How VET providers, enterprises and IT professionals can benefit from SEnDIng

Building the Data Science and IoT skills and competences of IT professionals
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UniCert premises, Athens, Greece

Dr. Ioannis Voyiatzis
Greek Computer Society
voyageri@uniwa.gr

Facts (1)

- 24,697 open Data Scientist positions on LinkedIn in the United States alone

- the top 3 most common skills requested in LinkedIn data scientist job postings are Python, R, and SQL

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Facts (2)

- **43%** IT Industry reports lack of DS skills
- **28%** demand increase for DS professionals in 2020
- **0.5M** Unfilled DS Positions by 2020
- **68%** businesses struggle to hire IoT experts

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Facts (3)

The SEnDIng vocational training programs

- are based on modular and multi-disciplinary curricula combining technical with transversal (or soft) skills.

- have been designed in consultation with VET providers, academics, technology companies and experts that are active at the Data Science and IoT domains.

- aim is to fight the skills' gap by providing vocational trainings that meet the demand and last trends of Data Science and IoT industries.

SEnDIng curricula key characteristics

Multi-disciplinar. The modules developed cover both technical knowledge and skills at DS and IoT domains as well as transversal skills and competences.

Modular. For each domain, the curriculum is separated in educational modules and training units (Introductory, Core, Advanced).

Learning outcomes-oriented. Knowledge, skills and competences that the learners will gain at the end of each module.

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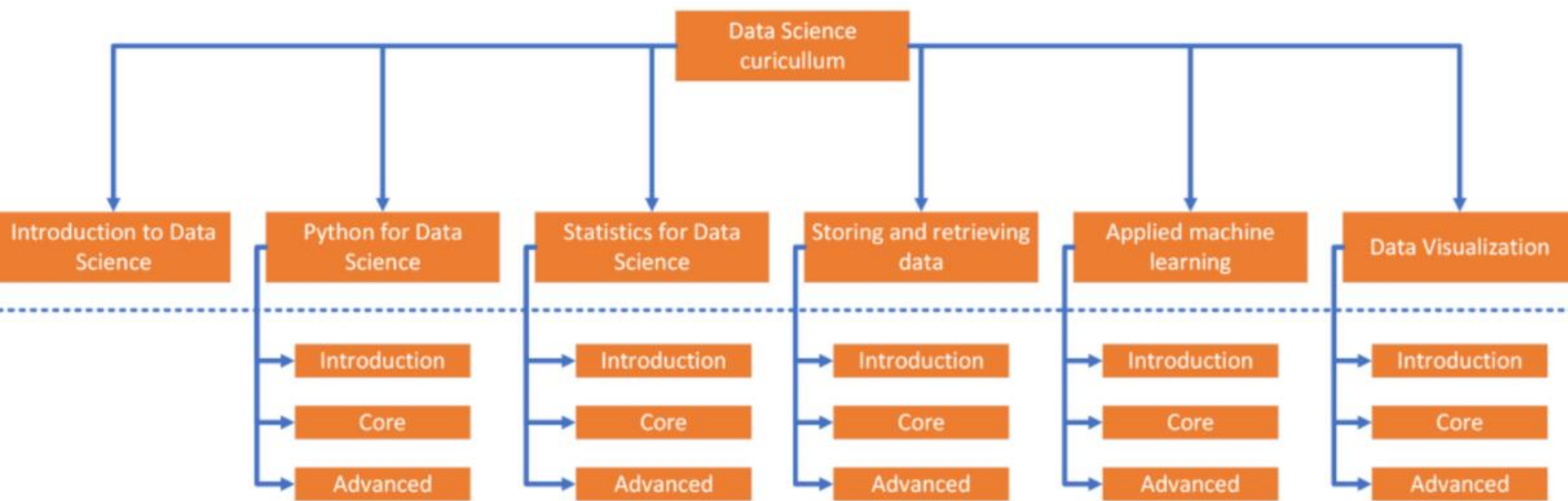
DS Curriculum

IoT Curriculum
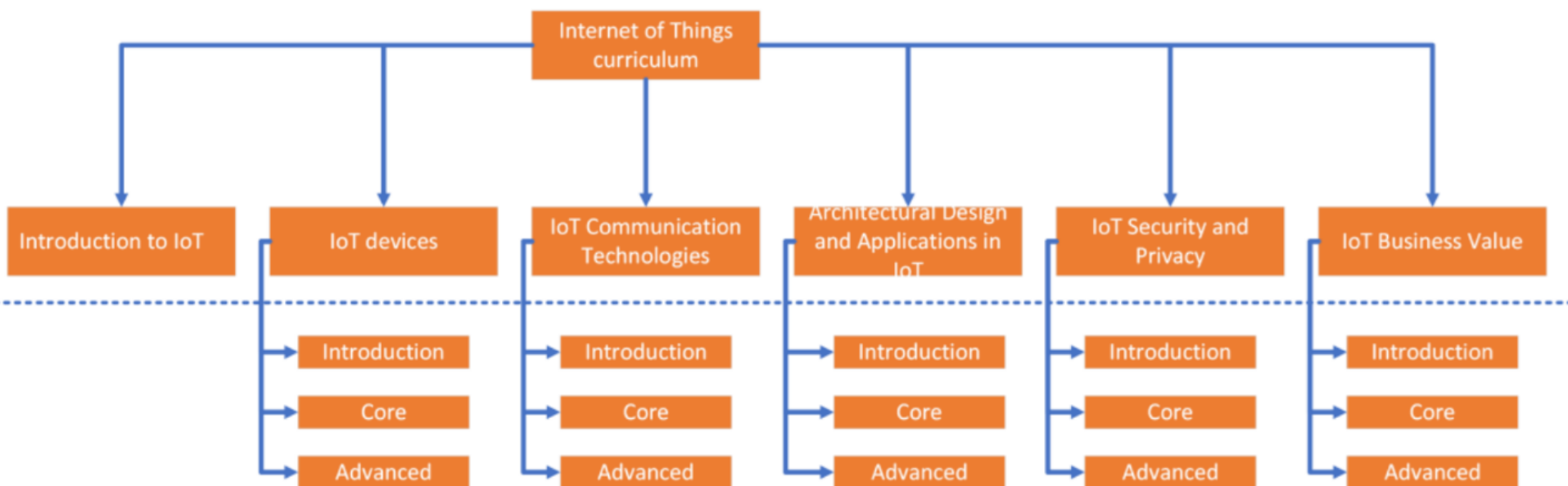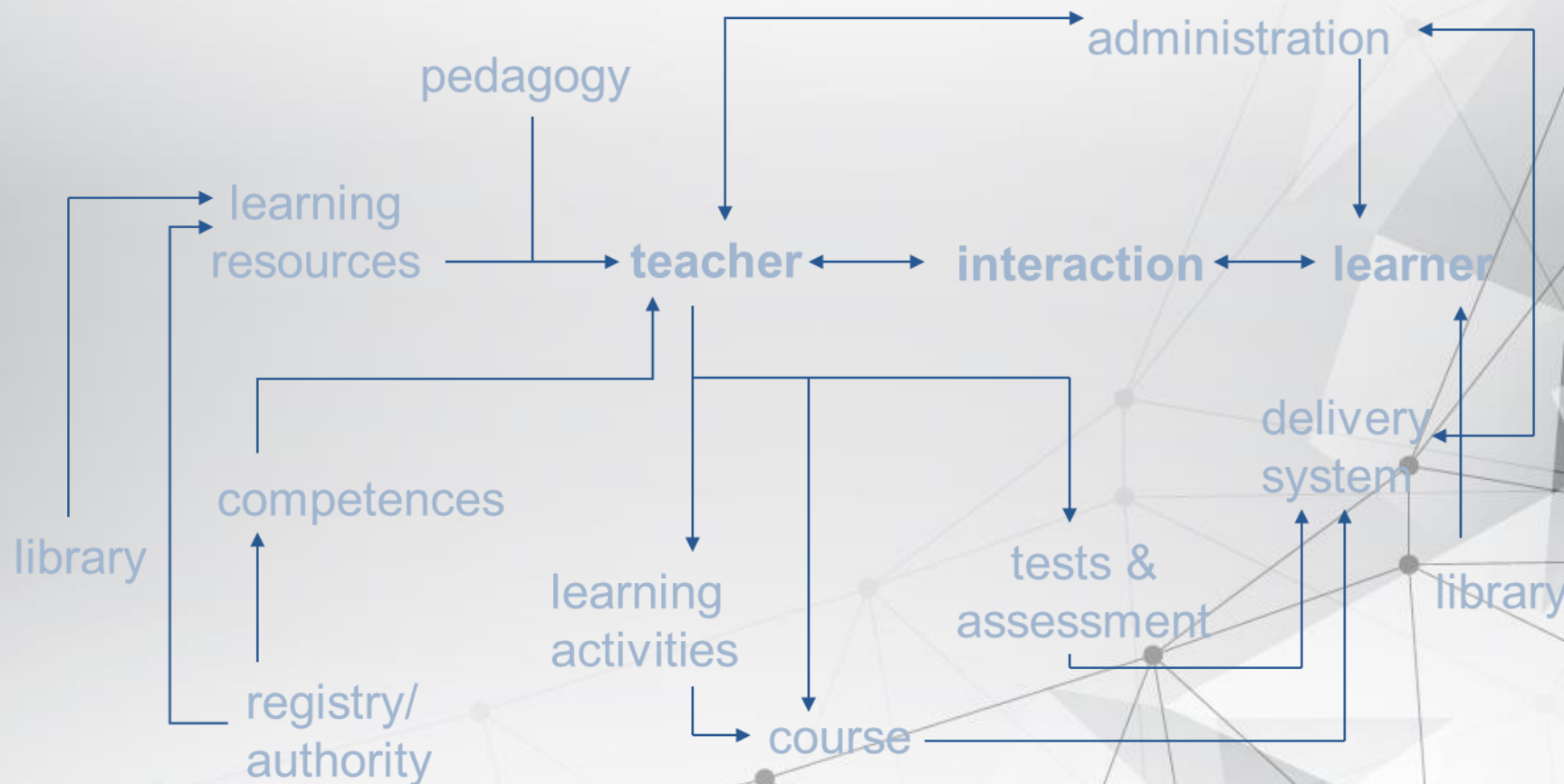
Original diagram by C. Duncan

Shift to Learning Outcomes

Learning outcomes
"what a learner knows, understands or is able to do at the end of a learning process"

Emphasis on ability to do irrespective of routes of acquisition

Associated with a learner-centered approach

Facilitates validation of non-formal and informal learning

Supports better matching between education and training provisions and labour market needs

Increases transparency of qualifications

Promotes mobility, employability, adaptability

Typology of Learning Outcomes

Competence =
Knowledge + Skills

cognitive (theoretical and/or factual)

Knowledge

Skill

apply knowledge, use know-how
(cognitive or practical)

Competence

use knowledge, skills in social context
(behavioural, attitudinal)
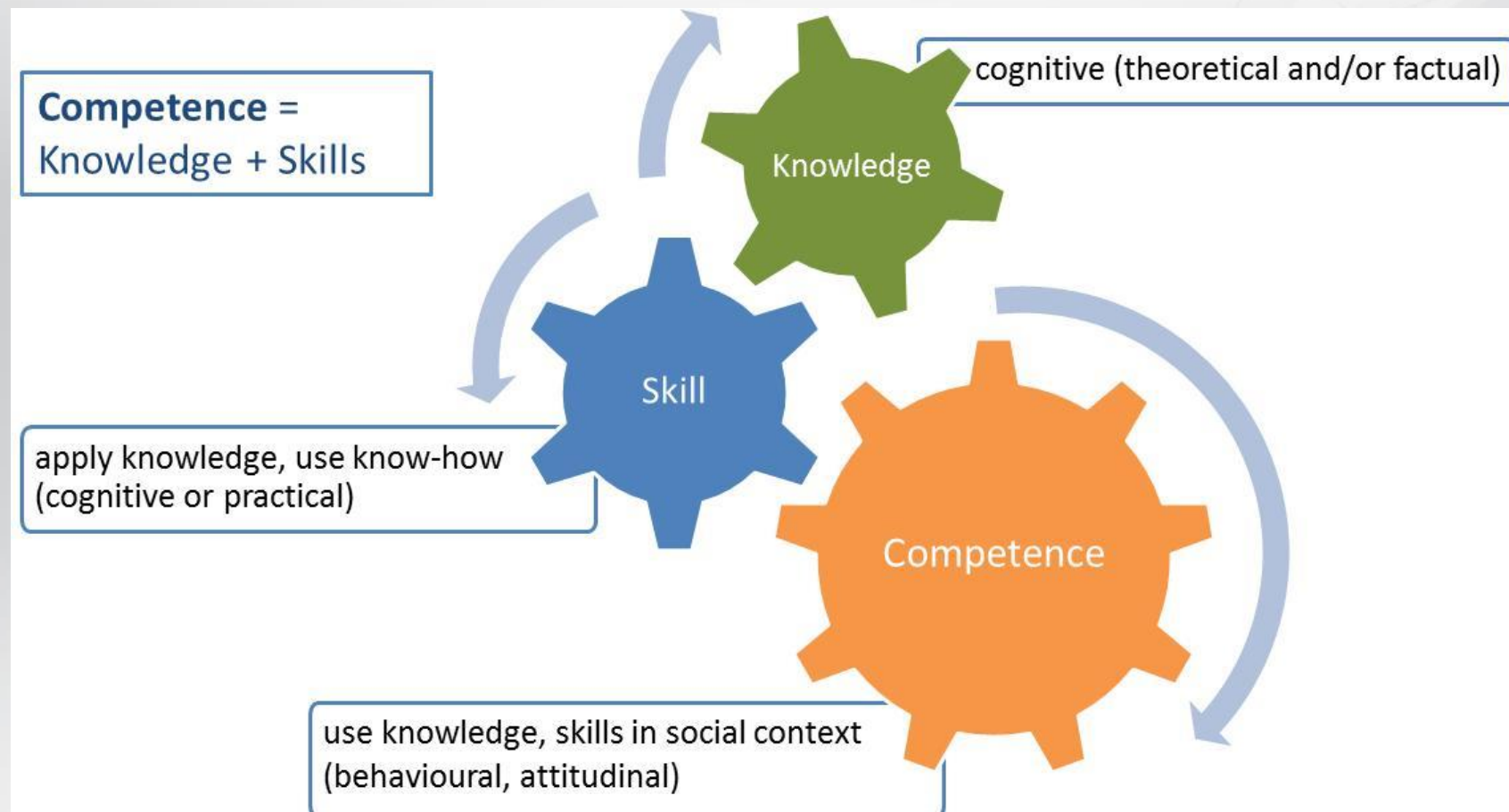
IoT Learning Outcomes (1)

Knowledge
- **Describe** the value that IoT delivers in different business domains.
- **Explain** the business processes related to IoT in specific domains.
- **Understand** IoT architectures and the related network and communication protocols.
- **Recognize** different types of sensors, actuators, displays and related embedded electronics
- **Design** the application level (e.g. use protocols that support different IoT applications) of IoT in the context of big data, cloud technologies and DS.
- **Formulate** requirements about IoT information security.

IoT Learning Outcomes (2)

Skills

- Analyse, argue and describe the business value of a particular IoT system.

- Design an IoT system that includes sensors, controllers, actuators and displays, connected to a cloud platform through Internet connection.

- Develop and deploy workflows and dashboards for an IoT system that includes sensors, controllers, actuators and displays, connected to a cloud platform through Internet connection.

- Develop working code for an IoT system that includes sensors, controllers, actuators and displays, connected to a cloud platform through Internet connection.

- Apply IoT information security concepts.

DS Learning Outcomes (1)

Knowledge

- Describe the key concepts of Data Science.

- Describe ICT methods and tools applicable for the storage and retrieval of data.

- Describe methods and tools applicable for the statistical analysis of data.

- Explain basic concepts and requirements related to information security and privacy.

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DS Learning Outcomes (2)

Skills

- Analyse domain specific trends and present them as structured information.

- Create code to statistically analyse data.

- Apply data statistics and data visualization.

- Deploy simple machine learning techniques.

- Deploy data storage and retrieval techniques.

- Implement data models validation techniques.

- Ensure that IPR, security and privacy issues are respected.

Transversal (soft) skills Learning Outcomes (1)

Transversal (soft) Skills

- Communication skills
- Adaptability to change
- Teamwork
- Ability to present in front of colleagues and clients
- Goal-orientation; Thinking outside the box; Agile mind-set

Transversal (soft) skills Learning Outcomes (2)

Competence

- Exercise self-management within the guidelines of work or study contexts that are usually predictable, but still are a subject to change;

- Supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities;

DS educational Modules

- **Introduction to Data Science (DS-EM1)**. learners are introduced to Data Science and its application at various disciplines.

- **Python for Data Science (DS-EM2).** learners are introduced to Python for solving Data Science problems.

- **Statistics for Data Science (DS-EM3).** learners are introduced to R and its use for solving Data Science problems.

- **Storing and retrieving data (DS-EM4).** learners are introduced to the Hadoop ecosystem and its application at storing and processing large volumes of data distributed across commodity servers.

- **Applied machine learning (DS-EM5).** learners are introduced to the concepts of Machine Learning and the application of machine learning techniques and methods in various domains.

- **Data Visualization (DS-EM6).** learners are introduced to Data Visualization and its application at various disciplines in order to enhance visual communication.

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IoT educational Modules

- **Introduction to IoT (IoT-EM1).** consists an introduction to the IoT concept and its applications.

- **IoT Devices (IoT-EM2)**. introduces the "Things" in the Internet of Things. More specifically, it is concerned about the different IoT devices (sensors, actuators, peripherals), their electronics, as well as, different microcontrollers and how they can interact with the environment.

- **IoT Communication Technologies (IoT-EM3).** introduces the plethora of communication protocols and standards that are used for signaling and data exchange in IoT systems in a comprehensive and visual way.

- **Architectural Design and Applications in IoT (IoT-EM4).** provides an introduction to the key aspects of the IoT system architecture (IoT edge devices, gateways) with emphasis on server-side infrastructure solutions (cloud computing service models, deployment models and public cloud providers).

- **IoT Security and Privacy (IoT-EM5).** introduces the risks of using IoT and possible measures to create a more secure environment.

- **IoT Business Value (IoT-EM6).** includes an introduction of IoT in the business world clarifying why companies need to understand IoT business.

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Data scientist roles

[adapted from the proposal done by the EDISON project for the extension of Data Science occupations at ESCO classification]

- **Data Analyst**. Analyses large variety of data to extract information about system, service or organization performance and present them in usable/actionable form.
- **Data Architect.** Designs and maintains the architecture of Data Science applications and facilities. Creates relevant data models and processes workflows.
- **Database Administrator.** Designs and implements or monitors and maintains large scale cloud databases.
- **Machine Learning Engineer.** Designs and applies machine learning algorithms.
- **Data Scientist.** Gathers and interprets rich data sources, manages large amounts of data, merges data sources, ensures consistency of data-sets, and creates visualizations to aid in understanding data. Builds mathematical models, presents and communicates data insights and findings.

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Mapping of DS training unit level to professional roles

Data Science Training Units	Data Analyst	Data Architect	DB Administrator	Machine Learning Engineer	Data Scientist
Introduction to DS	I	I	I	I	A
Python for DS	A	C	I	A	A
Statistics for DS	C	C	I	A	A
Storing and Retrieving Data	C	A	A	C	A
Applied Machine Learning	I	I	I	A	A
Data Visualization	A	I	I	C	A

IoT Engineer roles (1)

- **IoT Product Manager**. Supervises the execution part of the project. Collaborates with the development teams to take care of business requirements and implementations.

- **IoT Architect**. Manages the functional requirements gathering, technology (hardware, software, protocols) selection and solution architectural design for IoT systems and applications. The IoT Architect is responsible for creating effective, efficient, scalable, secure, and innovative IoT Solutions.

- **IoT Software Developer.** Implements IoT systems and applications according to approved designs and conducts rigorous testing of the applications. Deploys the systems and applications to the cloud as well as app stores.

IoT Engineer roles (2)

- **Data Scientist.** Finds and interprets rich data sources, manages large amounts of structured and unstructured data, merges data sources, ensures consistency of data-sets, and creates visualizations to aid in understanding data collected from IoT systems and applications.

- **IoT Cloud Engineer**. Deploys the IoT system infrastructure on the cloud, from middleware to data storage (e.g. databases) for collecting, storing and processing data from the IoT devices in the network

- **IoT Industrial Engineer**. Looks into the hardware components involved in IoT systems and applications, programs robots and smart embedded devices.

Mapping of IoT training unit level to professional roles

IoT Training Units	IoT Product Manager	IoT Architect	IoT Software Developer	Data Scientist	IoT Cloud Engineer	IoT Industrial Engineer
Introduction to IoT	I	I	I	I	I	I
IoT Devices	C	C	I	C	C	A
IoT Communication technologies	C	C	C	C	A	C
Architectural design and applications in IoT	C	A	A	C	A	C
IoT Security and Privacy	I	C	C	I	A	C
IoT Business Value	A	I	I	I	I	C

How can VET providers benefit from SEnDIng

- Up skill trainees in Data Science and IoT domains for FREE

- Find experts on IoT and Data Science certified by SEnDIng VET program

- Meet new challenges in the market

- Reap reduced training expenses

- Help organizations capitalize on the Data Science and IoT potential.

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How can enterprises benefit from SEnDIng

- Up skill employees at Data Science and IoT domains for FREE

- Find experts on IoT and Data Science certified by SEnDIng VET program

- Boosting Data Science & IoT Skills

- Meet new challenges in the market

- Reap reduced training expenses

- Help organizations capitalize on the Data Science and IoT potential.

How can IT professionals benefit from SEnDIng

- Up skill in Data Science and IoT domains for FREE
- Boosting Data Science & IoT Skills
- Reap reduced training expenses

Feedback and learning program assessment

- How do you evaluate the program?

- What do you like?

- What can we improve?

- Any comments…

Please, invest some time to fill out the questionnaires at the end of the workshop ☺ !

Thank you!

For further information please contact

Dr. Maria Rigou
Project coordinator
University of Patras
rigou at ceid.upatras.gr

Dr. Vasileios Gkamas
Technical Manager
University of Patras
gkamas at ceid.upatras.gr

or visit

http://sending-project.eu