Digital Twin Pipeline for Rural, Smart City and AgriFood architectures

Arne.J.Berre@sintef.no
Lead of BDVA/DAIRO TF6 Technical Priorities
Standards responsible in the DEMETER project

demeter

NGIoT Thematic Workshop: Rural Smart Communities and Agrifood
March 30th, 2021

AI DATA ROBOTICS PARTNERSHIP EU

BDV BIG DATA VALUE ASSOCIATION

DAIRO – Data, AI, Robotics

CLAIRE ellis EurAi eu ROBOTICS ETP 4 HPC EUROPEAN TECHNOLOGY PLATFORM FOR HIGH PERFORMANCE COMPUTING
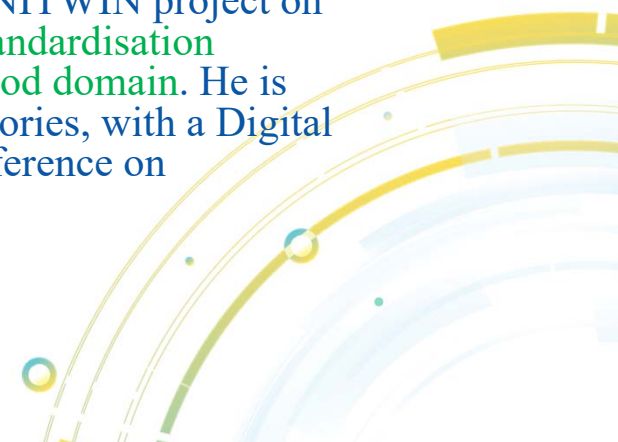
www.bdva.eu and https://www.bdva.eu/task-force-6

Bio

Arne J. Berre received his Ph.D. in Computer Science (Dr. Ing) from the Norwegian (NTNU) in 1993 on the topic of an Object-oriented Framework for Systems Interoperability. He is Chief Scientist at SINTEF Digital and Innovation Director at the Norwegian Center for AI Innovation (NorwAI), and responsible for the GEMINI center of Big Data and AI. He is the leader of the BDVA/DAIRO TF6 on Technical priorities including responsibilities for data technology architectures, data science/AI, data protection, standardisation, benchmarking and HPC. He has been in the technical lead of more than 20 European projects, including being responsible for the ATHENA Interoperability Framework and the BDVA Reference Model. He has been involved in the development of various standards for Interoperability - including Modeling for Geographic Information services with OGC, CEN/TC287 and ISO/TC211, ISO 19103, and been in lead in the standards development teams of the OMG standards of SoaML, VDML, General Ledger and Essence. He is the lead of the Norwegian committee for AI and Big Data with ISO SC 42 AI, and also involved in ISO SC41 IoT and Digital Twin. He has more than 100 scientific publications and has been involved in the organisation of a number of international conferences and workshops. He is the technical coordinator of the DataBench project on Big Data and AI Benchmarking and the COGNITWIN project on Cognitive and Hybrid Digital Twins for the process industry, and responsible for the standardisation framework in the DEMETER project on Digital platform interoperability in the AgriFood domain. He is working with SINTEF Ocean on the creation of an e-Infrastructure for Ocean Observatories, with a Digital Twin for the Ocean. He is the General co-chair for the BenchCouncil Bench´2021 Conference on Benchmarking for IoT, Edge, Big Data, AI and HPC.

https://ec.europa.eu/digital-single-market/en/destination-earth-destine

BioTech AgriFood	Transport Mobility	Health, Ageing	Manufacturing	Energy	Smart Cities & Rural	Agri Food	Telecom	Retail, FInance	others ...

bdva.eu (Reference model)

Structured Data/ Business Intelligence	Time series, IoT	Geo Spatial Temporal	Media Image Audio	Text, Language, Genomics	Web Graph Meta

Data Science

Data Visualisation and User Interaction

Data Analytics

Data Architecture

Data Processing Architectures

Data Protection

Data Management

Cloud and High Performance Computing (HPC)

Things/Assets, Sensors and Actuators (Edge, IoT, CPS)

AI, Cognitive Computing & Analytics Processing Platforms

Industrial & Personal Data Sharing Platforms, Research/ Public data **Data4AI**

Development - Engineering and DevOps

Standards

Communication and Connectivity, incl. 5G

CyberSecurity and Trust

AI, Data and Robotics PPP Ecosystem model

BDVA Reference Model

European AI, Data and Robotics Framework

European Fundamental Rights, Principles, and Values

Capturing Value for Business, Society, and People

Policy, Regulation, Certification, and Standards (PRCS)

Innovation Ecosystem Enabler

Skills and Knowledge

Data for AI

Experimentation and Deployment

Cross-Sectorial AI, Data and Robotics Technology Enablers

Sensing and Perception

Reasoning and Decision Making

Action and Interaction

Knowledge and Learning

Systems, Methodologies, Hardware and Tools

Big Data and AI

| Structured Data/ Business Intelligence | Time series, IoT | Geo Spatial Temporal | Media Image Audio | Text, Language, Genomics | Web Graph Meta |

Action/Interaction, Visualisation/Access (including data presentation environment/boundary/user action and interaction)

Analytics/AI/ Machine Learning (including data analytics, ML model training, model verification, operation)

Data Preparation (including Protection, Cleaning, Fusion, Integration, Linking, Extraction, Curation, Publication/Registration/ Discovery)

Data Acquisition/Collection (including Data Ingestion procession, Storage and Retrieval/Access/Queries, Different data types)

<Data sources>

| Structured Data/ Business Intelligence | Time series, IoT | Geo Spatial Temporal | Media Image Audio | Text, Language, Genomics | Web Graph Meta |

Data Visualisation and User Interaction

Data Analytics

Data Processing Architectures

Data Protection

Data Management

Cloud and High Performance Computing (HPC)

Things/Assets, Sensors and Actuators (Edge, IoT, CPS)

Data sharing platforms, Industrial/Personal

Development - Engineering and DevOps

Standards

Communication and Connectivity, incl. 5G

CyberSecurity and Trust

Collaboration need: Data and Analytic/AI/HPC/Processing pipeline – Adapted for Digital Twins – execution at Edge, Fog, Cloud, HPC, Mobile

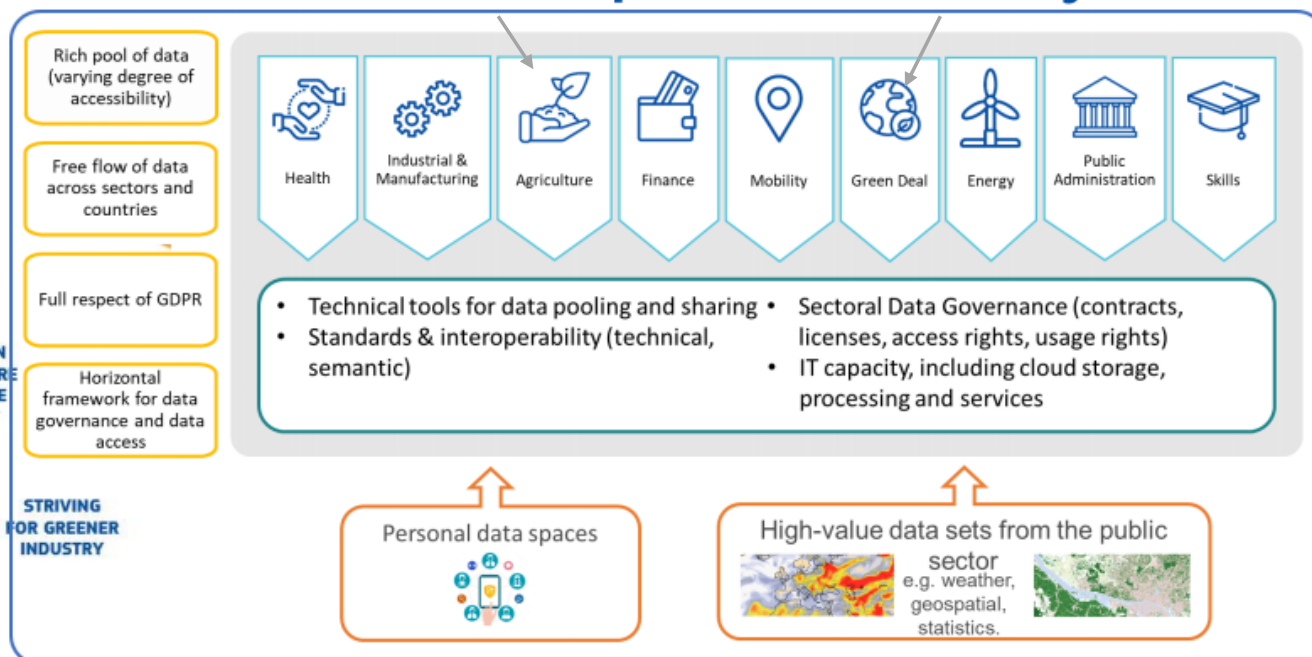Note: All technologies are sometimes needed to be deployed at the Edge !

Data Acquisition/Collection (including Data Ingestion processing, Streaming, Data Extraction, Ingestion Storage, Different data types)	Data Storage/Preparation (including Storage Retrieval/Access/Queries Data Protection, Curation, Integration, Publication)	Analytics/AI/ Machine Learning (including data analytics, ML model training, model verification, operation	Action/Interaction, Visualisation/Access (including data presentation environment/boundary/user action and interaction)
Digital Twin Data Acquisition/Collection	Digital Twin Data Representation	Digital Twin (Hybrid) Cognitive Analytics Models (Analytics/AI ++)	Digital Twin Visualisation and Control

Deployment alternatives / Processing: Edge   On-Premise   Fog   Cloud   HPC   Mobile, Browsers, Actuators

AI DATA ROBOTICS PARTNERSHIP EU

AI©TI — Alliance for Internet of Things Innovation

NGIoT

GAIA-X
INTERNATIONAL DATA SPACES ASSOCIATION
Common European Data Spaces

BDV

AI4EU

EUROPEAN OPEN SCIENCE CLOUD

EuroHPC

ECS — EUROPEAN CYBER SECURITY ORGANISATION

euOS — EU Observatory for ICT Standardisation

Focus areas of various European initatives and PPPs

European Common Data Spaces

Interoperability between data spaces is key

A European Strategy for Data, Feb. 19th, 2020
(Communication from the Commission)

The European Green Deal

- CLIMATE PACT AND CLIMATE LAW
- PROMOTING CLEAN ENERGY
- INVESTING IN SMARTER, MORE SUSTAINABLE TRANSPORT
- PROTECTING NATURE
- STRIVING FOR GREENER INDUSTRY
- FROM FARM TO FORK
- ELIMINATING POLLUTION
- LEADING THE GREEN CHANGE GLOBALLY
- ENSURING A JUST TRANSITION FOR ALL
- MAKING HOMES ENERGY EFFICIENT
- FINANCING GREEN PROJECTS

Rich pool of data (varying degree of accessibility)

Free flow of data across sectors and countries

Full respect of GDPR

Horizontal framework for data governance and data access

Health | Industrial & Manufacturing | Agriculture | Finance | Mobility | Green Deal | Energy | Public Administration | Skills

- Technical tools for data pooling and sharing
- Standards & interoperability (technical, semantic)
- Sectoral Data Governance (contracts, licenses, access rights, usage rights)
- IT capacity, including cloud storage, processing and services

Personal data spaces

High-value data sets from the public sector e.g. weather, geospatial, statistics.

EU Code of conduct on agricultural data sharing by contractual agreement

-ref. EIF Interoperability levels

LOCATION (SpatioTemporal) models is important In most of the FAIR data spaces

European Commission

Digital Twin – Technology and Standards initiatives

- IDTA - Industrial Digital Twin Association (from Platform Industrie 4.0) – ref. AAS – Asset Administration Shell
- Digital Twin Consortium (with Microsoft DTDL – Digital Twin Definition Language ++)
- IIC – Industrial Internet Consortium (Digital Twin Interoperability Group)
- IDSA – International Data Spaces + GAIA-X
- ISO SC41 IoT and Digital Twin
- ISO SC42 AI (and Big Data)
- ISO 23247 – Digital Twin Manufacturing Framework
- ISO/TC211 + OGC – Open Geodata Consortium (Spatio Temporal), CityGML + ERDA
- ISO 19650 - BIM – Building Smart

Supported by European initatives/PPPs: AIOTI + BDVA + AI-Data-Robotics + ECSO + EuroHPC

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Special Issue "Cognitive Digital Twins: Challenges and Opportunities for Process and Manufacturing Industries"

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Guest Editor
Fraunhofer IOSB, Germany
Interests: Industry 4.0; digital twins; knowledge engineering; IIoT architectural standards

Dr. Arne Jørgen Berre   E-Mail   Website   SciProfiles
Guest Editor
SINTEF Digital, SINTEF AS
Interests: Big Data; AI; interoperability; ICT standards; reference architectures

2021 BenchCouncil International Symposium on Benchmarking, Measuring and Optimizing (Bench'21)

Nov 14-16, 2021

Benchmarking is Important to understand the performance of various technologies !

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Benchmarks on
 - IoT
 - Edge
 - Big Data
 - AI
 - Architecture
 - HPC
 - ....
US + China - European interest ?

https://www.benchcouncil.org/bench21

AI DATA ROBOTICS PARTNERSHIP EU

https://ai-data-robotics-partnership.eu/

AIOTI
Alliance for Internet of Things Innovation

WG03 Standardisation

- 5G IA, the 5G Infrastructure Association,
- AIOTI, the Alliance of Internet Of Things Innovation,
- BDVA, the Big Data Value Association,
- CLAIRE, the Confederation of Laboratories for Artificial Intelligence Research in Europe,
- ECSO, the European Cybersecurity Organisation,
- ETP4HPC, the European Technology Platform for High-Performance Computing,
- EU-Maths-In, the European Service Network of Mathematics for Industry and Innovation,
- HiPEAC project (High Performance Embedded Architecture and Compilation).

BDV BIG DATA VALUE ASSOCIATION

TCI TransContinuum Initiative

The TransContinuum is the unison of related digital technologies which offers solutions for the operation of complex data workflow systems. In this continuum, HPC plays a central role as the engine propelling AI, Big Data, IoT, Cybersecurity, and Mathematical components to work together.

The Transcontinuum Initiative, or TCI, is developing a vision of the characteristics of the infrastructure required for the convergence of data and compute capabilities in many leading edge industrial and scientific use scenarios. A paradigm change is needed: we will have to design systems encompassing millions of compute devices distributed over scientific instruments, IoT, supercomputers and Cloud systems through LAN, WLAN and 5G networks.

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