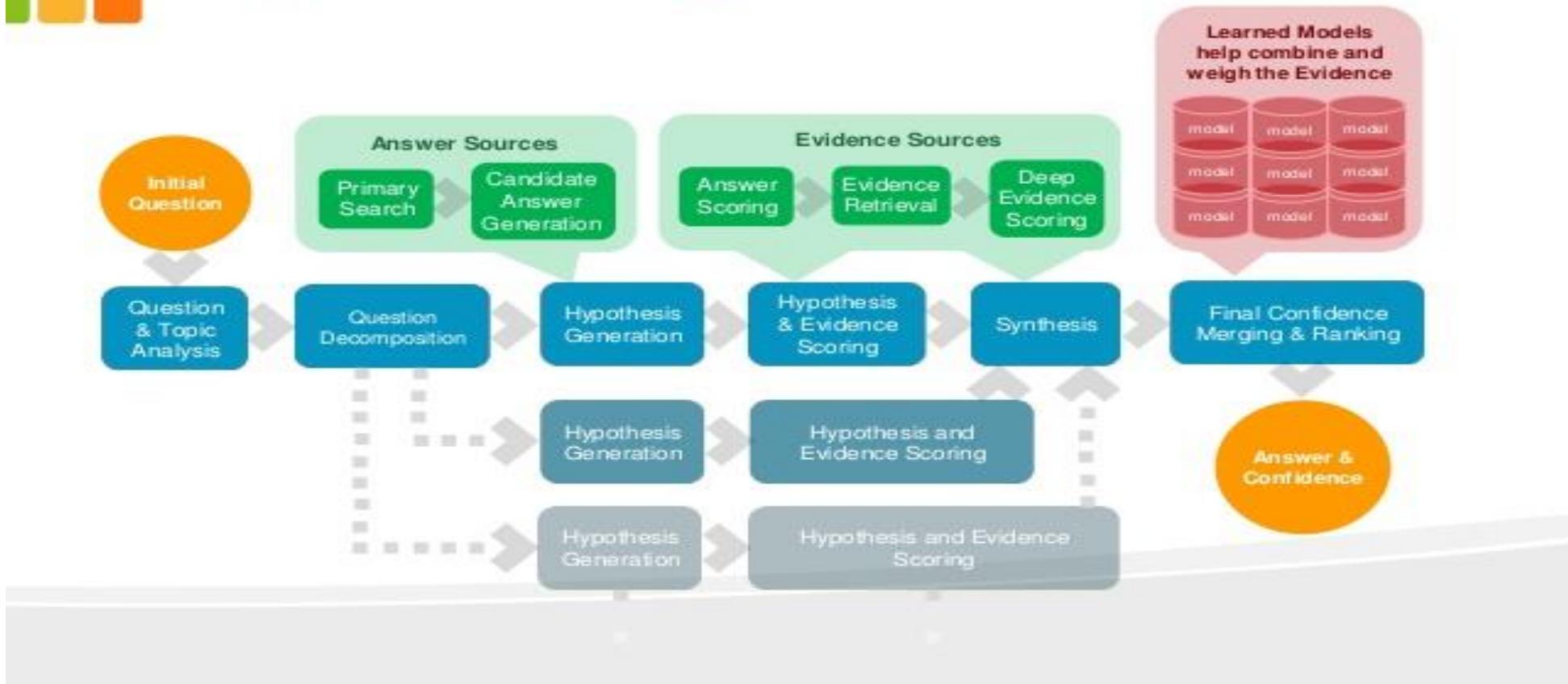


Figure: DeepQA Architecture

Source: <https://images.app.goo.gl/pgPk9szHyhNBCLjP6>

# Deep QA and hypothesis generation (2 of 2)



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Example	Experimental hypothesis: $H_1$	Null hypothesis: $H_0$
Music	The Beatles have sold more records than Michael Jackson.	The number of records sold by The Beatles and Michael Jackson will not be different.
Optometry (Correlational research)	The instance of dry eye is different in men and women.	There is no difference in the prevalence of dry eye in men and women.
Optometry (Experimental research)	Students with highly rated supervisors will have higher marks than students with lower rated supervisors.	No difference between the marks of students who had highly rated supervisors to those who had lowly rated supervisors.

Figure: Summery of  $H_1$  and  $H_0$  example

Source: <https://images.app.goo.gl/iekL2Tv5Nf2VjX7x6>

# Deep QA and hypothesis generation

## (3 of 3)



IBM ICE (Innovation Centre for Education)

- The doctor's hypotheses could have taken the following forms:
  - H1 “Childbed fever” is caused by “cosmic effects”.
  - H2 Overcrowding is the cause of “childbed fever”.
  - H3 Diet is the cause of “chitdbed fever”.
  - H4 the rough examination by the medical staff results in the onset of “childbed fever”.
  - H5 the dorsal delivery position results in the onset of “childbed fever”.
  - H6 Psychological effects (the priest) are the cause of “childbed fever”.
  - H7 Cadaverous material is the cause of “childbed fever”.

# Natural Language Process (NLP)

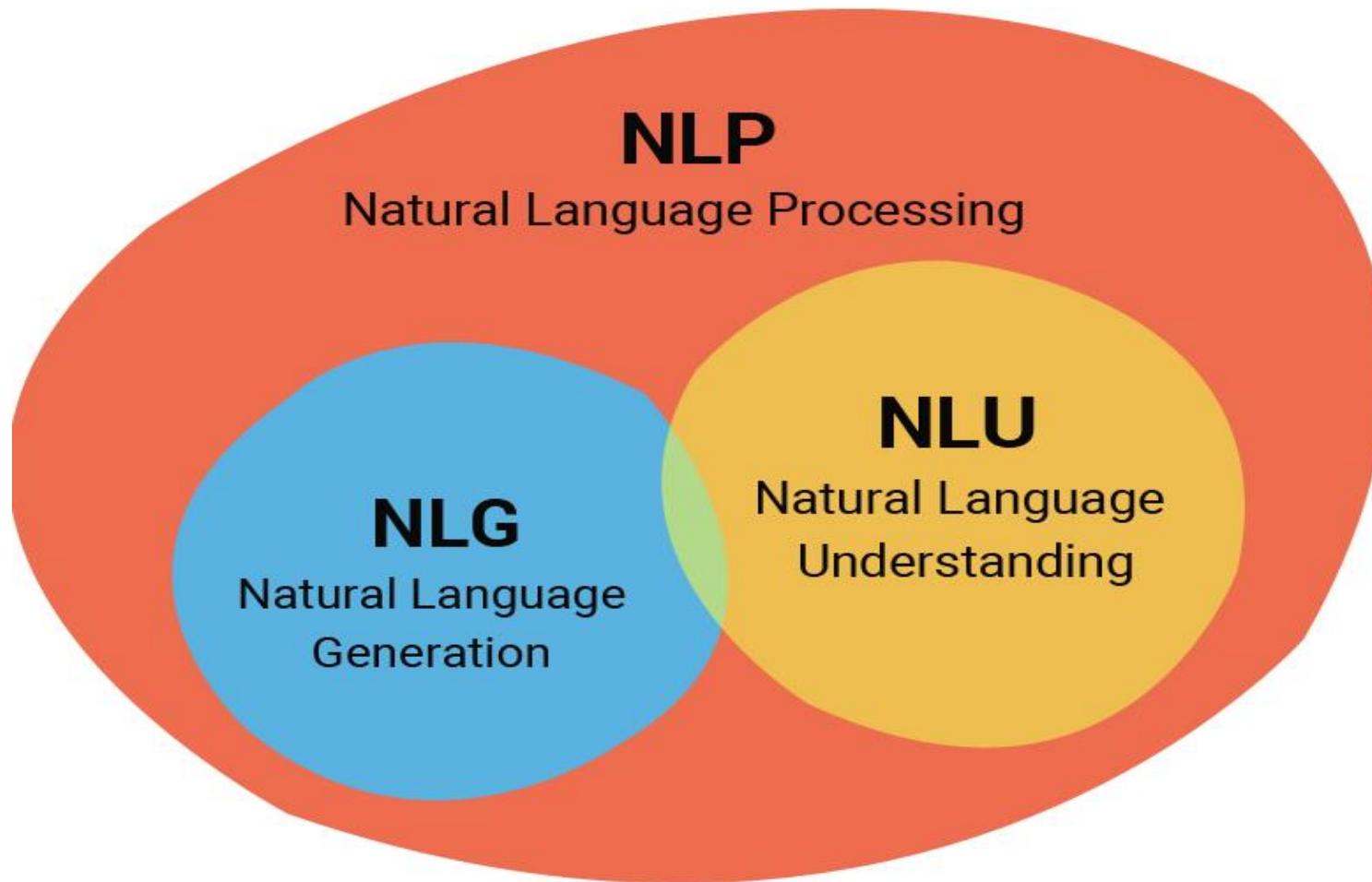


Figure: NLP, NLG and NLU

Source: <https://images.app.goo.gl/N8EwoKfzngbjjwK48>

# Cognitive training tools

Some of the Best Cognitive Computing Tools:

- SparkPredict by SparkCognition.
- ignio™ Cheetah by TCS.
- Iris by Apixio.
- AlphaGo by Google.
- Aila by Enterra Solutions.
- Cortex Certifai by CognitiveScale.
- IBM Watson.

# Data integration and representation

- Data pre-processing.
- Data cleaning: Fill in missing values, smooth noisy data, identify or remove outliers, and resolve inconsistencies.
- Data integration: Integration of multiple databases, data cubes, or files.
- Data transformation: Normalization and aggregation.
- Data reduction: Obtains reduced representation in volume but produces the same or similar analytical results.
- Data discretization: Part of data reduction but with importance, especially for numerical data

# Emerging hardware architectures (1 of 2)

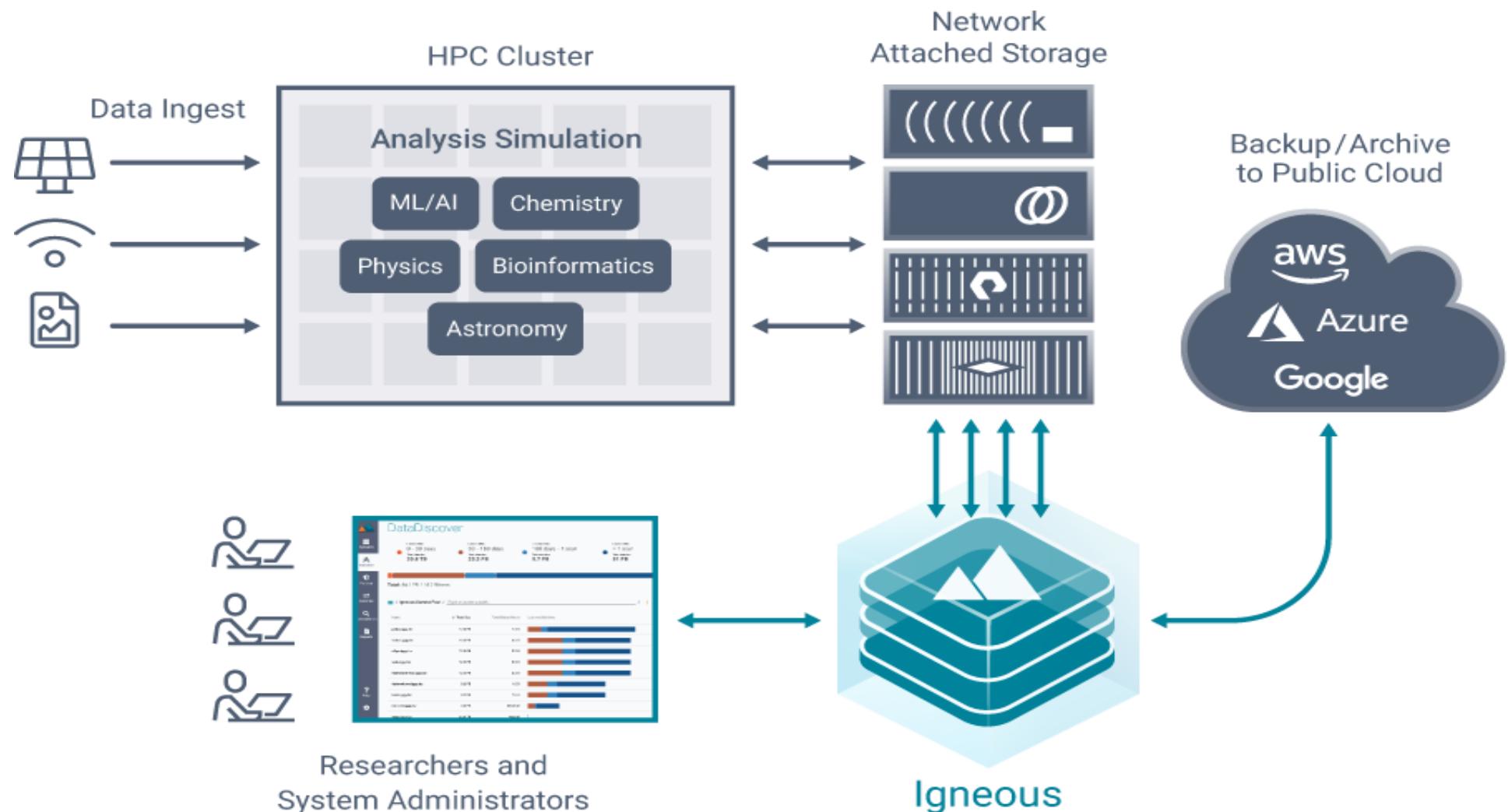


Figure: High Performance Computing

Source: <https://images.app.goo.gl/feDMJa9CFcmNr1qd8>

# Emerging hardware architectures (2 of 2)

- Neurosynaptic Architectures

	Conventional Computer	Brain Inspired Computer
Architecture	<b>Von Neumann</b>	<b>Neural Network</b>
Computing unit	CPU	Synaptic Chip (e.g. TrueNorth)
Storing unit	Memory	Synaptic Chip (e.g. TrueNorth)
Computing	Serial (multiple cores)	Massively Parallel
Communication	CPU <-> Memory	Neurons <-> Neurons
Advantage	Processing (Logical, Analytical)	Learning (Pattern Recognition)

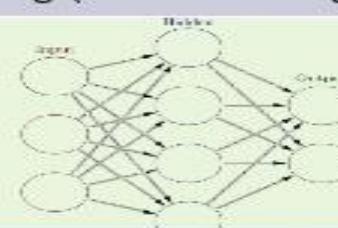
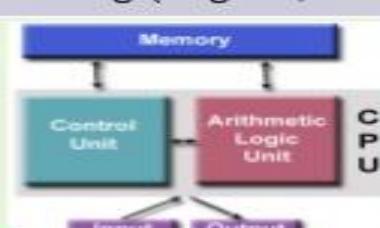


Figure: Comparison with conventional chips Architecture

Source: <https://images.app.goo.gl/JBbwUMK18M4kv8FK9>

# Emerging hardware architectures (3 of 3)

- Quantum Architectures

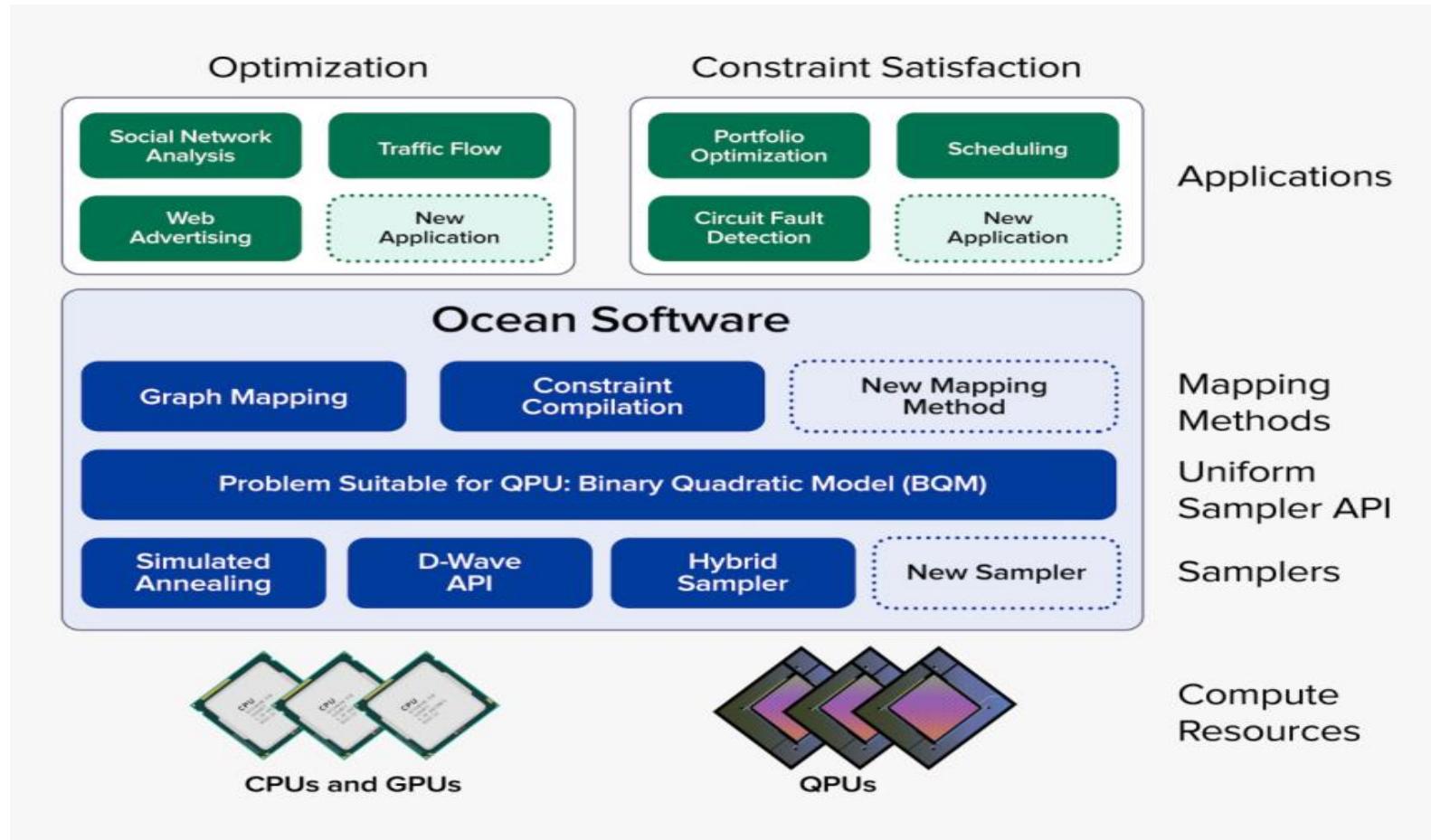


Figure: Quantum Architectures

Source: <https://images.app.goo.gl/mysDygWA2sv5ofRr7>

# Alternative models for natural cognitive models



IBM ICE (Innovation Centre for Education)

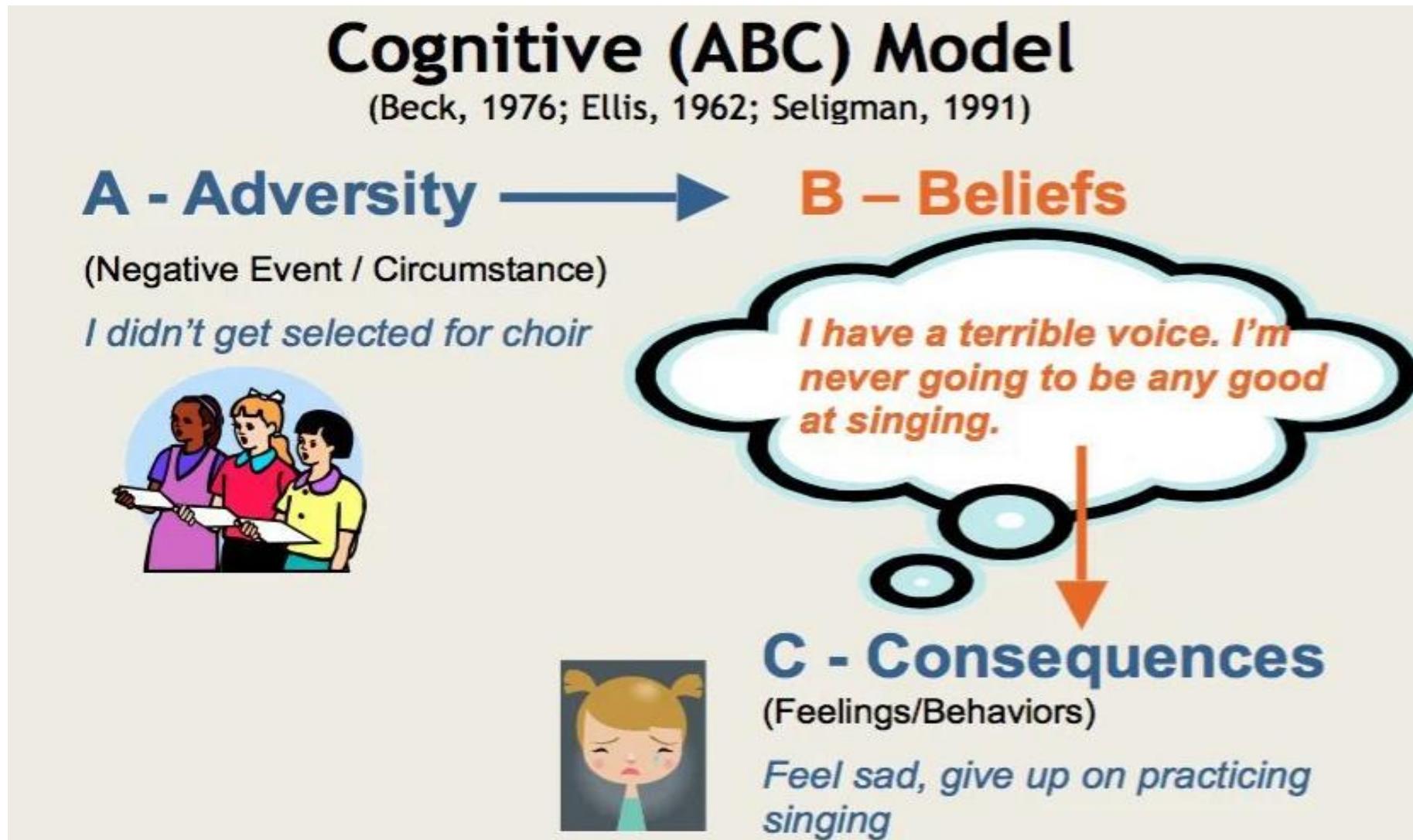


Figure: Alternative model for cognitive computing

Source: <https://images.app.goo.gl/E6oKFXC9byHrRo9i9>

# Self evaluation: Exercise 24

- To continue with the training, after learning the various steps involved in cognitive analytics and Watson machine learning, it is instructed to utilize the concepts of cognitive machine learning algorithms to perform the following activity.
- You are instructed to write the following activities using Python code.
- Exercise 24: Natural Language Processing

# Cognitive computing business approach with IBM Watson (1 of 2)



IBM ICE (Innovation Centre for Education)

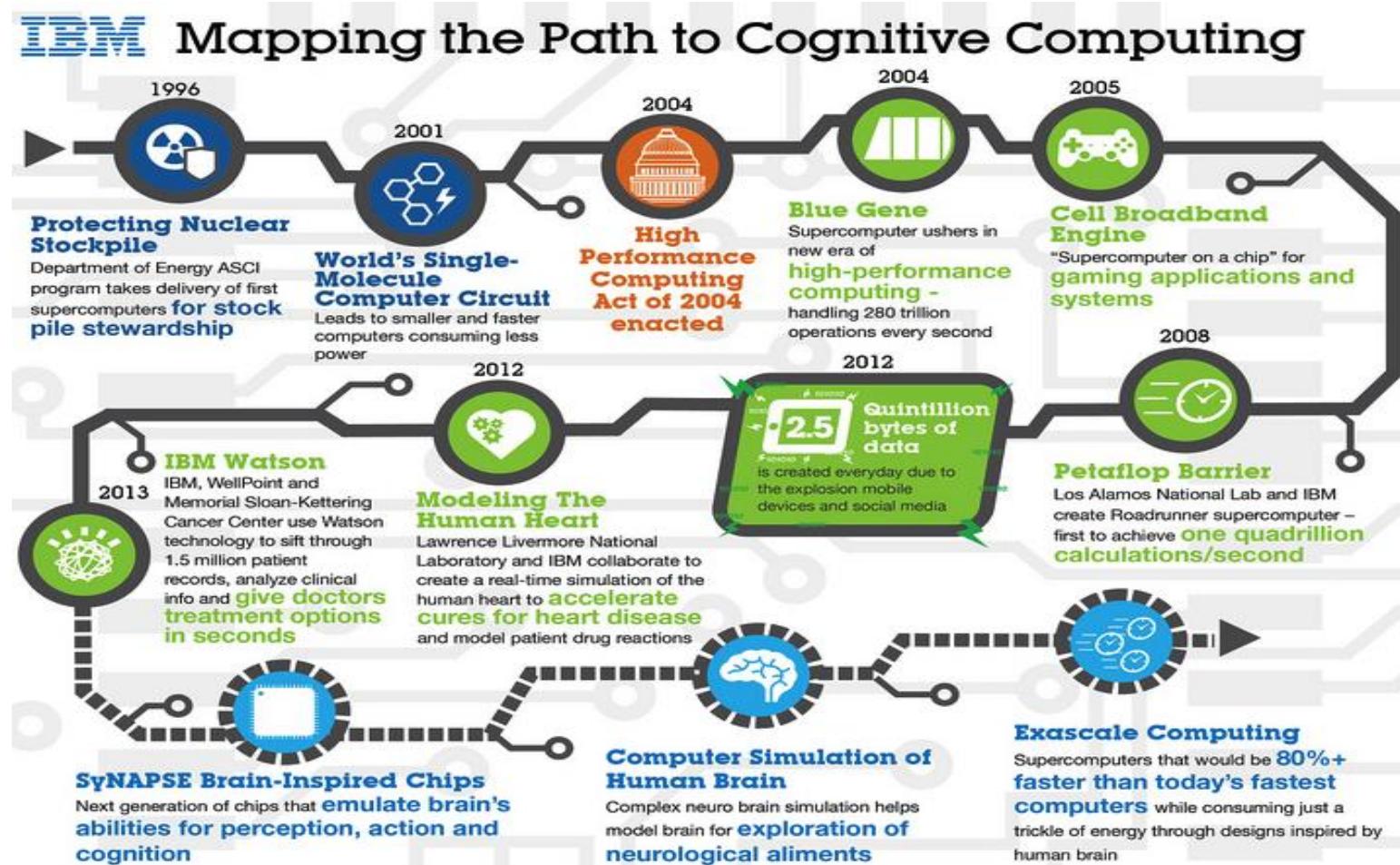


Figure: IBM Watson with cognitive computing

Source: <https://images.app.goo.gl/s066p7ycfJd4iyP47>

# Cognitive computing business approach with IBM Watson (2 of 2)



IBM ICE (Innovation Centre for Education)

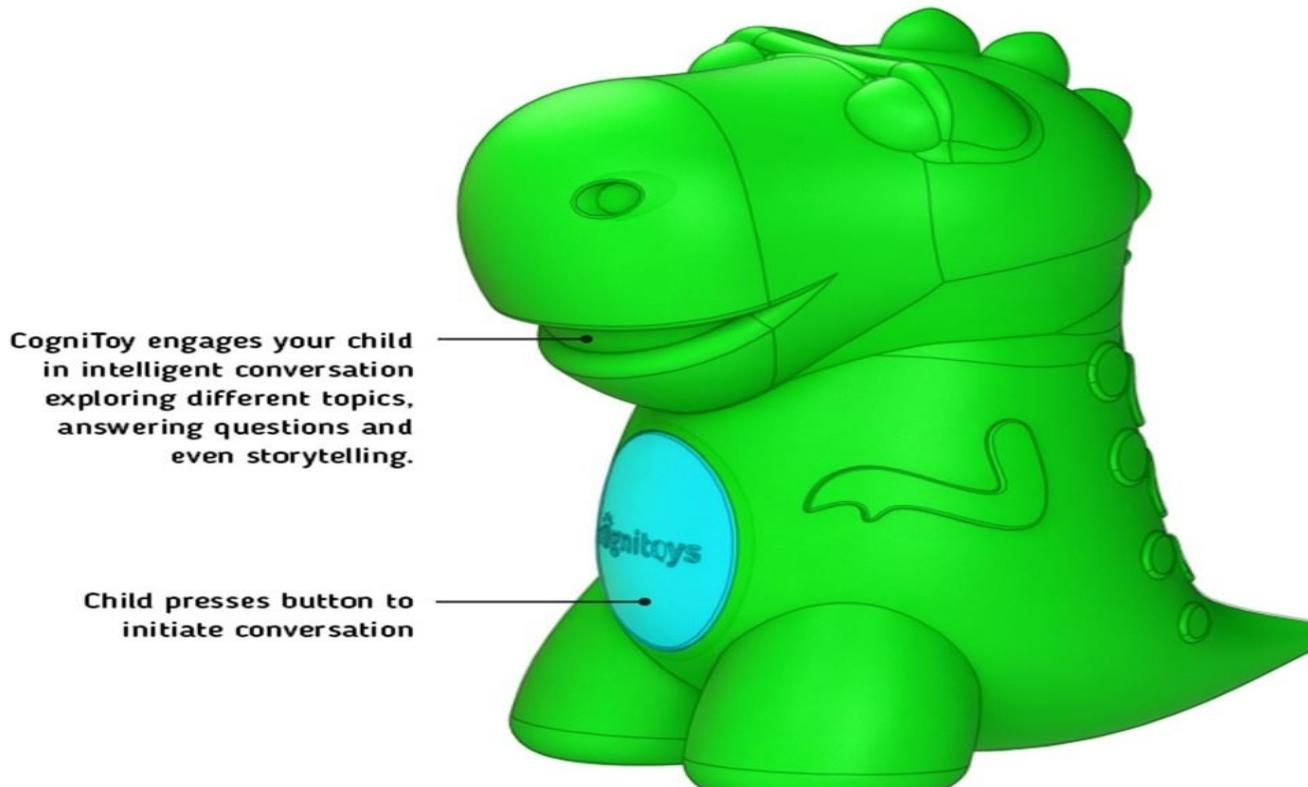


Figure: CogniToy

Source: <https://images.app.goo.gl/riMS8CPezXbDBznf9>

# A new cognitive era for business applications with Watson (1 of 2)



IBM ICE (Innovation Centre for Education)

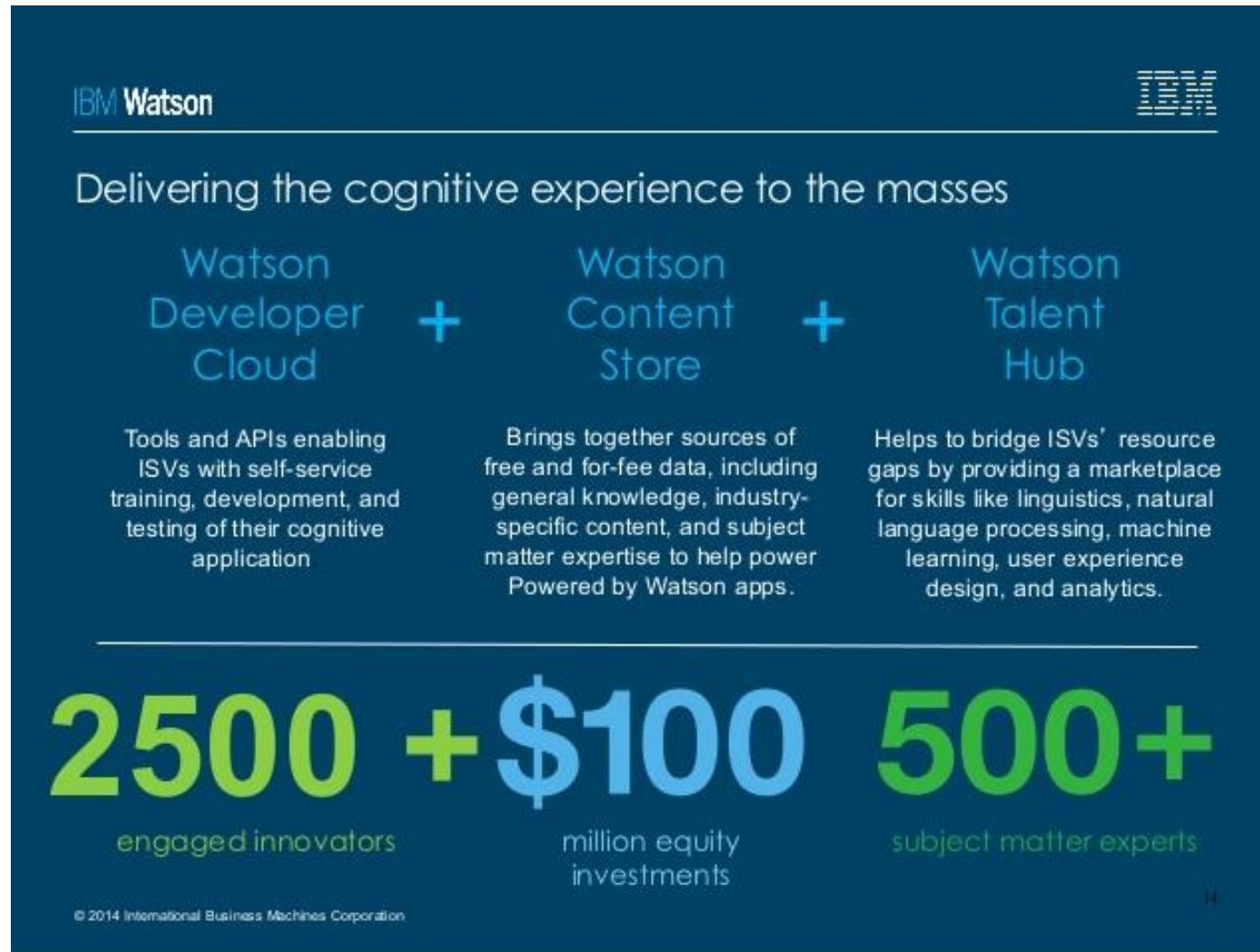


Figure: Cognitive era with watson

Source: <https://images.app.goo.gl/sCuf3dgLyqDp9uae6>

# A new cognitive era for business applications with Watson (2 of 2)



IBM ICE (Innovation Centre for Education)

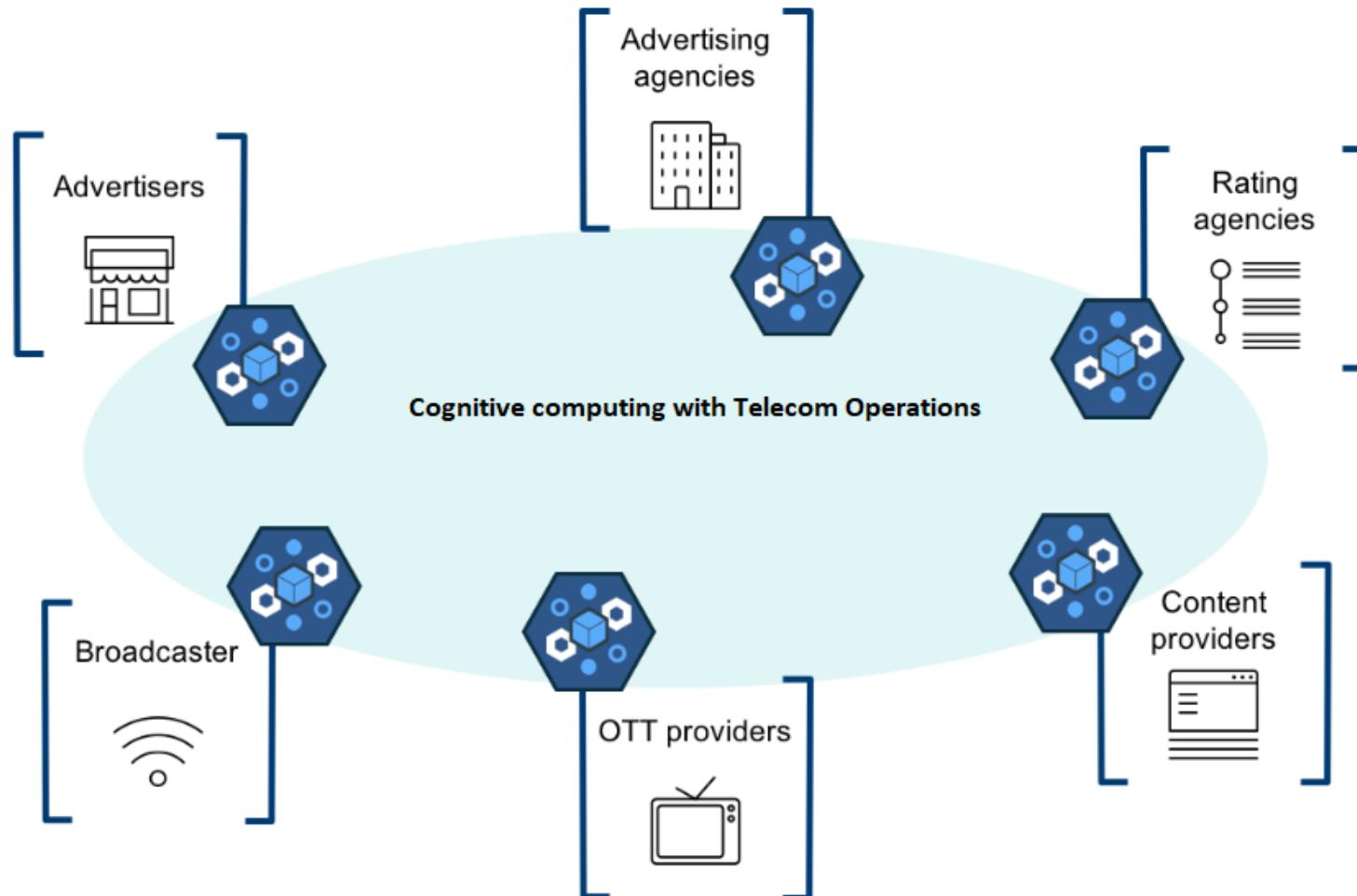


Figure: Cognitive in Telecom

# A new cognitive era for business applications with Watson (3 of 3)



IBM ICE (Innovation Centre for Education)

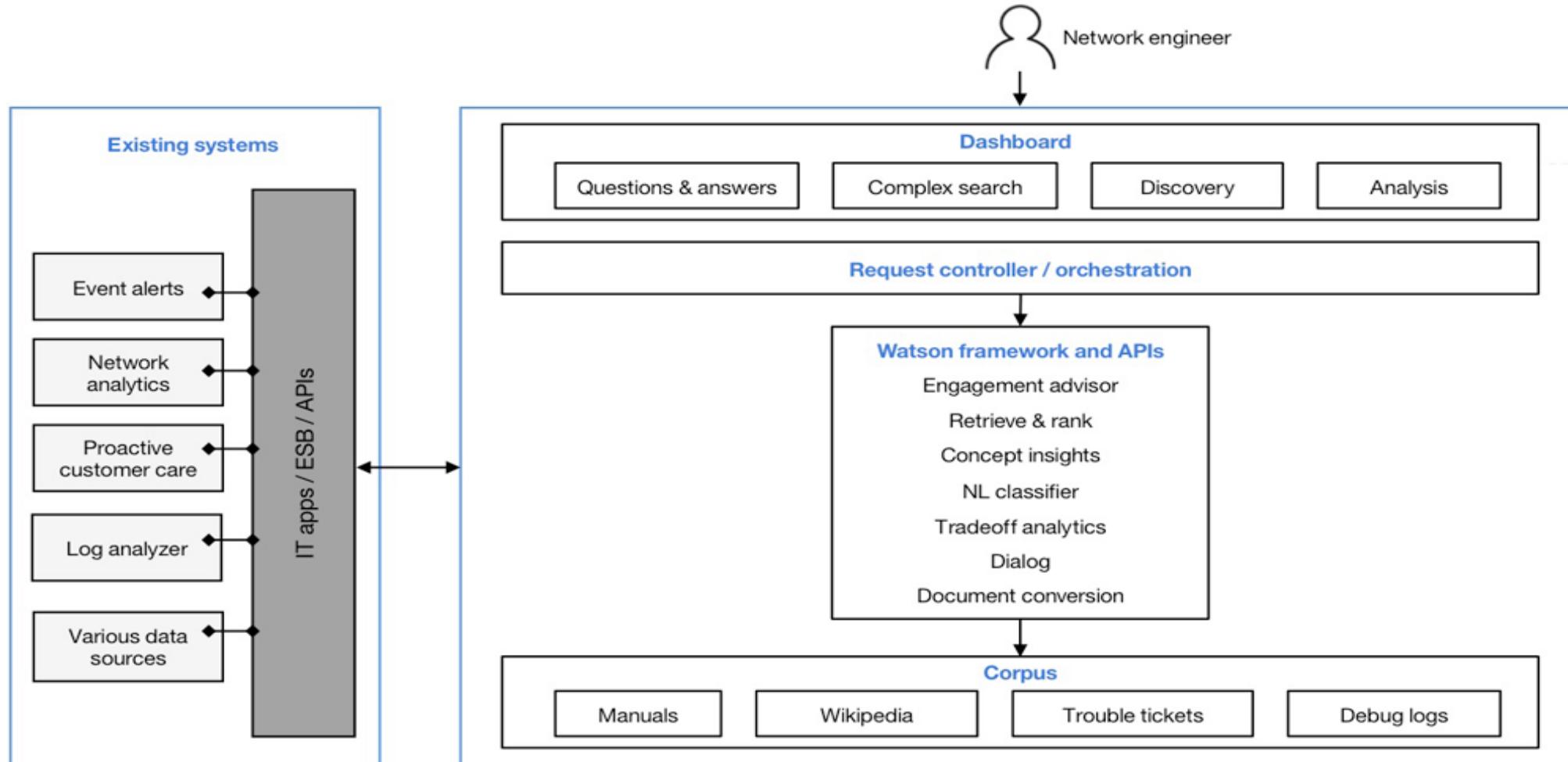
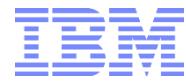


Figure: API and Framework

Source: <https://images.app.goo.gl/LZaGHCbwKuSkh56A>

# Example: Self-service agent-device doctor (1 of 2)



IBM ICE (Innovation Centre for Education)

The screenshot shows a user interface for 'Cognitive Customer Experience Management'. On the left is a dark sidebar with various menu items: Dashboard, Services, View Bill, Orders, Tickets, Ask Watson (which is highlighted in blue), Offers, and Make Payment. The main area is titled 'Conversation' and displays a chat log. The log starts with a greeting from the system: 'Hello Josh! Thanks for being a valued customer at MobileBusiness Inc. for 2 years.' followed by 'I am the Device Doctor, how can I assist you?'. A user message 'I want to update my ios' is shown in a light blue bubble. The system responds with 'I see you have 2 devices on your account.' and asks 'Just to make sure, which device are we currently talking about?'. The user replies 'iPhone5s'. The system then advises 'Before we begin with the update, I recommend that you backup your device:' and the user replies 'My device needs to be backed up'. Finally, the system prompts 'Please select one of the following methods to backup your iphone:' and the user is given two options: 'iTunes' and 'iCloud'.

Figure: Watson Customer Experience

Source: <http://www.redbooks.ibm.com/ sg248387>

# Example: Self-service agent-device doctor (2 of 2)



IBM ICE (Innovation Centre for Education)

The screenshot shows a dark-themed dashboard titled "Cognitive Customer Experience Management". On the left sidebar, there are several menu items: Dashboard, Services, View Bill, Orders, Tickets, Ask Watson (highlighted in blue), Offers, and Make Payment. The main area is titled "Conversation". It displays a message from the system: "You currently have iOS 8 installed on your iPhone5s. Your device is eligible to install iOS 9. Do you wish to proceed?". A large green button labeled "Yes" is visible. Below this, instructions say: "If a message says that an update is available, tap Install Now. You can also follow these steps: 1. Plug your device in to power and connect to the Internet with Wi-Fi. 2. Tap Settings --> General --> Software Update. 3. Tap Download and Install. If a message asks to temporarily remove apps because iOS needs more space for the update, tap Continue or Cancel. Later, iOS will reinstall apps that it removed. If you tap Cancel, learn what to do next. 4. To update now, tap Install. Or you can tap Later and choose Install Tonight or Remind Me Later. If you tap Install Tonight, just plug your iOS device in to power before you go to sleep. Overnight, your device will update automatically. 5. If asked, enter your passcode." Another "Yes" button is shown. At the bottom, the system asks: "So Josh, do you need to troubleshoot anything else?". A footer at the bottom of the main area says: "Please select an option: Yes No".

Figure: Cognitive customer experience management dashboard  
Source: <http://www.redbooks.ibm.com/ sg248387>

# Example: Network operations (1 of 2)

The screenshot shows a web-based interface for network operations. At the top, there's a search bar with the question "How can I verify if BGP peers are up?" and a large blue "Ask" button. Below the search bar is a navigation menu with tabs: Conversation, Documents (selected), Logs, Tickets, and Images. On the right side, there are two main sections: "BGP Context Information" and "Cognitive Graph".

**BGP Context Information:**

- Local OS: openBGPD
- Remote OS: JUNOS
- Datasource: OMNIBUS

**Cognitive Graph:**

```
graph LR; A((BGP path attributes)) -- 0.99 --> B((BGP Peers)); B -- 0.96 --> C((Autonomous system)); B -- 0.059 --> D((Route updates))
```

The main content area contains several text snippets with confidence scores:

- You can use bgpctl tool to know the status of your AS: Get a peers summary: bgpctl show. Display information about a particular neighbor: bgpctl show neighbor [router].... confidence: 0.850
- To verify that BGP peers are up, use the show ip bgp neighbors EXEC command. Following is the output of this command on Router A: RouterA# show ip bgp neighbors BGP neighbor is 129.213.11. remote AS ... confidence: 0.174
- The following commands configure a BGP peer group named internalmap on Router C and apply it to the other routers in AS 300: !Router C router bgp 300 neighbor INTERNALMAP peer-group neighbor INTERNAL... confidence: 0.106
- The following commands configure a BGP peer group named internalmap on Router C and apply it to the other routers in AS 300: !Router C router bgp 300 neighbor INTERNALMAP peer-group neighbor INTERNAL... confidence: 0.059

A small note at the bottom left: A BGP peer group is a group of BGP neighbors that share the same update policies. Update policies are usually set by route maps.

Figure: Network Operations

Source: <http://www.redbooks.ibm.com/ sg248387>

# Example: Network operations (2 of 2)

The screenshot shows the IBM Watson interface with a blue mountain background. At the top, there's a search bar with a globe icon and the placeholder "Enter message for Watson", followed by a teal "Ask" button. Below the search bar is a navigation menu with five items: "Conversation", "Documents", "Logs", "Tickets" (which is highlighted in teal), and "Images". A large teal callout box titled "Related Tickets" contains the following information:

• VLP IZ825-CONTAINMENT FROM THE STANDARDBGP SESSION IS INCORRECT

- Document Information
  - Visibility:** Confidential
  - Status:** Closed
  - Severity:** 2-High
  - Priority:** 2-High
- Product Information
  - Product:** OpenBGPD
  - Platform:** OpenBSD
- Ticket body
  - Abstract:** CONTAINMENT FROM THE STANDARDBGP SESSION IS INCORRECT

Figure: Network Operations

Source: <http://www.redbooks.ibm.com/ sg248388>

# Example: Network operations (3 of 3)

I would like to choose the best option according to the following criteria:

AlertType,  maximize Count,  maximize RevenueImpact in \$,  maximize CustomersImpacted,  maximize VIPCust,  maximize Severity

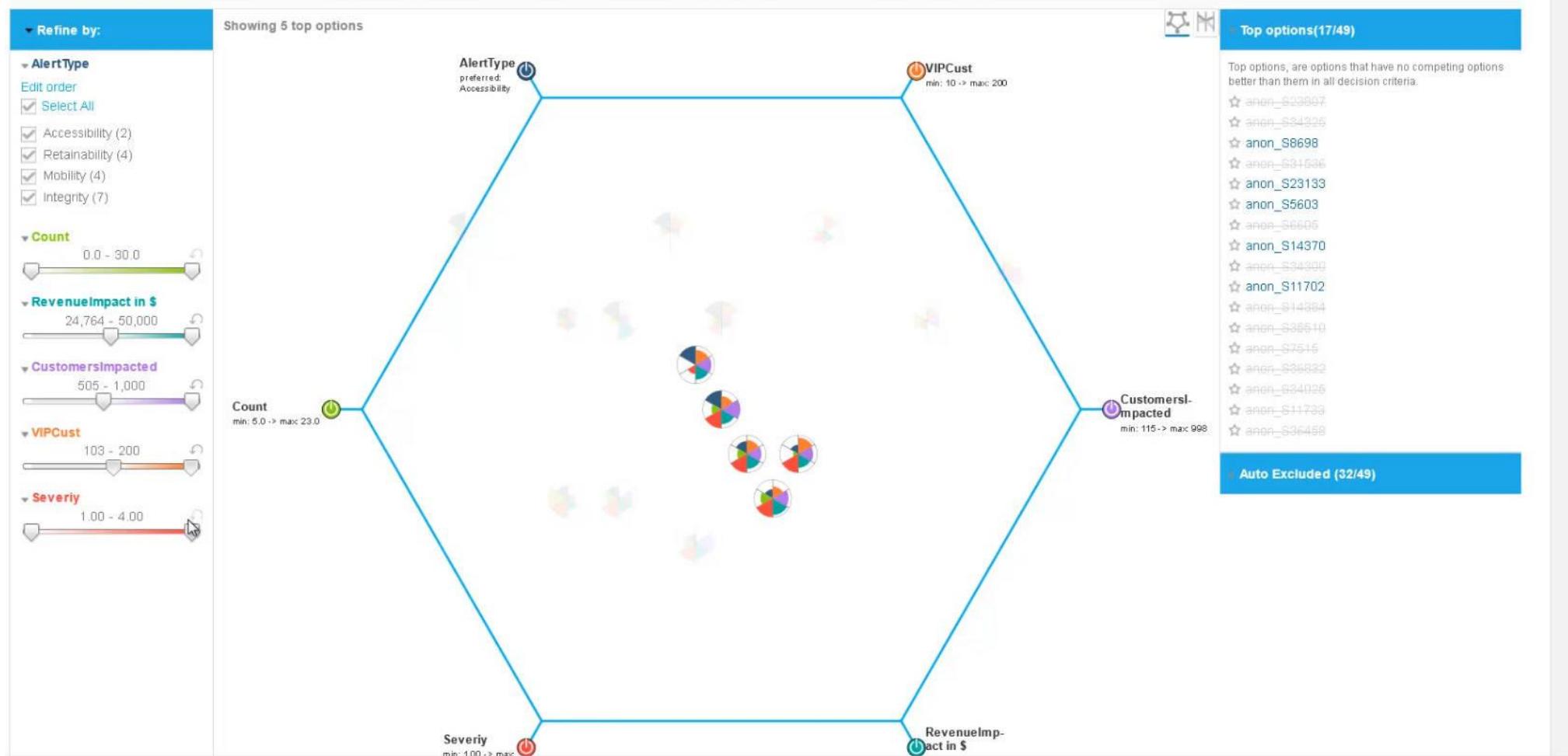


Figure: Network Operations for services

Source: <http://www.redbooks.ibm.com/> sg248387

# Example: Personalized TV (1 of 2)



## Annotations

### Out of the box recognition:

+ HEAD_AND_SHOUL	95%
+ FEMALE_ADULT	82%
+ PERSON	100%

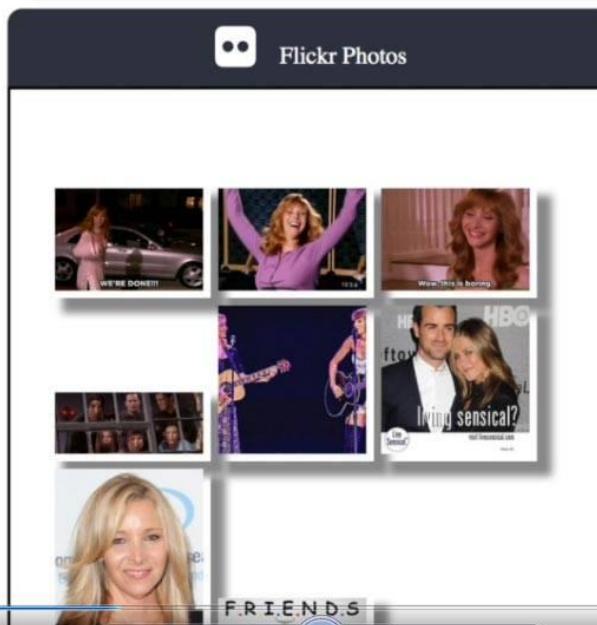
### Trained Visual Recognition addition:

+ TNT	98%
-------	-----

### Face Detection:

+ Number of People detected: 1	
✗ FEMALE	AGE (35-44)
+ Famous people detected:	

✗ LISA KUDROW 99%



Wikipedia

### Lisa Kudrow

Lisa Valerie Kudrow (/kuːdruː/; born July 30, 1963) is an American actress, comedian, writer and producer. She gained worldwide recognition for her ten-season run as Phoebe Buffay on the television sitcom Friends, for which she received many accolades, including an Emmy Award and two Screen Actors Guild Awards. She went on to produce, write and star in the 2005 HBO series The Comeback, which was revived nine years later and began airing its second season in November 2014. She also is currently starring in Web Therapy which is in its fourth season on Showtime. She was nominated for an Emmy Award ...

Last.fm

### Lisa Kudrow



Lisa V. Kudrow (born July 30, 1963) is an American actress, best known for her role as Phoebe Buffay in the popular television sitcom Friends. Throughout her career she has received many accolades for her work in

Figure: Personalized TV

Source: <http://www.redbooks.ibm.com/ sg248387>

# Example: Personalized TV (2 of 2)

- Actor 1: You created an account using my email account.
- Actor 1: This is not my accoun
- Actor 1: How can I delete this account?
- Actor 2: No. I did not.

# Chatbot: Conversation service for IBM Watson (1 of 2)



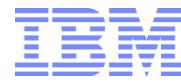
IBM ICE (Innovation Centre for Education)



Figure: Chatbot: Conversation service for IBM Watson

Source: <https://images.app.goo.gl/W1rNLpsJxhi6YBcp9>

# Chatbot: Conversation service for IBM Watson (2 of 2)



IBM ICE (Innovation Centre for Education)

## #INTENT

Represents the purpose of a user's input.

What the users want to achieve.

Active, a goal, an action, verbs.

In most cases, intents indicate the user stories or use case the user wants to perform.

Entities provide the context required to perform the user story or use case.

## @ENTITY

How the user's goal is to be achieved.  
Passive, qualifies the intents. Noun, things, objects, terms

Figure: Intent and entity definitions

Source: <http://www.redbooks.ibm.com/> sg248387

# Dialog node

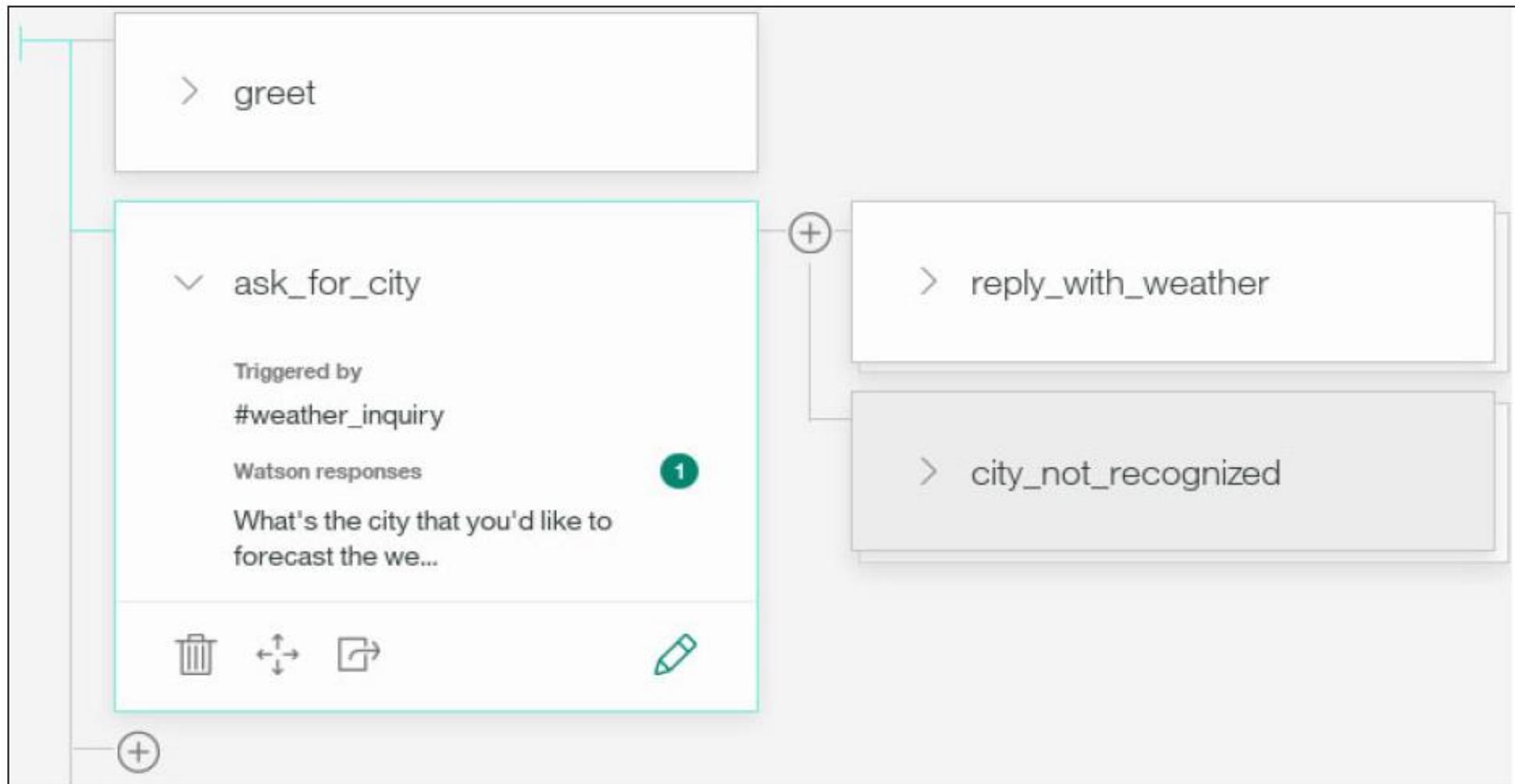
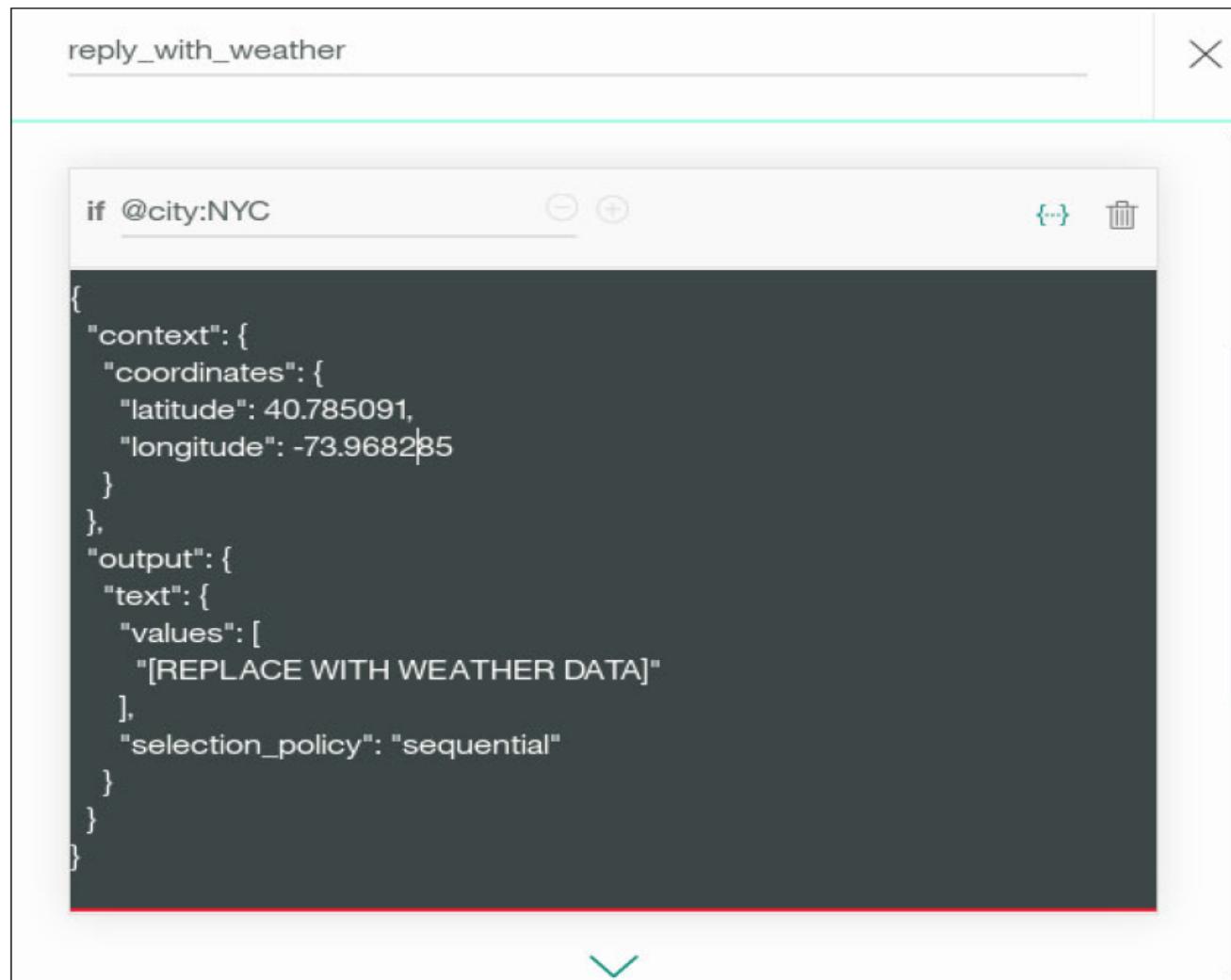


Figure: Example of dialog flow

Source: <http://www.redbooks.ibm.com/> sg248387

# Context



The screenshot shows a code editor window titled "reply\_with\_weather". The main content area contains the following JSON code:

```
if @city:NYC
{
  "context": {
    "coordinates": {
      "latitude": 40.785091,
      "longitude": -73.968285
    }
  },
  "output": {
    "text": {
      "values": [
        "[REPLACE WITH WEATHER DATA]"
      ],
      "selection_policy": "sequential"
    }
  }
}
```

The code is a conditional block that executes if the city is NYC. It sets coordinates for New York City and defines an output section with a single text value placeholder and a sequential selection policy.

Figure: setting the NYC coordinates

Source: <http://www.redbooks.ibm.com/ sg248387>

# Conversation turn

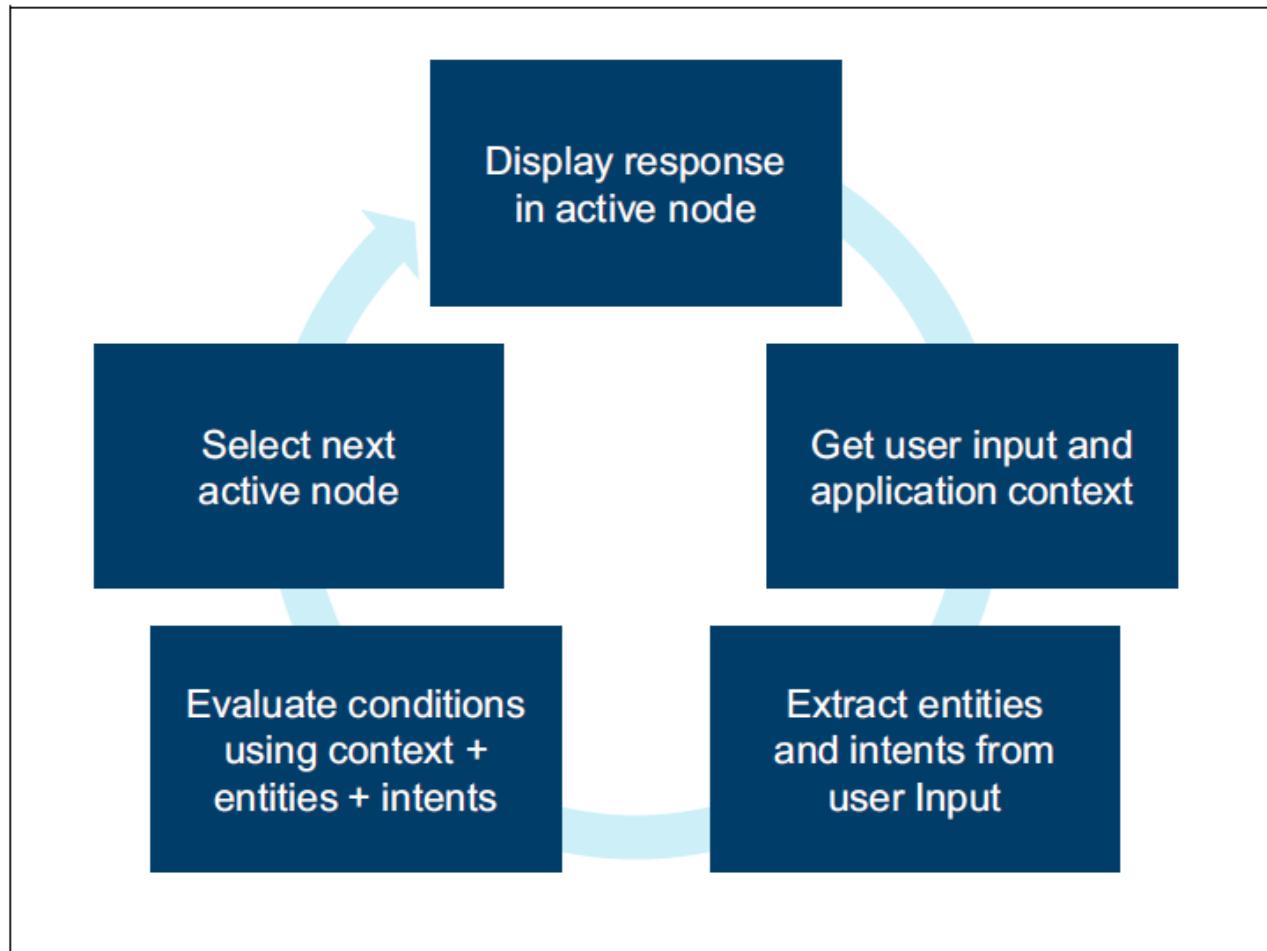


Figure: Conversation turn

Source: <http://www.redbooks.ibm.com/ sg248387>

# Typical conversation flow

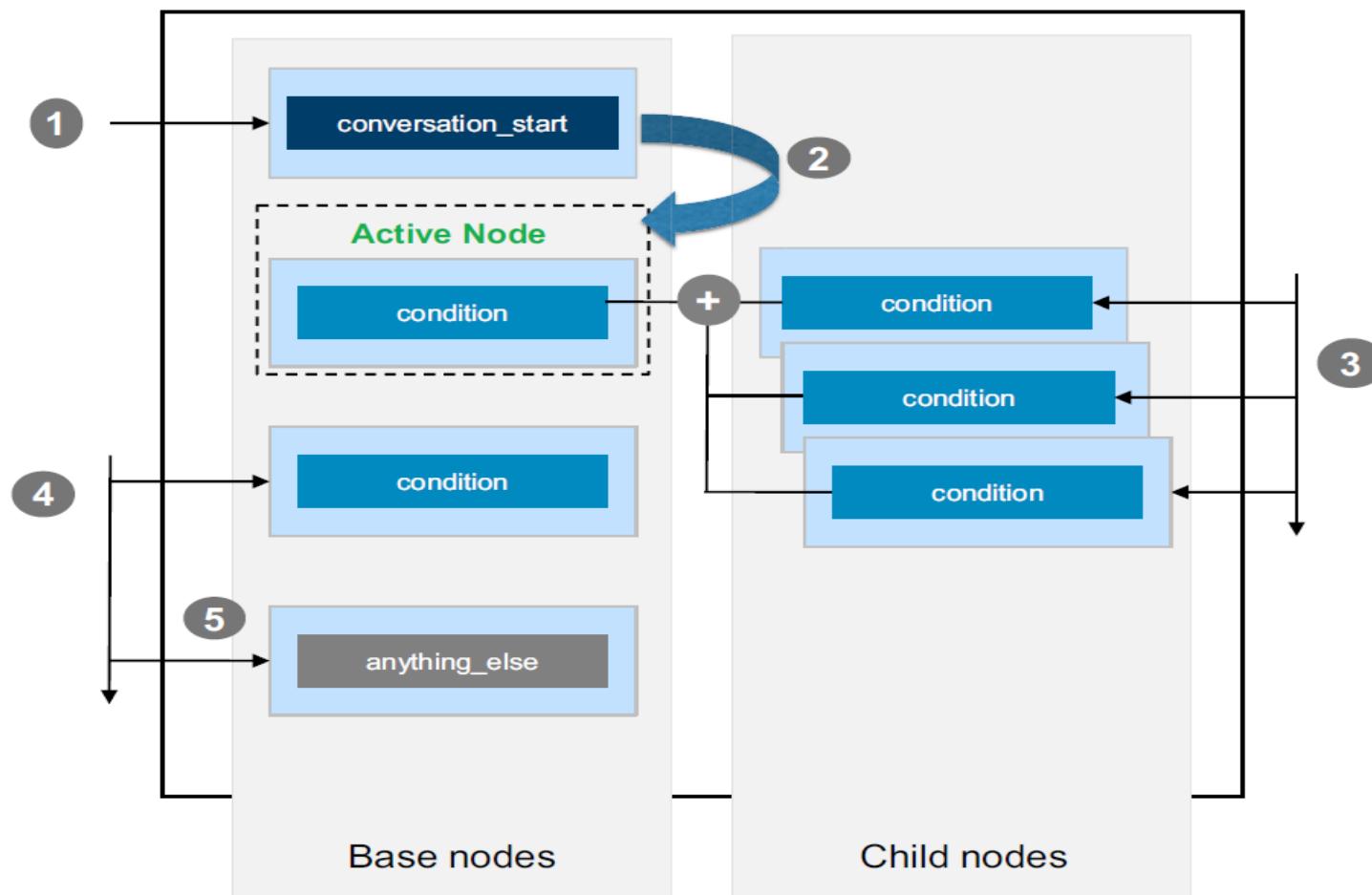


Figure: Next active node selection criteria

Source: <http://www.redbooks.ibm.com/ sg248387>

# Conversation service workspace (1 of 2)

The following stages include the use of the conversation service:

- Creating a Watson Conversation service instance
- Launching the Conversation tool
- Working with a workspace
- Adding intents
- Adding entities
- Building a dialog

# Conversation service workspace (2 of 2)

- The growing complexity in providing customer experience

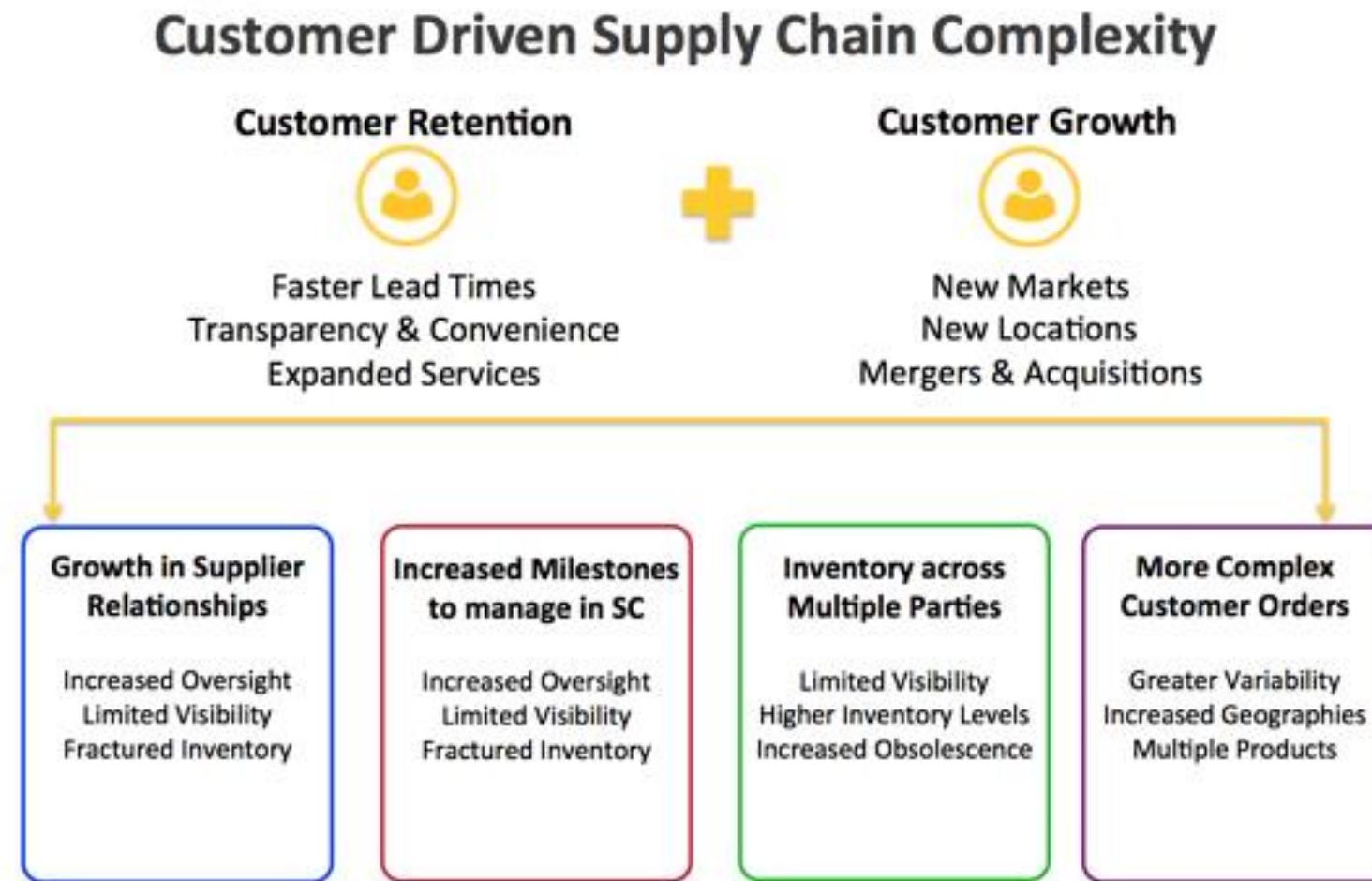


Figure: Customer SCM experience

Source: <https://images.app.goo.gl/b2NPi4hqCCvumbLY8>

# Conversation service workspace (3 of 3)

Areas of Deployment	Type of cognitive technology	Sample use cases
<b>Hyper relevant shopping journeys</b>	Using techniques like machine learning, natural language processing (NLP), speech recognition to enhance better experience and productivity	<ul style="list-style-type: none"><li>▪ Product recommendations in online shopping</li><li>▪ Personalized promotions</li><li>▪ Associates interacting with chatbots for checking product availability</li></ul>
<b>Insights driving hyper efficiency</b>	Cognitive techniques e.g.; computer vision and/or machine learning used in areas of scarce knowledge to get insights resulting in tremendous business value	<ul style="list-style-type: none"><li>▪ Labor utilization and optimization</li><li>▪ Optimal inventory determination to prevent stock outs</li><li>▪ "Share of shelf" insights for competing products</li><li>▪ Cognitive intelligence for energy efficiency</li></ul>

Figure: Cognitive computing in Retail

Source: <https://images.app.goo.gl/QMsdyzjuot9xwa6F9>

# Cognitive computing with IoT (1 of 2)

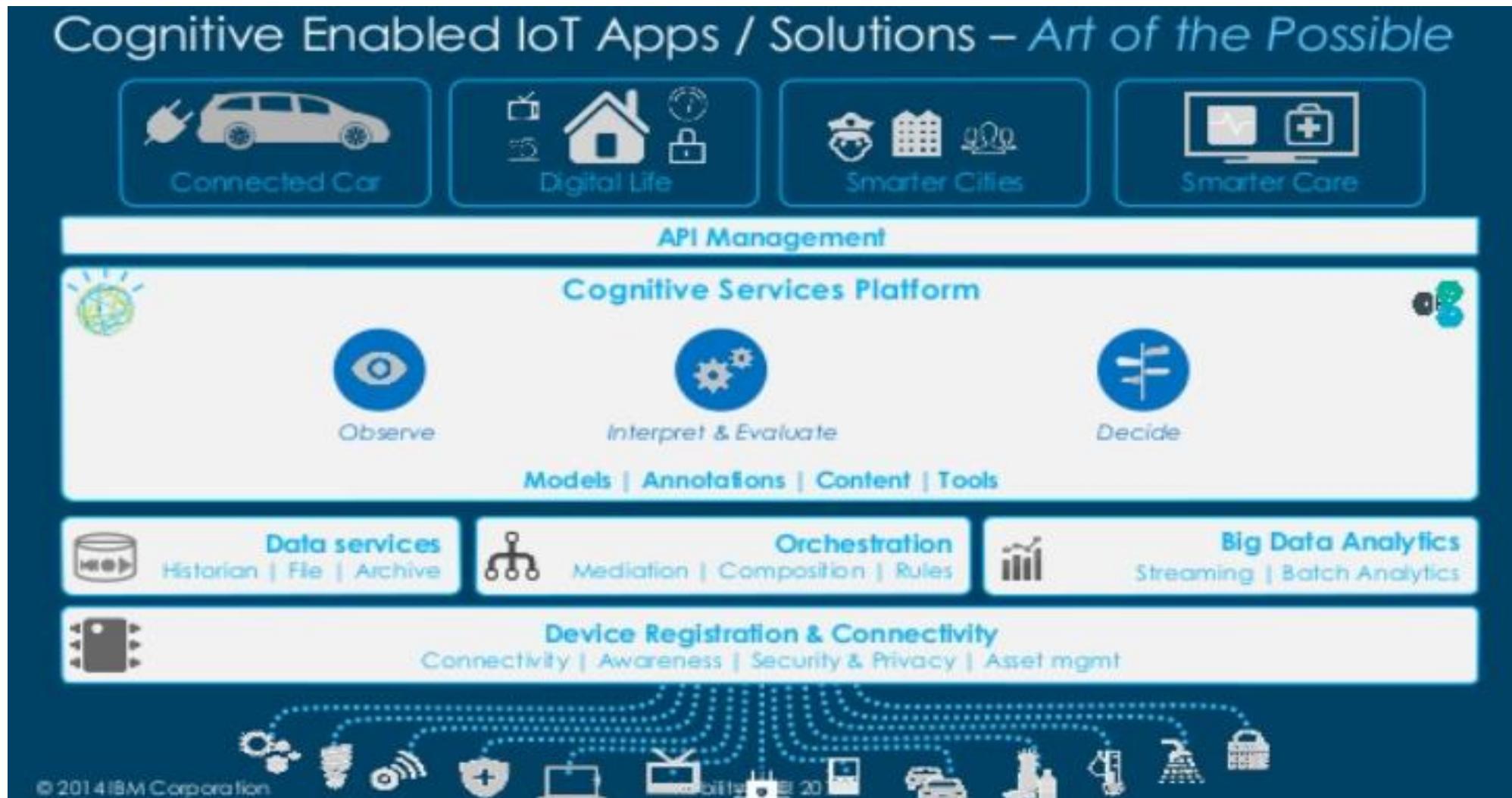


Figure: IOT Apps with cognitive computing  
Source: <https://images.app.goo.gl/QpNacxXC9ZW6aAyR7>

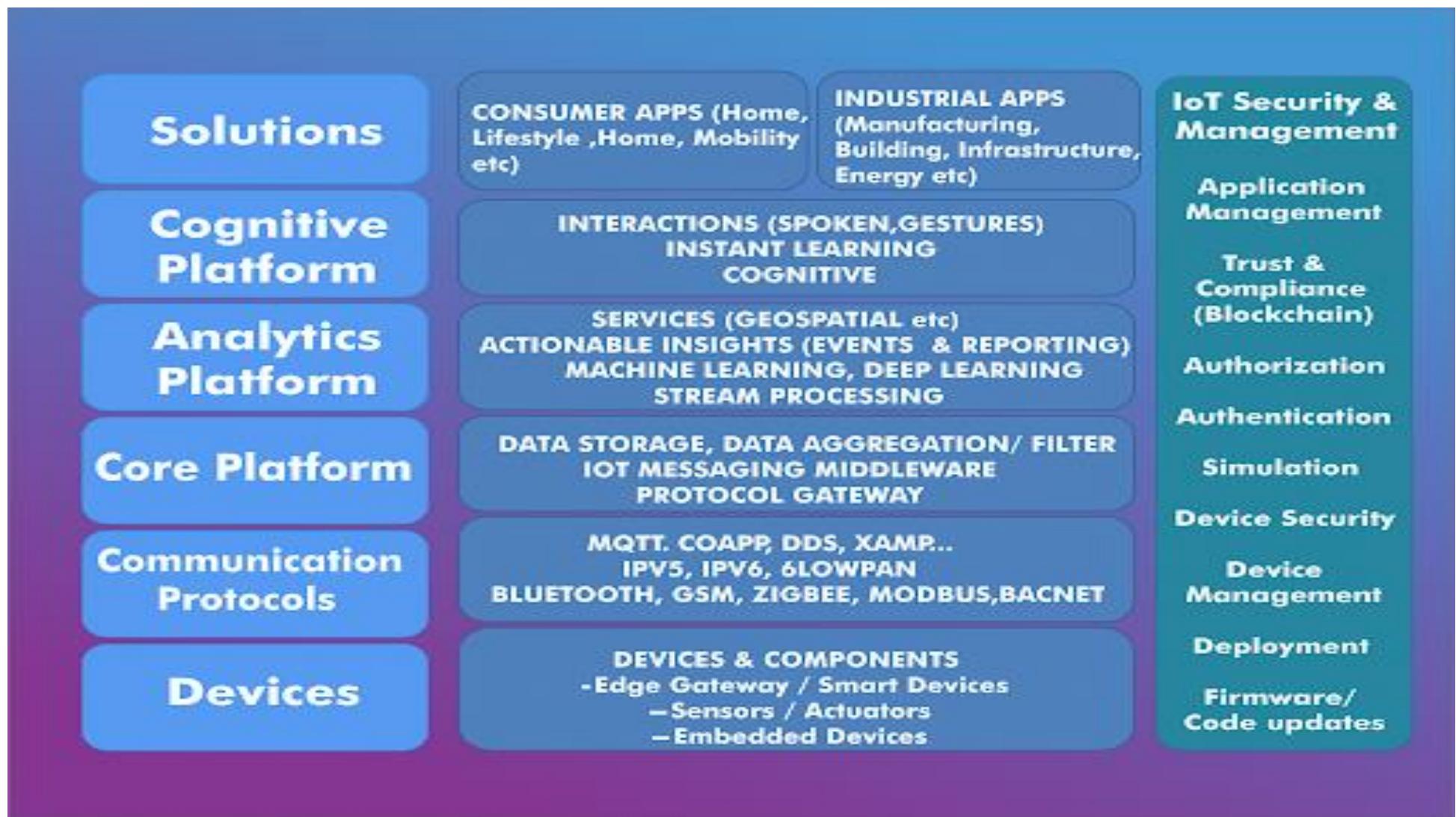


Figure: IOT core and Architecture

Source: <https://images.app.goo.gl/GANsWqeFoJDw5VbN8>

# Technologies driving cognitive manufacturing (1 of 2)



IBM ICE (Innovation Centre for Education)

## The Internet of Things

From connecting devices to human value

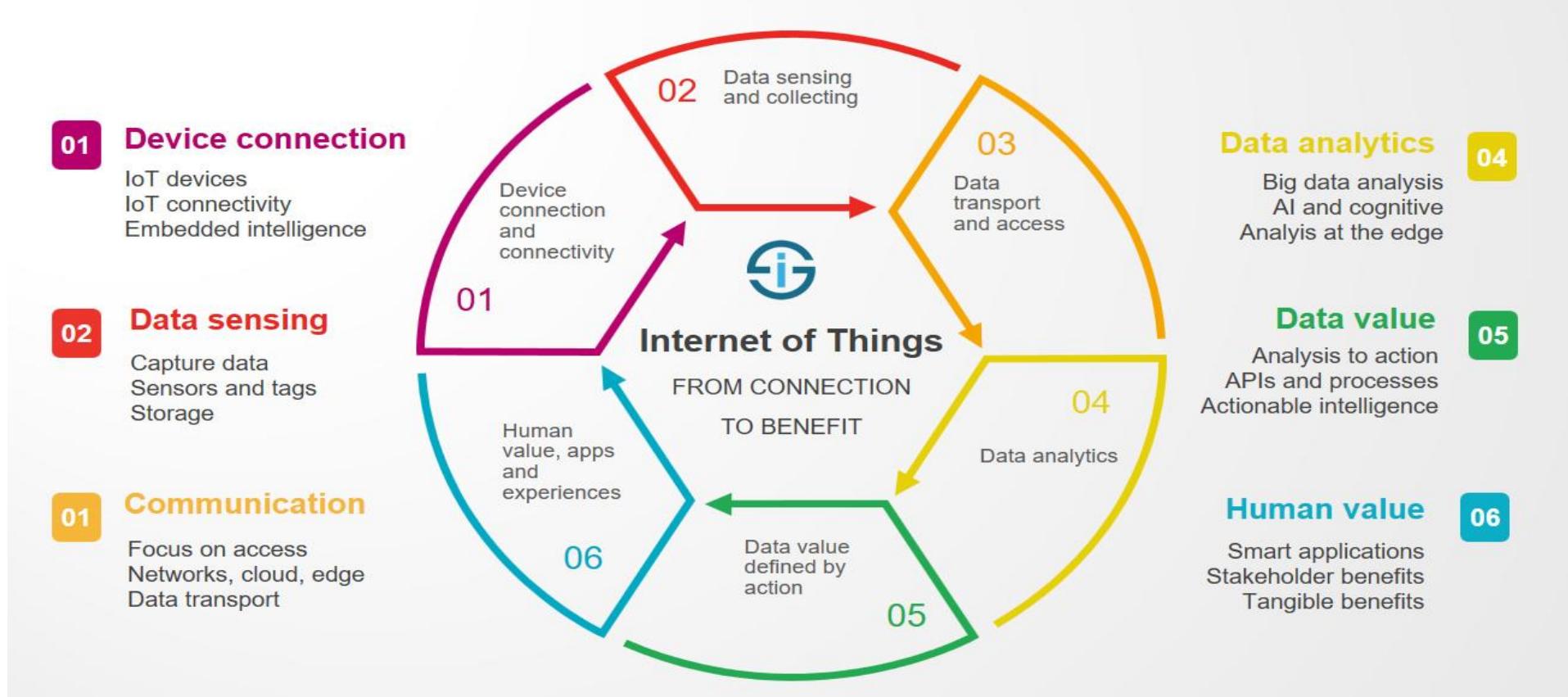


Figure: IOT Overview

Source: <https://images.app.goo.gl/hn2LVPJq85NBpj2c6>

# Technologies driving cognitive manufacturing (2 of 2)



IBM ICE (Innovation Centre for Education)

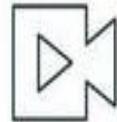
<h3>Natural Language Processing</h3>  <p>Enables interaction through natural human language and dialog E.g: Jefferson Hospital, Local Motors</p>	<h3>Machine Learning</h3>  <p>Automates data processing and continuously monitors new data to learn and improve results E.g: US Cycling, KONE</p>
<h3>Text Analytics</h3>  <p>Enables mining of textual sources to find correlations and patterns in these vast amounts of untapped data E.g: HONDA</p>	<h3>Video/Image Analytics</h3>  <p>Enables monitoring of unstructured data from video feeds and image snapshots to identify scenes and patterns E.g: Aerialtronics</p>

Figure: IOT with cognitive analytics

Source: <https://images.app.goo.gl/4x9h9gnxwuAZdLKE9>

# Cognitive Industry 4.0

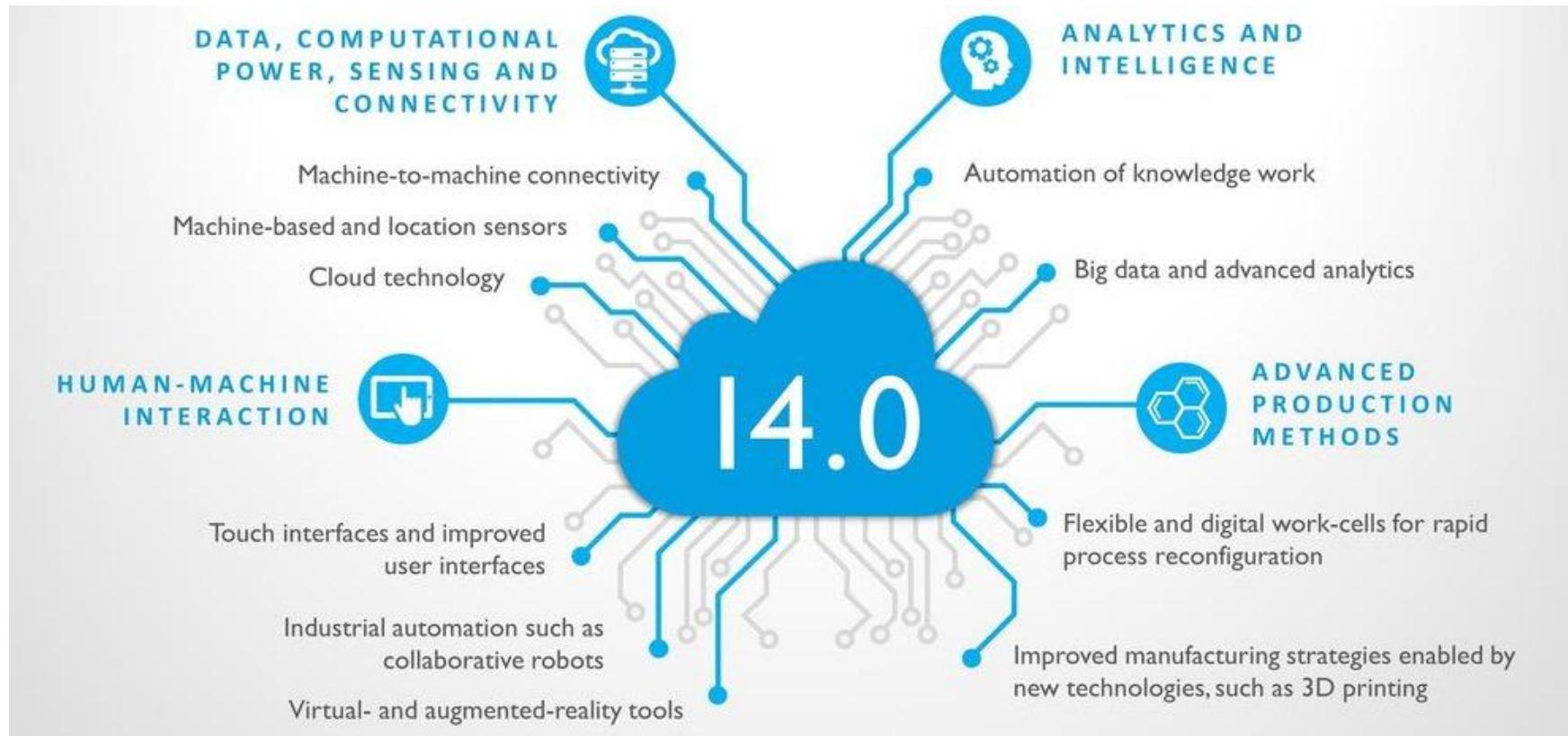


Figure: Industry 4.0

Source: <https://images.app.goo.gl/23UGm4URXGDrfiUp9>

# Brain-computer interface with cognitive computing (1 of 2)

IBM

IBM ICE (Innovation Centre for Education)

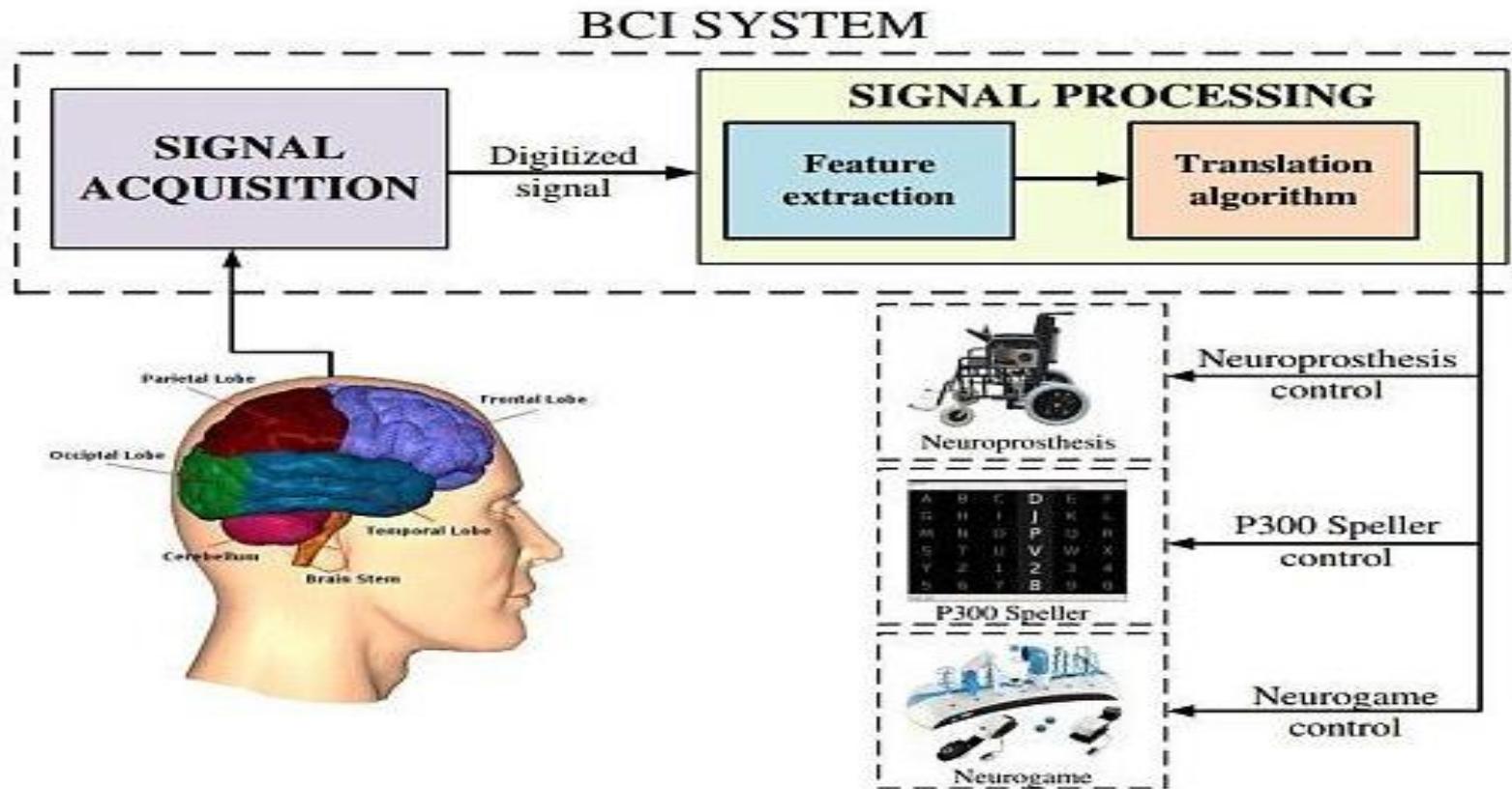
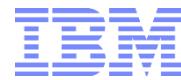


Figure: BCI System

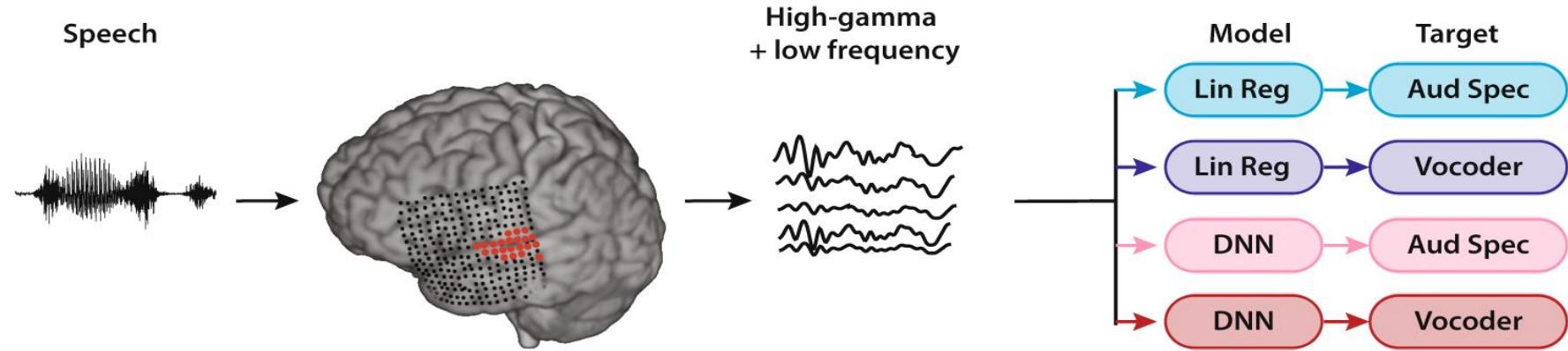
Source: <https://images.app.goo.gl/vSEqWDAe21XS1Rqq5>

# Brain-computer interface with cognitive computing (2 of 2)

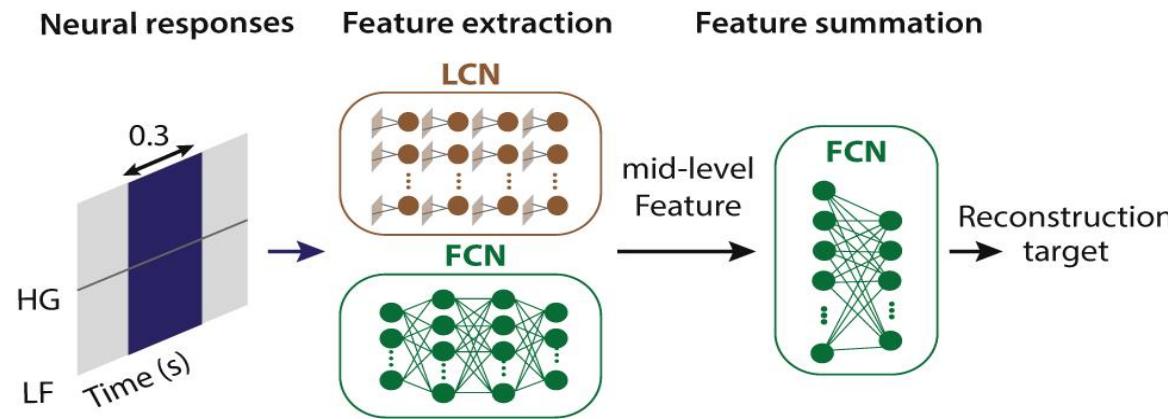


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## A. Reconstruction models and targets



## B. DNN architecture



## C. Vocoder parameters compression

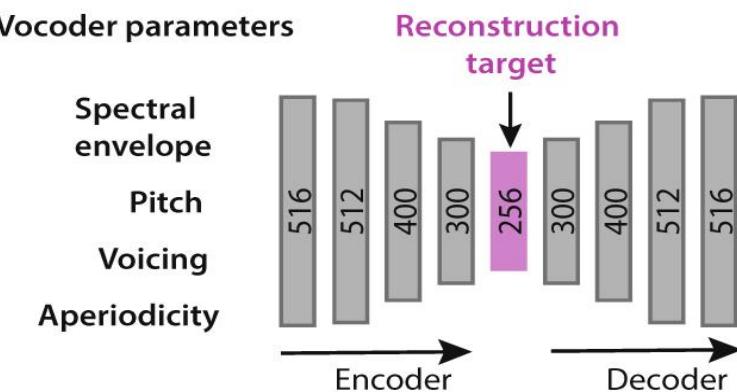


Figure: Human BCI research with cognitive Analytics

Source: <https://images.app.goo.gl/A3DgZFiVrnxQn57v7>

# Brain-computer interface with cognitive computing (3 of 3)



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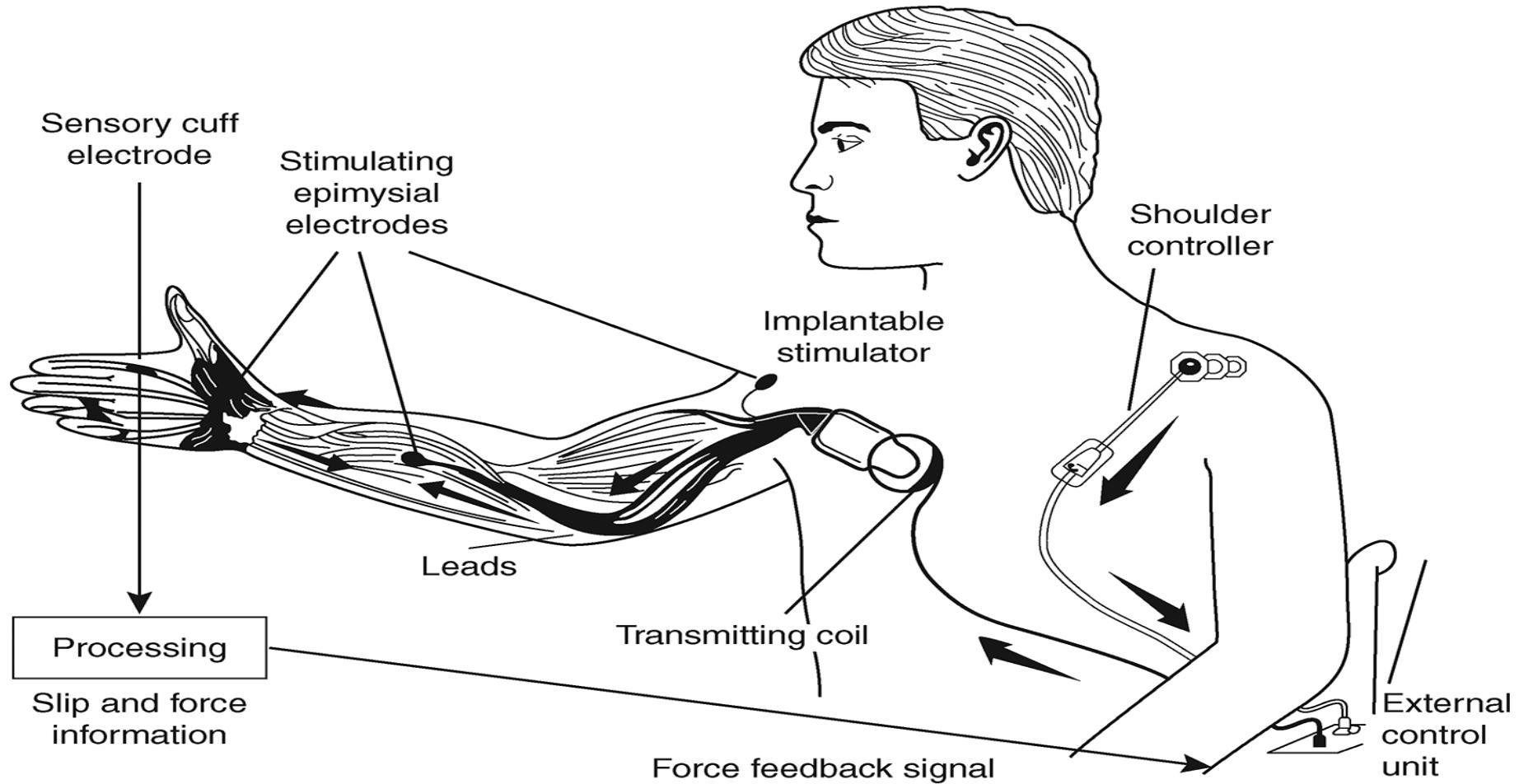


Figure: Motor neuroprostheses for BCI

Source: <https://images.app.goo.gl/szkYQK1UEEznX2xT9>

# Brain-computer interface with cognitive computing



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- It is applied to the inside the skull but outside the grey matter.
- It lowers risk of forming scar-tissue in the brain

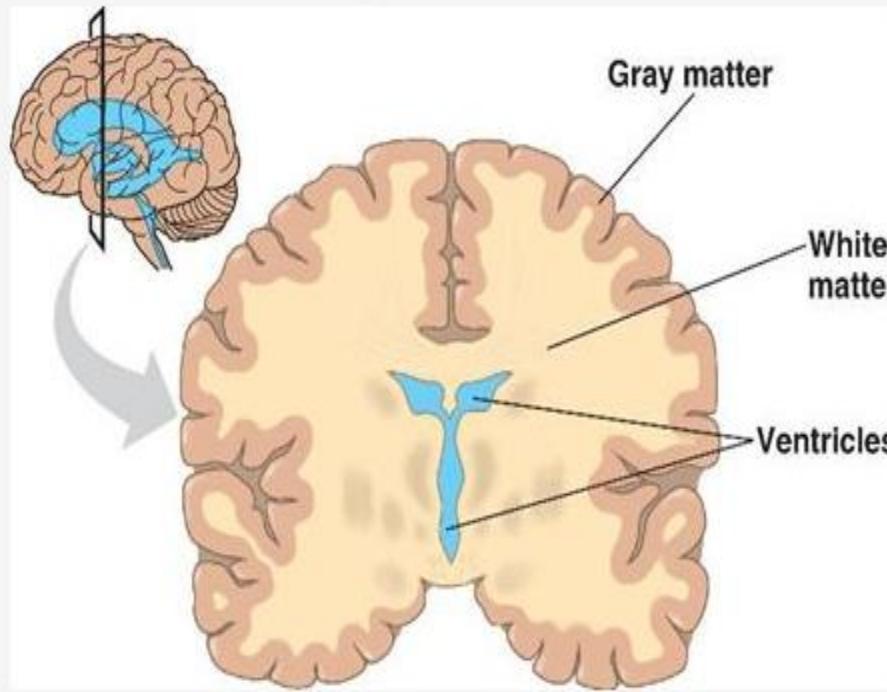


Figure: Partially invasive BCIs

Source: <https://images.app.goo.gl/KLWcBtNVYYATsEf8A>

# Use Case: Brain - Computer interface

ECOG is a neurophysiologic technique that records cortical electrical potentials directly from the surface of the brain.

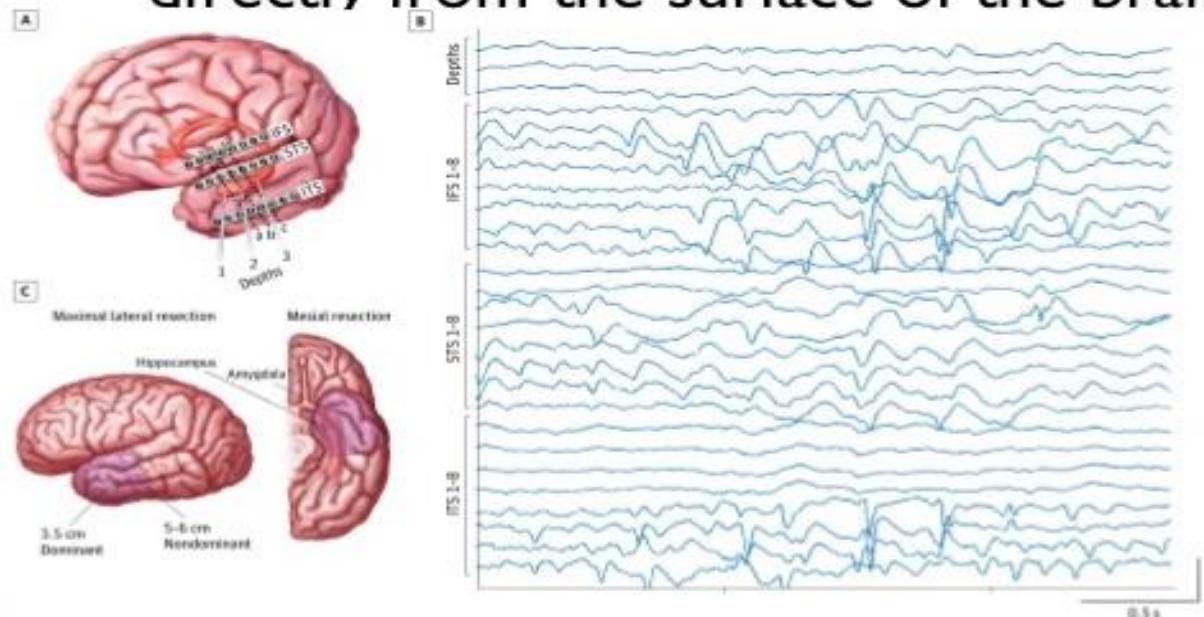
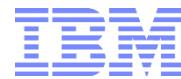


Figure: ECOG definition

Source: <https://images.app.goo.gl/4Mu12TrtNB5nnTt19>

# Pandemic analytics: How cognitive analytics is helping us combat COVID-19



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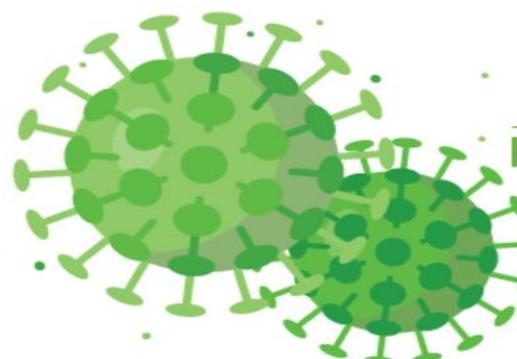
## COVID-19

Disease caused by the SARS-CoV-2 virus

### Novel coronavirus

Coronaviruses are viruses that **circulate among animals** but some of them are also known to affect humans.

The 2019 novel coronavirus was identified in China at the end of 2019 and is a new strain that has not previously been seen in humans.



### Symptoms

FEVER

COUGH

DIFFICULTY BREATHING

MUSCLE PAIN

TIREDNESS



### Prevention

#### When visiting affected areas

Avoid contact with sick people



Wash your hands with soap and water



If you develop cough, use a medical face mask



Wherever you travel apply general hygiene rules

### Transmission

VIA RESPIRATORY DROPLETS

2–14 days  
estimated incubation period



[ecdc.europa.eu/en/novel-coronavirus-china](http://ecdc.europa.eu/en/novel-coronavirus-china)

Figure: COVID 19 overview

Source: <https://images.app.goo.gl/i9nTsNSZDLbABHXS8>

# Self evaluation: Exercise 25

- To continue with the training, after learning the various steps involved in cognitive analytics and Watson machine learning, it is instructed to utilize the concepts of cognitive machine learning algorithms to perform the following activity.
- You are instructed to write the following activities using Python code.
- Exercise 25: Chatbot.

# Checkpoint (1 of 2)

## Multiple choice questions:

1. The stored learning from an organization's history that can be used for decision-making and other purposes best describes:
  - a) Organizational learning
  - b) Tacit knowledge
  - c) Knowledge warehouse
  - d) Organizational memory
  
2. Who will use their own IoT business models for smart city?
  - a) PaaS
  - b) SaaS
  - c) IaaS
  - d) Service provider
  
3. Which possibility automatically communicates with other vehicles?
  - a) Transportation and logistics
  - b) Energy and utilities
  - c) Automotive
  - d) Connected supply chain

# Checkpoint solutions (1 of 2)

## Multiple choice questions:

1. The stored learning from an organization's history that can be used for decision-making and other purposes best describes:
  - a) Organizational learning
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3. Which possibility automatically communicates with other vehicles?
  - a) Transportation and logistics
  - b) Energy and utilities
  - c) Automotive**
  - d) Connected supply chain

# Checkpoint (2 of 2)

## Fill in the blanks:

1. In order to promote \_\_\_\_\_ the government should employ more management.
2. ITS stands for \_\_\_\_\_.
3. A smart city \_\_\_\_\_ center is envisaged as an important part of the generic IoT platform to unify the organization.
4. NLP is the part of \_\_\_\_\_.

## True or False:

1. Does information resource management need to be integrated into market management?  
True/False
2. The use of RFID in product logistics may realize automatic acquisition of logistics information.  
True/False
3. Smart city is based on IOT Sensors and devices.  
True/False

# Checkpoint solutions (2 of 2)

## Fill in the blanks:

1. In order to promote eGovernment related the government should employ more management.
2. ITS stands for Intelligent Transportation Services.
3. A smart city Integrated Information center is envisaged as an important part of the generic IoT platform to unify the organization.
4. NLP is the part of Text processing.

## True or False:

1. Does information resource management need to be integrated into market management?  
**True**
2. The use of RFID in product logistics may realize automatic acquisition of logistics information.  
**True**
3. Smart city is based on IOT Sensors and devices.  
**True**

# Question bank

## Two mark question:

1. What is smart city?
2. What are the component of smart city?
3. What are the security factor for smart city?
4. What is Law enforcement issue?

## Four mark question:

1. Describe COPLink project.
2. What is area energy management solution for smart city?
3. What is the knowledge Management?
4. What is Quantum Architectures ?

## Eight mark question:

1. Explain Knowledge Management Architecture.
2. Explain Emerging Cognitive Computing Areas.

# Unit summary

**Having completed this unit, you should be able to:**

- Learn the concept of smarter cities of cognitive computing in Government
- Gain knowledge on emerging cognitive computing
- Gain an insight into areas & future applications for cognitive computing