

# Short Curriculum Vitae

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## Qualifications

- In April 2020, I received the Doctor of Philosophy (**Ph.D.**) **degree in Computer Science and Engineering** from **Università di Bologna, Italy**.
  - o **Ph.D. Thesis:** *I. M. H. Al Jawarneh, "Quality of Service Aware Data Stream Processing for Highly Dynamic and Scalable Applications"*, Ph.D. thesis, Alma Mater Studiorum - Università di Bologna, 2020.
    - **DOI** 10.6092/unibo/amsdottorato/9402.
  - o Evaluated **excellent**.
  - o **Supervisor:** Prof. Rebecca Montanari
    - UNIBO is a top ranked university in Italy and worldwide (1<sup>st</sup> in Italy, 160<sup>th</sup> QS ranking 2021, 75<sup>th</sup> in Europe).
    - THE world university ranking 2021: ranked 1<sup>st</sup> in Italy, 167<sup>th</sup> globally.
    - QS Rankings by Subject 2021: ranked 119<sup>th</sup> in Engineering & Technology.
    - QS World University Rankings by Subject 2021: ranked 51<sup>th</sup>-100<sup>th</sup> worldwide in Computer Science & Information Systems.
    - THE world university ranking 2021(global performance for the United Nations' Sustainable Development Goals (SDGs)): 6<sup>th</sup>.
- In March 2008, I received my **M.Sc. in Information Technology** from the **Universiti Utara Malaysia (UUM)**.
  - o **M.Sc. Thesis:** "A data warehouse dimensional model for student academic data at Universiti Utara Malaysia (UUM)".
  - o UUM is a top ranked university in Malaysia, Asia and worldwide,

- THE world university ranking 2021, Malaysia Rank 2021: 3<sup>rd</sup>
  - QS ranking 2021: ranked 531<sup>th</sup> – 540<sup>th</sup> worldwide.
  - QS ranking 2021: ranked 107<sup>th</sup> in Asia
- In June 2005, I completed my **bachelor's degree in computer science** at **AI Al-Bayt University**, Jordan.

## **Short Biography**

I received a Doctor of Philosophy (PhD) degree in computer science and engineering from University of Bologna, 2020, with an academic discipline (**Information Processing Systems**) - (ING-INF/05), with a specialization (concentration through thematic areas of research) in (**data science**). I am currently a postdoctoral researcher at University of Bologna.

my research specialization generally is "**Data Science and Computer Information Systems**" with a concentration in the following thematic areas (ERC<sup>1</sup> sectors):

**PE6\_10:** Web and information systems, database systems, information retrieval and digital libraries, data fusion

**Concentration** in: Databases, data warehousing big data analytics, time-series and temporal data management, big data visualization.

**PE6\_11:** Machine learning, statistical data processing and applications using signal processing –

**Concentration** in: Machine Learning, Deep Learning and Data Mining for spatial, temporal, times-series, and contextual data.

**PE6\_6:** Algorithms, distributed, parallel and network algorithms, algorithmic game theory

**Concentration** in: Distributed algorithms for the analysis of big data

## **Work Experiences**

### **Present appointment**

- In January 2020, I won a public examination for the position of **post-doctoral Fellow** at the Department of Computer Science and Engineering (DISI), **University of Bologna, Italy**. I covered that position at the University of Bologna starting from **March 2020 until now**.
  - **Project title:** Design of scalable processing system for cultural heritage data. As part of the PON "RESEARCH AND INNOVATION" 2014 - 2020-IDEHA, CUP J46C18000440008. **Supervisor:** Prof. Rebecca Montanari
  - **Responsibilities:**

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<sup>1</sup> European Research Council (ERC), sets the grouping of thematic research areas and research sectors.

- Designing spatial and temporal models for extracting insightful knowledge from human/vehicle mobility data
- Implementing a standard compliant prototype by coding patches and incorporating them transparently with de facto standard big data management frameworks such as Apache Spark, MongoDB and InfluxDB
- Writing and publishing research papers (as a first lead author or as co-author) and publishing in high-impact venues (internationally indexed journals and top-ranked conferences)

### **Professional experience**

- In January 2017, I won a public examination for the position of **Research Assistant** at **Centro Interdipartimentale di Ricerca Industriale ICT (CIRI ICT)**, a prestigious Industrial Research Center of the **University of Bologna, Italy** for information and communication technologies. I covered that position at the University of Bologna starting from **April 2017 until February 2020**.
  - **Project title:** State-of-the-art analysis and design of cloud solutions for smart management of cultural digital data. As part of the SACHER <sup>2</sup> (Smart Architecture for Cultural Heritage in Emilia-Romagna) funded by the POR-FESR 2014-20 (no. J32I16000120009) through CIRI.
  - **Responsibilities:**
    - Designing a distributed NoSQL-based data lake for cultural heritage data in Italy
    - Implementing a standard compliant prototype
    - Writing and publishing research papers (as a first lead author or as co-author) and publishing in high-impact venues
    - Presenting the work in international exhibitions such as Research to Business (R2B) in Bologna Fiere (June 2018) and Salone Internazionale del Restauro, dei Musei e delle Imprese Culturali in Ferrara Fiere (March 2018)

### **Experience in academic teaching**

- In February 2018, I won a public call for the position of **educational tutor (teaching assistant)** at **Scuola di Ingegneria e Architettura - University of Bologna**. I covered that position at the University of Bologna during the **2018 – 2019** academic year
  - **Responsibilities:**
    - Teaching the lab session of a master's degree level course entitled the "**principles, models and applications for distributed systems m**" Laurea Magistrale in scuola di ingegneria e architettura of the University of Bologna

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<sup>2</sup> <http://www.sacherproject.com/materiali>

- Preparing teaching materials for the lab, which was focusing on advanced programming concepts in distributed systems and their applications in Java, such as multithreading and networking
  - Preparing and conducting lab exams for the course, in addition to marking the exams
- In December 2008, I have won a public examination for the position of **Lecturer** at **University of Business and Technology (UBT)**, a leading private higher education provider in the Kingdom of Saudi Arabia. I covered that position from **February 2009 until February 2016**.
  - **Responsibilities:**
    - Teaching various Information Technology courses at bachelor's degree level, including, for example, object-oriented programming in Java, databases, and advanced data warehousing
      - ✓ object-oriented computer programming (3 credit hours)
      - ✓ data structure and algorithms (3 credit hours)
      - ✓ databases (3 credit hours)
      - ✓ software engineering (3 credit hours)
      - ✓ software design patterns (3 credit hours)
      - ✓ human - computer interaction (3 credit hours)
      - ✓ advanced programming (3 credit hours)
      - ✓ IT issues & management (3 credit hours)
      - ✓ introduction to software project management (3 credit hours)
      - ✓ needs assessment and technology evaluation (3 credit hours)
    - Preparing teaching materials including syllabus, lab, and term exam papers, in addition to marking student's exams
    - Supervising student's graduation projects (bachelor's level thesis) to the highest quality standards that conform to *Capstone*.
    - Preparing course files for the national and international (e.g., ABET) accreditation programs
    - Conducting high-quality research and publishing in high-impact venues with a focus on "data warehousing" and ETL design at the time.

### **Other academic responsibilities**

- I have **supervised & co-supervised student's thesis** and graduation projects at the **bachelor's** degree level, at University of Business and Technology (UBT)
- At University of Bologna, I have assisted my team leaders in *co-supervising* the *bachelor thesis* of their students
- I have actively participated in **preparing** and **supervised the preparation** of annual course reports for the university accreditation programs at **UBT**, at a national level (National Commission for Academic Accreditation and Assessment, **NCAAA**) and international level (**ABET**).

- I have assisted my team leaders at University of Bologna in writing fund-requesting research proposals for projects, in a national level (Italy) and International level (EU).

## **Research and scholarships**

### **Awards, grants & professional membership**

- **\*NEW\* → Artificial Intelligence (AI) for Earth Microsoft Azure Compute Grant.**  
In July 2020, I have been awarded an ‘**AI for Earth**’ Microsoft Azure Compute Grant (credits for Azure consumption up to **15000 USD**) for my project titled “*Supporting Highly-Efficient Machine Learning Applications for Reducing the Impact of Climate Change on Human Health in Metropolitan Cities* “. September 2020 – September 2021.
  - o **Short description:** EU-28 urban populations are witnessing an increase in fine dust (fine particulate matters PM10 and PM2.5) concentrations that significantly exceed the higher allowed values specified by European Environmental Agency (EEA) and the World Health Organization (WHO), adversely affecting the climate change, which wreak havoc on human health. I will be developing Artificial Intelligence (AI) applications and apply them to spatially-tagged time-series human and vehicle mobility data to help municipalities in Italy and Europe in their efforts for reducing potential impacts of climate change (which, together with global warming, are associated with air pollution) on human health.
- **PhD@ISA fellow.** In September 2016, I won a **PhD fellowship** provided by the Institute of the Advanced Studies (ISA), University of Bologna (UniBO). Since September 2016 until September 2020, I was a **PhD fellow at ISA, UniBO**. ISA UniBO promotes and organizes international and interdisciplinary research activities enriching and simplifying the acquisition of research knowledge for researchers and PhDs.
- **University of Business and Technology (UBT) Award.** I have been awarded a **30000 SAR (equivalent to \$8000)** for designing a DW model for student academic data at UBT, Saudi Arabia.

### **Research Topics**

I generally focus on several aspects of “**data science and Computer Information Systems**”. Such as big data management, distributed computing, and software architectures for data-intensive applications, with a domain emphasis on geo-referenced and temporal (including time-series) big data management. I also work with optimization problems in distributed computing systems and approximation algorithms for smart cities and mobility informatics. Specifically, I currently work extensively within the following thematic research areas:

- Highly dynamic and scalable applications in parallel computing environments:
  - Middleware for dynamic and adaptive services in big data management scenarios. Specifically, I am interested in working with spatiotemporal and time-series IoT data. Applications span many aspects of smart cities, urban computing, and Industrial Internet of Things (Industrial IoT)
  - Processing of highly burst data streaming workloads with guarantees of Quality of Service. Specifically, for spatially-tagged and temporal big datasets.
  - Context-aware computing. For example, context-aware recommender systems based on latest trending Deep Learning models.
- Active data warehousing
  - Stream-static join processing for dynamic big data scenarios including smart cities, Industry 4.0 and industrial IoT (Industrial IoT).
  - Distributed Extract, Transform and Load (ETL) processing and data warehousing.

### **Scientific production and indicators**

Isam Al Jawarneh, is a Postdoctoral Fellow who has been recently awarded the degree of Ph.D. in Computer Science and Engineering from University of Bologna in Italy. His research interests span from big data management in general to adaptive data stream processing, from active data warehousing to scalable online stream processing for smart cities and Industry 4.0.

From the point of view of his publication record (Google Scholar data – July 2020: h-index=4; i10-index: 2, citations=74), he has authored several **journal** articles (in publication venues that are considered the excellent ones in his research field, such as IEEE on network and service management, Journal of Network and Systems Management, Journal of Information Development, SAGE & IEEE Access) and co-authored (mostly as a first & corresponding author) more than 10 additional works published in **flagship conferences** (such as IEEE GLOBECOM and ICC) in addition to one **book chapter**.

### **Participation in research projects & research visits**

- **Project title:** Design of scalable processing system for cultural heritage data. As part of the PON "RESEARCH AND INNOVATION" 2014 - 2020- IDEHA, CUP J46C18000440008.
  - **Role: Research Fellow (postdoc.). Coordinator & supervisor:** Prof. Rebecca Montanari (**March 2020-current**).
  - A **brief:** I am responsible for designing highly-available and standard compliant prototype for efficiently managing geo-referenced human and vehicle mobility time-series data. I am designing novel indexing, partitioning and query processing algorithms that are aware of the multidimensional

nature and shape of mobility data (three dimensions, spatial, temporal, and contextual). The novel contribution is the design of Cloud-based algorithms that operate on the confluence between spatial and time-series data. Most methods of the relevant art are operating in one of the two modes (either spatial or time-series) but applications of both together remain humble. Methods that I am developing will be able to achieve both spatial and temporal awareness synergistically. A probable scenario would be modelling how my support can be used to distribute tourist people around archeological sites in a proper manner to avoid crowd and to maintain safety.

- **Project title:** State-of-the-art analysis and design of Cloud solutions for smart management of cultural digital data, **Funding Area:** ICT for innovative services in cultural heritage. As part of the SACHER (Smart Architecture for Cultural Heritage in Emilia-Romagna) funded by the POR-FESR 2014-20 (no. J32116000120009) through CIRI.
  - o **Role: Research Fellow.** Coordinator & supervisor: prof. Rebecca Montanari **(2016-2020)**.
  - o A **brief:** I was responsible for designing and manipulating a standard-compliant prototype for a NoSQL-based data lake for cultural heritage data in Italy. I have designed a framework and an efficient highly-available end-to-end pipeline for ingesting heterogeneous cultural heritage data, (optionally) passing it through purpose-built transformation stages and storing it in distributed NoSQL storage as raw data in a raw zone, transforming what is needed for decision making on-demand, putting raw data into NoSQL-based multidimensional models (such as star schemas) and offering it in a form that is transparently accessible by BI and OLAP tools. Data was coming from heterogeneous sources including SPARQL, flat files, RDBMSs and JSON.
- Design of a data warehouse model for decision support at higher education a case study. University of Business and Technology, Jeddah, Kingdom of Saudi Arabia, Project No.[107/E/2015]. **Role: primary investigator.** Amount: 30000 SAR (equivalent to \$8000). **March 2015 – November 2015**
  - o **Outcome:** a journal paper in *Information Development (SAGE)*. Refer to my publications list [j1]

### **Publications (in publication order)**

**N.B.** a star (\*) to the left of my name indicates being the first (main) and corresponding author

### **Peer-reviewed International Journals and Magazines**

[j4] \* **I. M. Al Jawarneh**, P. Bellavista, A. Corradi, L. Foschini, and R. Montanari, "Efficient QoS-Aware Spatial Join Processing for Scalable NoSQL Storage

Frameworks," IEEE Transactions on Network and Service Management, 2020. **Web of Science Categories:** Computer Science, Information Systems. Journal **Impact Factor** Trend 2019 (Thomson ISI): **3.878** \*NEW\*

[j3] \* **I. M. Al Jawarneh**, P. Bellavista, A. Corradi, L. Foschini and R. Montanari, "Big Spatial Data Management for the Internet of Things: A Survey," Journal of Network and Systems Management, pp. 1-46, 2020. **DOI:** 10.1007/s10922-020-09549-6. **Web of Science Categories:** Computer Science, Information Systems. Journal **Impact Factor** Trend 2019 (Thomson ISI): **2.250** \*NEW\*

[j2] \* **I. M. Al Jawarneh**, P. Bellavista, A. Corradi, L. Foschini, R. Montanari, J. Berrocal and J. M. Murillo, "A Pre-Filtering Approach for Incorporating Contextual Information Into Deep Learning Based Recommender Systems," IEEE Access, vol. 8, pp. 40485-40498, 2020. **DOI:** 10.1109/ACCESS.2020.2975167. **Web of Science Categories:** Computer Science, Information Systems. Journal **Impact Factor** Trend 2019 (Thomson ISI): **3.745**

[j1] \* **I. M. Aljawarneh**, "Design of a data warehouse model for decision support at higher education: A case study," Information Development, vol. 32, (5), pp. 1691-1706, 2016. **DOI:** 10.1177/0266666915621105. **Web of Science Categories:** Information Science & Library Science. Journal **Impact Factor** Trend 2019 (Thomson ISI): **1.440**

### **Peer-reviewed Conferences and Workshops**

[C10] \* **I. M. Al Jawarneh**, P. Bellavista, A. Corradi, L. Foschini, and R. Montanari, "Spatially Representative Online Big Data Sampling for Smart Cities," in 2020 IEEE 25th International Workshop on Computer Aided Modeling and Design of Communication Links and Networks (CAMAD), 2020: IEEE, pp. 1-6.

[C9] \* **I. M. Al Jawarneh**, P. Bellavista, L. Foschini and R. Montanari, "Spatial-aware approximate big data stream processing," in 2019 IEEE Global Communications Conference (GLOBECOM), 2019, pp. 1-6.

[C8] \* **I. M. Al Jawarneh**, P. Bellavista, F. Bosi, L. Foschini, G. Martuscelli, R. Montanari and A. Palopoli, "Container orchestration engines: A thorough functional and performance comparison," in ICC 2019-2019 IEEE International Conference on Communications (ICC), 2019, pp. 1-6.

[C7] \* **I. M. Al Jawarneh**, P. Bellavista, L. Foschini, G. Martuscelli, R. Montanari, A. Palopoli and F. Bosi, "Qos and performance metrics for container-based virtualization in cloud environments," in Proceedings of the 20th International Conference on Distributed Computing and Networking, 2019, pp. 178-182.

[C6] \* **I. M. Al Jawarneh**, P. Bellavista, A. Corradi, L. Foschini, R. Montanari and A. Zanotti, "In-memory spatial-aware framework for processing proximity-alike queries in



*big spatial data*," in 2018 IEEE 23rd International Workshop on Computer Aided Modeling and Design of Communication Links and Networks (CAMAD), 2018, pp. 1-6.

[C5] \* **I. M. Al Jawarneh**, P. Bellavista, F. Casimiro, A. Corradi and L. Foschini, "*Cost-effective strategies for provisioning NoSQL storage services in support for industry 4.0*," in 2018 IEEE Symposium on Computers and Communications (ISCC), 2018, pp. 1227.

[C4] **S. Bertacchi, I. M. Al Jawarneh**, F. I. Apollonio, G. Bertacchi, M. Cancilla, L. Foschini, C. Grana, G. Martuscelli and R. Montanari, "*SACHER project: A cloud platform and integrated services for cultural heritage and for restoration*," in Proceedings of the 4th EAI International Conference on Smart Objects and Technologies for Social Good, 2018, pp. 283-288.

[C3] \* **I. M. Al Jawarneh**, P. Bellavista, L. Foschini, R. Montanari, J. Berrocal and J. M. Murillo, "*Toward privacy-aware healthcare data fusion systems*," in International Workshop on Gerontechnology, 2018, pp. 26-37.

[C2] \* **I. M. Aljawarneh**, P. Bellavista, C. R. De Rolt and L. Foschini, "*Dynamic identification of participatory mobile health communities*," in Cloud Infrastructures, Services, and IoT Systems for Smart Cities Anonymous Springer, 2017, pp. 208-217.

[C1] \* **I. M. Aljawarneh**, P. Bellavista, A. Corradi, R. Montanari, L. Foschini and A. Zanolli, "*Efficient spark-based framework for big geospatial data query processing and analysis*," in 2017 IEEE Symposium on Computers and Communications (ISCC), 2017, pp. 851-856.

### **Peer-reviewed Book Chapters**

[B1] **P. Bellavista**, J. Berrocal, A. Corradi, S. K. Das, L. Foschini, **I. M. Al Jawarneh** and A. Zanni, "*How Fog Computing Can Support Latency/Reliability sensitive IoT Applications: An Overview and a Taxonomy of State of the art Solutions*," Fog Computing: Theory and Practice, pp. 139-213, 2020.

### **Further data**

#### **Posters**

[P1] \* **I. M. Aljawarneh**, P. Bellavista, A. Corradi, R. Montanari, L. Foschini. "*QoS-Aware Big Geospatial Data Processing*". Seventh European Business Intelligence & Big Data Summer School (eBISS 2017), 2017, Brussels, Belgium.

#### **Participation in exhibitions**

[E2] **I. M. Aljawarneh**. "*Multidimensional Search Engine for Cultural Heritage service (SACHER MuSE CH)*". Research to Business (R2B). Bologna Fiere, Bologna, Italy. June 2018.

[E1] **I. M. Al Jawarneh**. "Smart Architecture for Cultural Heritage in Emilia Romagna: Data Processing". *Salone Internazionale del Restauro, dei Musei e delle Imprese Culturali*. Ferrara Fiere, Ferrara, Italy. March 2018.

### **Potential publications under review**

[1] \***I. M. Al Jawarneh**, P. Bellavista, A. Corradi, L. Foschini and R. Montanari, "SpatialSSJP: QoS-Aware Adaptive Approximate Stream-Static Spatial Join Processor," Manuscript, 2020. **\*NEW\***

[2] \***I. M. Al Jawarneh**, P. Bellavista, A. Corradi, L. Foschini and R. Montanari, "Efficient QoS-Aware Spatial Join Processing for Scalable NoSQL Storage Frameworks," Submitted to an IEEE Transactions Journal, 2020. **\*NEW\***

[3] \***I. M. Al Jawarneh**, P. Bellavista, A. Corradi, L. Foschini and R. Montanari, "Locality-preserving spatial partitioning for geo big data analytics in main memory frameworks," Submitted to a Conference, 2020. **\*NEW\***

[4] \***I. M. Al Jawarneh**, P. Bellavista, A. Corradi, L. Foschini and R. Montanari, "Spatially representative online big data sampling for smart cities," Submitted to a conference, 2020. **\*NEW\***

### **Recent reviewing activities**

- **Reviewer** for the international journals/magazines:
  - o Mobile Information Systems, Hindawi, 2020
  - o IEEE Communications Magazine, 2020
  - o Wireless Networks, Springer, 2020
  - o International Journal of Distributed Sensor Networks (IJDSN), since 2018
  - o Concurrency and computation: practice and experience, since 2018
  - o Information Development – SAGE – since 2015
- **P.S.** Information available through publons:  
<https://publons.com/researcher/1547696/isam-mashhour-al-jawarneh/>
- **Reviewer** for the international conferences/workshops:
  - o 25th IEEE Symposium on Computers and Communications (**ISCC**), 2020
  - o 6th International Conference on Cloud and Big Data Computing, 2020
  - o IEEE Wireless Communications and Networking Conference (IEEE **WCNC** 2020)
  - o **CASPer'18**, 5th International Workshop on Crowd Assisted Sensing, Pervasive Systems and Communications (2018)
  - o IEEE 30th Annual International Symposium on Personal, Indoor and Mobile Radio Communications (**PIMRC**) (2019)
  - o IEEE Wireless Communications and Networking Conference (**WCNC**), 2019.

## **PhD courses attended & passed**

As part of the PhD program at DISI, UniBO, I have attended and passed PhD courses during my PhD.

- Blockchain Technologies and Cryptocurrencies, 2 ECTS<sup>3</sup>
  - o <http://www.cs.unibo.it/~sferrett/teaching.html>
  - o Outcome: a position paper, refer to my publications, [C3].
- Models and Algorithms for Matching and Assignment Problems, 4 ECTS
  - o [https://phd.unibo.it/ibes/en/courses\\_seminars\\_agenda/models-and-algorithms-for-matching-and-assignment-problems](https://phd.unibo.it/ibes/en/courses_seminars_agenda/models-and-algorithms-for-matching-and-assignment-problems)
- Advances and challenges in Business Intelligence & big data, 4 ECTS
- Spatial Multiagent Systems and Aggregate Computing: New Directions for Spatial Computing, 2 ECTS
  - o <https://apice.unibo.it/xwiki/bin/view/Courses/SpatialPhdBo2017>
- Introduction to deep learning, 3 ECTS
  - o [https://vision.deis.unibo.it/ssalti/?page\\_id=241](https://vision.deis.unibo.it/ssalti/?page_id=241)
- An Introduction to parallel programming, 2 ECTS
  - o <http://www.moreno.marzolla.name/teaching/intro-parallel-programming/2018-2019/>
- Learning-Based dense Depth Estimation from Stereo and Monocular Images, 4 ECTS
  - o <https://vision.disi.unibo.it/~mpoggi/teaching.html>

## **Technical Skills**

- Apache Spark, Spark Streaming, Spark Structured Streaming, Kafka, MongoDB
- Amazon Elastic MapReduce (EMR), Microsoft Azure, Amazon Web Services (AWS)
- Ubuntu, Windows
- Apache Zeppelin, Jupyter notebooks
- BigDL: A Spark-based Deep Learning framework
- Endnote, RefWorks
- JAVA, C#, Python, Scala, C++, R
- HTML, CSS and ASP.NET
- MySQL, MS SQL server
- SQL Server Integration Services (SSIS), Talend open studio
- SQL Server Reporting Services (SSRS)
- Time-series: InfluxDB, Prometheus

## **Language competence**

**Arabic, English, and Italian**

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<sup>3</sup> European Credit Transfer and Accumulation System

**Arabic:** Native proficiency

**English:** full professional proficiency (Level<sup>4</sup>: C1)

**Italian:** Average working proficiency (Level<sup>4</sup>: A2)

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<sup>4</sup> CERF levels, Common European Reference Framework