IoT Pedagogy

Ed Aractingi, Marshall University

Jim Dutcher, SUNY Cobleskill

Chris Sedore, NYSERNet and Syracuse University

Teaching Internet of Things at Marshall University

The introduction of the course

- The course was offered as a Special Topic in Computer Science at the College of Information Technology and Engineering
- Offered in Fall 2015, Spring 2016, Fall 2016, Spring 2017 and scheduled for Fall 2017
- Average of 30 graduate students mostly from Computer Science

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Class Areas of Focus

- IoT Use Cases and domains
- Architecture (Subscribe/Publish, Gateways ..etc.)
- Technologies (z-wave, zigbee, Bluetooth) and concepts (iBeacan, Geofencing, security ..etc.)
- Cloud Services (Azure, Bluemix, AWS and others)
- Devices and sensors (Raspberry Pi, Arduino …etc.)
- Lab work for course project

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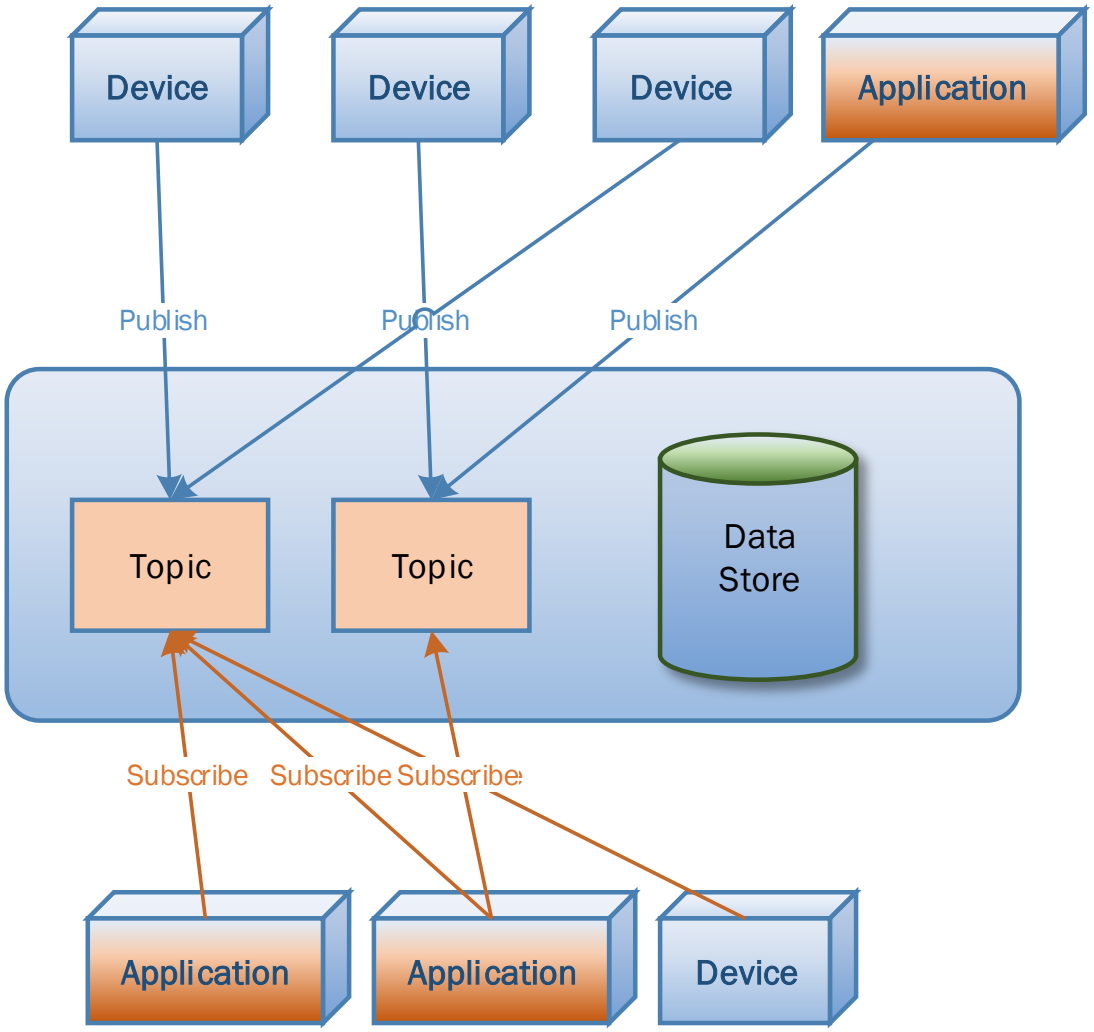

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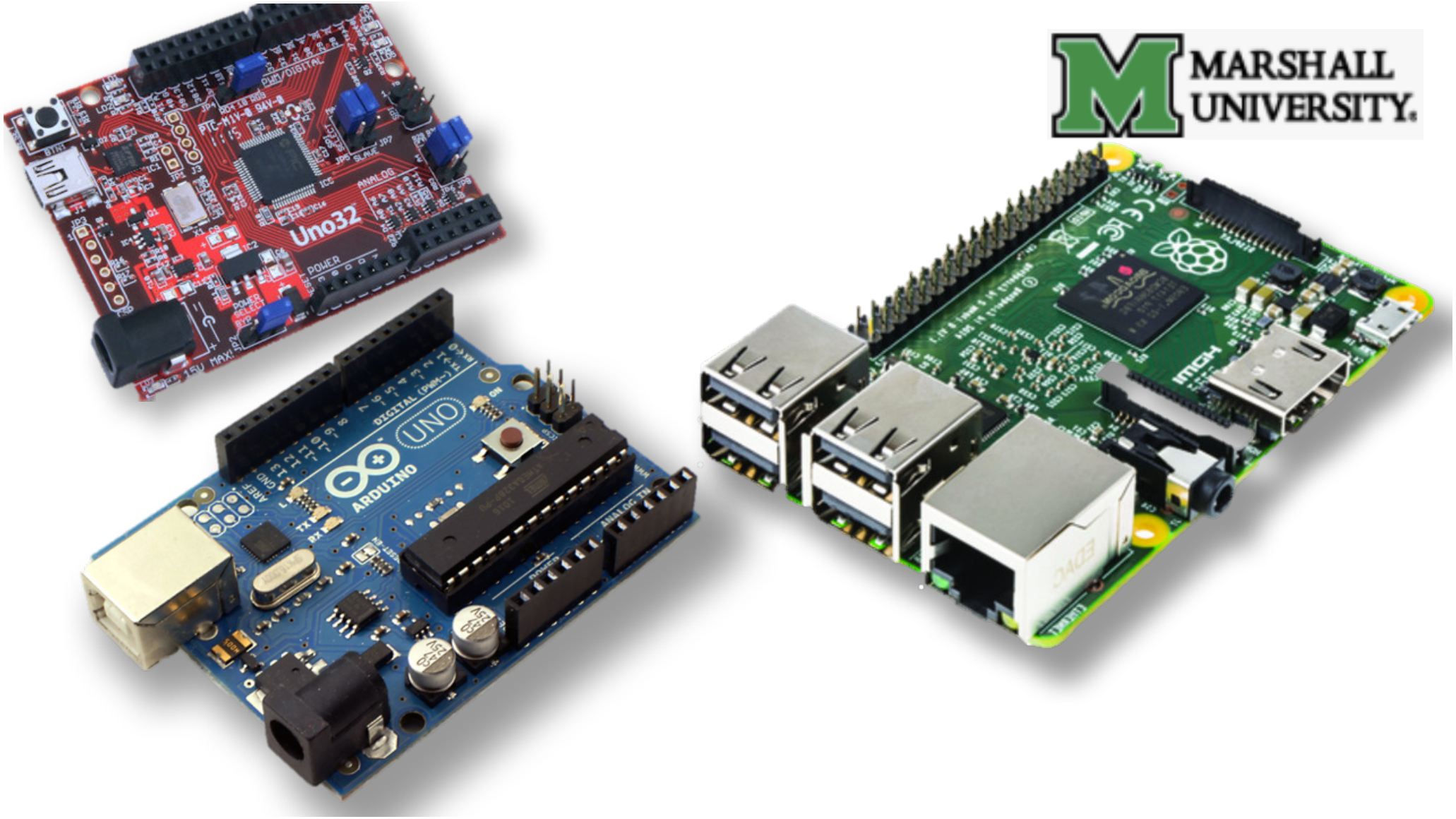
Uno32
POWER
ANALOG
ARDUINO
UNO
DIGITAL (PWM~)
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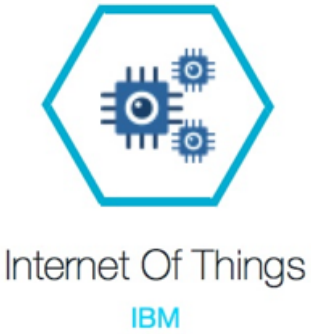
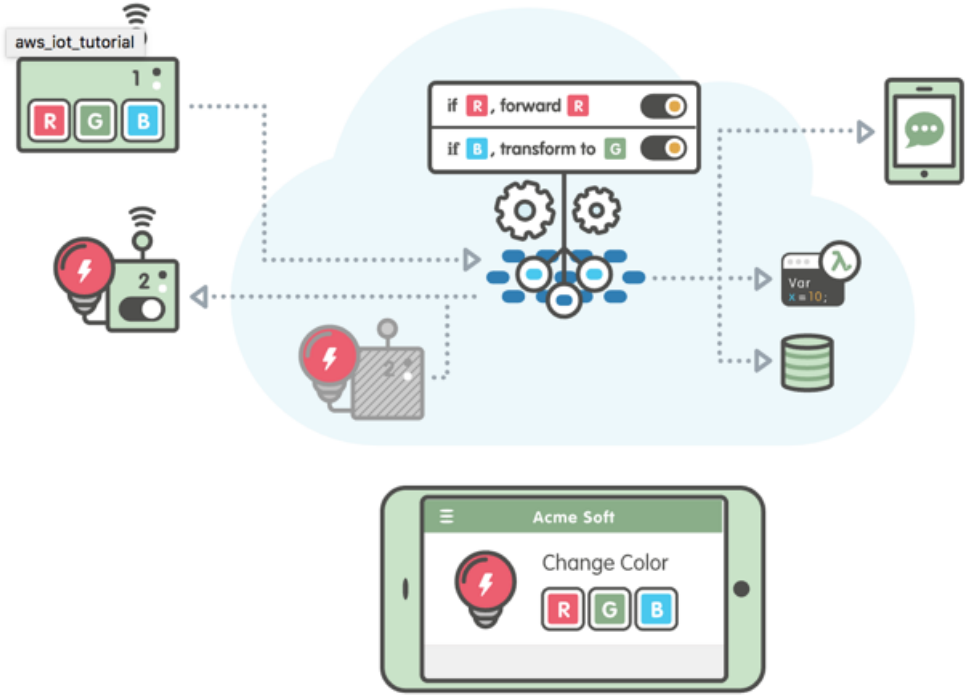
Cloud services



amazon web services

AWS IoT



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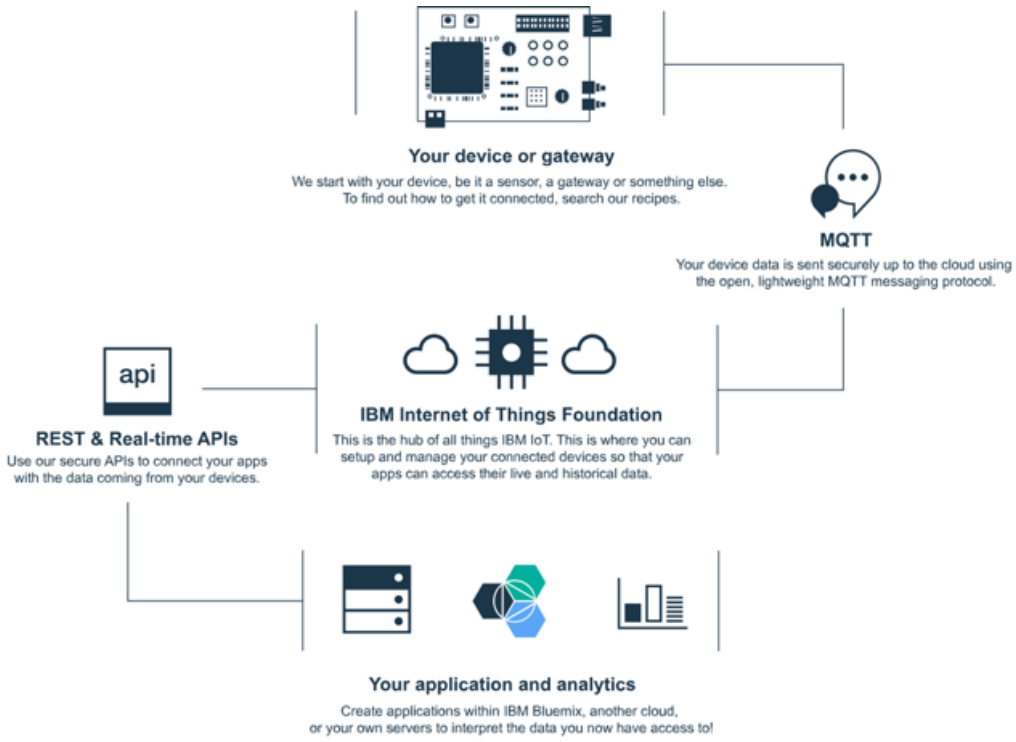
IBM Bluemix™

Internet Of Things
IBM



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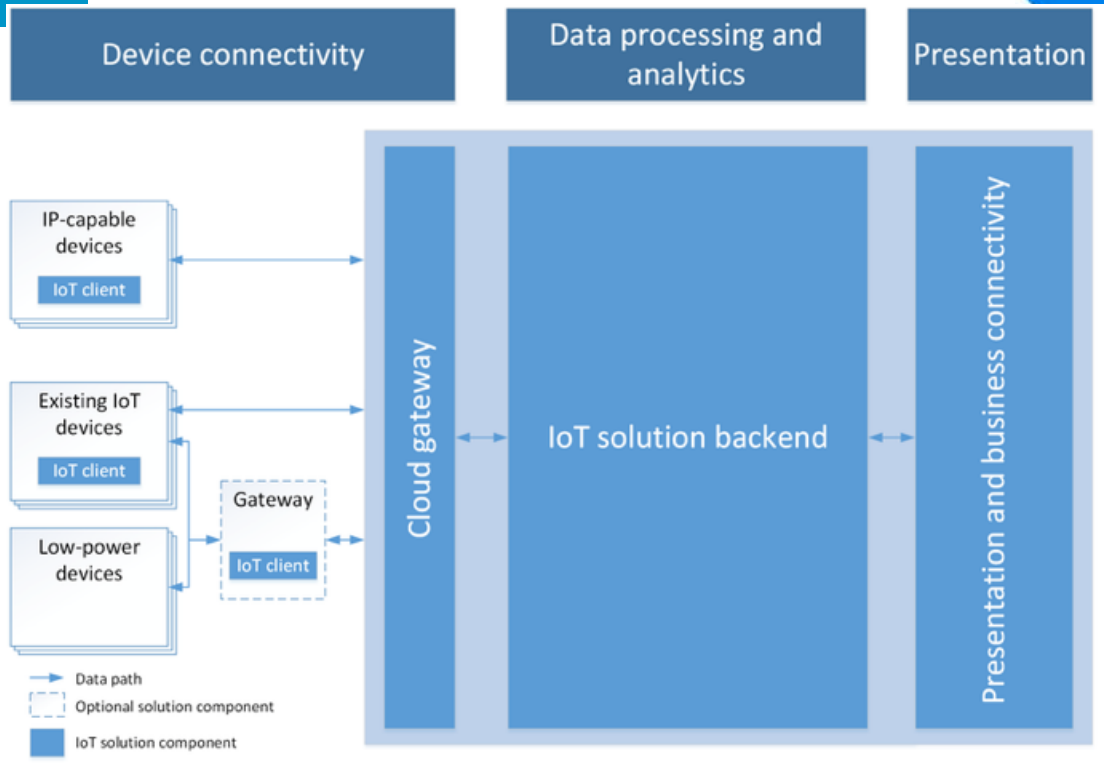
Microsoft Azure

Azure IoT Suite



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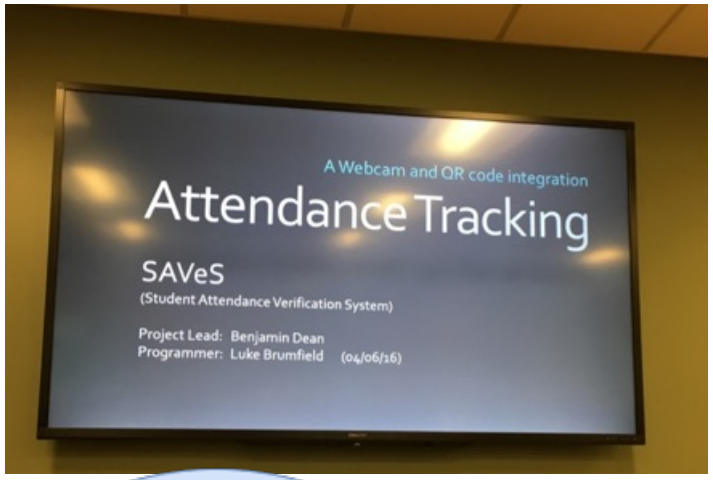
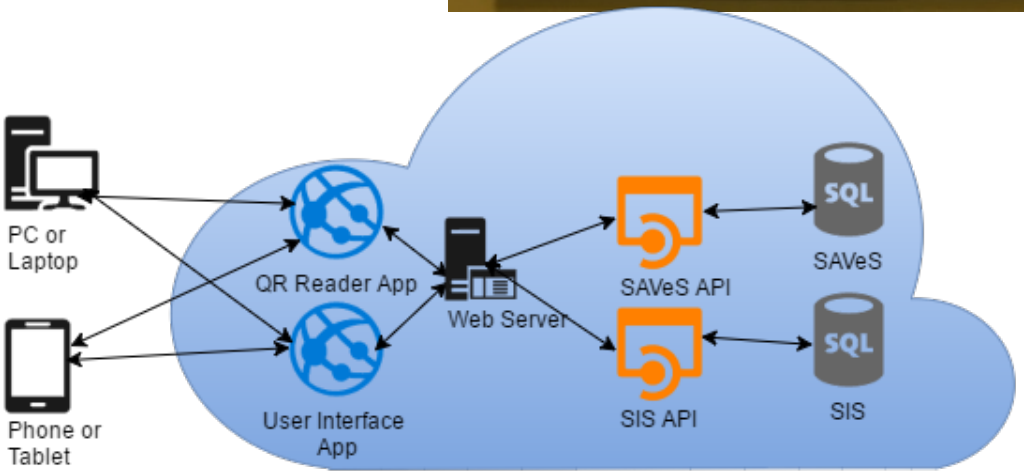
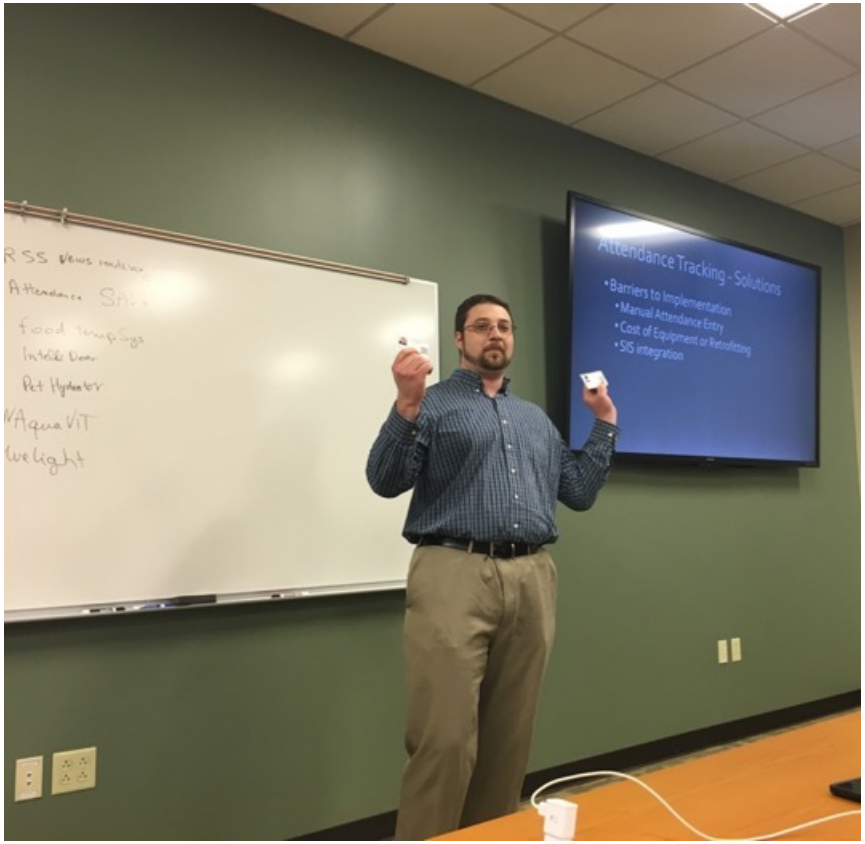
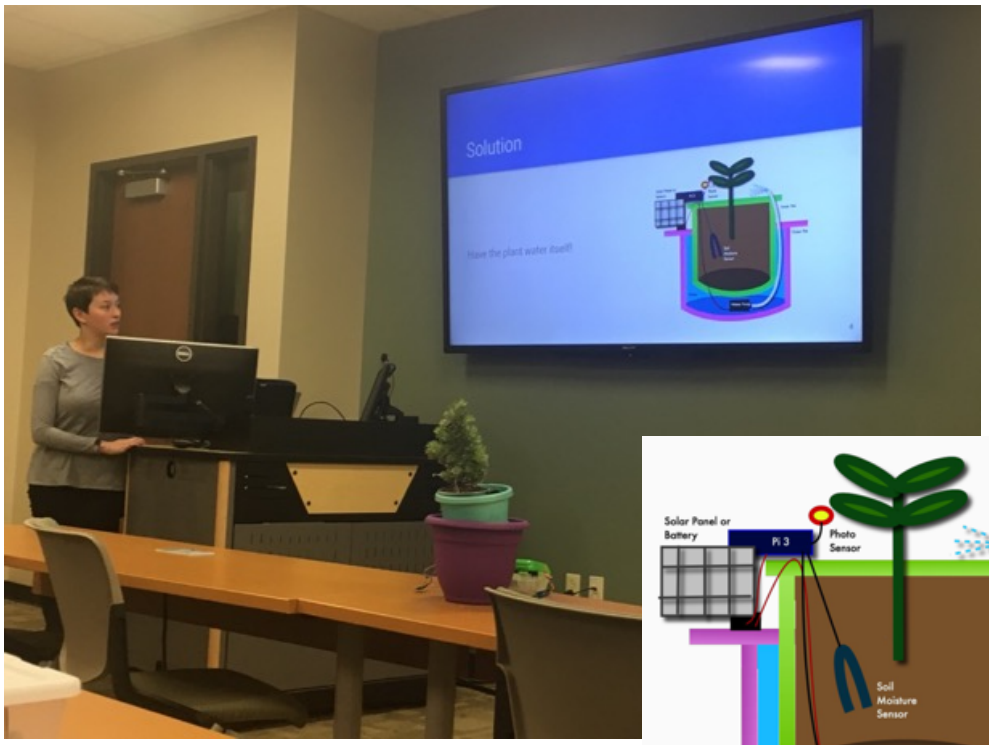
Attendance tracking system

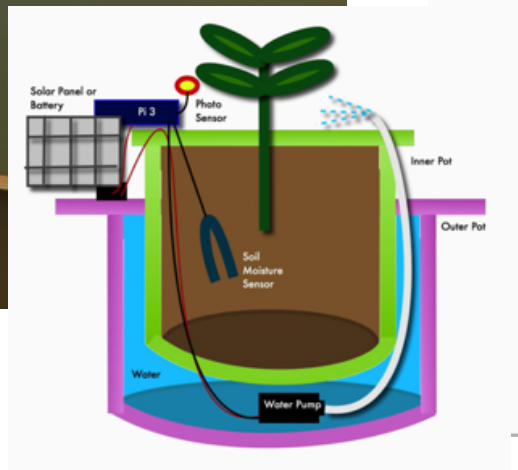


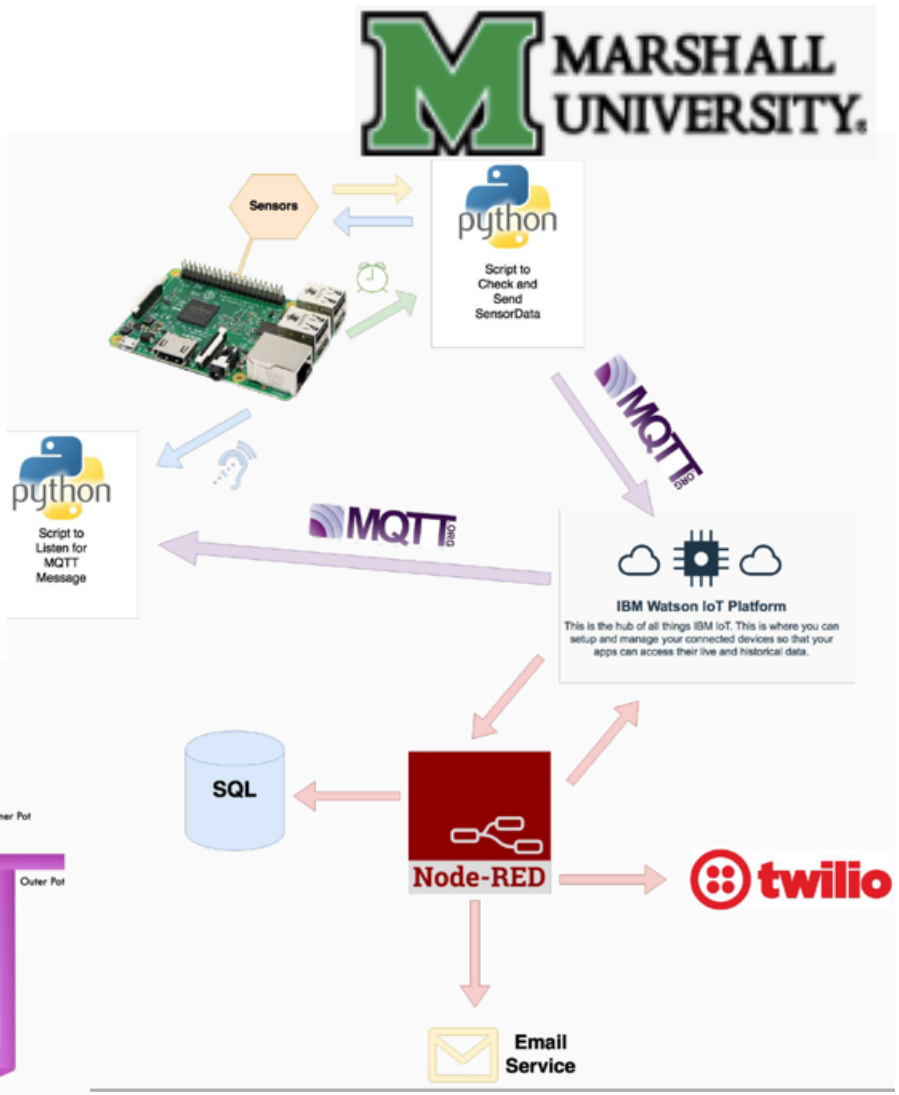




Self Watering Plant

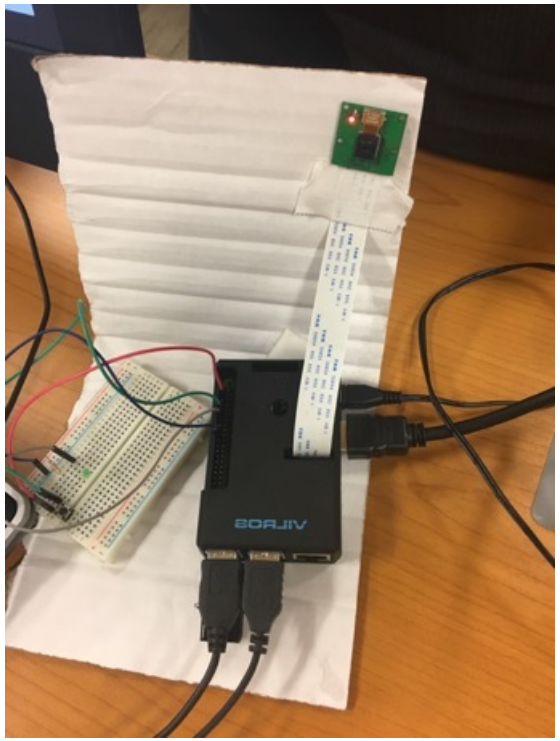




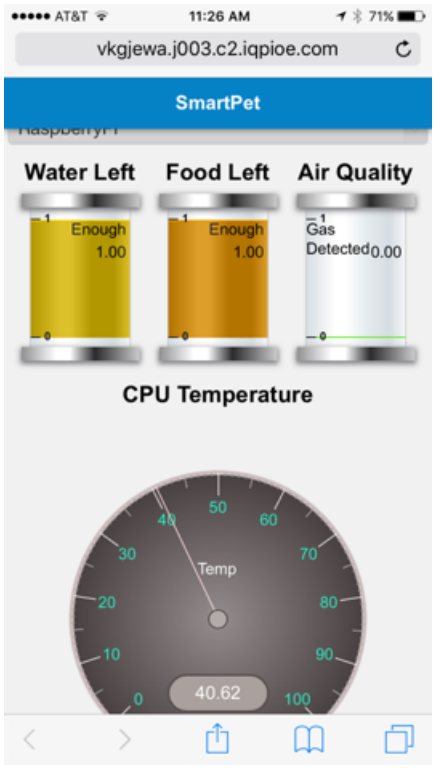


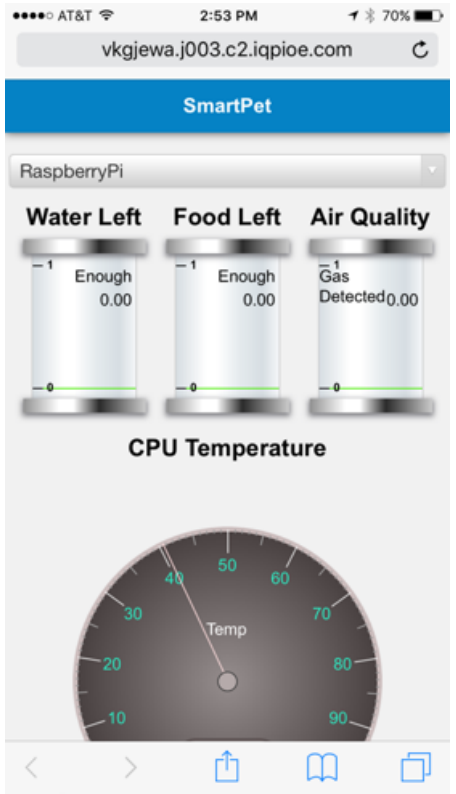
Home Automation

Smart Doorbell

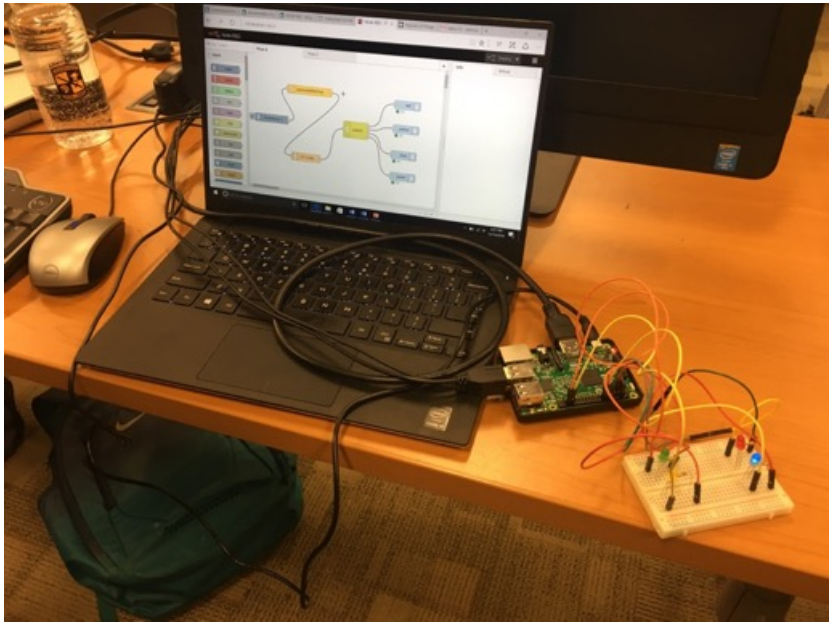


Pet care system





Weasley family clock



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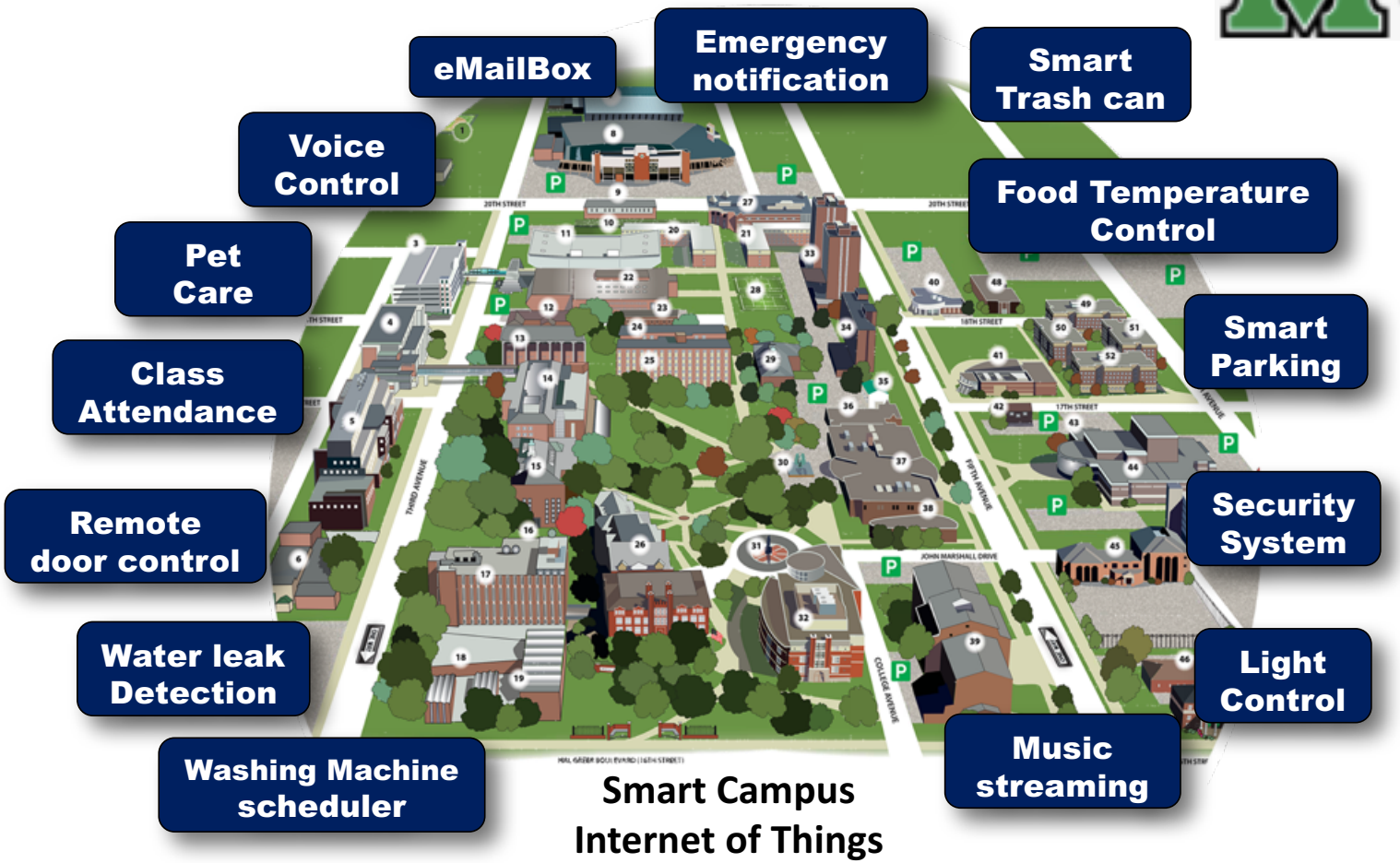

Smart Campus Internet of Things Class Projects

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Ag/IT

IoT (plus Cloud, Cloud Security and Big Data)

Roadmap

James M. Dutcher MS: PMP, CISSP, CISA, SCP/Sec+, AWS-ASA | CIO – SUNY - Cobleskill campus

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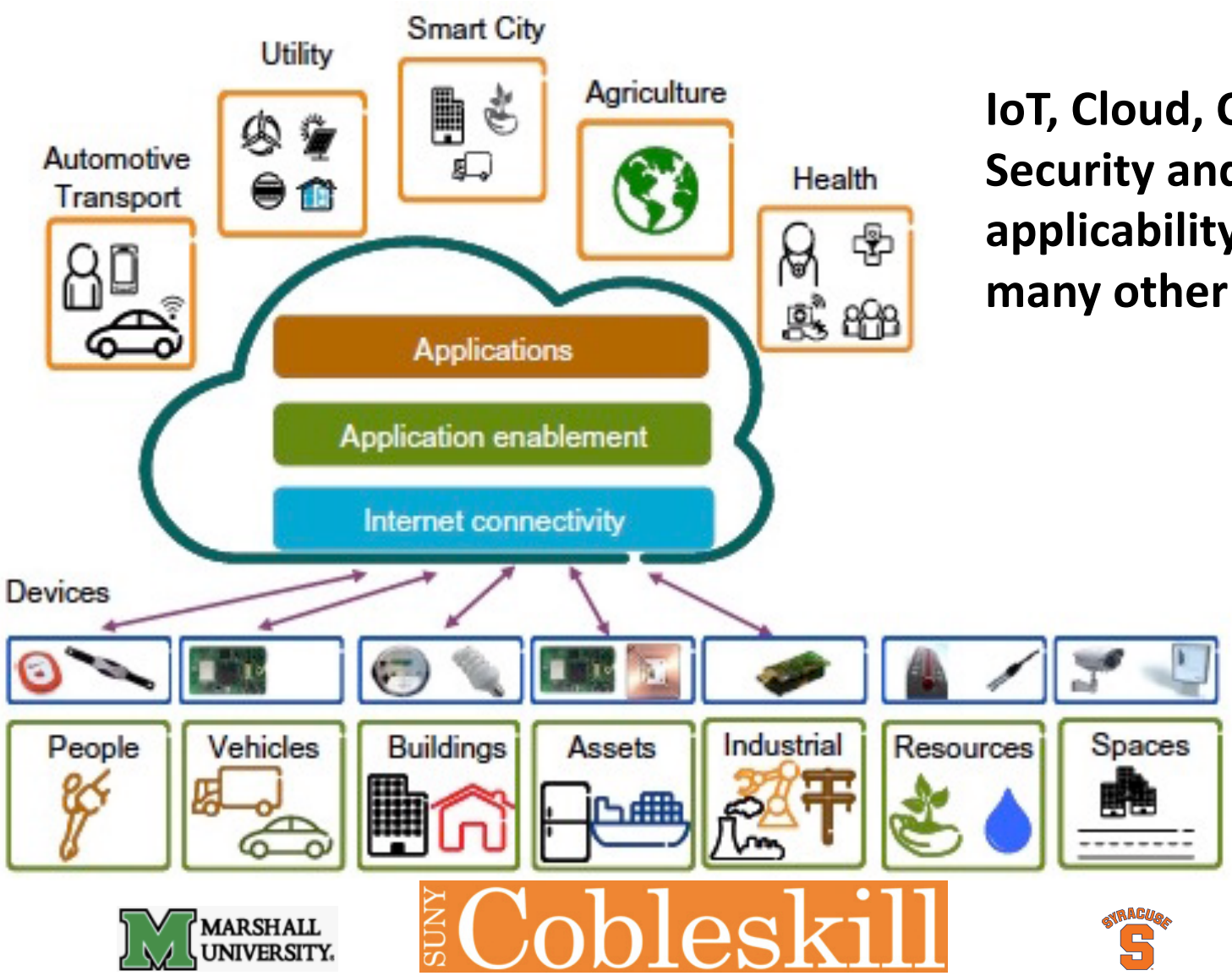

IoT, Cloud, Cloud Security and Big Data applicability across many other verticals

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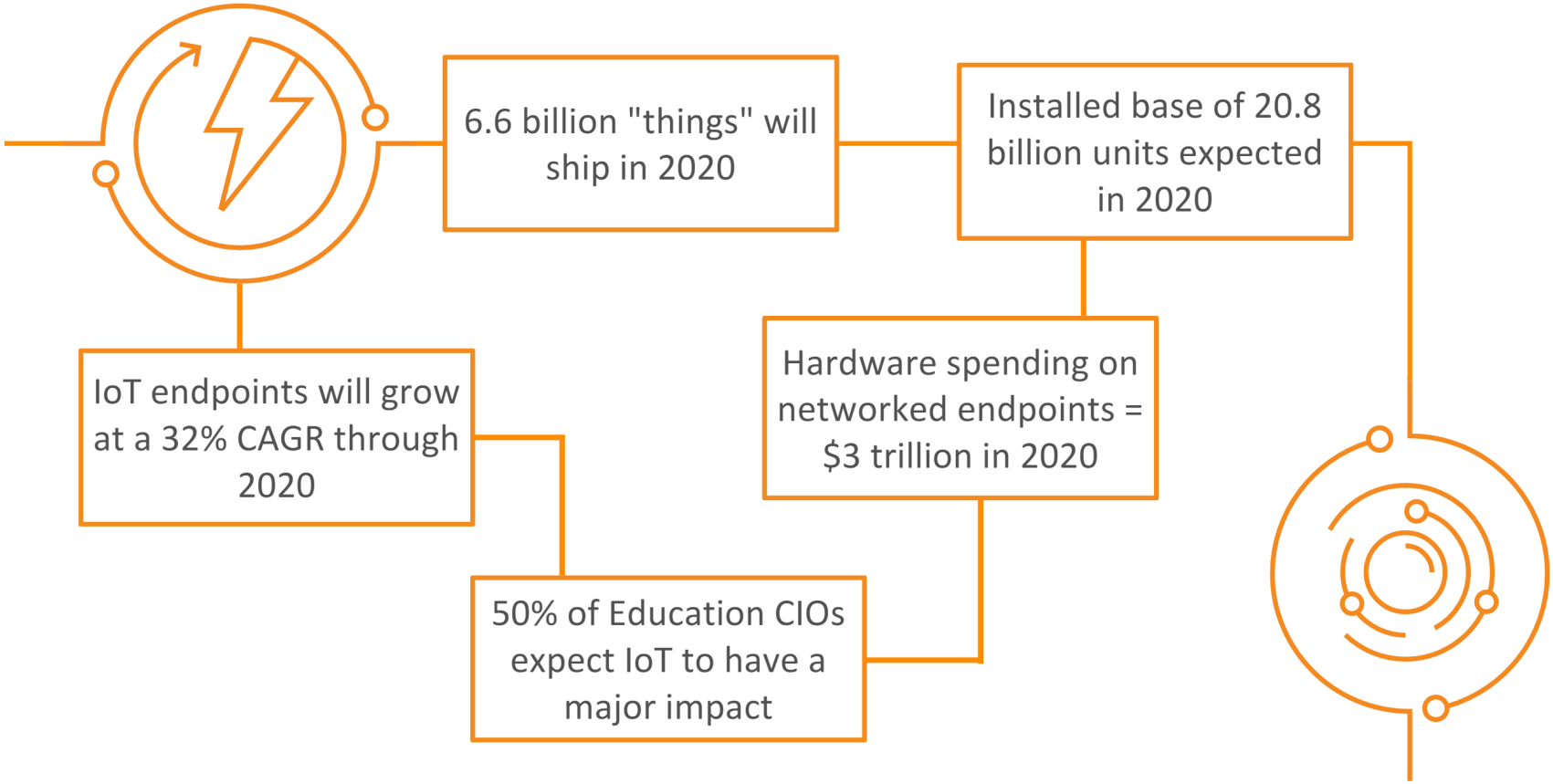
IoT is Set to Explode



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Background

- **IT Strategy – 100% out of the datacenter hosting business**
  - **Huge driving forces – IoT, Cloud, Cloud Security, Big Data – *NO organization can address/do it alone***
- **AWS – Academics & Research – Precision Ag**
  - **Trained/Certified staff**
  - **Continuing Ed./Certificate Courses**
  - **Academic Courses**
  - **Academic & Research Projects**
- **Azure – Administrative**
  - **Trained/Certified staff**
  - **Continuing Ed./Certificate Courses**
  - **Academic Courses**
  - **Datacenter Assessment -> Migration of existing services to off-prem providers**
  - **Administrative projects -> IT, Facilities, etc.**

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Learning Roadmap

1.0: Cloud Architecture

- AWS

- Azure

2.0: Cloud Security

- ISC2 CCSP

- AWS & Azure Labs

3.0: IoT, Big Data/Analytics

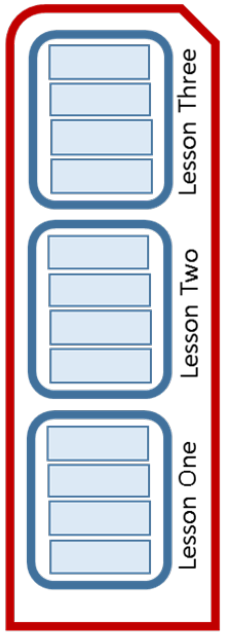
- AWS

- Azure

One Lesson
Approx. ½ hour

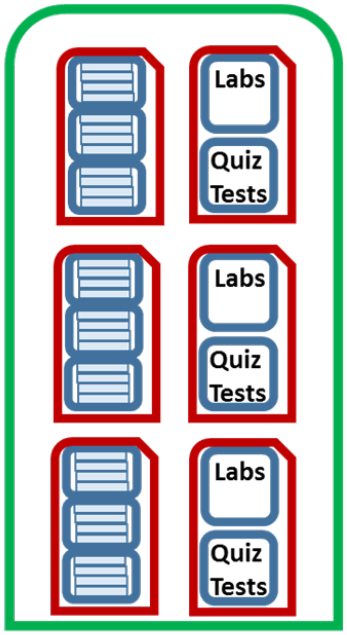
Research suggests ½ hour chunks of content is optimal for working adults

One Module = One Week
Three Lessons = ~90 min



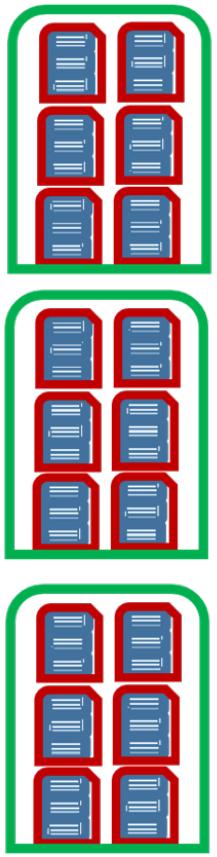
Recommended learning outcomes on the module-level, comprised of several (up to three lessons) which should provide guidance on the materials needed to cover that outcome.

Hands On Labs + Assessment =
Each Week ~90 min-240 min



Each week is comprised of several hands on labs plus assessment of the week's lesson materials in the form of multiple quizzes and tests

Weekly Office Hours = Ad hoc drop in
Each Week ~60 min-120min



Each office hour session is general Q&A, weekly lesson review, and/or hands-on demo

Pedagogical approach:
Confucius:
I hear and I think,
I see and I remember,
I do and I understand…
will be applied to all IoT, Cloud, Cloud Security, and Big Data online courses

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1st Pilot - AWS Cloud Architecture

AWS Provided Content (great time saver; general MO will be used existing content)

15 Hours of Lecture (live lecture)

35 Hours of Labs (asynchronous – NOTE: more hands-on lab time than lecture)

30 Hours of Assessments and Tests (asynchronous – to get certification ready)

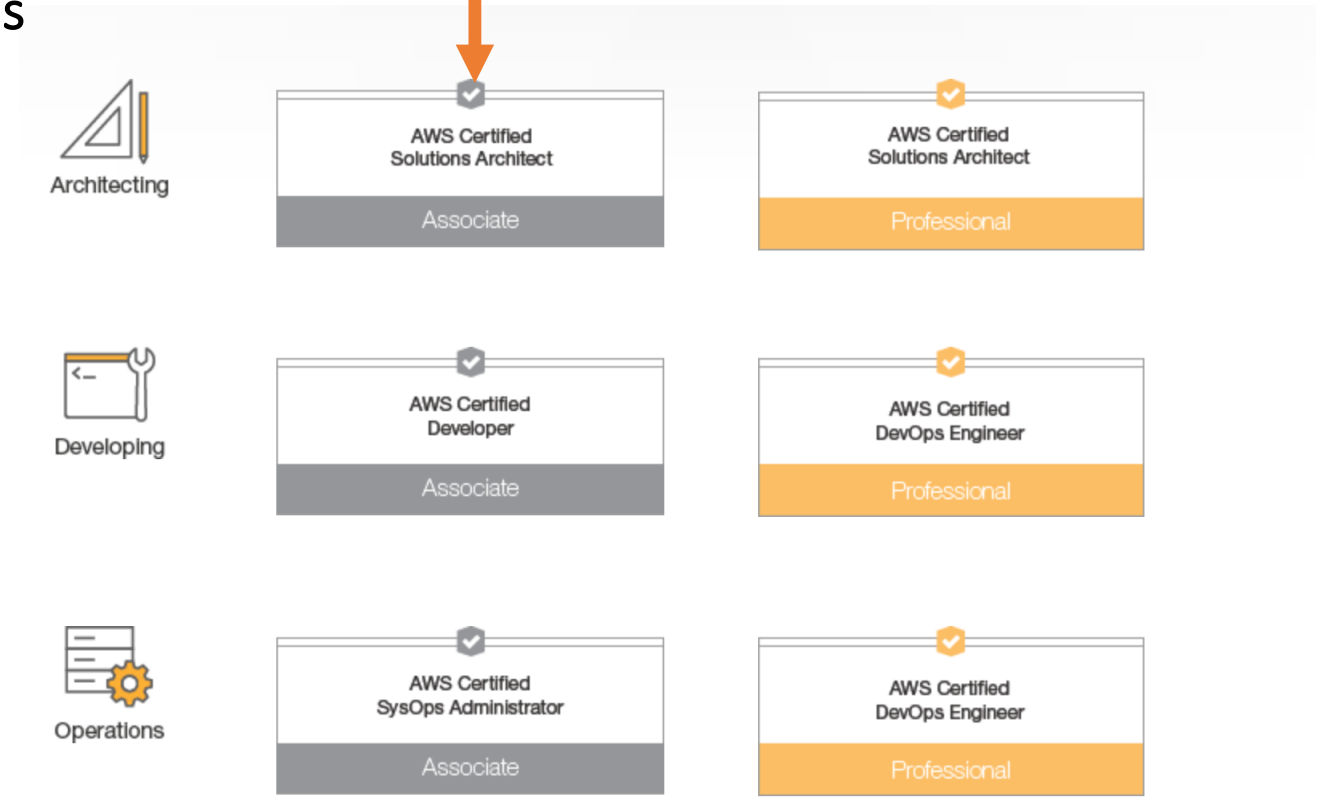
15 Hours of Office Hours (optional, drop-in)

Will be used as basis/model for all future courses

IoT, Cloud, Cloud Security, Big Data Realms:

$750 per class
3 Academic Credits

AWS Path – starting with existing content and certification paths



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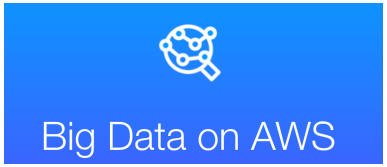
AWS Path – starting with existing content and certification paths



- Overview of Big Data
- Big Data Ingestion and Transfer
- Big Data Streaming and Amazon Kinesis
- Lab 1: Using Amazon Kinesis to Stream and Analyze Apache Server Log Data
- Big Data Storage Solutions
- Big Data Processing and Analytics
- Lab 2: Using Amazon Athena to Query Log Data From Amazon S3
- Apache Hadoop and Amazon EMR
- Lab 3: Storing and Querying Data on Amazon DynamoDB
- Using Amazon EMR
- Hadoop Programming Frameworks
- Lab 4: Processing Server Logs With Hive on Amazon EMR
- Web Interfaces on Amazon EMR
- Lab 5: Running Pig Scripts in Hue on Amazon EMR
- Apache Spark on Amazon EMR
- Lab 6: Processing NY Taxi data using Spark on Amazon EMR
- Amazon Redshift and Big Data
- Visualizing and Orchestrating Big Data
- Lab 7: Using TIBCO Spotfire to Visualize Data
- Managing Big Data Costs
- Securing Your Amazon Deployments
- Big Data Design Patterns

- **IAM**
- **TrustedAdvisor**
- **CloudTrail**

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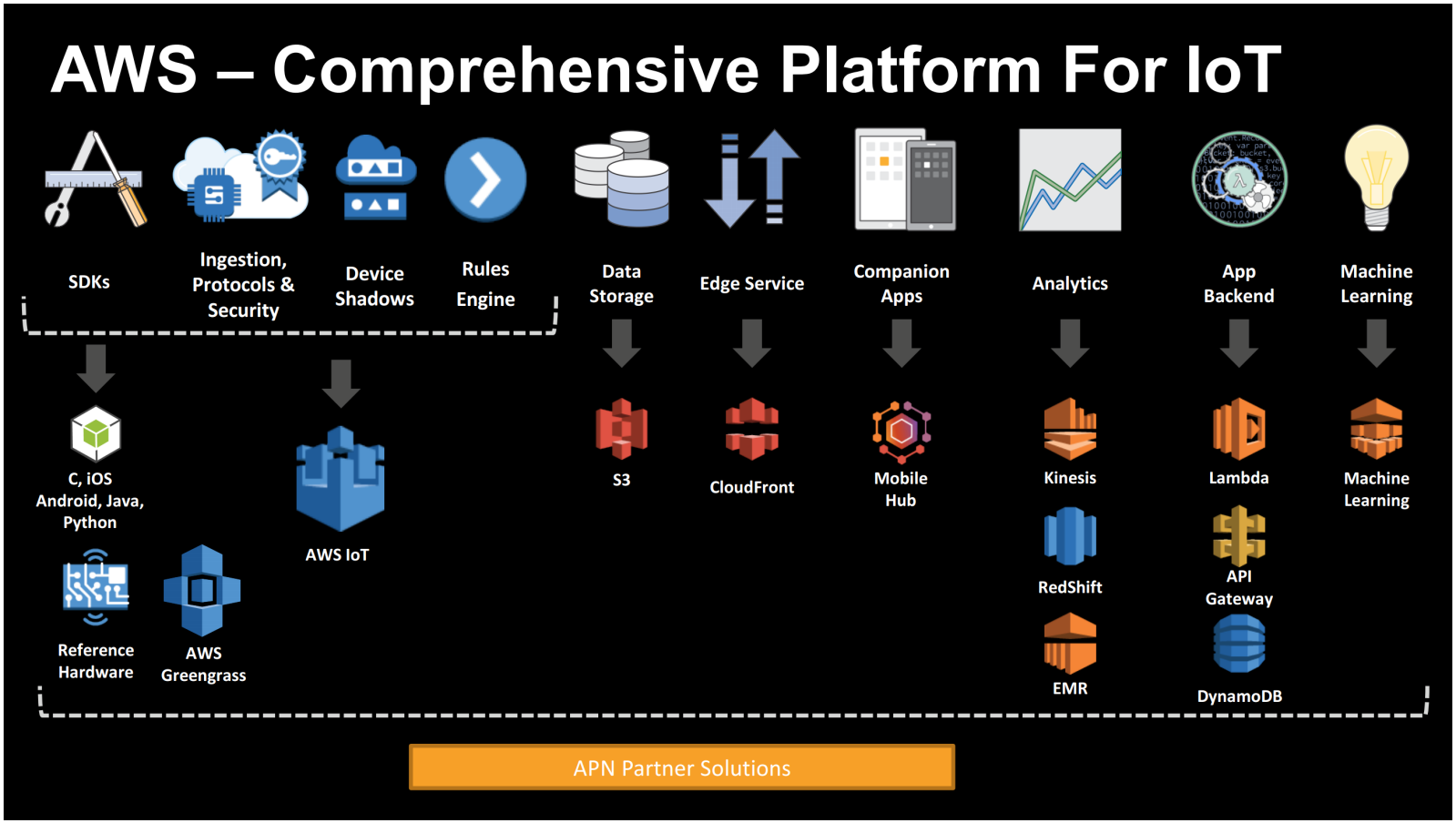
AWS Path – starting with existing content and certification

AWS Greengrass

Requested partnership & collaboration pilots to ramp up local skills & competencies



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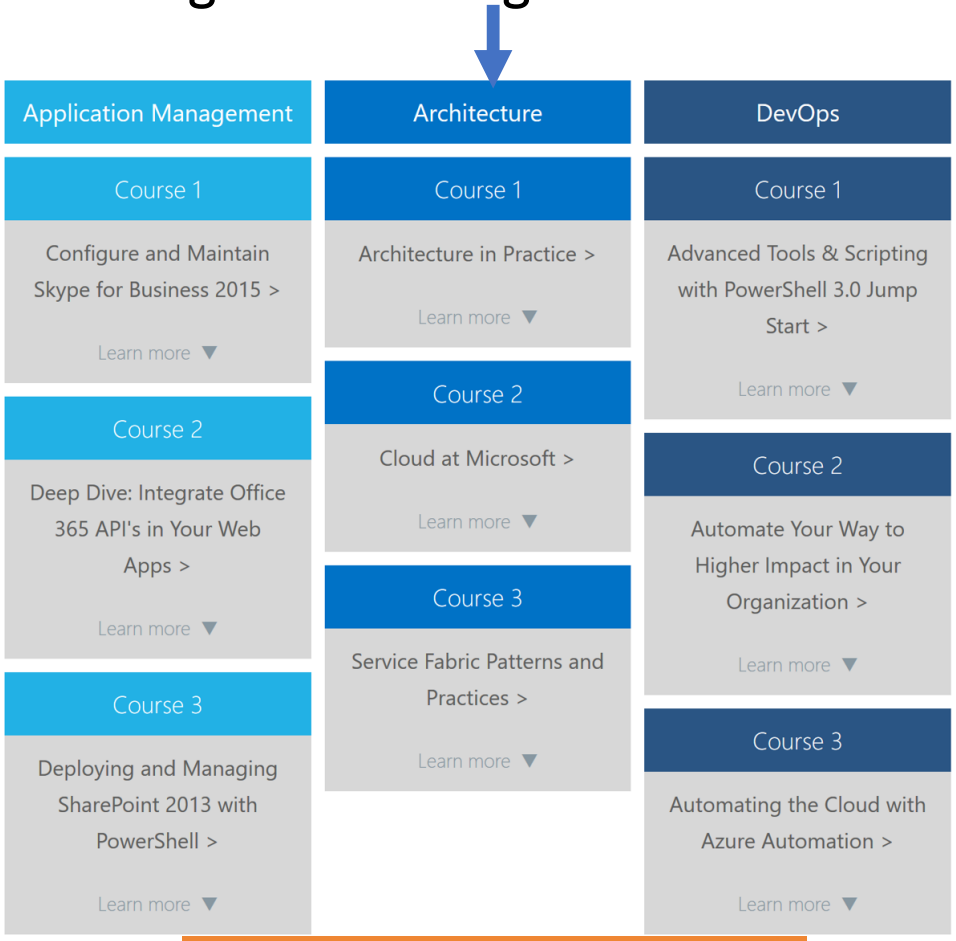
Azure Path – starting with existing content and certification paths



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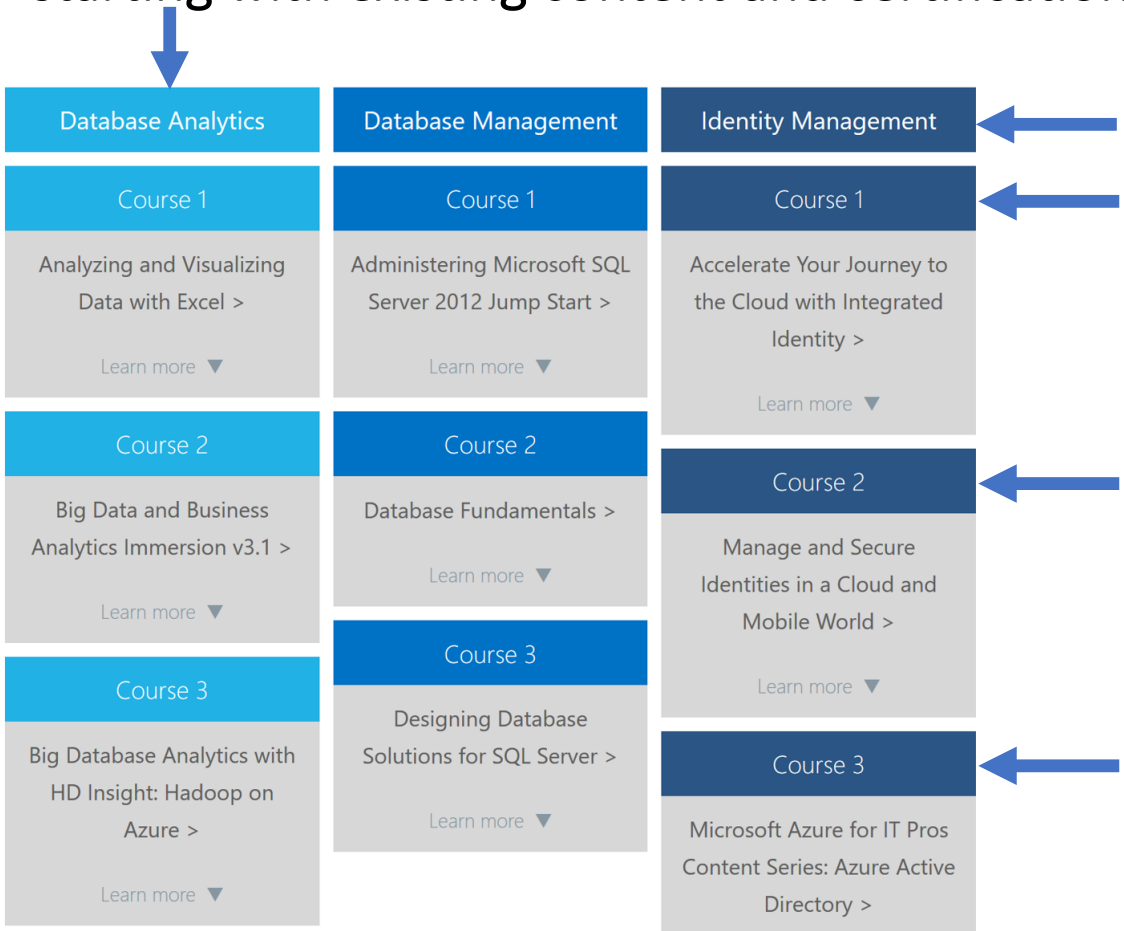
Azure Path – starting with existing content and certification paths



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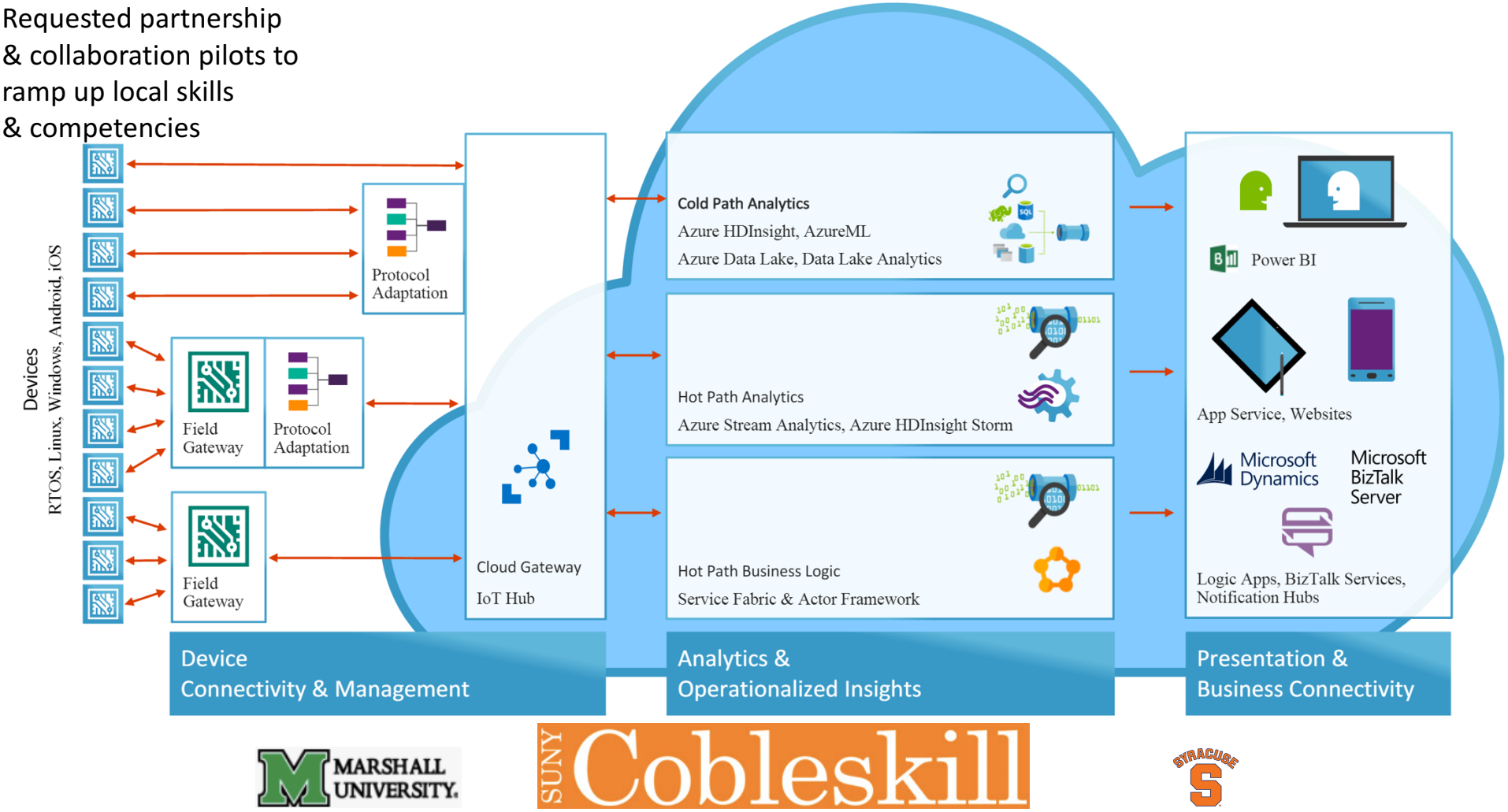
Azure Path – starting with existing content and certification paths

Requested partnership
& collaboration pilots to
ramp up local skills
& competencies



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ISC2/CCSP Path – starting with existing content and certification path

Domains:

1- Architectural Concepts & Design Requirements

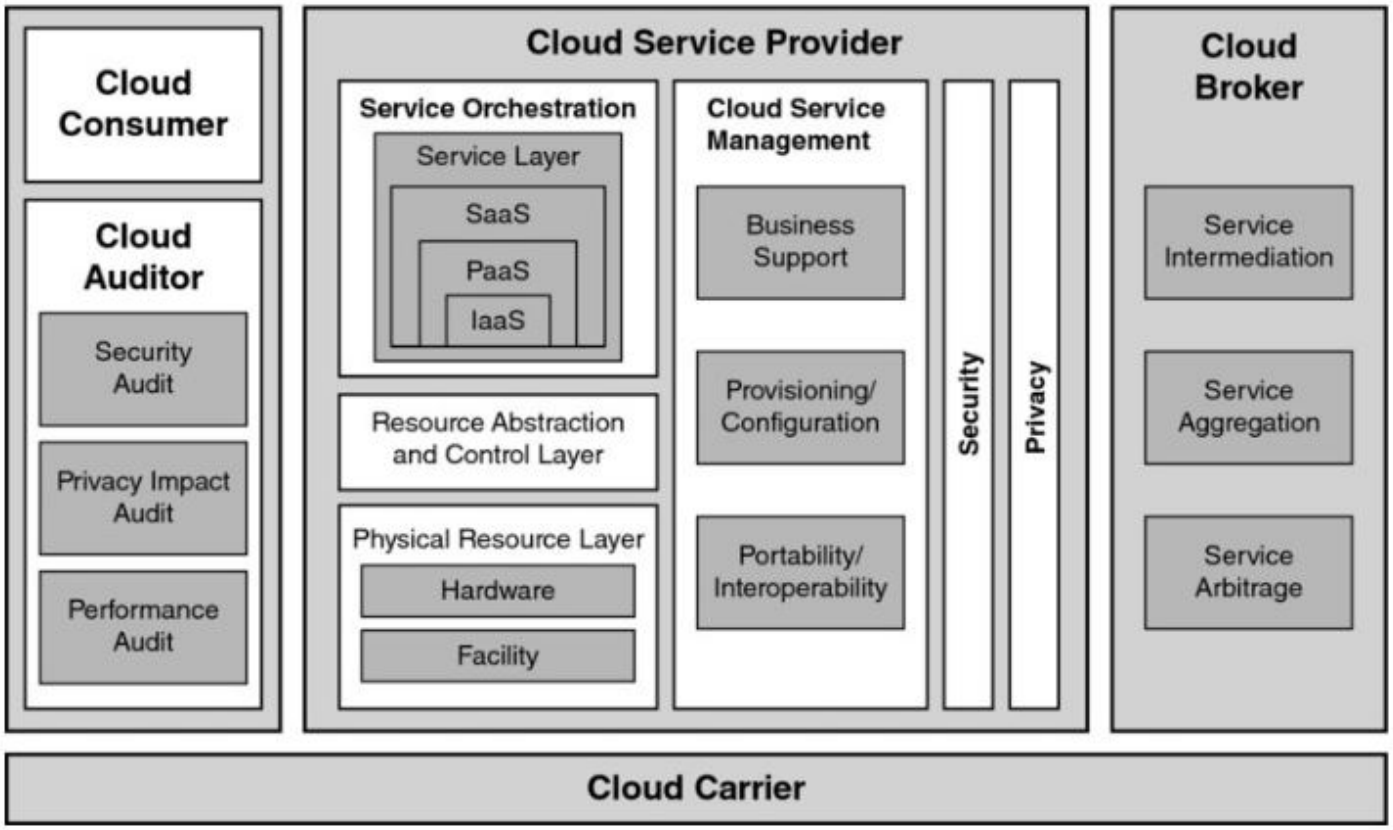
2- Cloud Data Security

3- Cloud Platform & Infrastructure Security

4- Cloud Application Security

5- Operations

6- Legal & Compliance



Requested partnership & collaboration pilots to ramp up local skills & competencies

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Learning Roadmap - Timeline

1.0: Cloud Architecture

- **AWS ✔ (***see below***)**
- **Azure (Fall 2017)**

2.0: Cloud Security

- **ISC2 CCSP (Summer 2017)**
  - **AWS & Azure Labs**

3.0: IoT, Big Data/Analytics

- **AWS (Fall 2017)**
- **Azure (Fall 2017)**

Choose from taking class every Tuesday night from 5 - 6:30 p.m. or every Friday morning from 10 - 11:30 a.m. The course runs for 12 consecutive weeks starting at the end of April.

Tuesday Classes 10 - 11:30 a.m.	**Friday Classes 10:00 - 11:30 a.m.**	**Office Hours**
April 25	April 28	Mondays May 1 - July 3
May 2, 9, 16, 23, 30	May 5, 12, 19, 26	9:00 - 11 a.m.
June 6, 13, 20, 27	June 2, 9, 16, 23, 30	

Register Now
For more details call:
518-255-5528 or
email:
SerdyML@cobleskill.edu

James M. Dutcher MS: PMP, CISSP, CISA, SCP/Sec+, AWS-ASA | CIO – SUNY - Cobleskill campus

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Digital Transformation and the Internet of Things

Chris Sedore

President, NYSERNet

Adjunct Instructor, Syracuse University School of Information Studies

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Origins of the course…

- Syracuse's School of Information Studies explores data and information as the nexus of people, communities, organizations, and, now, "things"
- IoT is will fundamentally expand the reach of connected technologies, opening tremendous possibilities to improve human endeavors – and thus serving as a driver for digital transformation
- IoT also presents new challenges with privacy, further extending the digital divide, and poses new moral questions

- When the opportunity came up to teach this course, I was glad to take it—my interest in connected things dates back 15+ years…

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IST 400: Digital Transformation and the Internet of Things

- Spring 2017 is the first time this course was offered
- 13 students
- All junior or senior undergraduates
- Most common are Information Studies majors, others majors are business, communications, design (all but one with a minor in Information Studies)

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Two part course:
IoT and Digital Transformation

- IoT core topics
  - IoT Concepts and Domains
  - IoT Architectures
  - Hardware Platforms
  - Connectivity
  - Security
  - Data and analytics
  - Morality, Ethics, and Privacy
- Digital Transformation, using *The Digital Transformation Playbook* as the text
  - Five Domains of Transformation
  - Harness Customer Networks
  - Build Platforms, Not Just Products
  - Turn Data into Assets
  - Innovate by Rapid Experimentation

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Some takeaways from course thus far

- Privacy -- what privacy?
- Interesting discussions on moral/ethical issues
- Understanding information security is not straightforward
- Working with IoT hardware led to some students buying their own

- The students presented very interesting IoT applications in their mid-term projects, across retail, health and wellness, and consumer sectors

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Looking forward…

- I plan to teach the course again in the fall
- Several improvements in mind
  - Students generally appreciated the hands-on work with devices as a route to understanding the principles of the technology, plan to incorporate more
  - “Prebaked” cloud environment for the class to share
  - Integrate the LoRaWAN/Things Network gateway NYSERNet has deployed

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IoT Pedagogy

Ed Aractingi, Marshall University

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INTERNET2 2017 global SUMMIT Washington DC April 23-26

CINO Sponsored Schedule of Events at Global Summit 2017

- **Sunday, April 24, 4:15-5:30pm: CINC UP: CINO Program Advisory Group Meeting (Open)**
- **Tuesday, April 25, 8-10am: CINC UP: Collaborative Innovation Community Meeting: IoT, E2ET&S, Smart Campus**
  - Collaborative Innovation Community & Innovation Working Groups Update: IoT, E2ET&S, DBDA
    - Smart Campus Initiatives Update and invitation to participate
    - Smart Campus: IoT Systems Risk Management Task Force Update. Demos Monday & Tuesday during lunch
    - TIPPSS for IoT: ITANA Collaboration and White Paper
  - Smart Campus-themed Cybersecurity Transition to Practice Researcher Presentations
  - IoT Pedagogy
- **Wednesday, April 26, 7:30-8:30am: CINC UP: NSF Big Data Innovation Hubs**
  - NSF Big Data Hubs and Spokes Overview
  - How to get involved, connections for researchers and IT on campus
- **Wednesday, April 26, 12:30-5:30pm: CINC UP: Cybersecurity Research Acceleration Transition To Practice (TTP) Workshop and Showcase (NSF #1650445)**
  - Goals & Approach for Cybersecurity Research Transition to Practice Acceleration
  - University CIO Perspective on Leveraging Cybersecurity Research
  - Researcher Presentations, Discussion, Pilot Opportunities, and Feedback
  - Poster Session & Networking. Also lunchtime poster sessions on Monday and Tuesday