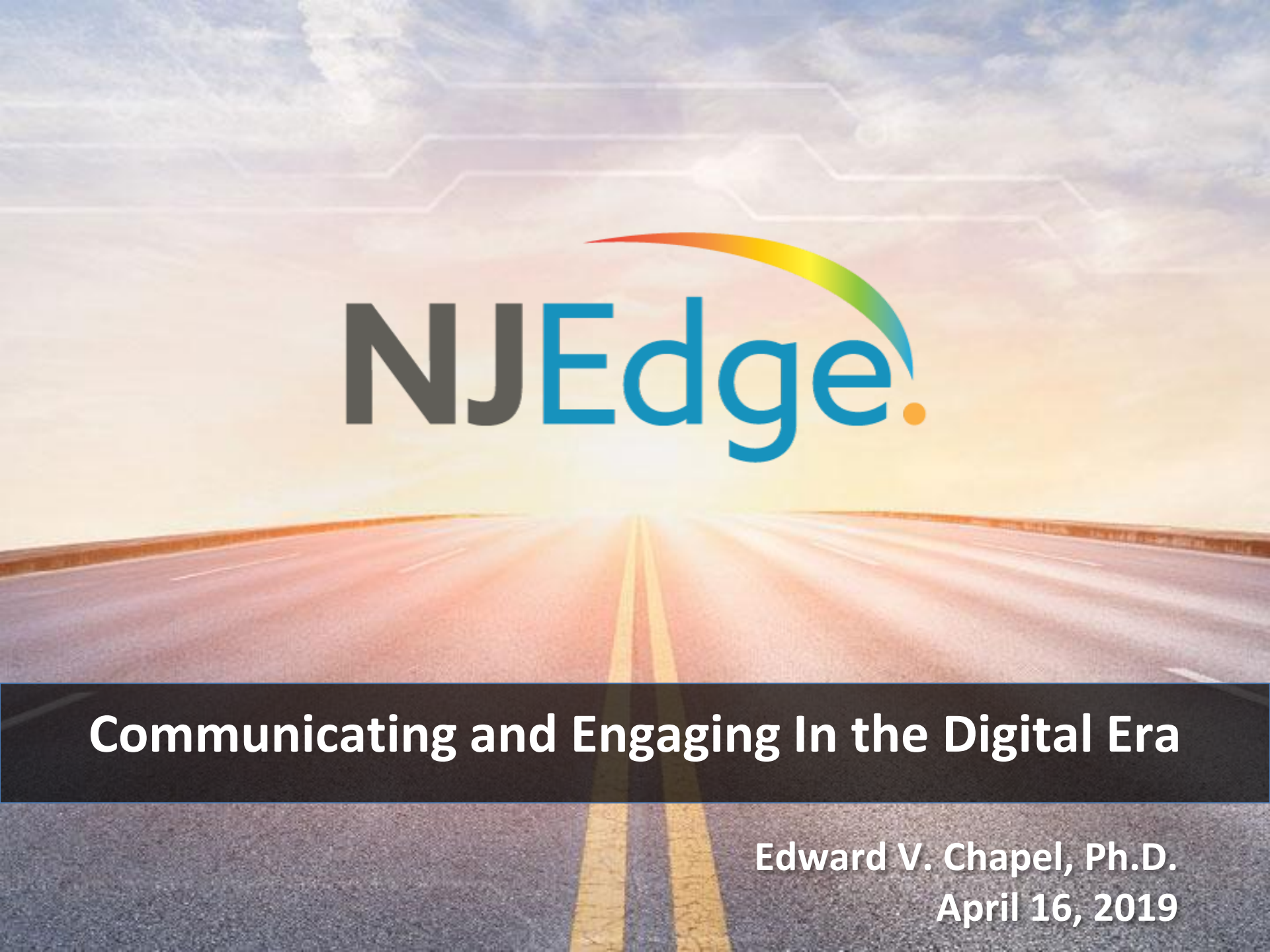


Communicating and Engaging In the Digital Era

Edward V. Chapel, Ph.D.

April 16, 2019

Thank you…

WILLIAM PATERSON UNIVERSITY

ups

NJEdge.

Our Agenda

Communicating and Engaging In the Digital Era

The Digital Era in Context – How did we get here?

Societal impact and the human experience

Transformational Dimensions:

- ✓ Future of Work
- ✓ Implications for Education
- ✓ New Paradigms for Research & Discovery

Premise:

Modes of subsistence, tools and technology have shaped societies throughout the ages.

Hunting & Gathering

- Consumption of wild animals
- Use of Primitive Tools

Pastoral-Horticultural – The 1st Transformation

Domestication

- Use of hand tools for crops
- Domestication of animals

Agricultural -The 2nd Transformation

The Plow

- Cultivation of crops
- Human and animal

Industrial – The Third Transformation

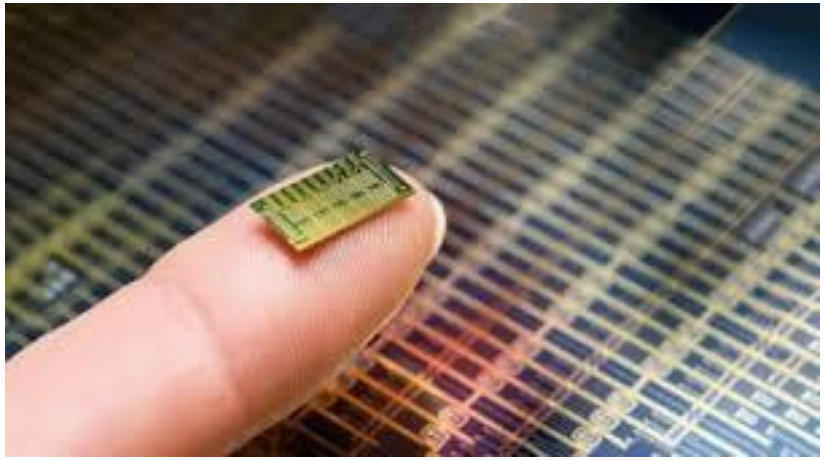
- Manufacture of goods
- Division of labor
- Urbanization
- Food surpluses

Mechanization

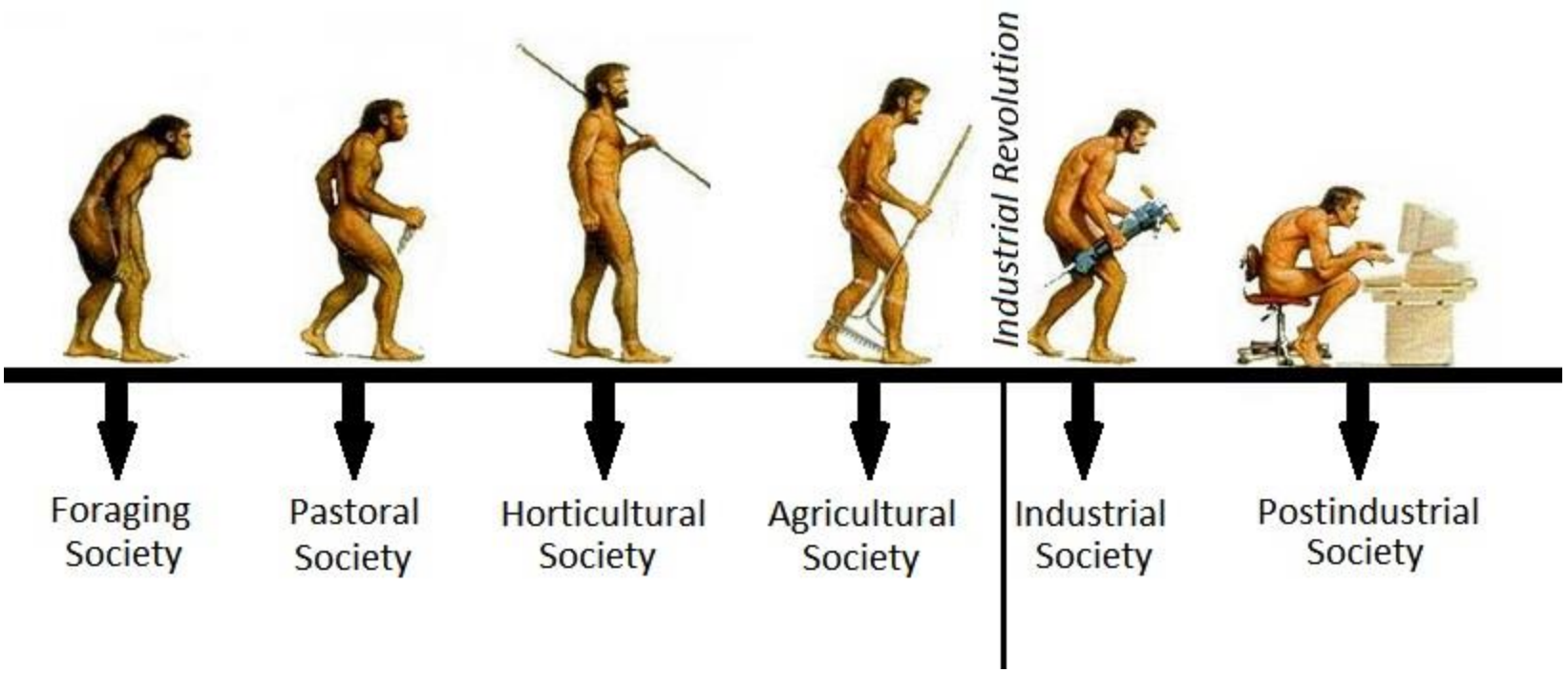
Postindustrial – The Fourth Transformation

Microprocessors

- Rise of the service sector
- Information-based work replaces manufacturing
- Academic knowledge displaces practical experience

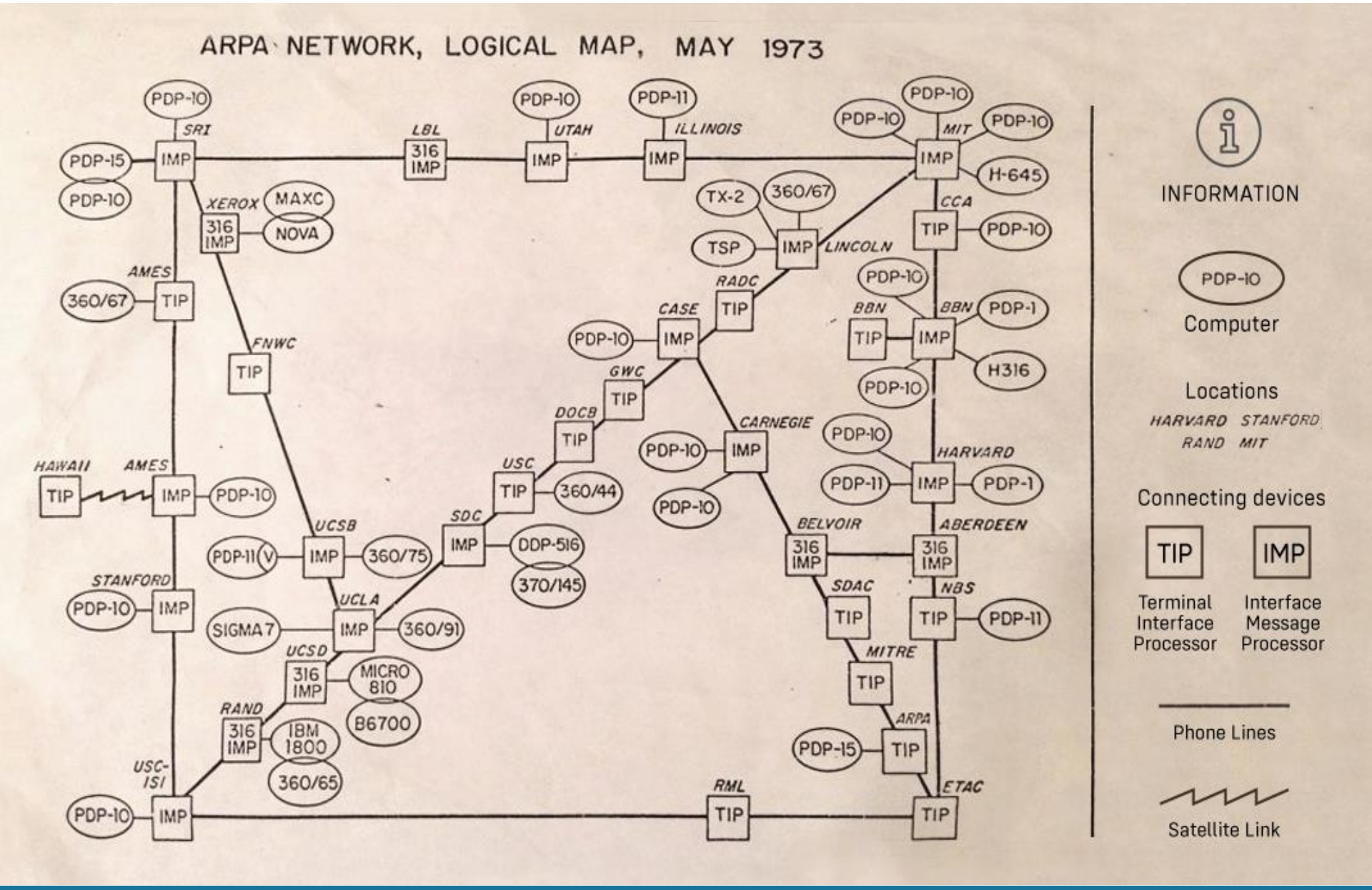


What's Next?

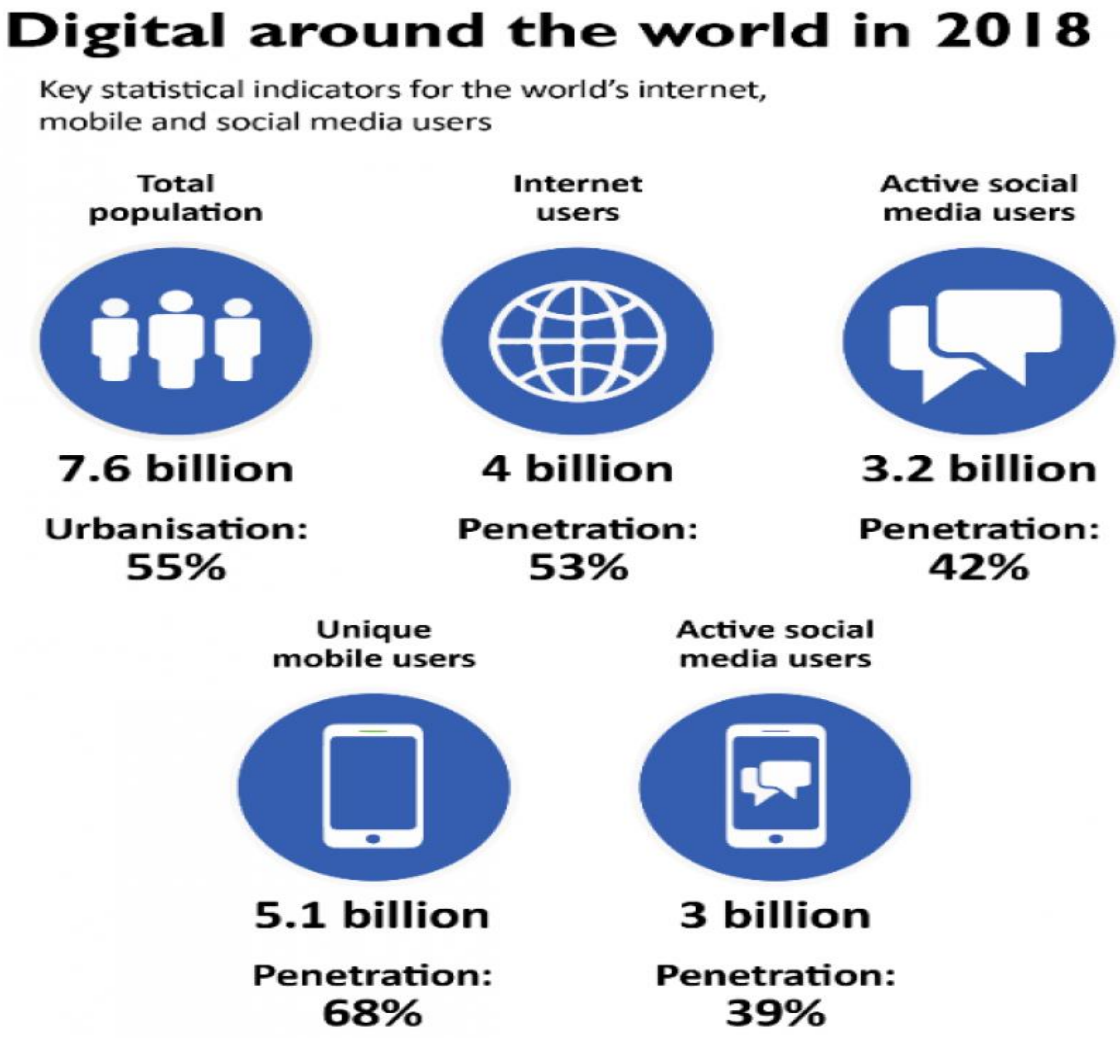

Industrial Revolution
Foraging Society
Pastoral Society
Horticultural Society
Agricultural Society
Industrial Society
Postindustrial Society

Digitization

The Earliest Internet

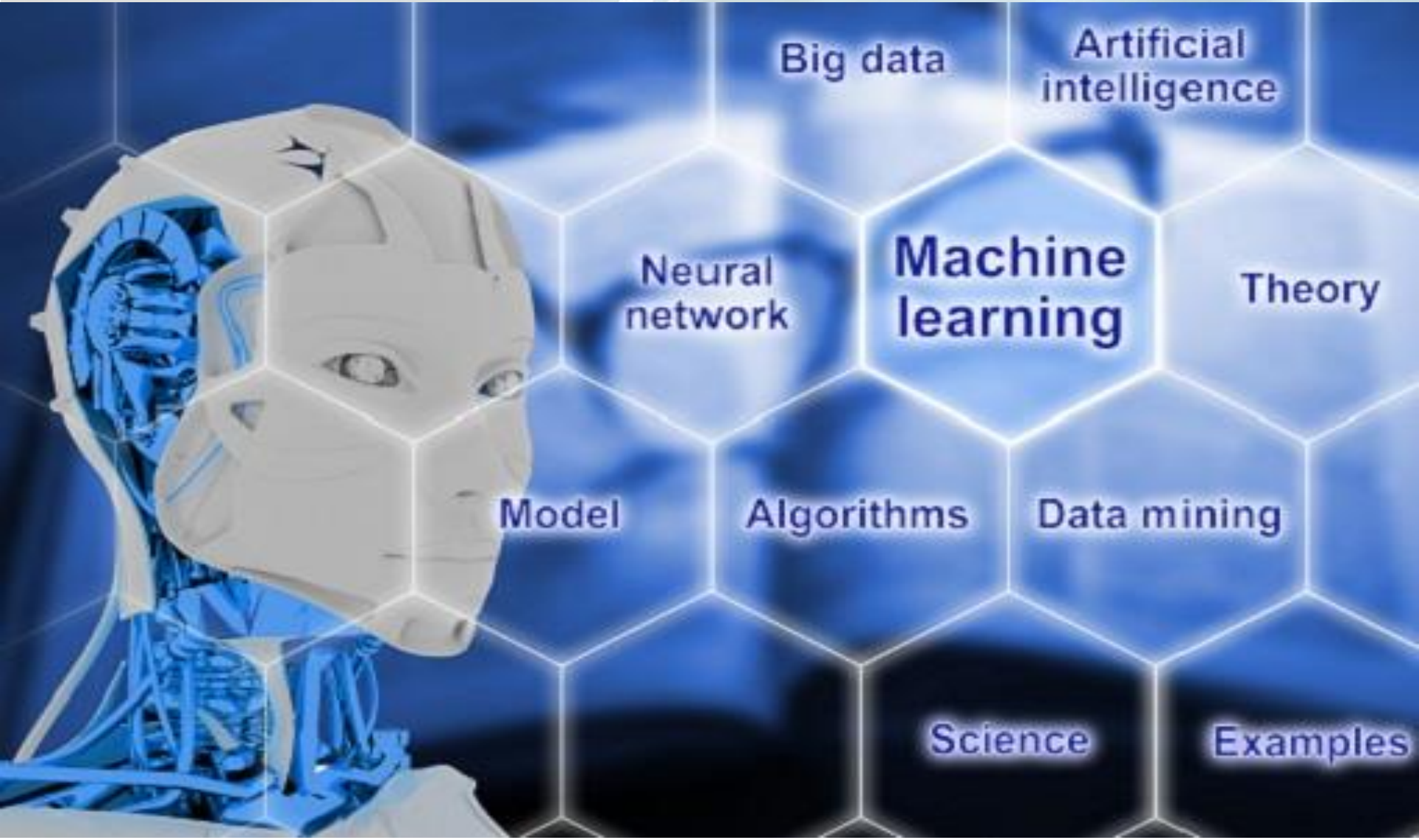


A Connected World



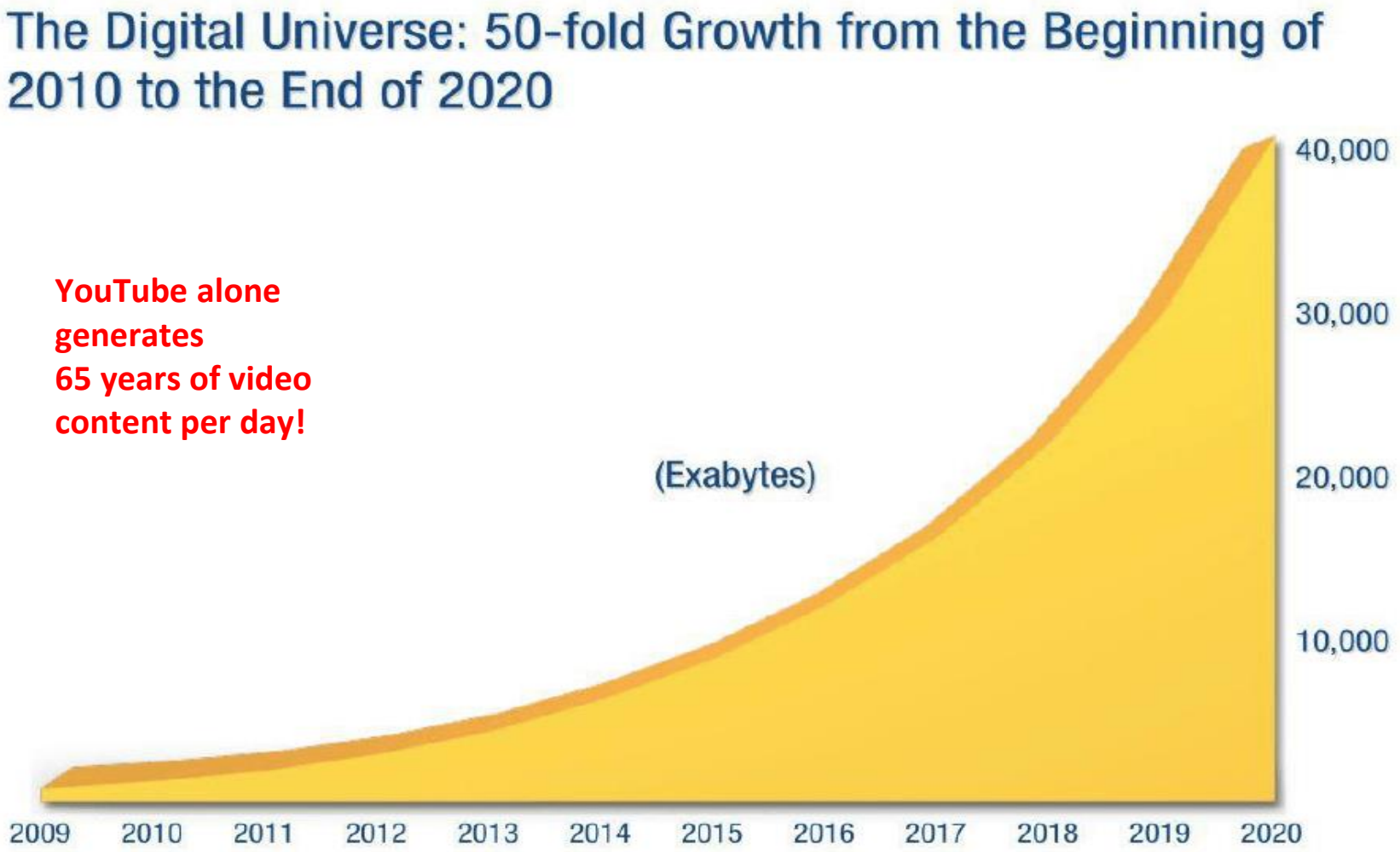
The Internet Today

The Digital Era – The 5th Transformation



The Search Engine

Orders of magnitude



This IDC graph predicts exponential growth of data from around 3 zettabytes in 2013 to approximately 40 zettabytes by 2020. An exabyte equals 1,000,000,000,000,000,000 bytes and 1,000 exabytes equals one zettabyte. Source: IDC's Digital Universe Study, December 2012, http://www.emc.com/collateral/analyst-reports/idc-the-digital-universe-in-2020.pdf.

What do these companies have in common?

Some points to ponder…

- The largest retailer in the world, Amazon, owns no stores
- The largest livery service in the world, Uber, owns no cars and has no employees who are drivers (likewise Lyft)
- Zillow and AirBnB are disrupting the real estate market and neither one of them owns properties

Forecast

- Number of connected devices worldwide will have risen from **15 billion to 50 billion by 2020**. Intel claims that over **200 billion devices will be connected.**

- Global spending on IoT devices and services will rise from $656 billion **to $1.7 trillion** fueled by growth in devices, connectivity solutions, IT services.

- **90% of cars will be online** compared with just 2% in 2012, supporting the growth of in-car infotainment, autonomous-driving, and embedded OS markets.

- **173.4 million wearable devices**

- "Industrial Internet" market (the connected industrial machinery) will **add $10 to $15 trillion to the global GDP** within the next 20 years

Societal Impacts

- Big Data, ML and AI will continue transform the economy and deliver a new wave of productive growth across all industry sectors.
- Talent and human capital will remain the most critical means of sustenance and technology in the digital age driving production in the data-driven economy.
- Technology and life-long (persistent) training and professional development are pre-conditions to thriving and growing in the digital landscape.
- By educating, training, and facilitating access to individuals with advanced computing and analytics skillsets, the United States can create a competitive advantage globally.

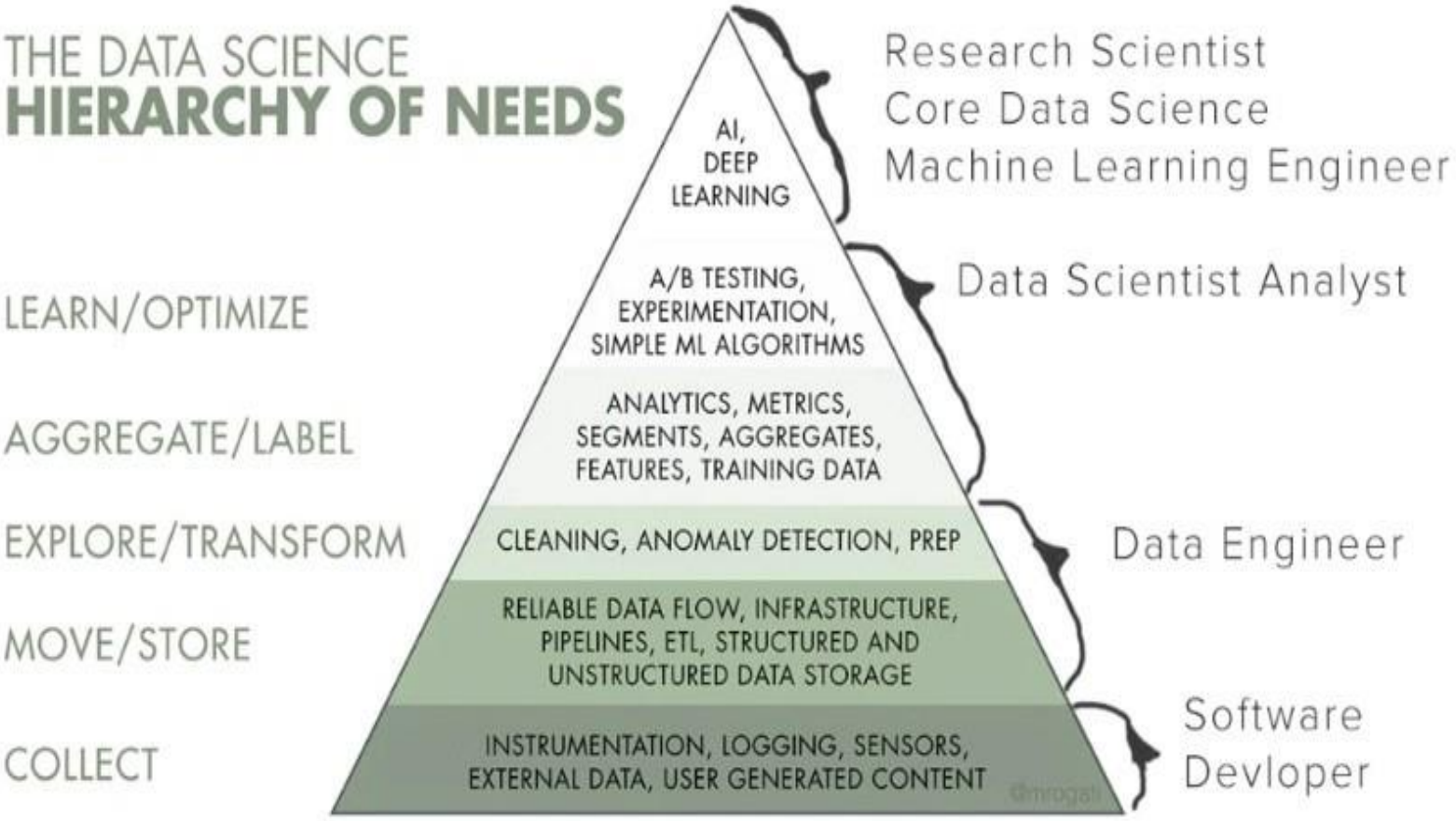
Technological Drivers

- Continually evolving computing capacity
- Cost efficiencies available through SaaS, PaaS, IaaS solutions
- Miniaturization of computing – sensor data, IoT

Data-Driven Decision Making

- **Machine learning (ML)**
  - Predictive modeling
  - Optimization
  - Computer vision
  - Natural language processing
  - Text mining
  - **Artificial Intelligence (AI)**
    - Multi-disciplinary efforts devoted to making machines intelligent, i.e. making machines function appropriately and with foresight

What Data Scientists Do

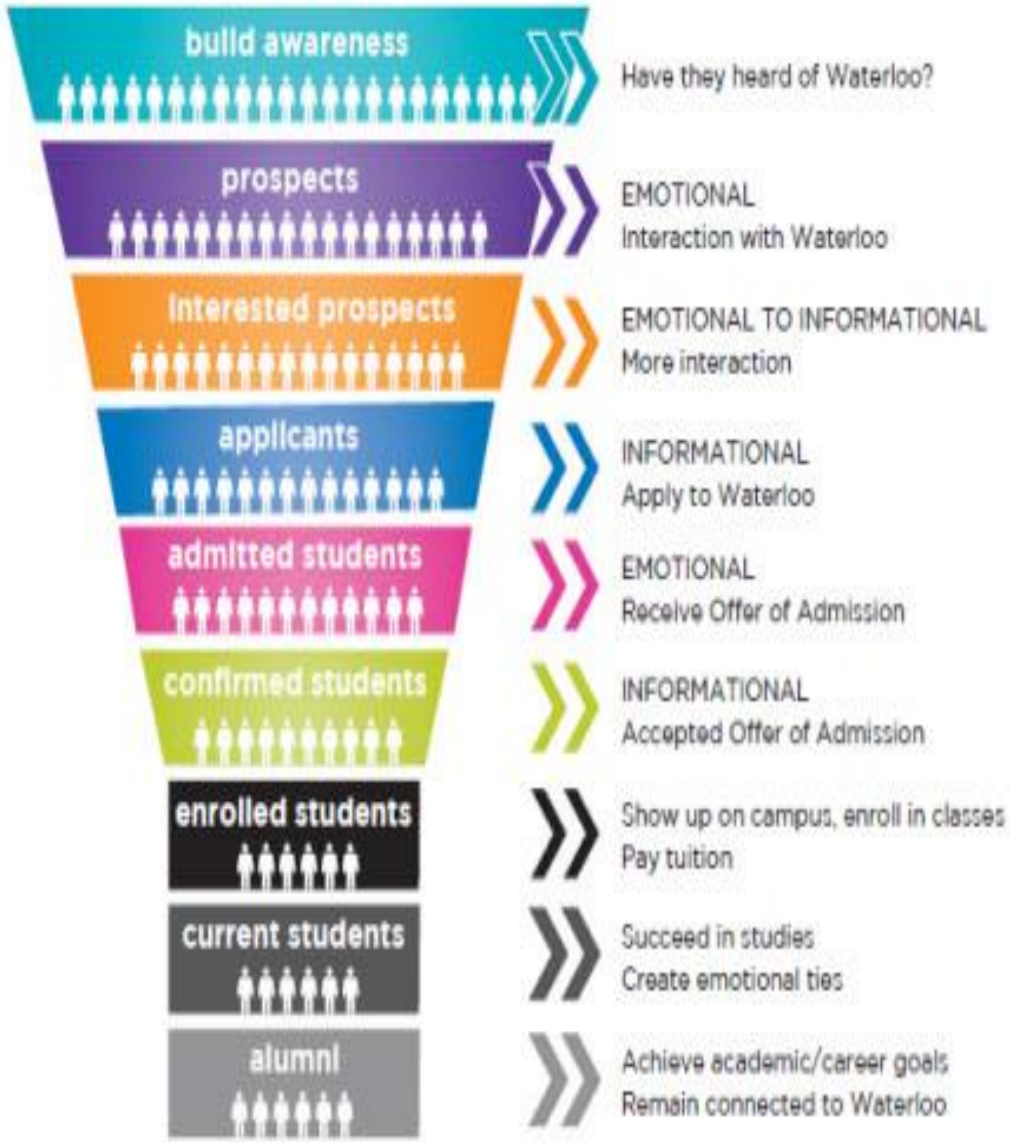


Areas of Opportunity

- The life-sciences
- Advanced Manufacturing
- Finance
- Transportation Logic & Distribution
- Food and Agriculture
- Clean Energy
- **Education???**

NJEdge.

A Use Case for Higher Education?



Source: Waterloo College

Inputs (Breadcrumbs)

- SIS, ERP, LMS, DAM, ID Card, Door Access, Meal Plan, Social Media, etc.

Strategy

- Removing the friction from the journey
- Personalization (digital moments)
- Smart Phone, Alexa
- Analytics/Real-time intervention

Examples

- Course signals
- Civitas
- Hobsons
- Ready Education
- Full Measure Education

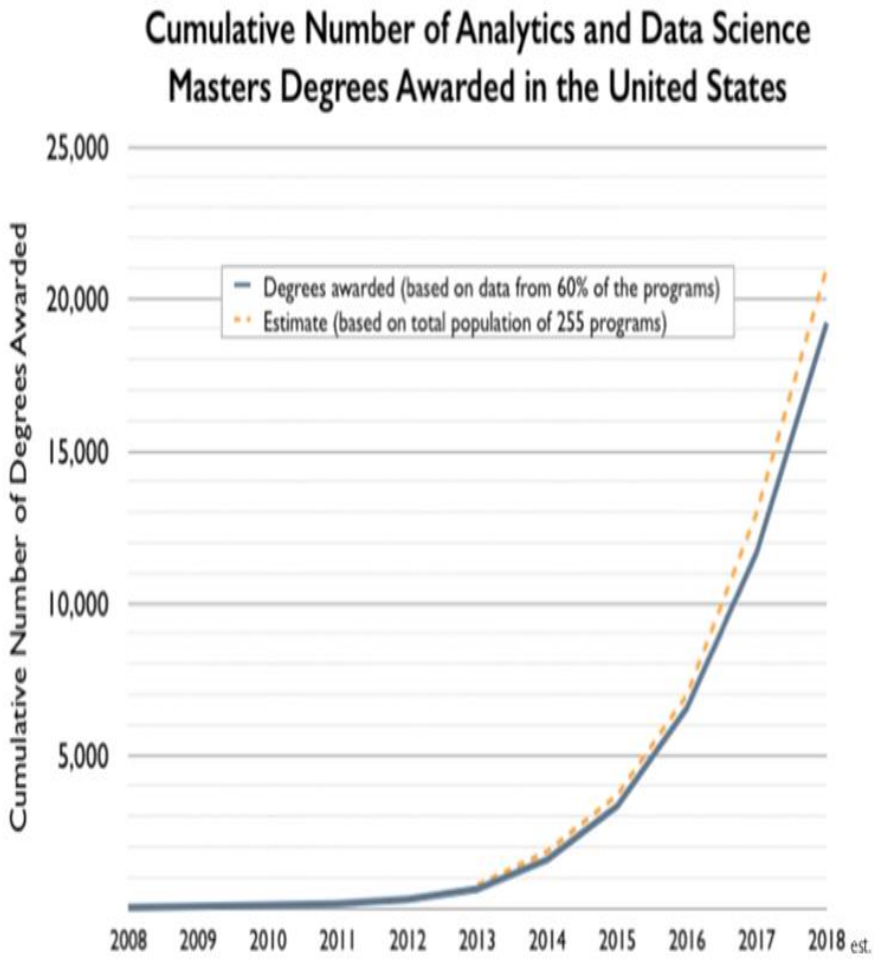
Preparing the Workforce for the Digital Era

- National surveys of existing data analytics and computing programs in the higher education domain reveal that two interdisciplinary fields – data science and business analytics – have emerged to address the data science talent shortage in the job market in the nation as well as in New Jersey.

- Analytics programs represent a new category of professional degrees with a strong interdisciplinary character that combines applied mathematics, statistics, computer science and business disciplines.

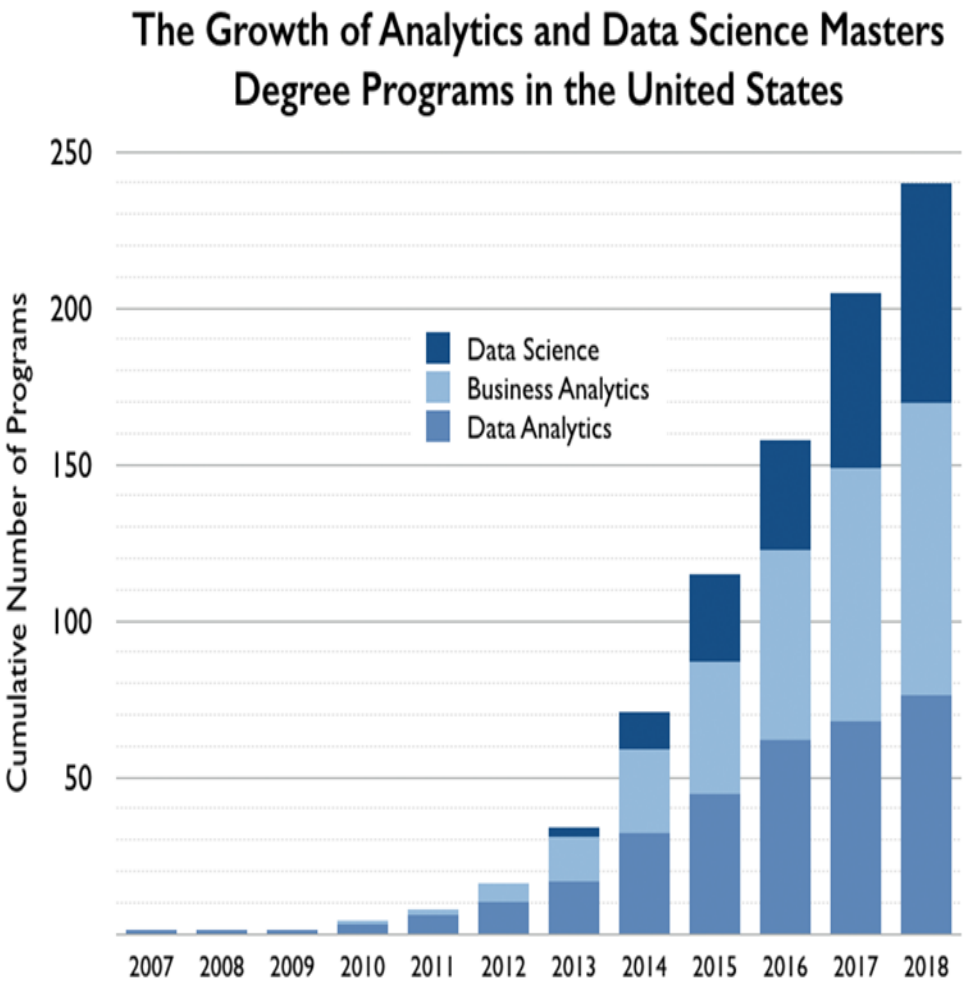
- However, some schools still offer data science and business analytics in disciplinary silos.

Data Science Master's Degree Programs in the US



Notes: About one-third of the programs were launched in the past 24 months and most will not award degrees until 2019. Data come from university offices of institutional research and other official sources of enrollment and degree data; academic program websites; commencement announcements; and private communications. The compilation of data has been ongoing since the inception of the initial program in 2008.

Source: Michael Rappa, Institute for Advanced Analyt
Updated 8/19/2018



Source: Michael Rappa, Institute for Advanced Analytics

NJEdge

Common Curriculum Areas

- **Big Data analytics** including structured, unstructured data including text, images, and videos.
- **Data Visualization** including data transformation, exploratory data analysis and descriptive modeling skills. For building both predictive and prescriptive models knowledge of Machine Learning algorithms, as well as linear and non-linear optimization techniques.
- Students should experience the entire **Big Data analytics life cycle**: data acquisition using SQL, data transformation, feature selection, model building and assessment, and putting the best model into production and use.
- **Communication and presentation skills** are essential for extracting information from large data sets and present insights to decision-makers. The ability to present the high-level insights in a clear, concise manner is crucial.

Analysis of Course Offerings in the Tri-State Area

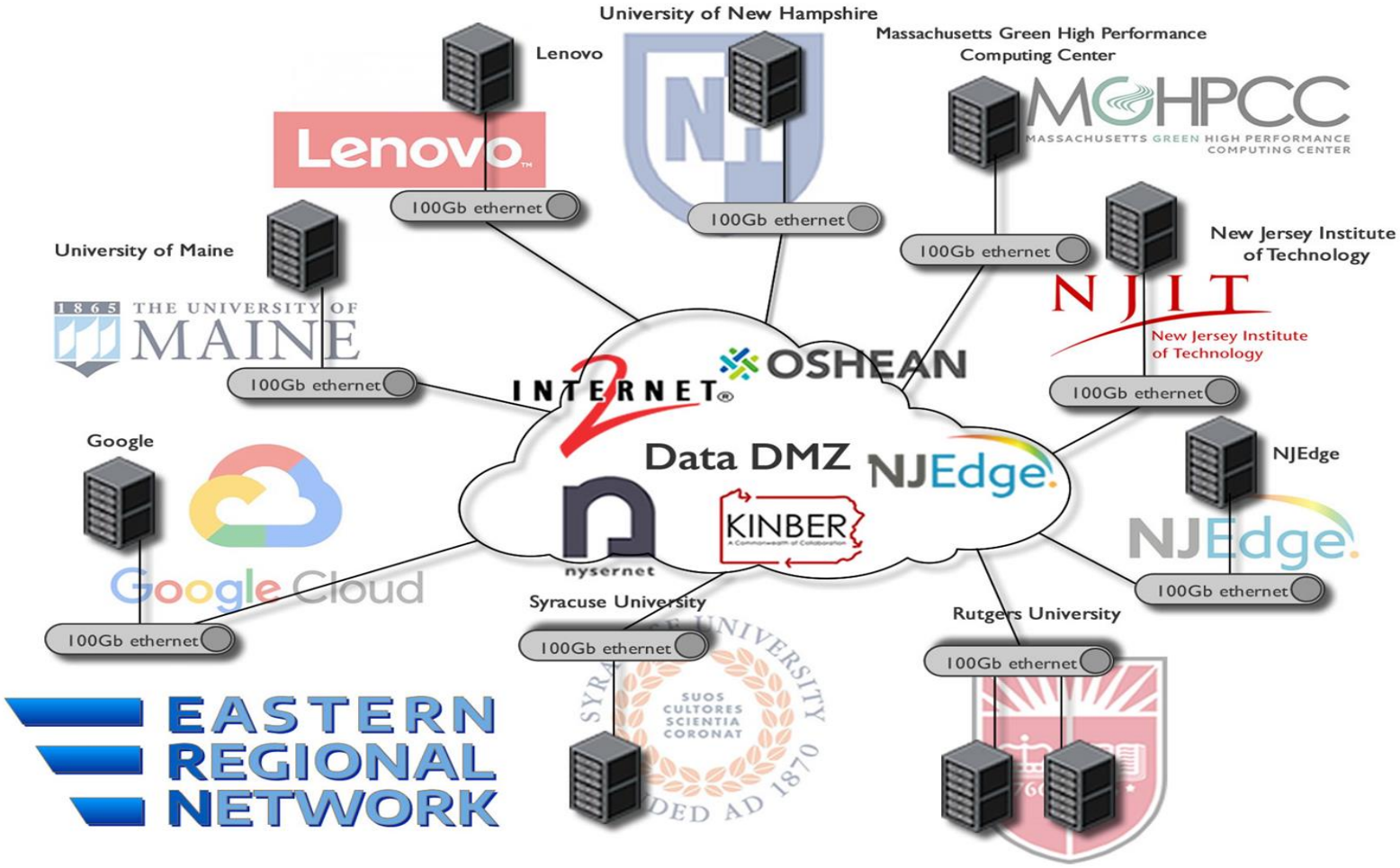
There are two major gaps in data science education that must be addressed for tomorrow's workforce to meet the evolving needs of industry in New Jersey:

1) Cross-program course offerings and
2) Bridging the divide between theory and practice

Data Science and Business Analytics Program Offerings in Four-Year Colleges and Universities (Undergraduate and Graduate) in NJ region (AY2019).

	Undergraduate	Graduate
Minor in Data Science or Related Field	85%	65%
Major in Data Science or Related Field	50%	77%
Major in Computer Science with Data Science, Artificial Intelligence, Big Data or Analytics Focus	100%	65%

ERN Federation Proof of Concept



EdgeNet - an evolution

- Generation 1 - Carrier provided MPLS {2002-2005}
  - 500Mb Shared Internet port
  - Member to member
  - QoS for Video
- Generation 2 - Carrier managed optical network {2005 - 2007}
  - 1Gb shared Internet circuit
- Generation 3 - NJEdge owned and operated optical network {2007 - 2012}
  - Leased dark fiber
  - Carrier circuit backbone redundancy
  - POPs
    - 2 major
    - 3 minor
  - Redundant Transit providers - Multiple 10Gb paths
  - Redundant member connections
  - LISP capability - NJEdge Software Defined Networking
    - Load Balancing with support for failover functionality

EdgeNet - on the horizon

- Better redundancy - member connections
- Facilitating access to member cloud partners
  - AWS - Direct Connect
  - Azure - ExpressRoute
  - Google - Dedicated Interconnect
- Improved member network reporting
- Next generation optical provides the foundation for research networking
  - Big Data Alliance
  - Science DMZs
- Regional peering
  - 32 Avenue of The Americas

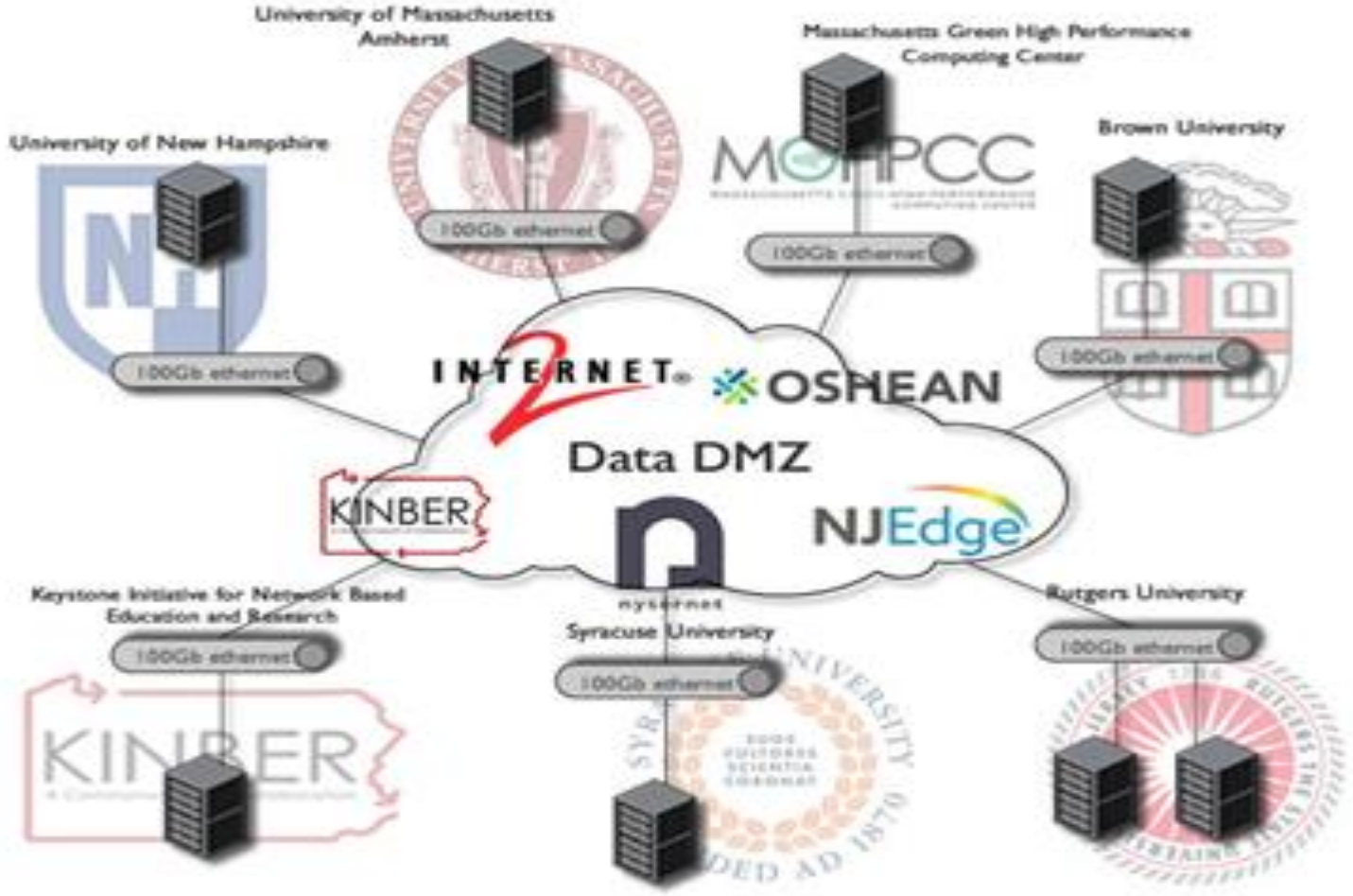
Research Capacity & Capability Strategic Investment

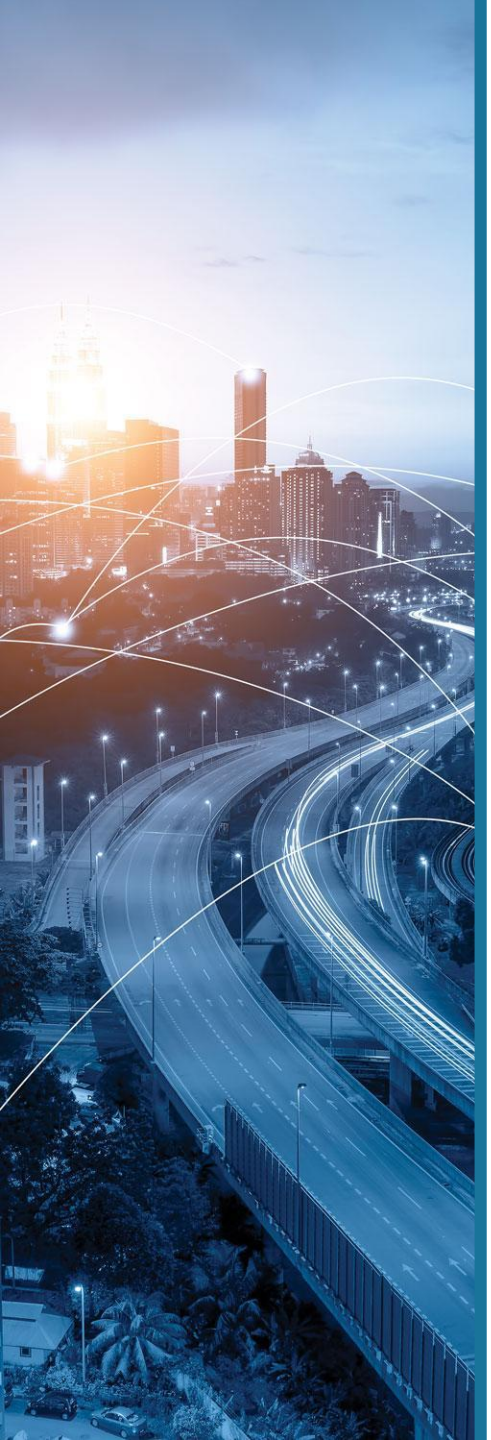
- ❑ Raising the research bar for NJEdge
- ❑ Associate Vice President for Research and Sponsored Programs to engage the research community
- ❑ Multiple upgrades and investment provide for a research ready partition for the NJedge network providing for scalability, survivability
- ❑ Regional and international reach with the opening of our NJFX node and our planned (FY2019) connection to 32 Avenue of the Americas in NYC
- ❑ Optical upgrades to 40 channel carrier class
- ❑ Participation in Perf Sonar and Fiona device testing

An Internet2 Gigapop for New Jersey

- NJ is the most densely populated state in the nation and home to six research universities
- The New Jersey Big Data Alliance now consists of 14 institutions with high performance networking requirements contemplated to support their curriculum and research agendas in this area
- Talks are underway on several fronts to establish NJEdge as New Jersey's I2 connector
- Coordination with regional partners will provide for redundant paths to I2

Regionalization and Participation in the Eastern Regional Network Platform Initiative





Thank you!

Questions?