Repositioning prospective graduates for relevance in the Emerging IT Landscape

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Town and Gown Seminar
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Covenant University, Ota

October 31 2016
Flight Plan

• The current focus of schools
• Emerging fields on the IT landscape
  • Features
  • Drivers
  • Challenges
  • Career opportunities
  • Skill requirements
• The Gap
• Bridging the gap
Current focus of our schools

• A Federal University
• Covenant University
Federal University

- The Vision of the Department is to be a world-class Department of Computer Science & Engineering with the Mission of producing World-Class:
  - Graduates of Computer Science & Engineering
  - Teachers of Computer Science & Engineering
  - Researchers in Computer Science & Engineering and
  - ICT Infrastructure for Community Service.
Philosophy of the computer science department

- The curriculum of the Computer Science emphasizes the art science, engineering and technology of computing and information systems. Students are made to enrol for core courses in Computer Science, Information Science, Electronic, Physics and Applied Mathematics.

- The students are developed to meet the challenges of self-employment as professional software and hardware engineers, private and public employment involving the following.

1. computer hardware system studies, design, assembling, construction, operation and maintenance.
2. computer software system studies, prototyping, development, implementation, documentation and maintenance.
3. Data mining and warehousing
4. Principles and practice of Information Technology and computer Networking, in oil and manufacturing industries, banks business and finance houses, educational institutions and government ministries and parastatals
Objectives of the computer science department

• The objectives of the department are to:
  • provide and promote sound practical and theoretical training in computer hardware, software and application areas, that will make the students useful in both private and public sectors of the economy.
  • identify the basic problems of the society and find appropriate computer solutions to them.
  • develop and offer service courses in Computer Science and Information Technology to other Departments in the University
  • equip the students with the capacity for professional practice in Information Technology
  • develop the students for the purpose of self employment and job placements in the government and industry.
  • develop the students through sound academic and professional programmes as a basis for postgraduate studies.
Objectives of CU Computer Science programme

1. To develop graduate with skills and knowledge needed to meet the requirements of a rapidly advancing and challenging field of ICT.

2. To produce graduates with IT skills and prepare them for the industry and global competitiveness.

3. To produce highly creative and innovative graduates that are competent enough to be self employed in the field of Information Technology and its allied disciplines, or in the least be immediately employable.

4. To develop human capital with emphasis on creating a knowledge-based society.

5. To develop manpower to pursue careers in a wide range of professions including software development, web design, and system administration, project management, and computational sciences, that would foster the attainment of the Vision 20:2020 and the Millennium Development Goals.

6. To provide a broad and balanced foundation in computer science knowledge and practical skills.

7. To provide students with knowledge and skills base for further studies in computer science or multi-disciplinary studies involving computer science.
Objectives of CU MIS programme

1. To develop graduates with skills and knowledge needed to meet the requirements of a rapidly advancing and challenging field of ICT and Management.

2. To produce graduates with IT, Management and Business skills and prepare them for the industry and global competitiveness.

3. To produce highly creative and innovative graduates that are competent enough to be self-employed in the field of Information Technology and Business and its allied disciplines or in the least be immediately employable.

4. To develop manpower to pursue careers in a wide range of professions including software development, web design, and system administration, project management, and information sciences, that would foster the attainment of the Vision 20:2020 and the Millennium Development Goals.

5. To provide a broad and balanced foundation in Information Systems and Management and practical skills that will enable them pursue higher degrees in Information Systems, Business and Management and or multi-disciplinary studies involving Information Systems.

6. To develop students with broad based knowledge in Information Systems and Business and Management that will apply the skills to all aspects of human endeavours.
Emerging Fields
Emerging fields on the IT landscape

Figure 1. Hype Cycle for Emerging Technologies, 2015

Emerging fields on the IT landscape

http://www.gartner.com/newsroom/id/3412017
Emerging fields on the IT landscape

DRIVERS OF EMPLOYMENT TRENDS

TECHNOLOGICAL

- Mobile internet, cloud technology
- Processing power, Big Data
- New energy supplies and technologies
- Internet of Things
- Sharing economy, crowdsourcing
- Robotics, autonomous transport
- Artificial intelligence
- Adv. manufacturing, 3D printing
- Adv. materials, biotechnology

Note: Names of drivers have been abbreviated to ensure legibility.

https://techcrunch.com/2016/01/21/the-world-economic-forum-on-the-future-of-jobs/
Emerging fields on the IT landscape

- Mobile Applications
- Big Data
- Cloud Computing
- Internet of Things (IoT)
- Devops
- Cybersecurity
- Gaming
- Software Defined Networking (SDN)
- Network Functions Virtualisation (NFV)
Mobile Applications
Mobile Apps

- Nick D'Aloisio at the age of 16 sold an app he developed to Yahoo for US$30m in March 2013, making him one of the youngest self-made millionaires ever
Mobile Apps

Spotify

airbnb

UBER

WhatsApp
Mobile overtakes Desktop use

http://www.smartinsights.com/mobile-marketing/mobile-marketing-analytics/mobile-marketing-statistics/
Emerging devices

http://www.smartinsights.com/mobile-marketing/mobile-marketing-analytics/mobile-marketing-statistics/
A mobile application, most commonly referred to as an app, is a type of application software designed to run on a mobile device, such as a smartphone or tablet computer.

Mobile applications frequently serve to provide users with similar services to those accessed on PCs.

Apps are generally small, individual software units with limited function. This use of software has been popularized by Apple Inc. and its App Store, which sells thousands of applications for the iPhone, iPad and iPod Touch.

A mobile application also may be known as an app, Web app, online app, iPhone app or smartphone app.

https://www.techopedia.com/definition/2953/mobile-application-mobile-app
Mobile Apps

Reasons users are more willing to pay for content on mobile devices than on desktops:

<table>
<thead>
<tr>
<th>Easy-to-Use/Secure Payment Systems</th>
<th>• embedded systems like carrier billing and iTunes allow real-time payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Price Tags</td>
<td>• most content and subscriptions carry sub-$5 price tags</td>
</tr>
<tr>
<td>Walled Gardens Reduce Piracy</td>
<td>• content exists in proprietary environments, difficult to get pirated content onto mobile devices</td>
</tr>
<tr>
<td>Established Store Fronts</td>
<td>• carrier decks and iTunes store allow easy discovery and purchase</td>
</tr>
<tr>
<td>Personalization</td>
<td>• more important on mobiles than desktops</td>
</tr>
</tbody>
</table>

Mobile Apps

http://www.slideshare.net/Mobinex/mobile-apps-dev-challenges
Mobile Apps

http://www.slideshare.net/Mobinex/mobile-apps-dev-challenges
Mobile Apps

http://www.slideshare.net/Mobinex/mobile-apps-dev-challenges
Mobile Apps

Mobile App Roles

UI/UX Designer → Mobile Developer → Backend Engineer → Operations Engineer

- UI/UX Designer: Visually creates the user interface (UI) and the overall user experience (UX)
- Mobile Developer: Converts the UI/UX design into Objective-C (iOS) or Java (Android)
- Backend Engineer: Converts the business logic into computer code using Java, JavaScript, PHP, Python, PERL, .NET, etc.
- Operations Engineer: Manages the servers, databases, DNS infrastructure, and other website infrastructure

http://www.slideshare.net/mrjain/startup-engineering-cookbook-for-mobile-apps
Mobile Apps

Wireframes

Wireframes start to give you an idea of what the mobile app will contain when it comes to information, navigation and interface design.

**Options:** Axure, Balsamiq, Flinto, HotGloo, Justinmind, MockFlow, Moqups, Sketch, Solidify and UXPin

**Our choice:** Any of the above + InVision. The ability to share designs and make comments can speed up the design process.

http://www.slideshare.net/mrjain/startup-engineering-cookbook-for-mobile-apps
Mobile Apps

Final Designs

After several rounds of discussion on the wireframes, you will have to lock down the features and flow so the designer can deliver the final screens that the developers will need.

Creating the look is one aspect, the others include animations and interactions the user will see on the screen. And, what gestures a user might need to perform in the app (ex. swipe to the right).

Options: Adobe Illustrator, Adobe Photoshop, CorelDRAW and Sketch

Our choice: Let the designers choose.

http://www.slideshare.net/mrjain/startup-engineering-cookbook-for-mobile-apps
Mobile Apps

Mobile Phone Platforms

There are really only two major mobile platforms that are currently in use – Android and iOS.

Other options: Blackberry and Microsoft Windows Phone

*Our choice: Android and iOS.* In Asia, Android is more popular but the tastemakers and journalists tend to be on iOS. In the US and Europe you can get away with iOS initially then Android.

http://www.slideshare.net/mrjain/startup-engineering-cookbook-for-mobile-apps
Mobile Apps

Our choice: It Depends. Native development brings a much richer experience but lately React Native is gaining traction for hybrid development.

http://www.slideshare.net/mrjain/startup-engineering-cookbook-for-mobile-apps
Mobile Apps

Native apps are specific to a given mobile platform (iOS or Android) using the development tools and language that the respective platform supports (e.g., Xcode and Objective-C with iOS, Eclipse and Java with Android). Native apps look and perform the best.

HTML5 apps use standard web technologies—typically HTML5, JavaScript and CSS. This write-once-run-anywhere approach to mobile development creates cross-platform mobile applications that work on multiple devices. While developers can create sophisticated apps with HTML5 and JavaScript alone, some vital limitations remain at the time of this writing, specifically session management, secure offline storage, and access to native device functionality (camera, calendar, geolocation, etc.)

Hybrid apps make it possible to embed HTML5 apps inside a thin native container, combining the best (and worst) elements of native and HTML5 apps.

https://developer.salesforce.com/page/Native,_HTML5,_or_Hybrid:_Understanding_Your_Mobile_Application_Development_Options
Mobile Apps

In-App Chat Messaging

One of the biggest features many mobile apps are implementing is the ability to let users chat within the app.

Options: Firebase, Layer, PubNub, Pusher, QuickBlox, Sinch, socket.io, XMPP

Our choice: For an MVP launch PubNub or Firebase are good. For the longer term building a chat system from scratch might using Socket.io be the right option.

http://www.slideshare.net/mrjain/startup-engineering-cookbook-for-mobile-apps
Mobile Apps

Mobile Backend as a Service

There is a growing trend around using Mobile Backend as a Service (MBaaS) options. It simplifies the backend services that are required for a mobile app but are not as feature rich as a full scale backend service.

Options: AnyPresence, Appcelerator, FeedHenry, Firebase, Kinvey, Meteor, ShepHertz

Our choice: Firebase. But your mileage may vary depending on how complex your mobile app is. A full scale backend might be required if the app is complex such as a marketplace mobile app.

http://www.slideshare.net/mrjain/startup-engineering-cookbook-for-mobile-apps
Mobile Apps

Infrastructure Provider

If you opt for a full scale backend, those components must reside somewhere.

Options: Amazon Web Services (AWS), Google Cloud Platform, local hosting provider, Microsoft Azure, Netmagic, Rackspace

Our choice: Amazon Web Services (AWS). They are the #1 leader in web infrastructure services also known as cloud services.

http://www.slideshare.net/mrjain/startup-engineering-cookbook-for-mobile-apps
Mobile Apps

Technology Stack

The “stack” refers to a set of software components needed to create a complete platform. For a mobile application that includes the operating system, web server, database and programming language.

1. LAMP Stack
   - Linux
   - Apache
   - MySQL
   - PHP
   - Perl
   - Python

2. LEMP Stack
   - Linux
   - Nginx
   - MySQL
   - PHP

3. MEAN Stack
   - MongoDB
   - Express
   - AngularJS
   - Node

4. Windows Stack
   - Windows Server
   - SQL Server
   - .NET

Our choice: It depends. Several factors to evaluate include time to market, cost and knowledge of the technology stack.

http://www.slideshare.net/mrjain/startup-engineering-cookbook-for-mobile-apps
Mobile Apps

Operating System

There are only two options - Microsoft Windows or Linux. Windows is limited in the type of programming languages that you can run on the server. Linux is open source and has a large community that is continually improving the operating system. Within Linux there are many versions such as Debian and Red Hat to choose from.

http://www.slideshare.net/mrjain/startup-engineering-cookbook-for-mobile-apps
Mobile Apps

Web Server

Software that delivers information from the server to a mobile app.

Options: Apache, Lighttpd, Microsoft Internet Information Server (IIS), Nginx, Node.js, Rails, Tornado

http://www.slideshare.net/mrjain/startup-engineering-cookbook-for-mobile-apps
Mobile Apps

Database

The heart of any mobile app is the database since it stores all the user information and everything else related to the mobile application. There are two categories to consider: SQL or NoSQL.

Options: Amazon DynamoDB, Cassandra, CouchDB, MariaDB, Microsoft SQL, MongoDB, MySQL, Oracle, PostgreSQL

http://www.slideshare.net/mrjain/startup-engineering-cookbook-for-mobile-apps
Mobile Apps

Programming Language

If you ask 4 programmers which is the best language, you will most likely get 5 different answers.

Options: Clojure, Express, Java, JavaScript, Microsoft’s .NET, Perl, PHP, Python, Ruby

http://www.slideshare.net/mrjain/startup-engineering-cookbook-for-mobile-apps
Mobile Apps

FUNCTIONALITY
End-to-end test, Interruption, Operability, Accessibility

USABILITY
Interface, Intuitiveness, Consistency, Soberness

COMPATIBILITY
OS & Hardware diversity, Screen size/resolution, Network config.

PERFORMANCE
Load, Memory, Data exchange, Synchronization

SECURITY
Penetration, Data protection, Hacking

LOCALIZATION
Globalization

Mobile Apps

Mobile App Development Trends For 2016

- Rapid Mobile Development Will Ramp Up
- Cloud-Driven App Will Steal the Show
- Apps Security Must Come First
- Mobile Banking, Payments, and M-Commerce Will Be A Necessity
- User Experience through App Analytics Will Be In The Spotlight
- Enterprise Apps Will Take The Centre Stage
- Mobile Gaming To Hit It High

7 Trends of Mobile App Development

01. Wearable Devices
02. Internet of Things and Mobile Connected Smart Objects
03. M-Commerce
04. Motion and Location Sensing
05. Innovative Mobile User Experience Design
06. Application Performance Management (APM)
07. Enterprise Mobile Management

http://www.marutitech.com/7-trends-of-mobile-application-development/
Mobile Apps

Four Years of App Economy Estimates

http://www.progressivepolicy.org/slider/app-economy-jobs-part-1/
Big Data
Big Data

Defining Big Data

- **Gartner**: High-volume, high-velocity, and/or high-variety information assets that require new forms of processing to enable enhanced decision-making, insight discovery and process optimization.

- **IBM**: Datasets whose size is beyond the ability of typical database software tools to capture, store, manage, and analyze.

- **NY Times**: Shorthand for advancing trends in technology that open the door to a new approach to understanding the world and making decisions.

- **McKinsey**: Large pools of data that can be brought together and analyzed to discern patterns and make better decisions.

http://www.slideshare.net/Dataversity/dataed-webinar-demystifying-big-data-30105185
Big Data

Figure 2
The evolution of big data

Focus areas

Data size and complexity

Very complex, unstructured

Complex relational

Primitive and structured

Data generation and storage

Data utilization

Data driven

1. Mainframes
   Basic data storage

2. Relational databases
   Data-intensive applications

3. Structured data
   Unstructured data
   Multimedia

Exponential growth in data volume

Pre-relational
(1970s and before)

Relational
(1980s and 1990s)

Relational+
(2000s and beyond)

Computing timeline

Source: A.T. Kearney analysis

https://www.atkearney.com/strategic-it/ideas-insights/article/-/asset_publisher/LCgOeS4t85g/content/big-data-and-the-creative-destruction-of-today-s-business-models/10192
Big Data

https://www.linkedin.com/pulse/do-you-have-big-data-strategy-part-1-viney-hora
Big Data

http://upxacademy.com/2016/05/30/beginners-guide-big-data/
Big Data

Volume
Data at Rest
Terabytes to exabytes of existing data to process

Velocity
Data in Motion
Streaming data, milliseconds to seconds to respond

Variety
Data in Many Forms
Structured, unstructured, text, multimedia

Veracity*
Data in Doubt
Uncertainty due to data inconsistency & incompleteness, ambiguities, latency, deception, model approximations

http://contest.trendmicro.com/2013/images/bigdata/big_data_4v.png
Big Data

Where does big data come from?

Most big data efforts are currently focused on analyzing internal data to extract insights. Fewer organizations are looking at data outside their firewalls, such as social media.

88% Transactions
73% Log data
57% Emails
43% Social media
38% Audio
34% Photos and video

https://dailyprivacy.files.wordpress.com/2013/02/2012_big_data_study_infographic_600.jpg
Big Data

7Bn people using technology means Big Data

VOLUME
In 2005, humankind created 150 exabytes of information.
In 2011, 1,200 exabytes were created.

VELOCITY
Worldwide digital content will double in 18 months, and every 18 months thereafter.

Processing

CRM Data
Inventory

Analytic Tools

Storage

Transactions

80% of enterprise data will be unstructured, spanning traditional and non traditional sources.

http://www.tcs.com/offerings/big-data/PublishingImages/TCS-Big-Data-Offering.jpg
Big Data

Brewer’s CAP Theorem

A distributed system can support only two of the following characteristics:

- **Consistency**
  All of the nodes see the same data at the same time, regardless of where the data is stored.

- **Availability**
  Node failures do not prevent survivors from continuing to operate.

- **Partition tolerance**
  The system continues to operate despite arbitrary message loss.

http://www.slideshare.net/gschmutz/nosql-databases-for-implementing-data-services-should-i-care
ACID vs. BASE style Transactions

Atomic
- All of the work in a transaction completes (commit) or none of it

Consistent
- Transaction transforms the database from one consistent state to another consistent state

Isolated
- results of any changes made during a transaction are not visible until committed

Durable
- Results of committed transaction survive failures

Basically Available
- Soft State
- Eventually Consistent

Weak consistency – stale data OK
- Availability first
- Best Effort
- Approximate answers OK
- Aggressive (optimistic)
- Simpler and Faster

http://www.slideshare.net/gschmutz/nosql-databases-for-implementing-data-services-should-i-care
Big Data

http://wikibon.org/w/images/4/46/NIST_CAP_Slide_with_Big_Data.jpg
## Big Data

<table>
<thead>
<tr>
<th></th>
<th>NoSQL</th>
<th>SQL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
<td>Non-relational</td>
<td>Relational</td>
</tr>
<tr>
<td></td>
<td>Stores data in JSON documents, key/value</td>
<td>Stores data in a table</td>
</tr>
<tr>
<td></td>
<td>pairs, wide column stores, or graphs</td>
<td></td>
</tr>
<tr>
<td><strong>Data</strong></td>
<td>Offers flexibility as not every record</td>
<td>Great for solutions where every record</td>
</tr>
<tr>
<td></td>
<td>needs to store the same properties</td>
<td>has the same properties</td>
</tr>
<tr>
<td></td>
<td>New properties can be added on the fly</td>
<td>Adding a new property may require altering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>schemas or backfilling data</td>
</tr>
<tr>
<td></td>
<td>Relationships are often captured by</td>
<td>Relationships are often captured in a</td>
</tr>
<tr>
<td></td>
<td>denormalizing data and presenting it in a</td>
<td>using joins to resolve references across</td>
</tr>
<tr>
<td></td>
<td>single record</td>
<td>tables</td>
</tr>
<tr>
<td></td>
<td>Good for semi-structured data</td>
<td>Good for structured data</td>
</tr>
<tr>
<td><strong>Schema</strong></td>
<td>Dynamic or flexible schemas</td>
<td>Strict schema</td>
</tr>
<tr>
<td></td>
<td>Database is schema-agnostic and the schema</td>
<td>Schema must be maintained and kept in</td>
</tr>
<tr>
<td></td>
<td>is dictated by the application. This</td>
<td>sync between application and database</td>
</tr>
<tr>
<td></td>
<td>allows for agility and highly iterative</td>
<td></td>
</tr>
<tr>
<td></td>
<td>development</td>
<td></td>
</tr>
<tr>
<td><strong>Transactions</strong></td>
<td>ACID transaction support varies per solution</td>
<td>Supports ACID transactions</td>
</tr>
<tr>
<td><strong>Consistency</strong></td>
<td>Consistency varies per solution, some</td>
<td>Strong consistency supported</td>
</tr>
<tr>
<td></td>
<td>solutions have tunable consistency</td>
<td></td>
</tr>
<tr>
<td><strong>Scale</strong></td>
<td>Scales well horizontally</td>
<td>Scales well vertically</td>
</tr>
</tbody>
</table>

Big Data

- **Relational (MySQL, Postgres)**
  - Pros
    - Transactions
    - Indexes
    - Joins
    - Strong consistency
  - Cons
    - Limited scalability
    - Schema
    - Weak consistency with datacenter failure

- **Relational Sharding (Vitess)**
  - Pros
    - Scalable (w/ caveats)
    - Transactions (limited)
    - Indexes (limited)
    - Joins
    - Tunable consistency
  - Cons
    - Schema
    - App-level sharding
    - Weak consistency with datacenter failure

- **NoSQL (HBase, Cassandra, Riak)**
  - Pros
    - Scalable
    - Unstructured data
    - Tunable consistency
  - Cons
    - No transactions
    - No indexes
    - No joins
    - No availability or weak consistency with datacenter failure

- **NewSQL (Cockroach, Spanner, FoundationDB, Clustrix)**
  - Pros
    - Scalable
    - Transactions
    - Indexes
    - Joins
    - Availability and strong consistency with datacenter failure
    - Tunable consistency
  - Cons
    - Semi-relational schema
    - Higher write latencies

https://www.pinterest.com/pin/510103095270939519/
Big Data

http://dataconomy.com/sql-vs-nosql-need-know/
Big Data

How Companies Are Using Big Data

Functional areas where companies do, and should, focus on using big data and analytics to improve overall performance.

- Customer insights, segmentation, or targeting: 49% currently, 60% ideally
- Budgeting, forecasting, or planning: 39% currently, 36% ideally
- Operations, service delivery, or supply chain management: 41% currently, 39% ideally
- Customer service/support: 40% currently, 37% ideally
- Performance management & transparency in internal operations: 39% currently, 39% ideally
- New product strategies: 40% currently, 28% ideally
- Pricing: 29% currently, 21% ideally
- Automation of common or straightforward decisions: 18% currently, 13% ideally
- Improvements to R&D processes: 19% currently, 12% ideally


http://reflectionsblog.emc.com/how-big-data-transforms-marketing/
Big Data

WHAT ARE THE CHALLENGES?

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Percentage of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Getting the appropriate infrastructure (hardware and software) installed and operational</td>
<td></td>
</tr>
<tr>
<td>Finding qualified resources with the necessary Big Data skills</td>
<td></td>
</tr>
<tr>
<td>Establishing the necessary processes to go from an experimental to a production grade environment</td>
<td></td>
</tr>
<tr>
<td>Implementing the required data compliance policies</td>
<td></td>
</tr>
<tr>
<td>Getting buy-in from internal business stakeholders</td>
<td></td>
</tr>
</tbody>
</table>

Not Challenging At All  Not Challenging  Somewhat Challenging  Very Challenging  Extremely Challenging

Big Data

Gartner's Report on Big Data Skill Gap

- Only 1/3 of the Big Data skill requirements are met.
- 2/3 of Big Data skill requirements are not met due to lack of skilled professionals.

http://www.edureka.co/blog/big-prospects-for-big-data/
Big Data

Data Science and Big Data Analytics
Management Skills Gap – Input From Over 1,000 Professionals

Understanding concepts & power of big data / analytics
- 16.4% Strong
- 40.8% Moderate
- 42.8% Weak

Grasping business impact of big data / analytics
- 12.6% Strong
- 41.7% Moderate
- 45.7% Weak

Appreciating skill set challenges re: team of data scientists
- 11.3% Strong
- 35.4% Moderate
- 53.2% Weak

Source: Managing Information Storage: Trends, Challenges and Options – 2013-14 Study – To be Published May 7, 2013,

http://pulseblog.emc.com/2013/04/22/transformation-transcends-it-emc-intros-new-courses-to-fill-business-leaders-skills-gap/
http://www.edureka.co/blog/10-hottest-tech-skills-in-2016/
http://www.edureka.co/blog/10-hottest-tech-skills-in-2016/
Big Data

The sexiest job of the 21st century according to the Harvard Business Review*

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**DATA ENGINEER**

I gather and store data. I do batch processing or real-time processing on data. I also serve data via an API to a data scientist who can easily query it.

**DATA ANALYST**

I collect, organize and interpret data to help companies make better business decisions.

**DATA SCIENTIST**

I have programming skills, knowledge of statistics and domain knowledge. I ask the right questions and try to find out insights from a given data set.

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http://upxacademy.com/2016/05/30/beginners-guide-big-data/

## Big Data

<table>
<thead>
<tr>
<th>Data Analyst</th>
<th>Data Scientist</th>
<th>Data Engineer</th>
</tr>
</thead>
</table>
| - Essentially a junior data scientist.  
- Perfect place to start a career in data  
- Don’t have the mathematical or research background to invent new algorithms  
- Have a strong understanding of how to use existing tools to solve problems. | - Requires more sophisticated skills to tackle a higher volume and velocity of data than data analyst.  
- Can do undirected research and tackle open-ended problems and questions.  
- Typically have advanced degrees in a quantitative field, like computer science, physics, statistics, or applied mathematics,  
- Have the knowledge to invent new algorithms to solve data problems.  
- Their work can uncover new business opportunities or save the organization money by identifying hidden patterns in data. | - Builds a robust, fault-tolerant data pipeline that cleans, transforms, and aggregates unorganized and messy data into databases or datasources.  
- Typically software engineers by trade.  
- Responsible for compiling and installing database systems, writing complex queries, scaling to multiple machines, and putting disaster recovery systems into place.  
- Lay the groundwork for a data analyst or data scientist to easily retrieve the needed data for their evaluations and experiments. |

# Big Data

<table>
<thead>
<tr>
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<th>Data Scientist</th>
<th>Data Engineer</th>
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</thead>
</table>
| - Need to have a baseline understanding of five core competencies: programming, statistics, machine learning, data munching, and data visualization. | - Explores data from many different sources.  
- Use tools like Hadoop (the most widely used framework for distributed file system processing), Use programming languages like Python and R  
- Apply the practices of advanced math and statistics. | - Have deep knowledge of and expertise in:  
  - Hadoop-based technologies like MapReduce, Hive, and Pig  
  - SQL based technologies like PostgreSQL and MySQL  
  - NoSQL technologies like Cassandra and MongoDB  
  - Data warehousing solutions |

# Big Data

<table>
<thead>
<tr>
<th>Data Analyst</th>
<th>Data Scientist</th>
<th>Data Engineer</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Are given direction from more experienced data professionals in their organization.</td>
<td>• Data scientists essentially leverage data to solve business problems. They interpret, extrapolate from, and prescribe from data to deliver actionable recommendations.</td>
<td>• Data engineers do the behind-the-scenes work that enables data analysts and data scientists to do their jobs more effectively.</td>
</tr>
<tr>
<td>• They acquire, process, and summarize data</td>
<td>• While a data analyst summarizes the past; a data scientist strategizes for the future.</td>
<td>• Responsible for making sure that data flows smoothly from source to destination so that it can be processed.</td>
</tr>
<tr>
<td>• Are the ones managing the quality assurance of data scraping, regularly querying databases for stakeholder requests, and triaging data issues to come to timely resolutions. Package the data to provide digestible insights in narrative or visual form.</td>
<td>• Data scientists could identify precisely how to optimize websites for better customer retention, how to market products for stronger customer lifecycle value, or how to fine-tune a delivery process for speed and minimal waste.</td>
<td></td>
</tr>
</tbody>
</table>

Big Data

Cloud Computing
Defining Cloud Computing

- “A style of computing in which scalable and elastic IT-enabled capabilities are delivered as a service using Internet technologies” – Gartner
- “Cloud computing is the use of computing resources (hardware and software) that are delivered as a service over a network” – Wikipedia
- “A pay per use model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” – NIST
- “Clouds are hardware based services offering compute, network and storage capacity where: Hardware management is highly abstracted from the buyer, buyers incur infrastructure costs as variable OPEX and infrastructure capacity is highly elastic” – McKinsey

http://www.slideshare.net/adityathatte/session-1-fdp
Cloud Computing

Evolution of Computing

1970-80s
Mainframe Technologies

1980s
Client Server Distributed Technologies

1990s
World Wide Web (WWW) Technologies

2000s
Cloud Computing (OnDemand Metered Grid usage)

2010s
Transported Technologies (Anywhere, Anytime, Anyuser)

Cloud & UbiComp

2020s
Pervasive/Ubiquitous Computing (Embedding processor in every live object)

https://www.linkedin.com/pulse/evolution-infrastructure-paul-m-veillard
Cloud Computing - key enabling technologies

- fast wide-area networks,
- powerful, inexpensive server computers
- high-performance virtualization for commodity hardware.

https://www.nist.gov/itl/cloud-computing
Cloud Computing Features

- Broad network access
- Rapid elasticity
- Measured service
- On-demand self-service

Essential characteristics

- Resource pooling

Service models

- Software as a Service (SaaS)
- Platform as a Service (PaaS)
- Infrastructure as a Service (IaaS)

Deployment models

- Public
- Private
- Hybrid
- Community

http://get.cloudbolt.io/blog/if-it-isnt-self-service-it-isnt-cloud
Cloud Computing

https://www.hpcwire.com/2013/06/28/nist_s_security_reference_architecture_for_the_cloud-first_initiative/
Cloud Computing Service Models

https://en.wikipedia.org/wiki/Cloud_computing
Cloud Computing

Delivery models

- **IaaS**
  - Infrastructure-as-a-Service
  - IBM SmartCloud Enterprise
  - Amazon Web Services
  - RackSpace
  - GoGrid

- **PaaS**
  - Platform-as-a-Service
  - Windows Azure
  - Google
  - Heroku

- **SaaS**
  - Software-as-a-Service
  - Microsoft Office 365
  - Dropbox
  - Salesforce.com
  - Autodesk

http://www.slideshare.net/adityathatte/session-1-fdp
Cloud Computing Stack

http://www.mazikglobal.com/blog/cloud-computing-stack-saas-paas-iaas/
Cloud Computing Architecture

https://www.hpcwire.com/2013/06/28/nist_s_security_reference_architecture_for_the_cloud-first_initiative/
Cloud Computing Benefits

- **Cost savings**: Cloud computing removes the requirement of a company to invest in storage hardware and servers.

- **Focusing on the business**: Since all the services will execute over the internet, a company does not have to bother about technical issues and other problems associated with physical storage and backup. A company can thus focus more on their core business.

- **Performance**: It delivers reliable performance irrespective to the geographical location of the user. Another key feature could be the automatic updating of services and applications.

- **Security**: Cloud Computing offers optimum security which protects you against any unauthorized access, modification and loss of data.

- **Flexibility**: Even if part of the cloud environment fails or stops working, the other resources continue to work until the problem is fixed.

Cloud Computing Drivers

What Are the Drivers of Cloud Computing Initiatives at Organizations Today?
Business agility, cost, and efficiency are driving cloud computing

- Business agility (faster time to market, increased user satisfaction) - 75%
- Reducing IT infrastructure investment - 56%
- Reducing IT management and maintenance - 53%

Source: "Global Cloud Computing Adoption" survey, CIO, January 2011
Base: 636 total respondents; 254 U.S. respondents; 202 EMEA respondents; 200 Asia Pacific respondents

CLOUD BARRIERS CAUSE COMPETITIVE DISADVANTAGES

Concerns Delaying Cloud Adoption

- Security: 50%
- Data protection: 44%
- Intellectual property protection: 24%
- Vendor lock-in: 23%

## Barriers for Cloud Computing Adoption

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Security</strong></td>
<td>The key concern is data privacy. Users do not have control of or know where their data is being stored.</td>
</tr>
<tr>
<td><strong>Interoperability</strong></td>
<td>A universal set of standards and/or interfaces have not yet been defined, resulting in a significant risk of vendor lock-in.</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td>The amount of control that the user has over the cloud environment varies greatly between vendors.</td>
</tr>
<tr>
<td><strong>Performance</strong></td>
<td>All access to the cloud is done via the internet, introducing latency into every communication between the user and the environment.</td>
</tr>
<tr>
<td><strong>Reliability</strong></td>
<td>Many existing cloud infrastructures leverage commodity hardware that is known to fail unexpectedly.</td>
</tr>
</tbody>
</table>

http://www.slideshare.net/roger.smith/government-applications-of-cloud-computing
Cloud Challenges 2016 vs. 2015

- Compliance: 26% (2016), 25% (2015)
- Managing multiple cloud services: 26% (2016), 25% (2015)
- Managing costs: 26% (2016), 24% (2015)
- Governance/control: 23% (2016), 23% (2015)
- Performance: 15% (2016), 17% (2015)

Source: RightScale 2016 State of the Cloud Report

SURVEY FINDINGS:
The New IT: Emerging Job Titles

<table>
<thead>
<tr>
<th>Cloud Architect</th>
<th>Cloud Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloud Service Architect</td>
<td>Cloud Security Engineer</td>
</tr>
<tr>
<td>IT Cloud Architect</td>
<td>IT Cloud Services Manager</td>
</tr>
<tr>
<td>Cloud Application Integration Expert</td>
<td>Cloud Security Manager</td>
</tr>
<tr>
<td>Cloud Coordinator</td>
<td>Cloud Service Manager</td>
</tr>
<tr>
<td>Cloud Computing Architecture</td>
<td>Cloud Solutions Manager</td>
</tr>
<tr>
<td>Cloud Computing Manager</td>
<td>Director Cloud Infrastructure</td>
</tr>
<tr>
<td>Cloud Infrastructure Manager</td>
<td>EVP Cloud Technologies</td>
</tr>
<tr>
<td>Cloud Integration Specialists</td>
<td></td>
</tr>
</tbody>
</table>

http://datacenterdialog.blogspot.com.ng/2011/03/survey-cloud-really-is-shaking-up-it.html
http://www.edureka.co/blog/10-hottest-tech-skills-in-2016/
Source: Forbes.com

http://www.edureka.co/blog/10-hottest-tech-skills-in-2016/
How does one navigate the cloud certifications to build a clear career path?

Cloud Computing Skills Requirements

**Technical Skills**
- Knowledge of HTML, PaaS (Platform as a Service), Cloud Computing Basics like Virtualization technologies (like VMWare), OOPS and programming languages like Java, C++, .Net etc.

**Business and Financial Skills**
- Knowledge of business case, online marketing strategies and financial terminologies like ROI (Return On Investment).

**Project Management**
- Negotiating with the clients and having knowledge of risk analytics, service agreements and policies.

**Data Integration and Analysis**
- Having knowledge of database, data mining and ERP system (Enterprise Resource Planning).

**Security**
- Having knowledge of internet security, encryption, authorization and security protocols.

https://www.urbanpro.com/a/cloud-computing-future-scope
Cloud Computing

Scott Lowe in “Closing the Cloud Skills Gap – How we can prepare ourselves for a future where the cloud is even more pervasive”

Risk Management - CRISC
IT Service Management - ITIL, PCSM
Project/Program Management – PMP, Prince2
Business-IT Alignment – COBIT5
Technical Skills in Cloud Implementation
  Software development basics (Devops)
  Linux
  Automation and orchestration tools
    Scripting tools –Powershell, Ruby, Perl, Python
    Configuration management tools – vCenter Orchestrator, vCAC, OpenStack
Public Cloud services – Amazon Web Services, Windows Azure, vmware vCloud

http://www.slideshare.net/lowescott/closing-the-cloud-skills-gap
Internet of Things (IoT)
IoT

“There is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.”

- Webopedia

http://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT

Get comprehensive graphic on IoT at
IoT

INTERNET OF THINGS (IoT)

DURING 2008, THE NUMBER OF THINGS CONNECTED TO THE INTERNET EXCEEDED THE NUMBER OF PEOPLE ON EARTH.

2003  2010  2015

By 2020 There Will Be FIFTY Billion

Source: Cisco

http://cloudcomputing.sys-con.com/node/3345432
IoT

2020

4 BILLION
Connected People

$4 TRILLION
Revenue Opportunity

25+ MILLION
Apps

25+ BILLION
Embedded and Intelligent Systems

50 TRILLION
GBs of Data

Source: Mario Morales, IDC

http://www.wordstream.com/blog/ws/2015/01/09/the-internet-of-things
The Industrial Internet of Things (IIoT) represents industry-oriented applications where:

- **Devices** are machines operating in industrial, transportation, energy or medical environment.
- **Data volumes and rates** tend to be from sustained to relatively high.
- **Applications** are mission and safety critical, e.g. the failure of a smart grid has severe impact on our life and economy, the misbehaving of a smart traffic system can threaten drivers.
- **IIoT applications** tend to be “system centric”.

1. The list of application domains is supposed to give examples and is not exhaustive.
IoT

Consumer Internet of Things (CloT)

The Consumer Internet of Things (CloT) represents the class of consumer-oriented applications where:

- Devices are **consumer devices**, such as smart appliances, e.g. refrigerator, washer, dryer, personal gadgets such as, fitness sensors, google glasses, etc.
- Data volumes and rates are relatively low
- Applications are **not mission or safety critical**, e.g., the failure of fitness gadget will make you, at worse, upset, but won’t cause any harm
- CloT applications tend to be “**consumer centric**”

THE HOME OF THE FUTURE:
MOST & LEAST WANTED “SMART” PRODUCTS, ACCORDING TO CONSUMERS

MOST WANTED
- Refrigerator – Enables remote viewing of its contents and recommends recipes based on stored items
- Light bulb – Turns off when no one is nearby and can be remotely activated
- Sprinkler system – Monitors weather over time and determines when to turn on and shut off
- Scale – Aggregates data from other devices and provides a constantly updated personal health plan
- Tap water filter – Automatically shuts off when nothing is in the sink and tracks water usage from all connected faucets and shower heads
- Laundry washer and dryer – Sends an alert when the cycle is done and can be remotely activated

SOMETHING WANTED
- Coffee maker – Syncs to an alarm clock
- Oven – Detects when food is done and sends a mobile alert
- Vacuum – Cleans without human involvement and can be remotely activated
- Packaged food – Sends an alert when the item is on sale and displays nutrition information for a specific amount of food determined by the user

LEAST WANTED
- Razor – Sends an alert when the blade needs to be replaced
- Baby diaper – Sends an alert when the diaper needs to be changed
- Toothbrush – Tracks brushing habits and sends data to the user’s dentist
- Wine bottle – Sends an alert when the wine’s flavor is best and, once opened, indicates when it’s no longer good to drink

The 10 Most Influential Internet of Things Companies

<table>
<thead>
<tr>
<th>RANK</th>
<th>NIS</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>757</td>
<td>Apple</td>
</tr>
<tr>
<td>2</td>
<td>549</td>
<td>Nest</td>
</tr>
<tr>
<td>3</td>
<td>243</td>
<td>Google</td>
</tr>
<tr>
<td>4</td>
<td>162</td>
<td>Intel</td>
</tr>
<tr>
<td>5</td>
<td>129</td>
<td>Microsoft</td>
</tr>
<tr>
<td>6</td>
<td>100</td>
<td>Cisco</td>
</tr>
<tr>
<td>7</td>
<td>94</td>
<td>Samsung</td>
</tr>
<tr>
<td>8</td>
<td>89</td>
<td>Vodafone</td>
</tr>
<tr>
<td>9</td>
<td>50</td>
<td>MediaTek</td>
</tr>
<tr>
<td>10</td>
<td>47</td>
<td>SecureRF</td>
</tr>
</tbody>
</table>

Apple announced partners for its HomeKit developer platform: Texas Instruments, Philips, Haier, Netatmo, Withings, Honeywell, Marvell, Osram and Broadcom.
- Source: The Guardian 06/02/2014

Samsung announced the launch of Samsung Smart Home ... Home automation with a single app.
- Source: Yahoo News 04/02/2014

Vodafone announced plans to Cobra Automotive Technologies [strengthening] its hand in the M2M and connected cars.
- Source: Mobile Money Live 09/16/2014

Semiconductor manufacturer MediaTek today announced their latest processor platform [LinkIt] targeted at wearables and Internet of Things.
- Source: Mobile Geeks 06/03/2014

http://www.codeproject.com/Articles/833125/Overview-of-The-Internet-of-Things
<table>
<thead>
<tr>
<th>Operating Systems for development IoT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contiki</strong></td>
</tr>
<tr>
<td>Website: <a href="http://www.contiki-os.org/">http://www.contiki-os.org/</a></td>
</tr>
<tr>
<td>Contiki is an open source, highly portable, multi-tasking operating system for memory-efficient networked embedded systems and wireless sensor networks.</td>
</tr>
<tr>
<td><strong>TinyOS</strong></td>
</tr>
<tr>
<td>Website: <a href="http://www.tinyos.net/">http://www.tinyos.net/</a></td>
</tr>
<tr>
<td>TinyOS is an embedded operating system written in the nesC programming language as a set of cooperating tasks and processes.</td>
</tr>
<tr>
<td><strong>RIOT OS</strong></td>
</tr>
<tr>
<td>Website: <a href="http://www.riot-os.org/">http://www.riot-os.org/</a></td>
</tr>
<tr>
<td>RIOT OS is an operating system for Internet of Things (IoT) devices. It is based on a microkernel and designed for: energy efficiency, hardware independent development, a high degree of modularity.</td>
</tr>
</tbody>
</table>
## Platforms for development of IoT

| AMEE Platform | Company: AMEE UK  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Website: <a href="http://www.amee.com/">http://www.amee.com/</a></td>
</tr>
</tbody>
</table>

| Arkessa Platform | Company: Arkessa  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ R K E S S Δ</td>
<td>Website: <a href="http://www.arkessa.com">http://www.arkessa.com</a></td>
</tr>
</tbody>
</table>

| IPv4 to IPv6 | IPv4 address won't be sufficient for these billions of device.  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IPv6 solves the scarcity of addresses.</td>
</tr>
</tbody>
</table>
**IoT**

What are the chief obstacles to your organisation using the IoT? Select up to two (% respondents)

<table>
<thead>
<tr>
<th>Obstacle</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of employee skills/knowledge</td>
<td>26</td>
</tr>
<tr>
<td>Lack of senior management knowledge/commitment</td>
<td>23</td>
</tr>
<tr>
<td>Products or services do not have an obvious IoT element to them</td>
<td>21</td>
</tr>
<tr>
<td>Immaturity of industry standards around the IoT</td>
<td>19</td>
</tr>
<tr>
<td>High costs of required investment in IoT infrastructure</td>
<td>18</td>
</tr>
<tr>
<td>Undeveloped consumer awareness</td>
<td>17</td>
</tr>
<tr>
<td>Weaknesses in your organisation’s technology infrastructure</td>
<td>15</td>
</tr>
<tr>
<td>Regulation (e.g., relating to data privacy)</td>
<td>15</td>
</tr>
<tr>
<td>Weaknesses in public communications infrastructure available to your organisation</td>
<td>12</td>
</tr>
<tr>
<td>General economic uncertainty</td>
<td>10</td>
</tr>
<tr>
<td>Other (please specify)</td>
<td>10</td>
</tr>
<tr>
<td>Don’t know</td>
<td>1</td>
</tr>
</tbody>
</table>

[http://www.theregister.co.uk/2013/10/30/need_a_job_the_internet_of_things_wants_you/](http://www.theregister.co.uk/2013/10/30/need_a_job_the_internet_of_things_wants_you/)
DevOps
DevOps

Conway's Law states:

*Organizations that design systems are constrained to produce designs which are copies of the communication structures of these organizations.*

DevOps

DevOps


http://cloudsmartz.com/devops-enabled-cloud-drives-paradigm-shift-to-it/
DevOps

- **DevOps** represents a change in IT culture, focusing on rapid IT service delivery through the adoption of agile, lean practices in the context of a system-oriented approach.

- DevOps emphasizes people (and culture), and seeks to improve collaboration between operations and development teams. DevOps implementations utilize technology — especially automation tools that can leverage an increasingly programmable and dynamic infrastructure from a life cycle perspective. - *Gartner*

  http://www.gartner.com/it-glossary/devops/
DevOps

Tangible Benefits
• Improvements in early defect detection
• Shorter Development Cycles – from requirements to production deployment
• Increased velocity of change/improvement in the Application
• Reduced deployment failures – With the availability of VMs for example, when there is a deployment to Production, it should not be the first time the release was deployed as if it were going to Production.

Soft Benefits
Essentially building a culture of performance and pride in what they own.
• Teams take on more ownership of their applications/products
• Teams that take ownership are always more productive and more creative
• Less finger-pointing and more teamwork
• Better/quicker problem solving

http://cloudsmartz.com/devops-enabled-cloud-drives-paradigm-shift-to-it/
DevOps

DevOps

http://www.collab.net/partners/technology/hp/devops
DevOps

DevOps Adoption Up in 2016

2016
74% Adopting DevOps
16% Not adopting
10% Don't Know

2015
66% Adopting DevOps
19% Not adopting
15% Don't Know

Source: RightScale 2016 State of the Cloud Report

http://www.edureka.co/blog/10-hottest-tech-skills-in-2016/
DevOps

DASA Competence Framework

The DASA Competence Framework Identifies

Knowledge Areas
- Business Value Optimization
- Business Analysis
- Architecture & Design
- Programming
- Continuous Delivery
- Test Specification
- Infrastructure Engineering
- Security, Risk & Compliance

Skills Areas
- Courage
- Teambuilding
- DevOps Leadership
- Continuous improvement

Skill Areas
- Knowledge Areas
  - 1 - Novice
  - 2 - Competent
  - 3 - Proficient
  - 4 - Expert
  - 5 - Master

https://www.linkedin.com/company/devops-skills-association
Cybersecurity
Cybersecurity: A National Priority

“...cybersecurity (i)s one of the most serious economic and national security challenges we face as a nation, but one that we as a government or as a country are not adequately prepared to counter.”
President Obama

Cybersecurity is expensive, continuous, evolving, adaptive, essential.
Cybersecurity

DATA BREACH STATISTICS
DATA RECORDS LOST OR STOLEN SINCE 2013

5,329,418,398

ONLY 4% of breaches were “Secure Breaches” where encryption was used and the stolen data was rendered useless.

DATA RECORDS ARE LOST OR STOLEN AT THE FOLLOWING FREQUENCY

EVERY DAY 3,820,372
EVERY HOUR 159,182
EVERY MINUTE 2,653
EVERY SECOND 44

www.breachlevelindex.com
## Cybersecurity

### Top Scoring Data Breaches

<table>
<thead>
<tr>
<th>Organization Breached</th>
<th>Records Breached</th>
<th>Date of Breach</th>
<th>Type of Breach</th>
<th>Source of Breach</th>
<th>Location</th>
<th>Industry</th>
<th>Risk Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>JPMorgan Chase</td>
<td>83,000,000</td>
<td>08/27/14</td>
<td>Identity Theft</td>
<td>Malicious Outsider</td>
<td>United States</td>
<td>Financial</td>
<td>10.0</td>
</tr>
<tr>
<td>Korea Credit Bureau, NH Nonghyup Card, Lotte Card, KB Kookmin Card</td>
<td>104,000,000</td>
<td>01/20/14</td>
<td>Identity Theft</td>
<td>Malicious Insider</td>
<td>South Korea</td>
<td>Financial</td>
<td>10.0</td>
</tr>
<tr>
<td>Target</td>
<td>110,000,000</td>
<td>11/04/13</td>
<td>Financial Access</td>
<td>Malicious Outsider</td>
<td>United States</td>
<td>Retail</td>
<td>10.0</td>
</tr>
<tr>
<td>Home Depot</td>
<td>109,000,000</td>
<td>09/02/14</td>
<td>Financial Access</td>
<td>Malicious Outsider</td>
<td>United States</td>
<td>Retail</td>
<td>10.0</td>
</tr>
<tr>
<td>MySpace</td>
<td>360,000,000</td>
<td>06/11/13</td>
<td>Account Access</td>
<td>Malicious Outsider</td>
<td>United States</td>
<td>Other</td>
<td>10.0</td>
</tr>
<tr>
<td>Anthem Insurance Companies (Anthem Blue Cross)</td>
<td>78,800,000</td>
<td>01/27/15</td>
<td>Identity Theft</td>
<td>State Sponsored</td>
<td>United States</td>
<td>Healthcare</td>
<td>10.0</td>
</tr>
</tbody>
</table>
Cybersecurity

Cybersecurity

Dropbox

September 2, 2016: The popular file-hosting service was forced to confront a data breach from four years ago that affected more users than originally believed. In 2012, Dropbox helped a small amount of users secure their accounts after some usernames were stolen. At the end of August 2016, however, it was revealed that more than 68 million Dropbox users had their usernames and passwords compromised in that initial breach. It does not look like the accounts have been illegally accessed at this time, and all Dropbox users who have not reset their passwords since 2012 have been prompted by the company to do so.

Yahoo!

September 22, 2016: In what may be the most expansive data breach of all time, Yahoo announced that a hacker had stolen information from a minimum of 500 million accounts in late 2014. The thief, believed to be working on behalf of a foreign government, stole e-mail addresses, passwords, full user names, dates of birth, telephone numbers, and in some cases, security questions and answers. At the time of the breach announcement, Yahoo was still working with law enforcement and the FBI on an investigation.

Weebly

October 20, 2016: Over 43 million Weebly users were notified about a data breach that happened in February, but was just discovered in October. Stolen data included usernames, passwords, e-mail addresses, and IP information, but Weebly does not believe any type of financial information was stolen because it does not store full credit card numbers on its servers. Hackers were not able to log directly into customer websites because passwords were protected by bcrypt hashing.

National Payment Corporation of India

October 20, 2016: The National Payment Corporation of India (NPCI) was notified by international banks, primarily in the U.S. and China, that some of its customers’ debit cards were being used illegally. Experts believe the breach began with a malware attack that originated at an ATM. The NPCI said that 32 lakh debit cards across 19 Indian banks were compromised, but customers were contacted to change the debit card PINs and customers they couldn’t reach had their cards canceled and were issued new ones.

https://www.identityforce.com/blog/2016-data-breaches
Cybersecurity

How Data Breaches Occur

1. **Research**
   - Attacker looks for weaknesses he can exploit

2. **Stage Attack**
   - Social Engineering:
     - Phishing email, spam with malware, phone call, dress like the night janitor, etc.
   - Infrastructure Weakness:
     - SQL injection, vulnerability exploitation, session hijacking, etc.

3. **Exfiltrate**
   - Database and file servers:
     - Personally identifiable information (PII), credit card numbers, email addresses, other social details, etc.
   - Accessed data is exfiltrated back to attacker

Cybersecurity

https://ccis.no/cyber-security-versus-information-security/
Cybersecurity

https://e-discoveryteam.com/2014/04/27/the-cia-cyber-security-triad-and-9ec4c12949a4f31474f299058ce2b22a/
Cybersecurity

Cyber Security Triads

Cybersecurity

IDENTIFY
- Asset management
- Business environment
- Governance
- Risk assessment
- Risk management strategy

PROTECT
- Access control
- Awareness and training
- Data security
- Information protection and procedures
- Maintenance
- Protective technology

DETECT
- Anomalies and events
- Security continuous monitoring
- Detection process

RESPOND
- Response planning
- Communications
- Analysis
- Mitigation
- Improvements

RECOVER
- Recover planning
- Improvements
- Communications

https://www.praetorian.com/blog/nist-cybersecurity-framework-vs-nist-special-publication-800-53
Cybersecurity

2016 Cybersecurity Skills Gap

Too Many Threats

$1 BILLION: PERSONALLY IDENTIFIABLE INFORMATION (PII) RECORDS STOLEN IN 2014

97% BELIEVE APTs REPRESENT CREDIBLE THREAT TO NATIONAL SECURITY AND ECONOMIC STABILITY

MORE THAN 1 IN 4 ORGANIZATIONS HAVE EXPERIENCED AN APT ATTACK

$150 MILLION: AVERAGE COST OF A DATA BREACH BY 2020

1 IN 2 BELIEVE THE IT DEPARTMENT IS UNAWARE OF ALL OF ORGANIZATION’S INTERNET OF THINGS (IOT) DEVICES

74% BELIEVE LIKELIHOOD OF ORGANIZATION BEING HACKED THROUGH IOT DEVICES IS HIGH OR MEDIUM

Too Few Professionals

2 MILLION: GLOBAL SHORTAGE OF CYBERSECURITY PROFESSIONALS BY 2019

3X RATE OF CYBERSECURITY JOB GROWTH VS. IT JOBS OVERALL, 2010-14

84% ORGANIZATIONS BELIEVE HALF OR FEWER OF APPLICANTS FOR OPEN SECURITY JOBS ARE QUALIFIED

89% OF U.S. CONSUMERS BELIEVE IT IS IMPORTANT FOR ORGANIZATIONS TO HAVE CYBERSECURITY-CERTIFIED EMPLOYEES

Cyberattacks are growing, but the talent pool of defenders is not keeping pace.

Although attacks are growing in frequency and sophistication, the availability of sufficiently skilled cybersecurity professionals is falling behind. Cybersecurity Nexus (CSX) is addressing this gap by creating a skilled global cybersecurity workforce. From the Cybersecurity Fundamentals Certificate for university students to CSXP, the first vendor-neutral, performance-based cybersecurity certification, CSX is attracting and enabling cybersecurity professionals at every stage of their careers.

Sources:
1. 2015 Cost of Data Breach Study: Global Analysis, IBM and Ponemon Institute, May 2015
2. ISACA 2015 APT Study, October 2015
3. ISACA 2015 APT Study
5. ISACA 2015 IT Risk/Reward Barometer-Member Study, September 2015
6. ISACA 2015 IT Risk/Reward Barometer-Member Study
7. UK House of Lords Digital Skills Committee
12. 2015 ISACA Risk/Reward Barometer-Consumer Study, September 2015

** “Employees” refers to data security professionals at organizations that potentially have access to survey respondent’s personal information.

Which areas of cybersecurity would you say that your organization has the biggest skills deficiency? (Percent of respondents, N=299, three responses accepted)

- Cloud security specialists: 33%
- Network security specialists: 28%
- Security analytics: 27%
- Data security specialists: 26%
- Security engineering: 23%
- Security operations: 20%
- Identity and access management: 15%
- Application security specialists: 14%
- Endpoint security specialists: 14%
- We don’t have any cybersecurity skills deficiencies: 9%


Cybersecurity

Goal 1
• focuses on the general public to provide basic information to both individuals and organizations on how to better protect themselves in cyberspace.

Goal 2
• focuses on students at every level to increase interest in cybersecurity classes while better preparing students to pursue careers in cybersecurity.

Goal 3
• focuses on the current cybersecurity workforce including providers, suppliers, and architects of cybersecurity to make the Nation’s cybersecurity workforce the best in the world.

Objective 2.1
Increase Exposure to Cybersecurity in PreK-12 education by Emphasizing Connections to Science, Technology, Engineering, and Mathematics (STEM) Education and the Role of Mathematics and Computational Thinking in Cybersecurity

Objective 2.2
Promote Interest in Computer Science and Cybersecurity by increasing the Diversity and Quantity of Course Offerings and Research Opportunities

Strategies for objective 2.2
1. Increase the quantity and diversity of computer science courses in high schools
2. Increase the quantity and diversity of undergraduate and graduate cybersecurity curricula
3. Champion cybersecurity competitions
4. Advance excellence in cybersecurity research and development
5. Coordinate a learning network of virtual national cybersecurity laboratories

[link to PDF document]
Cybersecurity

Only one university offers Cybersecurity as a course in Nigeria

Enough said!
The Gap
The Gap

13 Major Reasons Why Nigerian Graduates Are Unemployable

• **Lack of employability skills**
  
  Mr. Kenedy Brake, Former Kokodiagbene Youth leader and director, Brakin resources
  Sept 2014

• **Failure of school curriculum to place emphasis on practical concepts of entrepreneurship/ Too much emphasis on theoretical education than entrepreneurship exposure**
  
  Prof. Peter Okebukola, Former NUC Executive Secretary
  April 30, 2014

• **The quality and focus of training offered by the universities were not in tune with the needs of society**
  
  Prof. Julius Okojie, Former NUC executive secretary

• **Most of the programmes run in the universities are irrelevant**
  
  Prof. Sola Fajana, V.C Ayo Babalola University,
  Source: Daily Independent
  October 2, 2013

http://nigerianuniversityscholarships.com/13-major-reasons-nigerian-graduates-unemployable-share/
Bridging the Gap

Findings

• Collaboration is discouraged in the classroom but embraced in the workplace
• Canned problems vs real world disasters - students work on pre-packaged exercises

Recommendations:

• Building trust between the university and industry
• Curriculum change is a concept that university understands and that industry can provide invaluable insight
• Make Interdisciplinary Education (IE) teaching the norm by promoting incentives and faculty sabbaticals
• In the classroom, allow students to make mistakes, encourage interns to provide feedback, provide a forum for recent graduates and invest in the right technology tools
• In the workplace, provide student-centred internships and ongoing supervisor engagement

“Overcoming the skills gap in Big Data Analytics” by Patricia Cotter Ed. D.
(http://www.slideshare.net/trishcotter5/pcotter-research-presentation-v1-2)
“Over the past decade, research has emphasized the need for today’s young professionals to possess deep disciplinary knowledge along with a keen ability to communicate across social, cultural and economic boundaries.

These “T-shaped professionals” are in high demand for their ability to innovate, build relationships, advance research and strengthen their organizations.”
Bridging the Gap

http://tsummit.org/t
Bridging the Gap

Figure 1: Skills for the 21st century

21st-Century Skills

Foundational Literacies
- Literacy
- Numeracy
- Scientific literacy
- ICT literacy
- Financial literacy
- Cultural and civic literacy

Competencies
- Critical thinking/problem-solving
- Creativity
- Communication
- Collaboration

Character Qualities
- Curiosity
- Initiative
- Persistence/ grit
- Adaptability
- Leadership
- Social and cultural awareness

Lifelong Learning


https://oecdskillsandwork.wordpress.com/2016/06/17/soft-skills-for-the-future/
Bridging the Gap

Soft Skills

- Effective Communication
- Effective Meetings
- Effective Leadership
- Presentation Skills
- Stress Management
- Time Management & Organisational Skills
- Transition & Change
- High Performance Team Building and Managing
- Conflict Resolution
- Problem Solving Strategies
- Dealing with difficult people
- Effective Listening
## Bridging the Gap

### Effective Communication

**Communication at a workplace** goes beyond e-mails and meetings. It requires new dimensions when one has to deal with people from different backgrounds, cultures, and language. Expertise is acquired slowly. However, feedback from mentors is one great way to help in honing these critical skills.

### Problem Solving

**A typical IT role demands problem-solving skills** to enhance the existing solutions. Problem-solving is all about applying logic, and imagination to make sense of the situation and come up with an intelligent solution. You will need to adopt a mindset of learning as a continuous journey.

### Teamwork

**Teamwork is an essential skill** not just for IT industry but for any. **Any job requires the employee to coordinate with multiple people** from several functions and varying geographies. Coordinating with different people, understanding from their perspective, and respecting them for the positive changes they bring to the company is an invaluable “team asset”.

### Self Improvement

Your employer may make learning options and tools available to you, but the responsibility to use and learn at work will be only yours. **Spending minimum 2 hours on the weekends to keep yourself up-to-date of technology trends will go a long way and benefit you.**

### Time Management Skills

You will be crowded with people, activities, e-mails, discussions, and a lot. But remembering your tasks, prioritizing them, and staying organized will benefit you in **building your credibility as an efficient and reliable employee.**

http://www.universalhunt.com/articles/top-5-soft-skills-for-it-job-aspirants/10140
4 TRENDS AFFECTING HIRING AND PAY FOR TECHNOLOGY JOBS

1. Timing is everything
Top candidates often receive multiple offers, so organizations need to move quickly. When faced with a lengthy hiring process, 39% of candidates lose interest and pursue other roles.

2. Skilled talent is in short supply
The unemployment rates for specialized positions are typically lower than the national rate. These professionals are difficult to hire given the high demand and short supply.

3. Education is essential
Employers consider college a must for most professional roles. More than 95% of jobs created during the recovery have gone to those with some college education.

4. Temporary is becoming permanent
Rather than let a job sit vacant, firms are bringing in temporary professionals. This gives them more time to recruit or determine if the temporary worker is the right fit for a full-time role.

Sources:
1. Robert Half survey of more than 1,000 working professionals
3. “America’s Divided Recovery: College More and More Nuts,” Georgetown University Center on Education and the Workforce

Bridging the Gap

• Determine your area(s) of interest within the fields presented
  • I hope I have been able to stimulate your interest!

• Acquire knowledge and skills online
  Visit https://www.onlinecoursereport.com/
  • Cybrary
  • Edureka
  • Coursera
  • Google CS Education

• You are on twitter and facebook, why are you not on
  • Job search sites (it’s not too early!)
  • Linkedin
Bridging the Gap

Be social! Be technical!

- NACOSS

- Nigeria Computer Society (NCS)

- Student Member
  - Student member is currently undergoing a course of study in computer science/Computer Engineering/Information Technology or related course in a University or Polytechnic or other Institutions of Higher learning recognized by the Society.

- Join local chapters of relevant associations
  - ISACA (Student and Young Professionals Groups are encouraged)
Bridging the Gap

- Collaborative competition

nacoss week '16
Coding & Graphics Contest

Date
13/10/14

Venue
CST
CONFERENCE ROOM

Time
2:00pm

Prizes and Certificates Up For Grabs.
Bridging the Gap

THE MINE 1.0
FIRST EVER STARTUP COMPETITION IN COVENANT UNIVERSITY

GET A RECEIPT
Visit the student council office to get a form for just N2000

FILL THE FORM
Fill the google online form given to you after getting the receipt.

CREATE A VIDEO
Create a 1 minute video, using the details given to you.

SUBMIT THE VIDEO
Submit your video on Sunday 2nd October, 2016. Wait patiently till you are called.

₦1 MILLION CASH PRIZE
No talk. All Action.
3 weeks intensive mentorship

8th of October, 2016 | ALDC, COVENANT UNIVERSITY

Judges:
Sola Akinlade
CEO/Co-Founder Paystack

Aniedi Udo-Obeng
Google Rep. Sub-Saharan

Kunle Sinadu
CEO Gingerbox

Stephen Oluwatobi
Director CEDS
Covenant University

Godwin Olatunde
CEO Callbase

MadePossible by:
Google, TECHCADAL, GINGERBOX, Paystack, CEDS

CENTRE FOR ENTREPRENEURIAL DEVELOPMENTAL STUDIES
Bridging the Gap
Bridging the Gap

• Curriculum Revision
  • Educational institutions need to revise their curriculum

• Partnership with the industry
  • Industry needs to view it as investment in probable workforce

• Interswitch Skills Base (https://lms.skillbaseng.com/)
  • 3rd & Final Year Students, Entrepreneurs & Professionals in Financial Services
  • Final Year Students, Graduates & Professionals in Financial Services
Bridging the Gap

Commendable strides of Covenant University that are bridging the gap

• The 1st International Workshop on Pattern Discovery in Biology was organised and hosted by the department from 18th – 27th April 2005.

• The department also organised and hosted International Conference on New Trends in the Mathematical and Computer Sciences with Application to Real World Problems from 19th – 23rd June 2006.

• The 2nd International Workshop on Pattern Discovery in Biology was organised and hosted by the department from 6th – 11th July 2009.

• The 1st International Conference and Workshop on Software Engineering and Intelligent Systems (Theme: Towards the Evolution of Smart Systems) was organised and hosted by the department from the 5th – 9th July 2010.

• Yearly Computer training programme for the staff and students of two (2) schools within its community:
  • 1. Iganmode High School, Oju-ore, Ota.
  • 2. Iju Ibiye Grammar School, Iju, Ota.

• Town & Gown Seminar Series

Keep it up!
About Safe Sail Consulting Ltd.

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Questions?