Coordination and cooperation to establish new profession of Data Scientist for European Research and Industry

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The Data Science Conference 2016

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EDISON – **E**ducation for **D**ata **I**ntensive **S**cience to **O**pen **N**ew science frontiers

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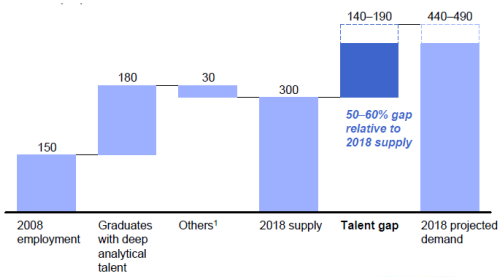
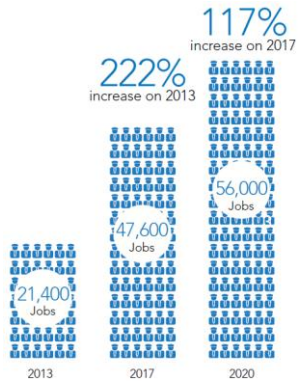
Outline

- Background and motivation
  - Demand for Data Science and data related professions
  - European initiatives related to Digital Single Market (DSM) and demand to data related competences and skills
- EDISON Data Science Framework
  - From Data Science Competences to Body of Knowledge and Model Curriculum
- Data Science Competence Framework: Essential competences and skills
- Taxonomy: Data Science occupations family
- Data Science Body of Knowledge (DS-BoK)
  - Knowledge areas and academic disciplines
- Further steps

Demand for Data Science and data related professions



- McKinsey Global Institute on Big Data Jobs (2011) http://www.mckinsey.com/mgi/publications/big_data/index.asp
  - 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)

- IDC Report on European Data Market (2015)
  - 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 (2016) identified need for data experts and data stewards
  - Estimation: More than 80,000 data stewards (1 per every 20 scientists)
  - Core data experts need to be trained and their career perspective improved

Recent European Commission Initiatives

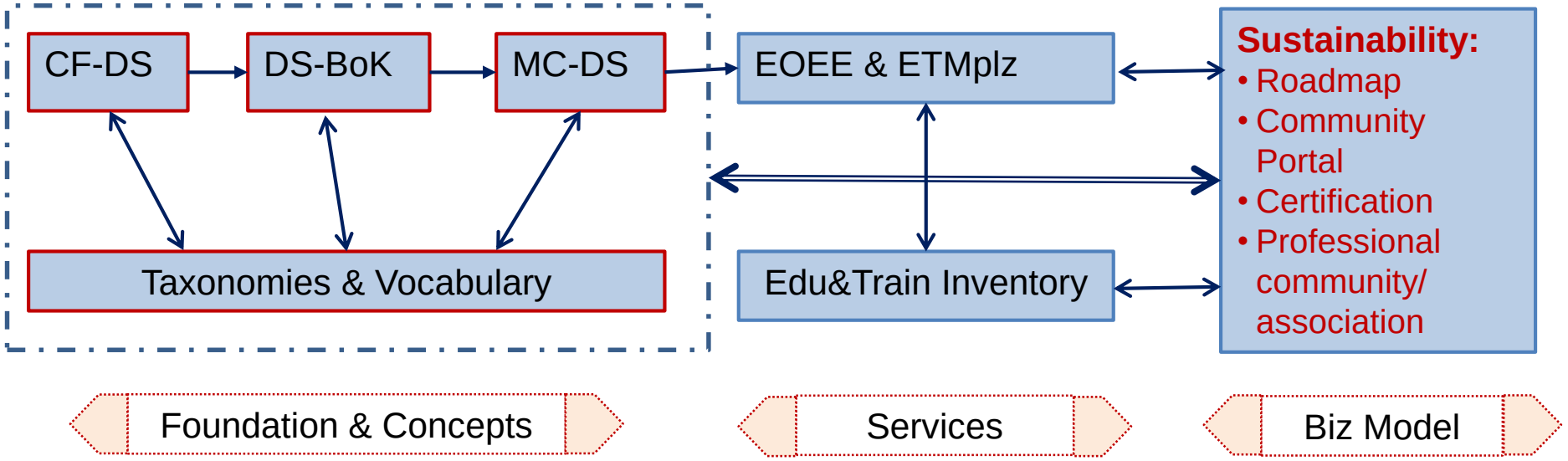
Digitising European Industry: Reaping the full benefits of a **Digital Single Market**. COM(2016) 180 final, Brussels, 19.4.2016

- The need for new multidisciplinary and digital skills is exploding, including such as (Data Scientist) combining data analytics and business or engineering skills.
  - Expected rapidly growing demand will lead to more than 800 000 unfilled vacancies by 2020.
- The forthcoming New Skills Agenda for Europe (exp May 2016) to address the need for digital and complementary skills, ensure young talents flow into data driven research and industry

European Cloud Initiative - Building a competitive data and knowledge economy in Europe, COM(2016) 178 final, Brussels, 19.4.2016

- 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
- Raise awareness and change incentive structures for academics, industry and public services to share their data, and improve data management training, literacy and data stewardship skills
- Address growing demand and shortage of data-related skills and lack of recognition of their value (in all sectors).

EDISON Framework: Building the Data Science Profession



- EDISON Framework components
  - CF-DS – Data Science Competence Framework
  - DS-BoK – Data Science Body of Knowledge
  - MC-DS – Data Science Model Curriculum
  - Data Science Taxonomies and Scientific Disciplines Classification
    - Linked to e-CFv3.0, ACM CCS (2012) and ESCO
  - EOEE - EDISON Online Education Environment

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
  - Intended inclusion of the Data Science occupations family – end of 2016
- ACM Classification of Computer Science – CCS (2012)
  - ACM Computer Science Body of Knowledge (CS-BoK) and ACM and IEEE Computer Science Curricula 2013 (CS2013)

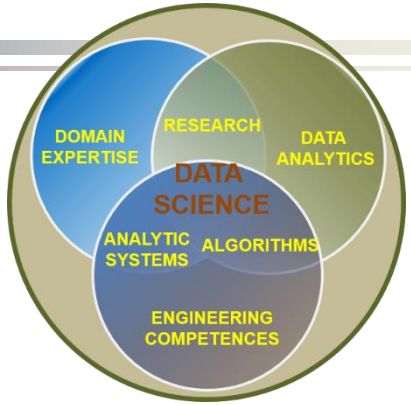
EDISON Data Science Competence Framework

- How it was made
- 5 main Data Science competences groups
- Skills, tools and languages
- Suggested extensions and identified profiles
- Data Science occupations family

Demanded Data Science Competences and Skills: Jobs market analysis

- Initial Analysis (period Aug – Sept 2015)
  - 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
  - Using manually data analytics methods: classification, clustering, expert evaluation
  - Research methods: Data collection - Hypothesis – Artefact - Evaluation
- Observations
  - Many job ads don't use Data Scientist as a definite profession:
    - Data Science competences/skills are specified as part of traditional ICT professions/positions
  - Many academic openings without specified skills profile
  - Explicit Data Scientist jobs specify wide variety of expected functions/responsibilities and required skills and knowledge

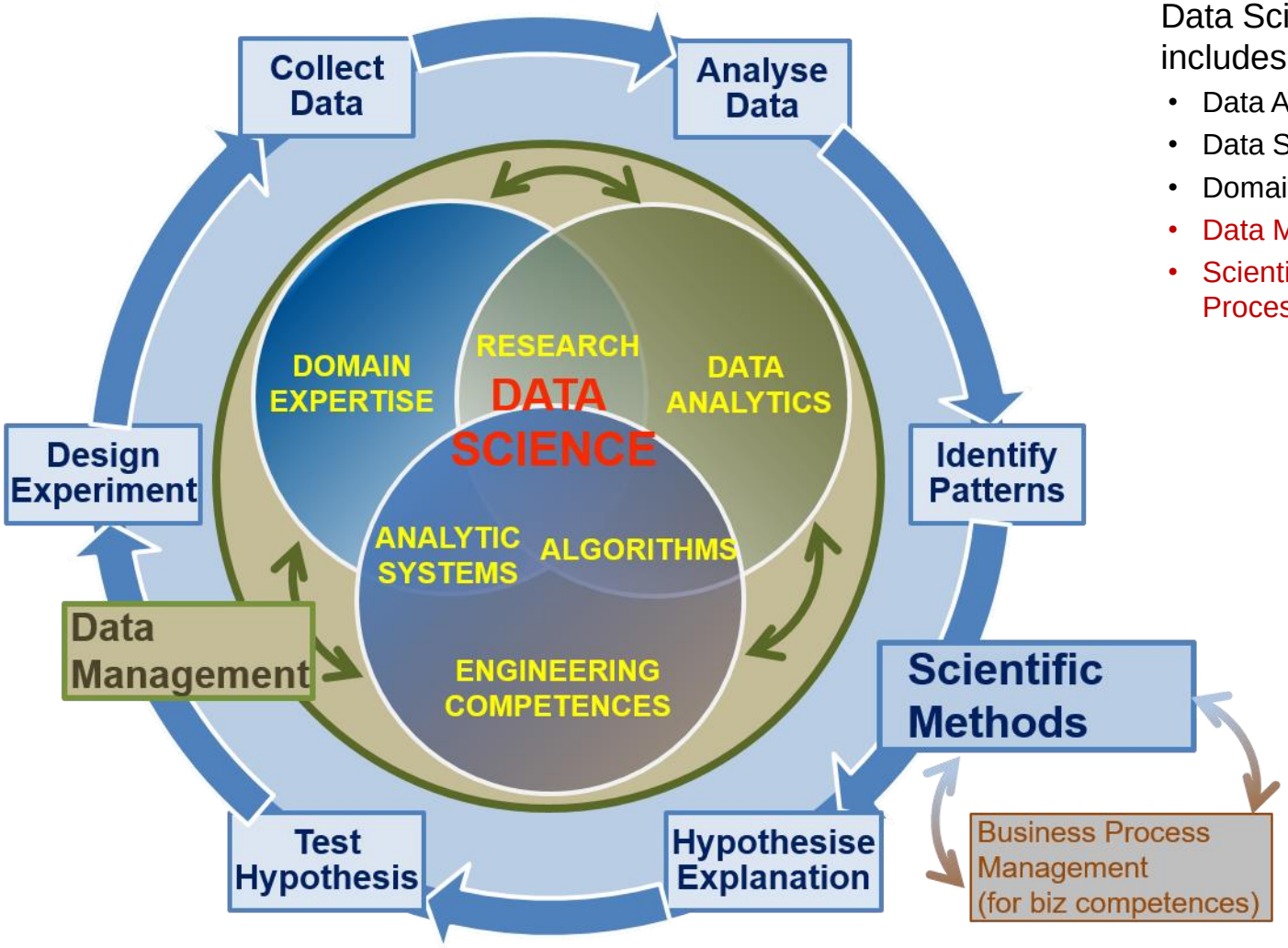
Identified Data Science Competence Groups



[ref] Legacy: NIST BDWG definition of Data Science

- Traditional/known 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 intelligence”
  - Inter-personal skills or 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 (or Big Data) **literacy** for all involved roles and management
  - Common agreed and understandable way of communication and **information/data presentation**
  - ***Role of Data Scientist: Provide such literacy advice and guiding 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)

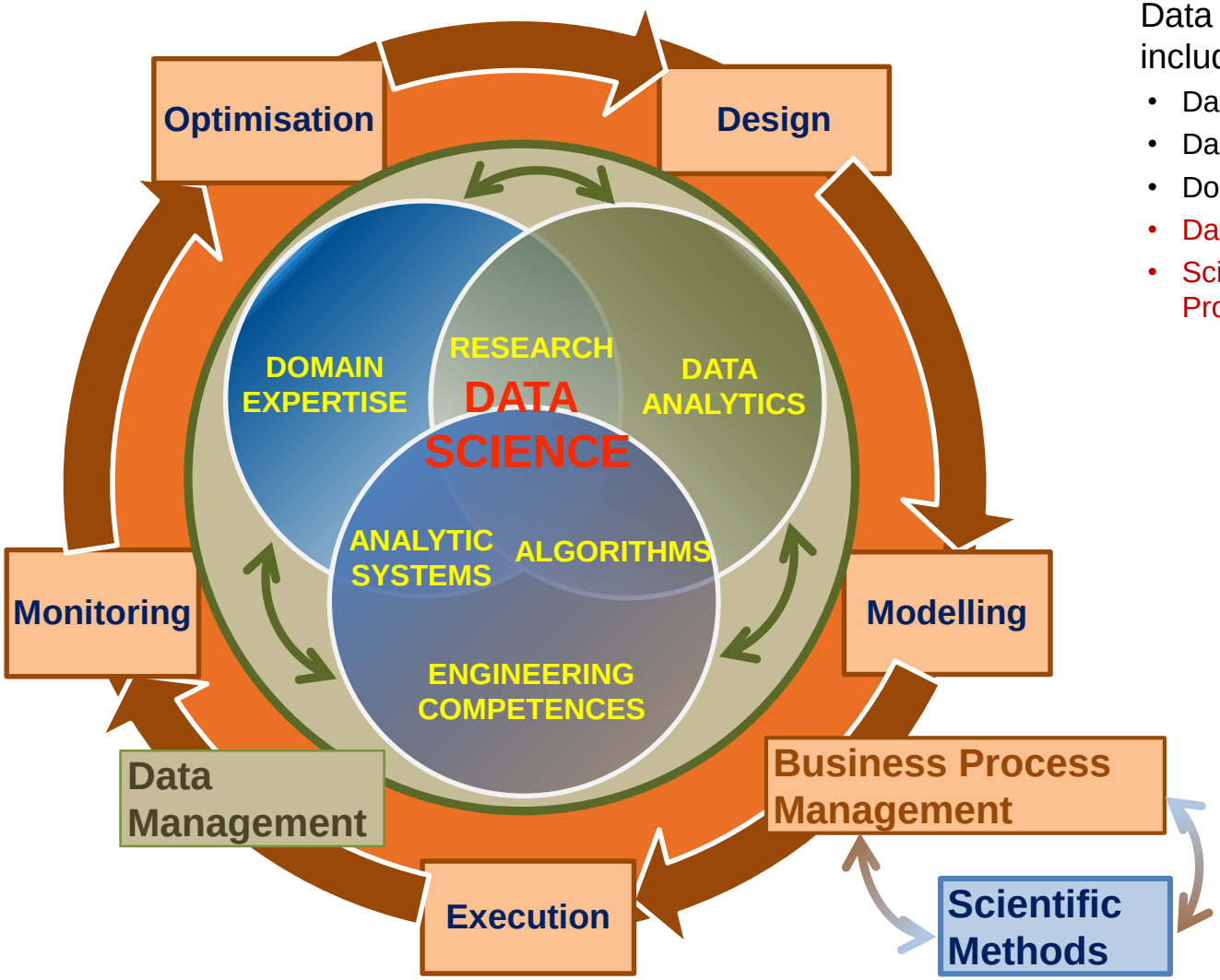
Scientific Methods

- 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



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Scientific Methods

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- 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

	Data Analytics (DA)	Data Management/ Curation (DM)	DS Engineering (DSE)	Scientific/Research Methods (DSRM)	DS Domain Knowledge (including Business Apps)
1	Use appropriate statistical techniques on available data to deliver insights	**Develop and implement data strategy**	Use engineering principles to research, design, or develop structures, instruments, machines, experiments, processes, systems, theories, or technologies	Create new understandings and capabilities by using the scientific method's hypothesis, test, and evaluation techniques; critical review; or similar engineering research and development methods	Understand business and provide insight, translate unstructured business problems into an abstract mathematical framework
2	Use predictive analytics to analyse big data and discover new relations	**Develop data models including metadata**	Develops specialized data analysis tools to support executive decision making	Direct systematic study toward a fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts, and discovers new approaches to achieve goals	Use data to improve existing services or develop new services
3	Research and analyze complex data sets, combine different sources and types of data to improve analysis.	**Integrate different data source and provide for further analysis**	Design, build, operate relational non-relational databases	Undertake creative work, making systematic use of investigation or experimentation, to discover or revise knowledge of reality, and uses this knowledge to devise new applications	Participate strategically and tactically in financial decisions that impact management and organizations
4	Develop specialized analytics to enable agile decision making	**Develop and maintain a historical data repository of analysis**	Develop and apply computational solutions to domain related problems using wide range of data analytics platforms	Apply ingenuity to complex problems, develop innovative ideas	Recommends business related strategic objectives and alternatives and implements them
5		**Collect and manage different source of data**	Develop solutions for secure and reliable data access	Ability to translate strategies into action plans and follow through to completion.	Provides scientific, technical, and analytic support services to other organisational roles
6		**Visualise complex and variable data.**	Develop algorithms to analyse multiple source of data	Influence the development of organizational objectives	Analyse multiple data sources for marketing purposes
7			Prototype new data analytics applications		Analyse customer data to identify/optimise customer relations actions

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
  - Application/subject domain related (research or business)
  - Mathematics and Statistics
- **Group 2: Big Data (Data Science) tools and platforms**
  - Big Data Analytics platforms
  - Math & Stats apps & 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 (also called social intelligence or soft skills)

Data Science Skill Groups related to Competences

	Data Analytics and Machine Learning	Data Management/ Curation	Data Science Engineering (hardware and software)	Scientific/ Research Methods	Personal/Inter-personal communication, team work	Application/subject domain (research or business)
1	Artificial intelligence, machine learning	Manipulating and analyzing complex, high-volume, high-dimensionality data from varying sources	Design efficient algorithms for accessing and analyzing large amounts of data	Interest in data science	Communication skills	Recommender or Ranking system
2	Machine Learning and Statistical Modelling	for data improvement	Big Data solutions and advanced data mining tools	Analytical, independent, critical, curious and focused on results	Inter-personal intra-team and external communication	Data Analytics for commercial purposes
3	Machine learning solutions and pattern recognition techniques	Data models and datatypes	Multi-core/distributed software, preferably in a Linux environment	Confident with large data sets and ability to identify appropriate tools and algorithms	Network of contacts in Big Data community	Data sources and techniques for business insight and customer focus
4	Supervised and unsupervised learning	Handling vast amounts of data	Databases, database systems, SQL and NoSQL	Flexible analytic approach to achieve results at varying levels of precision		Mechanism Design and/or Latent Dirichlet Allocation
5	Data mining	Experience of working with large data sets	Statistical analysis languages and tooling	Exceptional analytical skills		Game Theory
6	Markov Models, Conditional Random Fields	(non)relational and (un)-structured data	Cloud powered applications design			Copyright and IPR
7	Logistic Regression, Support Vector Machines	Cloud based data storage and data management				
8	Predictive analysis and statistics (including Kaggle platform)	Data management planning				
9	(Artificial) Neural Networks	Metadata annotation and management				
10	Statistics	Data citation, metadata, PID (*)				

Suggested e-CF Competences for Data Science:
Next eCF Workshop meeting – 14 April 2016

A. PLAN and Design (9 basic competences)
- A.10* Organisational workflow/processes model definition/formalisation
- A.11* Data models and data structures

B. BUILD: Develop and Deploy/Implement (6 basic competences)
- B.7* Apply data analytics methods (to organizational processes/data)
- B.8* Data analytics application development
- B.9* Data management applications and tools
- B.10* Data Science infrastructure deployment

C. RUN: Operate (4 basic competences)
- C.5* User/Usage data/statistics analysis
- C.6* Service delivery/quality data monitoring

15 Data Science Competences proposed covering different organizational roles and workflow stages
- **Data Scientist roles are crossing multiple org roles and workflow stages**

D. ENABLE: Use/Utilise (12 basic competences)
- D10. Information and Knowledge Management (powered by DS)
- D.13* Data presentation/visualisation, actionable data extraction
- D.14* Support business processes/roles with data and insight (support to D.5, D.6, D.7, D.12)
- D.15* Data management/preservation/curation with data and insight

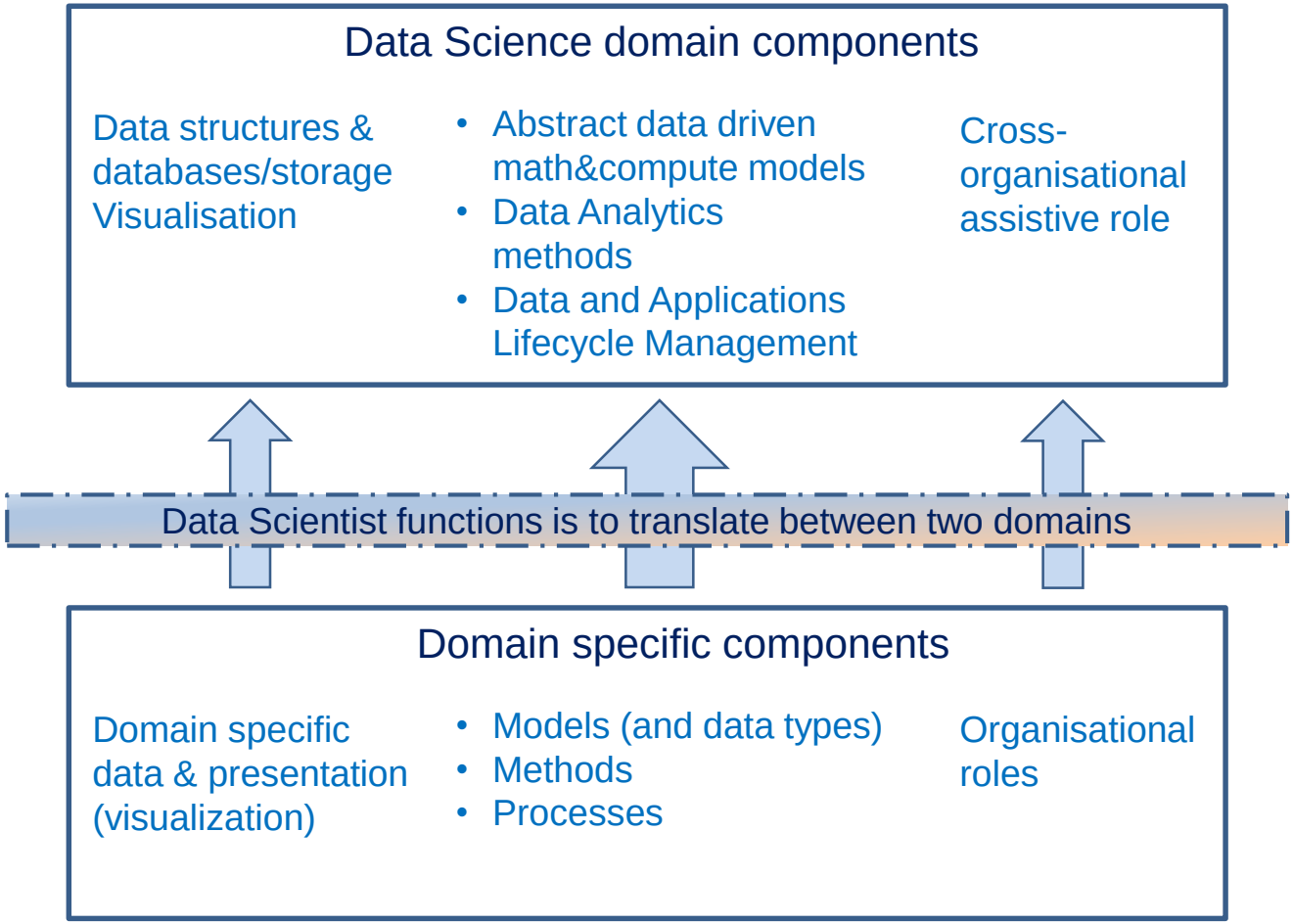
E. MANAGE (9 basic competences)
- E.10* Support Management and Business Improvement with data and insight (support to E.5, E.6)
- E.11* Data analytics for (business) Risk Analysis/Management (support to E.3)
- E.12* ICT and Information security monitoring and analysis (support to E.8)

Data Scientist and Subject Domain Specialist

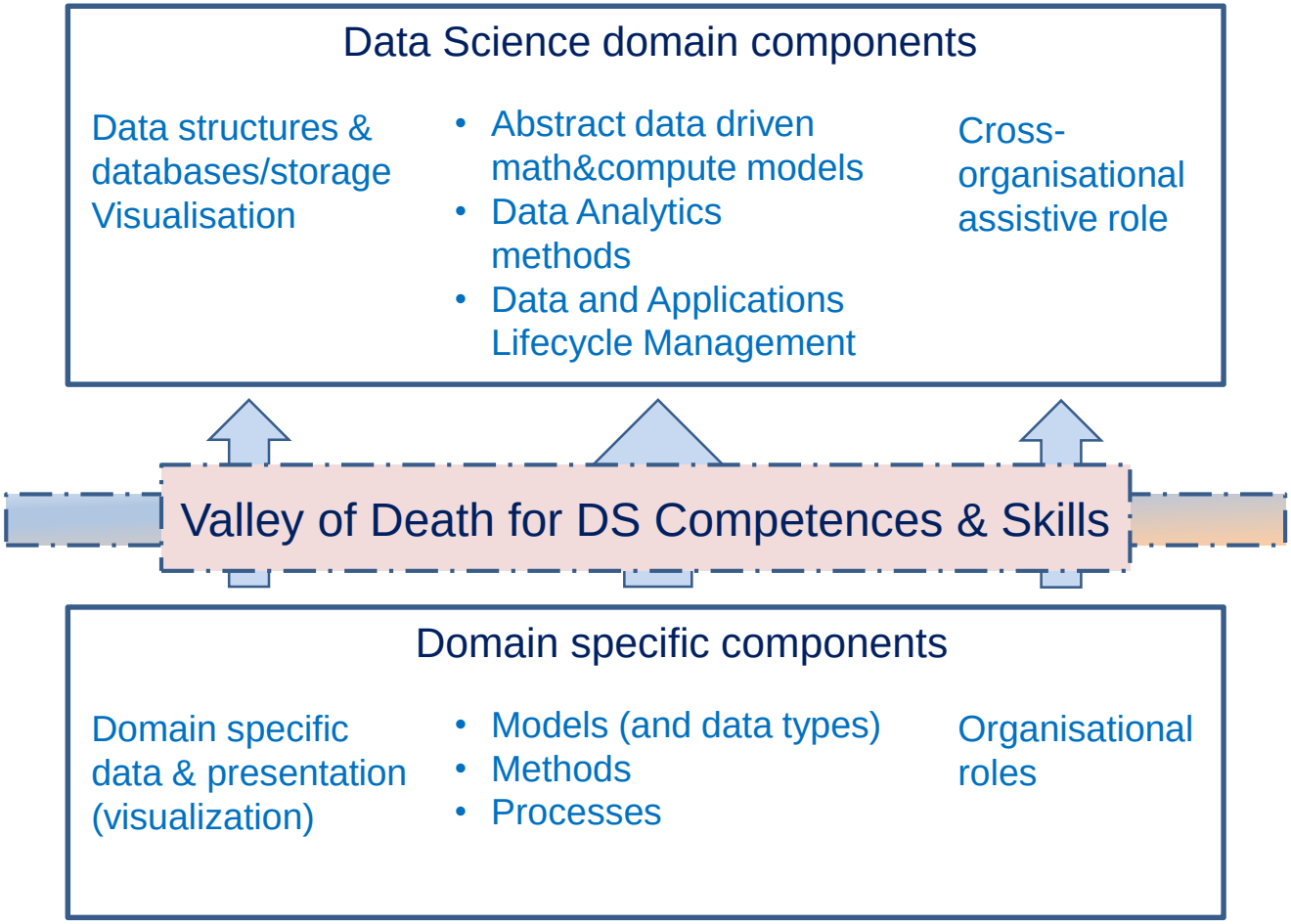
- **Subject domain components**
  - Model (and data types)
  - Methods
  - Processes
  - Domain specific data and presentation/visualization methods
  - Organisational roles and relations

- **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 Science and Subject Domains



Data Science and Subject Domains



Possible Data Scientist profiles/roles as extension to CWA16458 (2012)

- Data Analyst, Business Analyst
  - Data Mining
  - Machine Learning
- Digital Librarian, Data Archivist, Data Curator, Data Steward
  - Data Management related competences
- Data Science Engineer/Administrator/Programmer
  - Data analytics applications development
  - Scientific programming
  - Data Science/Big Data Infrastructure development/operation
- Data Science Researcher
  - Data Science research methods
  - Data models and structures
- Data Scientist in subject/research domain

- Research e-Infrastructure brings its own specifics to required competences and skills definition

Data Science occupations in ESCO taxonomy (1)

Professionals				
	Science and engineering professionals	**Data Science Professionals**	Data Science professionals not elsewhere classified	Data Scientist
				Data Science Researcher
				(Big) Data Analyst
				Data Science (Application) Programmer
				Business Analyst
		Database and network professionals	Large scale (cloud) data storage designers and administrators	Large scale (cloud) database designer*)
			Database designers and administrators	Large scale (cloud) database administrator*)
			Database and network professionals not elsewhere classified	Scientific database administrator*)
	Information and communications technology professionals	**Data Science technology professionals**	Data handling professionals not elsewhere classified	Digital Librarian
				Data Archivist
				Data Steward
				Data curator

Data Science occupations in ESCO taxonomy (2)

Technicians and associate professionals				
	Science and engineering associate professionals	**Data Science Technology Professionals**	Data Infrastructure engineers and technicians	Big Data facilities Operators
				Large scale (cloud) data storage operators
			Database and network professionals not elsewhere classified	Scientific database operator*)
Managers				
	Production and specialised services managers	**Data Science/Big Data Infrastructure Managers**		Data Science/Big Data Infrastructure Manager
			Research Infrastructure Managers	RI Manager
				RI Data storage facilities manager
Clerical support workers				
	General and keyboard clerks			
	Data handling support workers (alternative)	**Data and information entry and access**	Digital Archivists and Librarians	Digital Librarian
				Data Archivist
				Data Steward
				Data curator

Data Science or Data Management Group/Department: Organisational structure and staffing

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

Data Science or Data Management Group/Department: Organisational structure and staffing - EXAMPLE

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

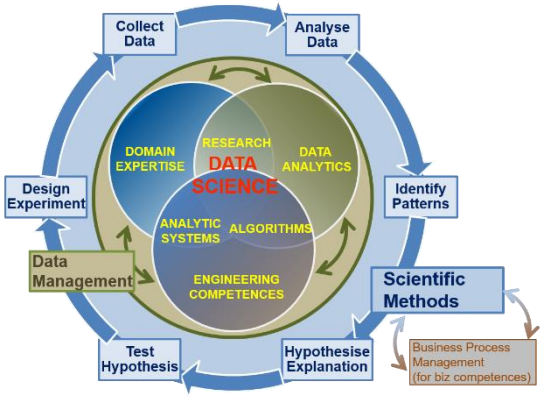
Group of 10-12 specialists for research institution of 200-300 staff.

Education and Training

- Foundation and methodological base
  - Data Science Body of Knowledge (DS-BoK)
    - Taxonomy and classification of Data Science related scientific subjects
  - Instructional methodologies and teaching models
- Platforms and environment
  - Virtual labs, datasets, developments platforms
  - Access control and accounts/identity management
  - Online education environment and courses management
- Services
  - Individual benchmarking and profiling tools (competence assessment)
  - Knowledge evaluation tools
  - Certifications and training
  - 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

KAG3-DSDM: *Data Management group: data curation, preservation and data infrastructure*

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 European Open Data initiatives, European Open Data Cloud, and RDA (Research Data Alliance)

(12) PID, metadata, data registries

(13) Data Management Plan

(14) Open Science, Open Data, Open Access, ORCID

(15) Responsible data use

Topics considered for the Data Management (Literacy) Training – Working draft

A. Use cases for data management and stewardship
- Preserving the Scientific Record

B. Data Management elements (organisational and individual)
- Goals and motivation for managing your data
- Data formats
- Creating documentation and metadata, metadata for discovery
- Using data portals and metadata registries
- Tracking Data Usage
- Handling sensitive data
- Backing up your data
- Data Management Plan (DMP) - to be a part of hands on session

C. Responsible Data Use Section (Citation, Copyright, Data Restrictions)
D. Open Science and Open Data (Definition, Standards, Open Data use and reuse, open government data)
- Research data and open access
- Repository and self- archiving services
- ORCID identifier for data
- Stakeholders and roles: engineer, librarian, researcher
- Open Data services: ORCID.org, Altmetric Doughnut, Zenodo

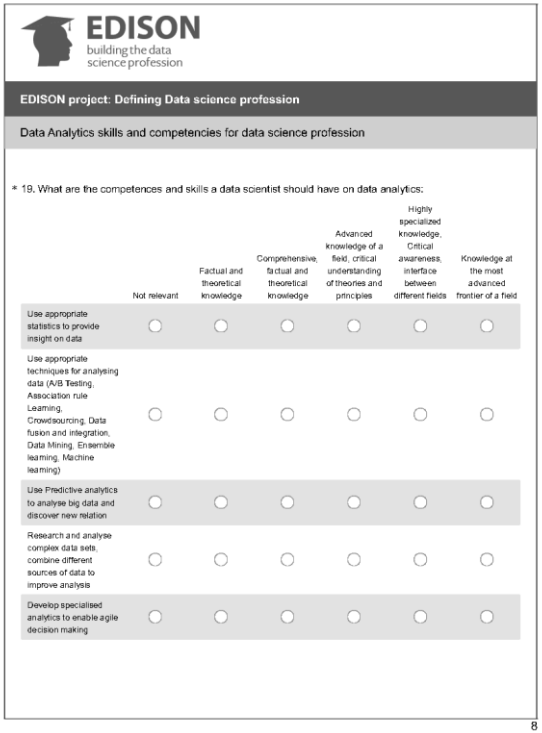
E. Hands on:
a) Data Management Plan design
b) Metadata and tools
c) Selection of licenses for open data and contents (e.g. Creative Common and Open Database)

Further Steps

- Define a taxonomy and classification for DS competences and skills as a basis for more formal CF-DS definition
  - Closer look at skills, tools and platforms
- Run surveys for target communities
  https://www.surveymonkey.com/r/EDISON_project_-_Defining_Data_science_profession
  - Plan a number of key interviews, primarily experts and top executives at universities and companies
- Proceed with suggested e-CF3.0 extensions and participate in the next e-CF meetings
  - Talk to national e-CF bodies or adopters if available
- Provide feedback and contribution to ESCO with the definition of the Data Science profession family
- Suggest ACM CCS2012 Classification extensions and officially contact ACM
- Involve academic and industry experts and professional organisations to the definition of DS-BoK following from CF-DS
  - Link/Map to taxonomy of academic and educational and training courses
- Create open community forum to collect contribution
  - CF-DS and DS-BoK documents are on public comments available from EDISON website
    http://www.edison-project.eu/data-science-competence-framework-cf-ds
    http://www.edison-project.eu/data-science-body-knowledge-ds-bok

Discussion

- Questions
- Observations
- Survey: Invitation to participate



EDISON
building the data science profession

EDISON project: Defining Data science profession

Data Analytics skills and competencies for data science profession

* 19. What are the competences and skills a data scientist should have on data analytics:

	Not relevant	Factual and theoretical knowledge	Comprehensive, factual and theoretical knowledge	Advanced knowledge of a field, critical understanding of theories and principles	Highly specialized knowledge, Critical awareness, interface between different fields	Knowledge at the most advanced frontier of a field
Use appropriate statistics to provide insight on data	○	○	○	○	○	○
Use appropriate techniques for analysing data (A/B Testing, Association rule Learning, Crowdsourcing, Data fusion and integration, Data Mining, Ensemble learning, Machine learning)	○	○	○	○	○	○
Use Predictive analytics to analyse big data and discover new relation	○	○	○	○	○	○
Research and analyse complex data sets, combine different sources of data to improve analysis	○	○	○	○	○	○
Develop specialised analytics to enable agile decision making	○	○	○	○	○	○

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https://www.surveymonkey.com/r/EDISON_project_-_Defining_Data_science_profession

EXAMPLE: e-CF Dimensions for RI Technical (based on RDA IG-ETRD work)

- Dimension 1: 5 e-Competence areas, derived from the ICT processes present in RI development, management and operation:
  A. PLAN and DESIGN
  B. **DEVELOP and DEPLOY/IMPLEMENT** (BUILD)
  C. **OPERATE** (RUN)
  D. **USE**: UTILISE (ENABLE)
  E. **MANAGE**

- Dimension 2: A set of reference competences for each area; currently identified 35 competences that are mapped from the general eCFv3.0.

- Dimension 3: Proficiency levels of each e-Competence, currently using e-CF approach that provides European reference level specifications on e-Competence levels e-1 to e-5, which are related to the EQF levels 3 to 8.
  – Increasing number of practicing data scientists have master degree and higher

- Dimension 4: Samples of knowledge and skills related to e-Competences in dimension 2. They will be provided to add value and context and are not intended to be exhaustive.
  – Knowledge identification is important to build Body of Knowledge

EXAMPLE: Use of e-CF3.0 for Defining Profile of RI Technical (part of RDA IG-ETRD work)

A. PLAN and DESIGN

- A.2. Service Level Management
- A.3. Product / Service Planning
- A.5. Application Design
- A.4. Architecture Design

Additional

- A.6. Sustainable Development
- A.7. Innovating and Technology Trend Monitoring
- A.8. Business/Research Plan Development and Grant application
- A.1. RI and Research Strategy Alignment

B. BUILD: DEVELOP and DEPLOY/IMPLEMENT

- B.1. Application Development (Reqs Engineering, Function Specs, API, HCI)
- B.2. Component Integration
- B.3. Testing (RI services and Scientific Apps)
- B.4. Solution/Apps Deployment

Additional

- B.5. Documentation Production
- B.6. Systems Engineering (DevOps)

C. OPERATE (RUN)

- C.1. User Support
- C.2. Service Delivery
- C.3. Problem Management

Additional

- C.4. Change Support (Upgrade/Migration)

D. USE: UTILISE (ENABLE)

- D.1. Scientific Applications Integration (on running RI)
- D.5. Data collection and preservation
- D.4. New requirements and change Identification
- D.6. Education and Training Provision

Additional

- D.2. Information Security Strategy Development
- D.3. RI/ICT Quality Strategy Development
- D.7. Purchasing/Procurement
- D.8. Contract Management
- D.9. Personnel Development
- D.10. Dissemination and outreach

E. MANAGE

- E.1. Overall RI management (by systems and components)
- E.5. Information/Data Security Management

Additional

- E.6. Data Management (including planning and lifecycle management, curation)
- E.4. RI Security and Risk/Dependability Management
- E.2. Project and Portfolio Management
- E.3. ICT Quality Management and Compliance
- E.7. RI/IS Governance

Definitions (according to e-CFv3.0)

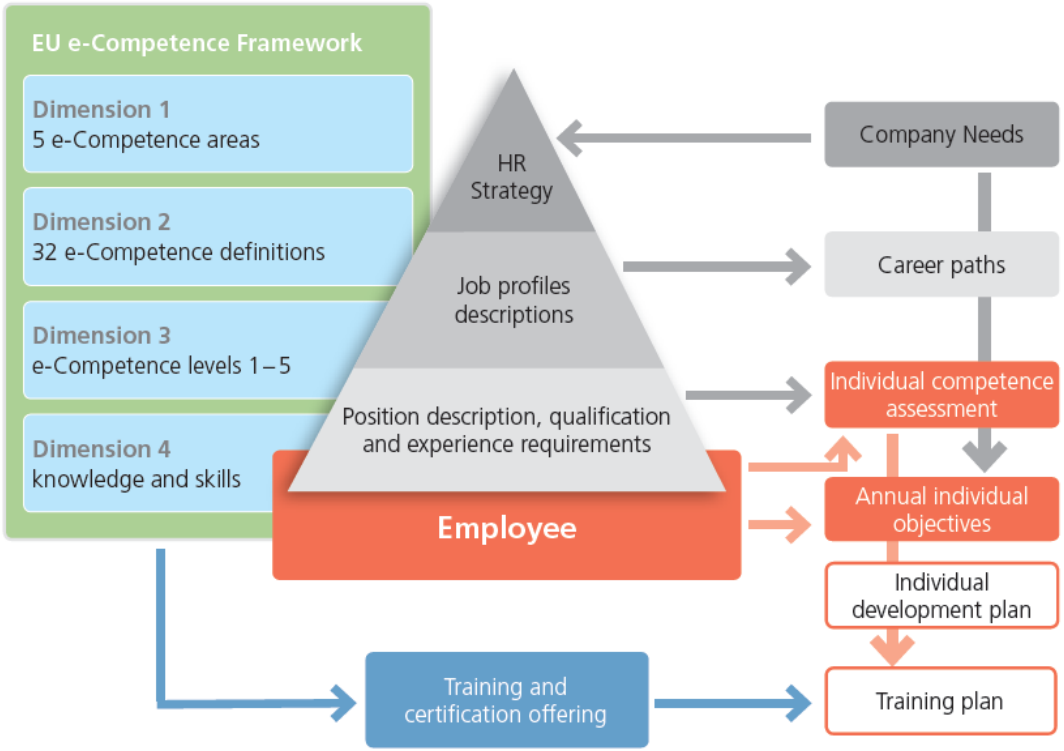
- **Competence** is a demonstrated ability to apply knowledge, skills and attitudes for achieving observable results.
  - Competence vs Competency (e-CF vs ACM)
    - Competence is ability acquired by training or education (linked to learning outcome)
    - Competency is similar to skills or experience (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.

EDISON Approach: CF-DS and e-CFv3.0

- Competence Framework for Data Science (CF-DS) definition will be built based on European e-Competence framework for IT (e-CFv3.0)
  - Linking *scientific research lifecycle*, organizational roles, competences, skills and knowledge
  - Defining *Data Science Body of Knowledge (DS-BoK)*
  - Mapping CF-DS and DS-BoK to academic disciplines in a DS *Model Curriculum (MC-DS)*



- Multiple use of e-CFv3.0 within ICT organisations
- Provides basis for individual career path, competence assessment, training and certification

- EDISON CF-DS will be used for defining DS-BoK and MC-DS, linking organizational functions and required knowledge
- Provide basis for individual (self) training and certification

e-CFv3.0 Internal Structure: Refactoring for CF-DS

European e-Competence Framework 3.0 overview

Dimension 1 5 e-CF areas (A – E)	Dimension 2 40 e-Competences identified	Dimension 3 e-Competence proficiency levels e-1 to e-5, related to EQF levels 3–8				
		e-1	e-2	e-3	e-4	e-5
A. PLAN	A.1. IS and Business Strategy Alignment				■	■
	A.2. Service Level Management			■	■	
	A.3. Business Plan Development			■	■	■
	A.4. Product/Service Planning		■	■	■	
	A.5. Architecture Design			■	■	■
	A.6. Application Design	■	■	■		
	A.7. Technology Trend Monitoring				■	■
	A.8. Sustainable Development			■	■	
	A.9. Innovating				■	■
B. BUILD	B.1. Application Development	■	■	■		
	B.2. Component Integration		■	■	■	
	B.3. Testing	■	■	■	■	
	B.4. Solution Deployment	■	■	■		
	B.5. Documentation Production	■	■	■		
	B.6. Systems Engineering			■	■	
C. RUN	C.1. User Support	■	■	■		
	C.2. Change Support		■	■		
	C.3. Service Delivery	■	■	■		
	C.4. Problem Management		■	■	■	
D. ENABLE	D.1. Information Security Strategy Development				■	■
	D.2. ICT Quality Strategy Development				■	■
	D.3. Education and Training Provision		■	■		
	D.4. Purchasing		■	■	■	
	D.5. Sales Proposal Development		■	■		
	D.6. Channel Management			■	■	
	D.7. Sales Management			■	■	■
	D.8. Contract Management		■	■	■	
	D.9. Personnel Development		■	■	■	
	D.10. Information and Knowledge Management			■	■	■
	D.11. Needs Identification			■	■	■
	D.12. Digital Marketing		■	■	■	
E. MANAGE	E.1. Forecast Development			■	■	
	E.2. Project and Portfolio Management		■	■	■	■

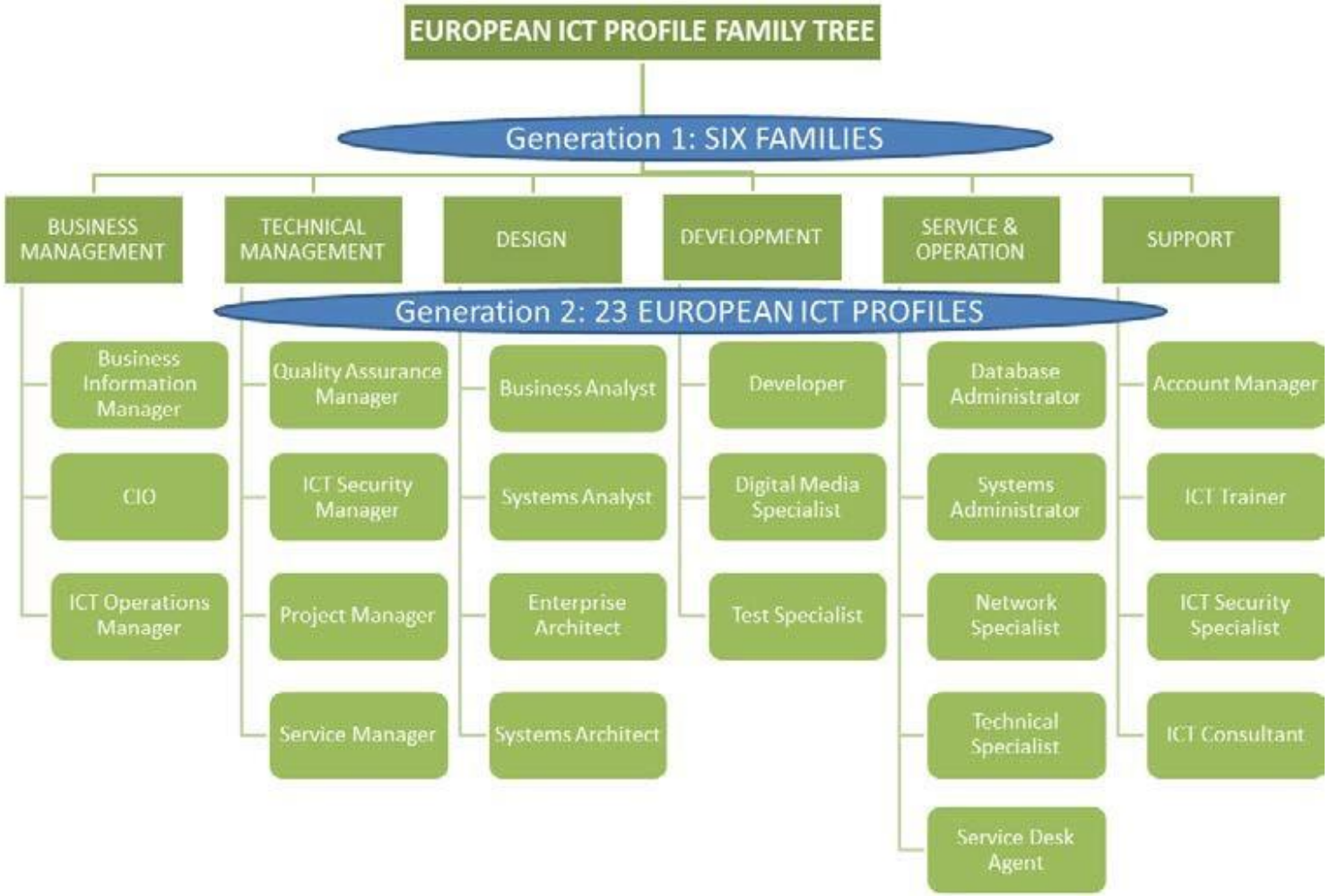
- 4 Dimensions
  - Competence Areas
  - Competences
  - Proficiency levels
  - Skills and Knowledge
- 5 Competence Area defined by ICT Business Process stages
  - Plan
  - Build
  - Run
  - Enable
  - Manage

-> Refactor to Scientific Research cycle/workflow (and linked to Scientific Data Lifecycle)

  - See example of RI manager at IG-ETRD wiki and meeting

- Each competence has 5 proficiency level
  - Ranging from technical to engineering to management to strategist/expert level
- Knowledge and skills property are defined for/by each competence and proficiency level (not unique)

CWA 16458 (2012): European ICT Professional Profiles Family Tree



- European ICT Profile Family Tree – Generation 1 and 2 as a shared European reference