EDISON Data Science Framework:

Foundation for Building Data Science Profession for Research and Industry

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Big Data Innovation Conference BDIC2016

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EDISON – Education for Data Intensive Science to Open New science frontiers

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Outline

• Background and motivation
  – Demand for Data Science and data related professions
  – European initiatives related to Digital Single Market and Digital Skills Agenda
• EDISON Data Science Framework (EDSF)
  – From Data Science Competences to Body of Knowledge and Model Curriculum
• Data Science Competence Framework: Essential competences and skills
• Data Science Professional profiles and taxonomy
  – Mapping to competences and team profiling
• Educational and training focus
  – Data Science Body of Knowledge (DS-BoK)
  – Data Science Model Curriculum (MC-DS)
  – Example Research Data Management Literacy curriculum
• Further developments to formalise EDSF and Data Science profession establishment
  – Invitation to cooperation
Visionaries and Drivers: Seminal works, High level reports, Activities

**The Fourth Paradigm: Data-Intensive Scientific Discovery.**

**Riding the wave: How Europe can gain from the rising tide of scientific data.**

**The Data Harvest:**
How sharing research data can yield knowledge, jobs and growth.
An RDA Europe Report. December 2014

**NIST Big Data Working Group (NBD-WG)**
http://bigdatawg.nist.gov/

**ISO/IEC JTC1 Big Data Study Group (SGBD)**
http://jtc1bigdatasg.nist.gov/home.php

EDISON Data Science Framework

DTW2016 12 Dec 2016
The Fourth Paradigm of Scientific Research

1. Theory and logical reasoning
2. Observation or Experiment
   - E.g. Newton observed apples falling to design his theory of mechanics
   - But Galileo Galilei made experiments with falling objects from the Pisa leaning tower
3. Simulation of theory or model
   - Digital simulation can prove theory or model
4. Data-driven Scientific Discovery (aka Data Science)
   - More data beats hypnotized theory
Data Driven Victories and Failures - Politics

Very high impact events and facts

• US Election 2012 – Obama’s campaign and rise of Big Data analytics
  – Micro-targeting and Social Networks analysis

• Brexit 2016
  – “Data driven Brexit” – first serious ring for right use of Big Data technologies

• US Election 2016
  – Clinton’s campaign – “Data driven” but using only upper layer of Social Network (SN) web
  – Trump’s campaign – Targeting bottom SN web and “forgotten people not to be forgotten”
  – Matt Oczkowski, leader on Trump’s campaign: “If he was going to win this election, it was going to be because of a Brexit style mentality and a different demographic trend than other people were seeing.”
Data-Driven Brexit: A Wakeup Call for Analysts
By Barry Devlin, June 28, 2016

Book: In Data We Trust: How Customer Data is Revolutionising Our Economy (Aug 2012)
• A strategy for tomorrow’s data world

• Article “In Data we trust” by T.Edsall in The New York Times
• Multimillion-dollar contract for data management and collection services awarded May 1, 2013 to Liberty Work to build advanced list of voters

• There are significant lessons for believers in data-driven business to learn from how data was and wasn’t used for decision making before, during, and after the Brexit vote.
• Human attitude -- including emotion, intuition, and social empathy -- and motivation are at the heart of decision making and the action that follows
• Information will only be accepted when it conforms to preconceived notions. Expertise is not sufficient and, in extremis, will be dismissed with ridicule.

DTW2016 12 Dec 2016
EDISON Data Science Framework
Demand for Data Science and data related professions

- McKinsey Global Institute on Big Data Jobs (2011)
  - Estimated gap of 140,000 - 190,000 data analytics skills by 2018

- UK Big Data skills report 2014
  - 6400 UK organisations with 100+ staff will have implemented Big Data Analytics by 2020
  - Increase of Big Data jobs from 21,400 (2013) to 56,000 (2017)

  - Number of data workers 6.1 mln (2014) - increase 5.7% from 2013
  - Average number of data workers per company 9.5 - increase 4.4%
  - Gap between demand and supply 509,000 (2014) or 7.5%

- HLEG report on European Open Science Cloud (October 2016) identified need for data experts and data stewards
  - Recommendation: Allocate 5% grant funding for Data management and preservation
  - Estimation: More than 80,000 data stewards (1 per every 20 scientists)
  - Core Data Experts (as defined) need to be trained and their career perspective improved

- The need for new multidisciplinary and digital skills in particular Data Scientist
  - Expected rapidly growing demand will lead to more than 800 000 unfilled vacancies by 2020


- **European Open Science Cloud (EOSC)** and European digital research and data infrastructure
  - To offer 1.7 million European researchers and 70 million professionals in science and technology open and seamless services for **storage, management, analysis and re-use** of research data

- Address growing demand and shortage of data-related skills


- Addresses the need for digital and complementary skills, ensure young talents flow into data driven research and industry
- Launch **Digital Skills and Jobs Coalition** (1st December 2016, Brussels) to develop comprehensive national digital skills strategies by mid-2017
OECD on Digital Economy

- Demand for new type of “dynamic self-re-skilling workforce”
- Continuous learning and professional development to become a shared responsibility of workers and organisations

[ref] SKILLS FOR A DIGITAL WORLD, OECD, 25-May-2016
EDISON Data Science Framework (EDSF) Release 1 (October 2016)

Data Science Framework

- CF-DS – Data Science Competence Framework
- DS-BoK – Data Science Body of Knowledge
- MC-DS – Data Science Model Curriculum
- DSP – Data Science Professional profiles
- Data Science Taxonomies and Scientific Disciplines Classification
- EOEE - EDISON Online Education Environment
Data Scientist definition

Based on the definitions by NIST Big Data WG (NIST SP1500 - 2015)

- **A Data Scientist** is a practitioner who has sufficient knowledge in the overlapping regimes of expertise in business needs, domain knowledge, analytical skills, and programming and systems engineering expertise to manage the end-to-end scientific method process through each stage in the **big data lifecycle**
  - … Till the delivery of expected scientific and business value to science or industry

- **Other definitions to admit such features as**
  - Ability to solve variety of business problems
  - Optimize performance and suggest new services for the organisation
  - Develop a special mindset and be statistically minded, *understand raw data* and “*appreciate data as a first class product*”

- **Data science** is the empirical synthesis of actionable knowledge and technologies required to handle data from raw data through the complete data lifecycle process.

- **Big Data** is the technology to build system and infrastructures to process large volume of structurally complex data in a time effective way

[ref] Legacy: NIST BDWG definition of Data Science
Background Frameworks and Standards

• e-CFv3.0 - European e-Competence Framework for IT
  – Structured by 4 Dimensions and organizational processes
    • Competence Areas: Plan – Build – Run – Enable - Manage
    • Competences: total defined 40 competences
    • Proficiency levels: identified 5 levels linked to professional education levels
    • Skills and Knowledge

• CWA 16458 (2012): European ICT Professional Profiles Family Tree
  – Defines 23 ICT profiles for common ICT jobs

• ESCO (European Skills, Competences, Qualifications and Occupations) framework
  – Standard for European job market since 2016
  – Expected inclusion of the Data Science occupations family – mid 2017

• ACM Classification of Computer Science – CCS (2012)
  – ACM Computer Science Body of Knowledge (CS-BoK) and ACM and IEEE Computer Science Curricula 2013 (CS2013)
• How it was made
• 5 main Data Science competences groups
• Skills, tools and languages
• Practical use of the CF-DS
• Data Science Professional profiles and occupations family
Demanded Data Science Competences and Skills: Jobs market analysis and stakeholders

- Initial Analysis (period Aug – Sept 2015) -> Continuous monitoring (in development)
  - IEEE Data Science Jobs (World but majority US)
    - Collected > 120, selected for analysis > 30
  - LinkedIn Data Science Jobs (NL)
    - Collected > 140, selected for analysis > 30
  - Existing studies and reports + numerous blogs & forums

- Analysis methods
  - Data analytics methods: classification, clustering, expert evaluation
  - Research methods: Data collection - Hypothesis – Artefact - Evaluation
Identified Data Science Competence Groups

• Commonly accepted Data Science competences/skills groups include
  – Data Analytics or Business Analytics or Machine Learning
  – Engineering or Programming
  – Subject/Scientific Domain Knowledge

• EDISON identified 2 additional competence groups demanded by organisations
  – Data Management, Curation, Preservation
  – Scientific or Research Methods and vs Business Processes/Operations

• Other skills commonly recognized aka “soft skills” or “social or professional intelligence”
  – Inter-personal skills and team work, cooperativeness

• All groups need to be represented in Data Science curriculum and training programmes
  – Challenging task for Data Science education and training

• Another aspect of integrating Data Scientist into organisation structure
  – General Data Science (and Data) literacy for all involved roles and management
  – Common agreed and understandable way of communication and information/data presentation
  – Role of Data Scientist: Provide a kind of literacy advice and guidance to organisation
Data Science Competence Groups - Research

Data Science Competence includes 5 areas/groups
- Data Analytics
- Data Science Engineering
- Domain Expertise
- Data Management
- Scientific Methods (or Business Process Management)

Scientific Methods
- Design Experiment
- Collect Data
- Analyse Data
- Identify Patterns
- Hypothesise Explanation
- Test Hypothesis

Business Operations
- Operations Strategy
- Plan
- Design & Deploy
- Monitor & Control
- Improve & Re-design
Data Science Competences Groups – Business

Data Science Competence includes 5 areas/groups
- Data Analytics
- Data Science Engineering
- Domain Expertise
- Data Management
- Scientific Methods (or Business Process Management)

Scientific Methods
- Design Experiment
- Collect Data
- Analyse Data
- Identify Patterns
- Hypothesise Explanation
- Test Hypothesis

Business Process Operations/Stages
- Design
- Model/Plan
- Deploy & Execute
- Monitor & Control
- Optimise & Re-design
## Identified Data Science Competence Groups

<table>
<thead>
<tr>
<th>Data Science Analytics (DSDA)</th>
<th>Data Management (DSDM)</th>
<th>Data Science Engineering (DSENG)</th>
<th>Research/Scientific Methods (DSRM)</th>
<th>Data Science Domain Knowledge, e.g. Business Processes (DSDK/DSBPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>0</strong> Use appropriate statistical techniques and predictive analytics on available data to deliver insights and discover new relations</td>
<td>Develop and implement data management strategy for data collection, storage, preservation, and availability for further processing.</td>
<td>Use engineering principles to research, design, develop and implement new instruments and applications for data collection, analysis and management</td>
<td>Create new understandings and capabilities by using the scientific method (hypothesis, test/artefact, evaluation) or similar engineering methods to discover new approaches to create new knowledge and achieve research or organisational goals</td>
<td>Use domain knowledge (scientific or business) to develop relevant data analytics applications, and adopt general Data Science methods to domain specific data types and presentations, data and process models, organisational roles and relations</td>
</tr>
<tr>
<td><strong>1</strong> DSDA01 Use predictive analytics to analyse big data and discover new relations</td>
<td>DSDM01 Develop and implement data strategy, in particular, Data Management Plan (DMP)</td>
<td>DSENG01 Use engineering principles to design, prototype data analytics applications, or develop instruments, systems</td>
<td>DSRM01 Create new understandings and capabilities by using scientific/research methods or similar domain related development methods</td>
<td>DSBPM01 Understand business and provide insight, translate unstructured business problems into an abstract mathematical framework</td>
</tr>
<tr>
<td><strong>2</strong> DSDA02 Use statistical techniques to deliver insights</td>
<td>DSDM02 Develop data models including metadata</td>
<td>DSENG02 Develop and apply computational solutions</td>
<td>DSRM02 Direct systematic study toward a fuller knowledge or understanding of the observable facts</td>
<td>DSBPM02 Participate strategically and tactically in financial decisions</td>
</tr>
<tr>
<td><strong>3</strong> DSDA03 Develop specialized data analytics</td>
<td>DSDM03 Collect integrate data</td>
<td>DSENG03 Develops specialized tools</td>
<td>DSRM03 Undertakes creative work</td>
<td>DSBPM03 Provides support services to other</td>
</tr>
<tr>
<td><strong>4</strong> DSDA04 Analyze complex data</td>
<td>DSDM04 Maintain repository</td>
<td>DSENG04 Design, build, operate</td>
<td>DSRM04 Translate strategies into actions</td>
<td>DSBPM04 Analyse data for marketing</td>
</tr>
<tr>
<td><strong>5</strong> DSDA05 Use different analytics</td>
<td>DSDM05 Visualise complex data</td>
<td>DSENG05 Secure and reliable data</td>
<td>DSRM05 Contribute to organizational goals</td>
<td>DSBPM05 Analyse optimise customer relations</td>
</tr>
</tbody>
</table>
Identified Data Science **Skills/Experience** Groups

- **Group 1: Skills/experience related to competences**
  - Data Analytics and Machine Learning
  - Data Management/Curation (including both general data management and scientific data management)
  - Data Science Engineering (hardware and software) skills
  - Scientific/Research Methods or Business Process Management
  - Application/subject domain related (research or business)
  - Mathematics and Statistics

- **Group 2: Big Data (Data Science) tools and platforms**
  - Big Data Analytics platforms
  - Mathematics & Statistics applications & tools
  - Databases (SQL and NoSQL)
  - Data Management and Curation platform
  - Data and applications visualisation
  - *Cloud based platforms and tools*

- **Group 3: Programming and programming languages and IDE**
  - General and specialized development platforms for data analysis and statistics

- **Group 4: Soft skills or Social Intelligence**
  - Personal, inter-personal communication, team work, professional network
Practical Application of the CF-DS

• Basis for the definition of the Data Science Body of Knowledge (DS-BoK) and Data Science Model Curriculum (MC-DS)
  – CF-DS => Learning Outcomes (MC-DS) => Knowledge Areas (DS-BoK)
  – CF-DS => Data Science taxonomy of scientific subjects and vocabulary

• Data Science professional profiles definition
  – Extend existing EU standards and occupations taxonomies: e-CFv3.0, ESCO, others

• Professional competence benchmarking
  – For customizable training and career development
  – Including CV or organisational profiles matching

• Professional certification
  – In combination with DS-BoK professional competences benchmarking

• Vacancy construction tool for job advertisement (for HR)
  – Using controlled vocabulary and Data Science Taxonomy
Individual Competences Benchmarking

Individual Education/Training Path based on Competence benchmarking

- Red polygon indicates the chosen professional profile: Data Scientist (general)
- Green polygon indicates the candidate or practitioner competences/skills profile
- Insufficient competences (gaps) are highlighted in red
  - DSDA01 – DSDA06 Data Science Analytics
  - DSRM01 – DSRM05 Data Science Research Methods
- Can be used for team skills match marking and organisational skills management

[ref] For DSP Profiles definition and for enumerated competences refer to EDSF documents CF-DS and DSP Profiles.
Data Science Professions Family

**Managers:** Chief Data Officer (CDO), Data Science (group/dept) manager, Data Science infrastructure manager, Research Infrastructure manager

**Professionals:** Data Scientist, Data Science Researcher, Data Science Architect, Data Science (applications) programmer/engineer, Data Analyst, Business Analyst, etc.

**Professional (database):** Large scale (cloud) database designers and administrators, scientific database designers and administrators

**Professional (data handling/management):** Data Stewards, Digital Data Curator, Digital Librarians, Data Archivists

**Technicians and associate professionals:** Big Data facilities operators, scientific database/infrastructure operators

**Support workers and data handling clerks:** User support workers, data entry clerks, data entry field workers

Icons used: Credit to [ref] https://www.datacamp.com/community/tutorials/data-science-industry-infographic
DSP Profiles mapping to corresponding CF-DS Competence Groups

- Relevance level from 5 – maximum to 1 – minimum
Data Science Competence Framework (CF-DS) and DSP Profiles Mapping
Building a Data Science Team

Data Science Group Manager, Data Science Architect

Data Collection

Data Ingest

Data Source (Experiment, Data Driven Application)

Data Science Applications Developer

Data Steward

Data Entry/Support

Researcher (Scientific domain)

Data Facilities Operator

Data Steward

Data Steward

Data Steward

Data Steward

Data Analyst/Business Analyst

Data Scientist

Data Scientist

Data Scientist

Data Scientist

Data Scientist

Data Engineer, Database Developer

Data Science Applications Developer

Data Science Researcher

Data Science Researcher

Business Analyst

Results, Actionable Data

Data Visualisation, Reporting, Storage
Data Science or Data Management Group/Department: Organisational structure and staffing - EXAMPLE

Data Science or Data Management Group/Department

- Group Manager
- Data Science Architect
- Data Analyst
- Data Science Application programmer
- Data Infrastructure/facilities administrator/operator: storage, cloud, computation
- Data stewards

>> Reporting to CDO/CTO/CEO
  - Providing cross-organizational services
Data Science or Data Management Group/Department: Organisational structure and staffing - EXAMPLE

Data Science or Data Management Group/Department

- (Managing) Data Science Architect (1)
- Data Scientist (1), Data Analyst (1)
- Data Science Application programmer (2)
- Data Infrastructure/facilities administrator/operator: storage, cloud, computing (1)
- Data stewards, curators, archivists (3-5)

>> Reporting to CDO/CTO/CEO
  - Providing cross-organizational services

Estimated: Group of 10-12 data specialists for research institution of 200-300 research staff.
[ref] Cortnie Abercrombie, What CEOs want from CDOs and how to deliver on it [online] http://www.slideshare.net/IBMDBA/what-ceos-want-from-cdos-and-how-to-deliver-on-it
Education and Training

• Foundation and methodological base
  – Data Science Body of Knowledge (DS-BoK)
    • Taxonomy and classification of Data Science related scientific subjects
  – Data Science Model Curriculum (MC-DS)
    • Set Learning Units mapped to CF-DS Learning and DS-BoK Knowledge Areas/Units
  – Instructional methodologies and teaching models

• Platforms and environment
  – Virtual labs, datasets, developments platforms
  – Online education environment and courses management

• Services
  – Individual benchmarking and profiling tools (competence assessment)
  – Knowledge evaluation tools
  – Certifications and training for self-made Data Scientists practitioners
  – Education and training marketplace: Courses catalog and repository
Data Science Body of Knowledge (DS-BoK)

DS-BoK Knowledge Area Groups (KAG)

- KAG1-DSA: Data Analytics group including Machine Learning, statistical methods, and Business Analytics
- KAG2-DSE: Data Science Engineering group including Software and infrastructure engineering
- KAG3-DSDM: Data Management group including data curation, preservation and data infrastructure
- KAG4-DSRM: Scientific/Research Methods group
- KAG5-DSBP: Business process management group

Data Science domain knowledge to be defined by related expert groups
Data Science Model Curriculum includes

- Learning Outcomes (LO) definition based on CF-DS
  - LOs are defined for CF-DS competence groups and for all enumerated competences

- LOs mapping to Learning Units (LU)
  - LUs are based on CCS(2012) and universities best practices
  - Data Science university programmes and courses inventory (interactive)
    http://edison-project.eu/university-programs-list

- LU/course relevance: Mandatory Tier 1, Tier 2, Elective, Prerequisite

- Learning methods and learning models (in progress)
Example DS-BoK Knowledge Areas definition and mapping to existing BoKs and CCS (2012)

<table>
<thead>
<tr>
<th>Knowledge Area Groups (KAG)</th>
<th>Knowledge Areas (KA)</th>
<th>Suggested Knowledge Units (KU)</th>
<th>Mapping to CCS2012 (including suggested Data Science extensions) and existing BoKs</th>
</tr>
</thead>
<tbody>
<tr>
<td>KAG1-DSDA: Data Analytics group (including Machine Learning, statistical methods)</td>
<td>Theory of computation</td>
<td>Design and Analysis of Algorithms</td>
<td>CCS2012: Theory of computation&lt;br&gt;Design and analysis of algorithms&lt;br&gt;Data structures design and algorithms</td>
</tr>
<tr>
<td>KAG2-DSENG: Data Science Engineering group including Software and Infrastructure engineering</td>
<td>Computer systems organisation for Big Data</td>
<td>Parallel and Distributed Computer Architecture</td>
<td>CCS2012: Computer systems organization&lt;br&gt;Architectures&lt;br&gt;Parallel architectures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Data Management and Enterprise data infrastructure</td>
<td>DM-BoK selected KAs&lt;br&gt;(1) Data Governance,&lt;br&gt;(2) Data Architecture,&lt;br&gt;(3) Data Modelling and Design,&lt;br&gt;(4) Data Storage and Operations,&lt;br&gt;(5) Data Security,&lt;br&gt;(6) Data Integration and Interoperability,&lt;br&gt;(7) Documents and Content,&lt;br&gt;(8) Reference and Master Data,&lt;br&gt;(9) Data Warehousing and Business Intelligence,&lt;br&gt;(10) Metadata, and&lt;br&gt;(11) Data Quality.</td>
</tr>
</tbody>
</table>

- Mapping suggested to CCS2012 and existing BoKs
Example MC-DS Mapping Learning Units to DS-BoK and CCS (2012)

<table>
<thead>
<tr>
<th>KAG/LU#</th>
<th>Learning Unit (course name)</th>
<th>Type/relevance</th>
<th>Map to DS-BoK, CCS2012 and known BoKs</th>
<th>Map to DS-BoK, CCS2012 and known BoKs</th>
</tr>
</thead>
<tbody>
<tr>
<td>KAG/</td>
<td></td>
<td>Tier 1 Tier 2</td>
<td>Elective Pre requisite</td>
<td>Elective Pre requisite</td>
</tr>
<tr>
<td>LU#</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Software requirements and design
  - Extensions are suggested from SWEBOK
  - SWEBOK selected KAs
    - Software requirements
      - Configuration
      - Engineering
      - Software process modeling

- Information theory
  - Mathematical analysis

- Extensibility point for adding new courses

- Artificial Intelligence
  - Computing methodologies
  - Artificial Intelligence

- Natural Language Processing

- Knowledge Representation
  - Data mining and knowledge discovery
    - Data type registries, PID, metadata
  - Text analysis, Data n
  - Text analytics include linguistic, and struct techniques to analyze and unstructured data
    - Research data infrastructure, Open Science, Open Data, Open Access, ORCID
    - Extensibility point for adding new courses
  - Machine Learning algorithms
  - Classification methods

- Research methodology, research cycle
  - Modelling and experiment planning

- Extended with the general Data Management Knowledge Areas and related academic subjects.
- Extended with the general Scientific/Research Methods subjects and related academic subjects.

- General Data Management KA’s
  - Data Lifecycle Management
  - Data archives/storage compliance and certification
  - New KAs to support RDA recommendations and community data management models (Open Access, Open Data, etc)
  - Data type registries, PIDs
  - Data infrastructure and Data Factories
  - TBD – To follow RDA and ERA community developments

- Suggested KAs to develop DSRM related competences:
  - Research methodology, research cycle
  - 4 step model Hypothesis – Research Methods – Artefact –

Mapping suggested to ACM CCS2012, DS-BoK and other related BoKs
Outcome Based Educations and Training Model

From Competences and DSP Profiles to Learning Outcomes (LO) and to Knowledge Units (KU) and Learning Units (LU)

- EDSF allow for customized educational courses and training modules design
DM-BoK version 2 “Guide for performing data management”
- 11 Knowledge Areas
  (1) Data Governance
  (2) Data Architecture
  (3) Data Modelling and Design
  (4) Data Storage and Operations
  (5) Data Security
  (6) Data Integration and Interoperability
  (7) Documents and Content
  (8) Reference and Master Data
  (9) Data Warehousing and Business Intelligence
  (10) Metadata
  (11) Data Quality

Other Knowledge Areas motivated by RDA, European Open Data initiatives, European Open Data Cloud
  (12) PID, metadata, data registries
  (13) Data Management Plan
  (14) Open Science, Open Data, Open Access, ORCID
  (15) Responsible data use

- Highlighted in red: Considered (Research) Data Management literacy (minimum required knowledge)
Further Developments and Actions

- Run surveys and key interviews for target communities
  - Primarily experts, visionaries and top executives at universities and companies
- Work with champion universities to practically validate the proposed EDSF
- Run a serial of the Champion Universities conferences: Spring 2017 and Summer 2017
  - Extend scope to Champions, Adopters, Ambassadors and Professionals
- Involve academic and industry experts and professional organisations to the definition of DS-BoK following from CF-DS
- Formally provide suggestions to ESCO for the definition of the Data Science professional profiles (occupations) family
- Formally provide suggestions for e-CF3.0 extensions for Data Science to CEN/PC 428
  - Involve national e-CF bodies and adopters where available
- Suggest required ACM CCS(2012) Classification extensions and proposal for Data Science curriculum definition
Discussion

• Questions
• Comments

• Invitation to contribution and cooperation:
  – Forum, EDISON Liaisons Groups, Champions Conference (Spring & Summer 2017)

• EDISON project website http://edison-project.eu/

• EDISON Data Science Framework Release 1 (EDSF) http://edison-project.eu/edison-data-science-framework-edsf
  – Data Science Body of Knowledge http://edison-project.eu/data-science-body-knowledge-ds-bok

• Survey Data Science Competences: Invitation to participate https://www.surveymonkey.com/r/EDISON_project_-_Defining_Data_science_profession
Definitions (according to e-CFv3.0)

- **Competence** is a demonstrated ability to apply knowledge, skills and attitudes for achieving observable results.
  - Competence vs Competency (e-CF vs ACM)
    - Competence is ability acquired by training or education (linked to learning outcome)
    - Competency is similar to skills or experience (acquired feature of a person)
  - Competence is not to be confused with process or technology concepts such as, ‘Cloud Computing’ or ‘Big Data’. These descriptions represent evolving technologies and in the context of the e-CF, they may be integrated as elements within knowledge and skill examples.

- **Knowledge** in the context of competence definition is treated as something to know, to be aware of, familiar with, and obtained as a part of education.

- **Skills** is treated as provable ability to do something and relies on the person’s experience.
Data Scientist and Subject Domain Specialist

• **Subject domain components**
  – Model (and data types)
  – Methods
  – Processes
  – Domain specific data and presentation/visualization methods
  – Organisational roles and relations

• **Data Scientist is an assistant to Subject Domain Specialists**
  – Translate subject domain Model, Methods, Processes into abstract data driven form
  – Implement computational models in software, build required infrastructure and tools
  – Do (computational) analytic work and present it in a form understandable to subject domain
  – Discover new relations originated from data analysis and advice subject domain specialist
  – Present/visualise information in domain related actionable way
  – Interact and cooperate with different organizational roles to obtain data and deliver results and/or actionable data
Data Scientist functions is to translate between two domains

Data Scientist role is to maintain the Data Value Chain (domain specific):
• Data Integration => Organisation/Process/Business Optimisation => Innovation