

DIGITAL TVILLING



The Digital Twin Approach Book 1

💭 🔘) DIGITAL TVILLING

Table of contents

Philosophy and Approach	3
Our toolbox	10
Examples	14
The Team	24





We believe in:

- the power of telling by showing, the beauty of discovery in questions and the fun of collaborative work.

If your people don't see the same reality, and can't make sense of what they do see – they absolutely won't understand each other. That is bad for business. We want to change that.

We think it would be good if the systems used for operating and planning in companies and the people involved where connected through the same views of the actual events. In short: enabling smart decisions without getting lucky. We have the technology, people and methods to do that.

For us DATA DRIVEN means to make decisions and act based on evidence and to the best of our knowledge.

We have an ARTISTIC APPROACH to all our projects, and focus on COLLABORATION, CREATIVITY and FUN in the way we work.

To design is to devise courses of action aimed at changing existing situations into preferred ones.







The da Vinci Code

Inspired by the original renaissance man, Leonardo da Vinci, we believe that the principles guiding his life also work for business.

- 1. Curiosità curiosity is the mother of invention, and at the heart of learning.
- **Dimostrazione** we believe in demonstrated knowledge, insight born of testing and failure.
- 3. Sensazione we hone and sharpen all our senses, our understanding of the world depends on it.
- 4. **Sfumato** to explore the fog of the unknown you must be comfortable in ambiguity and dare confront contradictions.
- 5. Arte/Scienza based in science we still maintain an artistic flair, innovation needs both craft and artistry
- 6. Corporalita a healthy mind needs a healthy body. Physical well being fosters creativity and clarity.
- 7. **Connessione** complexity means interconnectedness. We strive for connection, collaboration and the big picture in all our work.



The Triple Perspective – part of our DNA

What we do is:

Map out important aspects of the organization and look for gaps.

Get important and/or difficult data, ingest it into the platform, make it structured and explore the data.

Talk to the right people in the organization, be curious and ask questions.

Scale and repeat

Connect the dots



Focus on patterns and evidence in the work, add more data, visualize, analyze and continue building.

When is the business in balance or flow? Contextualize, evaluate and learn.

Bring people together, prototype, share ideas and forge better ones.









The Dual Track

- validates learning

Our projects work in two tracks. The top track runs towards **discovery** to seek out hidden knowledge and new solutions to test. These are reviewed and validated with our partner and the data. The bottom track is focused on **delivery** and runs implementation, operation and measurement of results and value. The tracks often run in parallel.

Our loops of learning employ methodological tools such as POLE, PDCA, Ooda and SCQA to get results fast and create value as we go.

For case-based work or innovation sprints we move mostly in the top, but the dual track is needed to develop lasting products or services. We are data driven in both **exploration** and **exploitation**.











Our clients are dependent on complex logistics to perform their core activities. We build comprehensive structures for connecting the different actors and data points in the supply chain. We are rooted on scientific research and always seek evidence rather than assumptions.



We often work case based with the intent of analysing and solving real business problems from the people engaged in the daily operations. A lot of effort is put into cooperating with our partners to know their needs and ways of working. We believe the best way to this is seeing and understanding what actually happens before jumping to the fix.

Hvor gode er RIGGEN til å melde LASTEN

We approach all projects by connecting (siloed) data into a digital representation of end-to-end flows. We organize datapoints into **People-Objects-Locations-Event chains, with properties and** dependencies. We make true digital twins of past and present data to support decisions on the future. To do this, we have a cuttingedge platform solution, expert technical teams, robust methods and brilliant creatives.

Digital Twin approach





We work with historical and real-time data to support flow balance, timeto-problem solutions and predictive capabilities.

Interconnected complications and rapid changing plans are our bread and butter. We aim to handle as many dependencies as possible and tailor business logic into our products.

Visual to our core, we strive to use the most human friendly and functional views for both application and analysis. Our toolbox is ever expanding, and always suited to the task.









Our Digital Twin

Historically digital twins have been offline virtual representations of objects in the real world, containing blueprints, maintenance data, sensors etc. This can be anything from an oil rig to a car engine.

We take it one step further and make connected smart maps of your business. Our twins mirror complex value chains and feral challenges from the real world, based on real data, connected to real systems, displayed as graphics understandable by humans. - And then we dream.

Our platform is built with a twofold purpose:

To capture, process, combine and connect data from REALITY into a digital representation - what we call a DIGITAL TWIN.

To create applications that support decisions and feed back into the real world.

The platform can handle vast levels of detail in both time, space and complexity. We tailor the platform to ensure the right tools for the specific needs, problems and case at hand.



Bridging organisational gaps

We provide collaboration and decision-support tools

Our digital twins are connected to reality, behave like reality and are understood by people. We connect data from internal silos, external systems and give them context. And we bring them together into a coherent and truthful twin of your business.

We use tools, methods and practices born out of the digital age, the rigorous research of the past, and the human innovation of all ages. We believe in utilizing what works and pushing the envelope of what has not worked – yet.

From our experience with distributed value chains, the specialized departments (silos) have over time developed their own processes, information and IT-systems and thus decreased the end-to end flow and transparency. We call this organizational gaps. Our core business is building the necessary bridges, both between humans and systems.











PDCA & Digital Twin

Plan -> Do -> Check -> Act cycles are well suited for continuous improvement and rapid learning loops. These loops need to be rooted in reality. The digital twin will serve as a model for the real world and as a baseline for improvements within the cycles.

We recommend establishing a multidisciplinary team combining the Digital Tvilling team: typically Data Hunter, Data Scientist, Solution Architect and Project Lead with necessary personnel such as case owner, domain experts and it-support on data pipeline or warehouse.



PLAN

Use the digital twin to capture and store logistics plans (including changes). Implement changes from previous cycle.

Example: Reported containers and bulk D-7 before sailing. And track changes D-3, D-1.

DO

Use the digital twin to capture and store data about what actually happens across the supply chain during execution of the plan (Persons, Location, Objects and Events). Utilise real-time visualisation for improved collaboration and decision support.

Example: Monitor last minute changes to cargo on sailing day (by whom, why, where and when).

CHECK

Use the digital twin to analyse planned vs. actual. Establish methods for performance reviews. Pattern recognition, deep learning and advanced data science for bottlenecks, root cause analysis, flow balance, value leakage etc. Visual dashboards and reports. Observe and verify cycle effects.

Example: Analyse gap between planned and actual to measure planning accuracy of customers and suppliers.

ACT

Use the digital twin to develop and validate best possible scenarios. Collaborate on new strategies for behavioral change. Use digital twin to identify and validate data.

Example: Incentives early registration and precision on load quantities in planning phase.

















The toolbox

The plattform covers a full stack of services, including data handling, governance, integration, visualization and analysis. Working with us, you get the benefits of both cutting edge digital tools tailored for your business, industry experts in our network and, in our opinion, some of the most creative and collaborative people to be found.

The basis of our platform is the knowledge graph — we use your data to build complex representations that show dependencies in context. This allows you to see and analyze your business as-it-is, historical and in real time connected to the real world. We think of it as a smart and interactive blueprint for building a better business.

The knowledge graph is not based on constraints, but poses a flexible framework that you build-as-you-go, rearranging, expanding and connecting new or better data. We visualize the knowledge and systems in your organization, the challenges of your project and the movements of your assets with ease and digital precision. We question what we see and build to understand.



Platform overview

The platform is our custom instrument for building digital representations of real-world systems.

It can be perceived as a general application that supports a wide area of use cases and user groups such as: analytics, operational procedures, supervision and decision support. Different clients use different parts of the platform, and this is defined in the early phases of the engagement.

The platform has multiple components which handle integration, data processing, storage, visualisation and analytics.

In the platform we also deploy custom applications for specific needs (e.g. industry specific applications) based on the Digital Tvilling architecture.

We run on modern technology and a variety of both cloud providers and onpremise and offer services of analytics, governance, implementation, hosting and management.

Portal

Graph analytics / Visual dashbords / Data science workbench / Real time map

0.

3920

00

000

AIM

00000000

Custom applications

INTEGRATION & PROCESSING

APIs / integration platform / data transformation & calculations

Graph database / Relational database / other

DATA STORAGE

Hosting & management

Schematic sketch of a graph

Based on data and insights we anchor the relationships between entities within and across systems. Central to this is the structure of our knowledge graph.

The graph can connect data across organizational and systemic borders and bridge knowledge gaps. Both nodes (circles) and edges (lines) have properties, and connect through networks of dependencies.

Due to our flexible data model, we can start building the digital representation anywhere along the value chain and iteratively add new parts as needed.

As a consequence of our build, the real enterprise architecture will emerge. Based on real data the graph will produce an as-is model and thus removing costly guesswork.

By recording historical data, we help understand the distribution of values pending other values, e.g. ETA of a delivery due to weather or traffic. This way we can both take necessary pro-active actions (Time To Problem), and find balanced flow for future operations.

Data-pipeline

The Digital Twin platform can CONNECT data from client data repositories, PARTNER data sources, IoT sensors and EXTERNAL sources for weather, sailing conditions etc. Utilizing existing and trusted GLOBAL DATA STANDARDS like GS1, ILAP and Peppol increases efficiency, ensures interoperability and quality within the pipeline.

Experienced Data Wizards and Data Hunters are mobilized to cooperate with the client team in integrating data points to the pipeline and platform.

Our platform and team perform both VALIDATION and ANALYSIS of the data and have solutions for SHARING and VISUALIZATION.

Our Digital Twin approach facilitates for PERFORMANCE and COLLABORATION.

Flow balance & analytics dashboards

Root cause & graph analysis expert systems

Record Collaborative decision support

0

y

.

Examples from Aquaculture

Digital Tvilling work with leading organizations in aquaculture and make groundbreaking innovations with our plattform and ways of working.

Contextual MAP for aquaculture with realtime AIS data from boats, marine installations, anchor heads, OLEX depth data, sea currents, salinity etc., all aligned with needs from marine harvest. Production ready to include populations in cages, history and more.

Biological effect calculator: PoC for calculating biological effect of environmental factors and feed on fish growth, welfare and harvest result. Next generation data-driven aquaculture value chain in the making.

TRACK and TRACE solution: roe-toharvest for historical datasets going back to 2016. The most complete value chain graph known to the industry. Spanning not only vast amounts of data, generations of fish, but also land, sea and laboratory.

Connecting the dots: successful test of Al assisted event-tracking using normal language model to find and sort connections across several datasets within plattform. Respond to realworld events with the speed of AI and the precision of a knowledge graph.

Value chain innovation and visibility: proven concept for increased value visibility by utilizing datapoints that show weight, count and distribution of harvest 12 hours prior to factory grader analysis.

Examples from Transportation

Digital Tvilling is deeply invested in the infrastructure and logistics of modern society and complex businesses. We pride ourselves with improving the critical systems of everyday transportation of goods, services and people.

First ever real-time map of Sweden's railways system with precise locomotive movement on actual rails. We have been recording since 2019 and our database structure is continuously enriched with contextual data. We dare say our transportation twin is Europe's strongest logistics innovation platform.

You would believe trains move on schedule - think again. Todays schedules are disconnected from the operations of the real world, and are planned with times that don't exist. Our plattform stand ready to put the trains back on track and give passengers and operators the slots they deserve.

Field tested warning system for human and wildlife rail crossings. Digital Tvilling have developed a mobile physical system ready for deployment that will warn humans and scare wildlife at dangerous intersections and save both lives and resources.

Europes strongest locomotives pull the 750 meters long iron ore trains of LKAB in the arctic route from Kiruna to Narvik. We work in concert with the mining company to create the future of logistics flow balance in the project Hugin & Munin supported by Vinnova.

The Dream Team

- bridge complex problems

Our teams are rigged for handling the ambiguity of our approach and put the task and clients before their pride. Complex problem-solving demands overlapping capabilities and respect for individual strengths.

The Shepherd coaches and connects both our team and our partners' people. Main strengths are stakeholder management, business mindset, human connections and keeping the plan on track.

The Hacker integrates data and builds prototypes. Equal parts scientist and wizard she bridges and analyses the possibilities of the digital realm. Key capabilities are raw analytical power, technical know-how and the ability to build as we go.

The Hunter explores and brings in both data and insight, giving context and real observations to the project. Superpowers include curiosity, creativity and collaborative sense making.

SHEPHERD

The Shepherd

- connecting the virtual scoreboard

The coach is a role that closely resembles the shepherd. The role plays a pivotal part in nurturing growth and harmonizing operations by combining business development, problem-solving, seamless teamwork, and project management. The responsibilities involve spotting opportunities for expansion, building valuable connections, untangling complex challenges, smoothing cross-team collaboration, and guiding projects from start to finish.

Systems thinking is about zooming in and out, and focuses on understanding the interconnected elements of a complex system and how they influence one another, enabling holistic problem-solving and decision-making to address multifaceted challenges.

Business development is the process of identifying opportunities for growth, expansion, and profitability within an organization. It involves creating and nurturing relationships, exploring new markets, and implementing strategies to enhance a company's overall performance.

Coordination is about holding together the efforts and guiding partners or others in their search. Questions: «Did we get the data we need from org X?», «When will we get the export of the needed data?» and «Are we aligned on the objectives of our current path?».

Connecting people through effective communication and inclusive thinking are at the heart of this position, ensuring that the organisation thrives through innovation and synergy.

The Hacker

- coding the bridges of tomorrow

The hacker is tasked with defining data models for how information can be found and structured for various visualizations and analyses. She builds integrations to go from data in source systems/APIs to data in platform and beyond. The hacker's deep interest in complexity works from the credo: «How can we build solutions that support different applications in many different areas based on the same data?» Typically the hacker will have domain expertise in one or more of the following areas:

Data science refers to the act of studying data to extract meaningful insights for business. For us it is a multidisciplinary approach that combines principles and practices from the fields of mathematics, statistics, artificial intelligence, and computer engineering to analyze large amounts of data.

Front-end/back-end programming involves creating the user interface and experience of our software applications, and the server side of our plattform. It focuses on the visual elements that users interact with directly and ensures that the application runs smoothly and can handle user requests efficiently.

Data integration is the process of combining and unifying data from different sources, formats, or locations into a single, coherent data repository. This integration ensures that data can be analysed, shared, and utilized seamlessly across an organisation, improving data consistency and accessibility.

Data security refers to the practice of safeguarding data from unauthorized access, breaches, or alterations. It involves implementing measures and protocols to protect sensitive and confidential information, ensuring its confidentiality, integrity, and availability while preventing unauthorized disclosure or data breaches.

The Data Hunter

- scouting the digital wilderness

The data hunter is tasked with locating, gathering and making available data needed to deliver our core product. The hunter cooperates with case owners and connects the organizational gaps. Key to the hunter is creative sense making on the go and the ability to readily facilitate for insight. Data hunting has four facets: digital anthropology, systems tech, synthesis and design thinking.

Digital anthropology refers to the «human» side of hunting data and contains interviews, field work and networking. Questions: «Who knows what data we need?», «who owns that data?», «what is the story behind this way of handling the data?».

The systems tech part is about understanding data quality, data systems, formats etc., in short the technical aspects of the data needed for the specific case or project. Questions: «Is this the right type of data?», «How is the data structured?», «Is there an API for the data?».

Synthesis is the combination of insights from work with systems tech and digital anthropology that are gathered from the data hunt. These might be crucial insights for the tech team, viz team, solution architect or case owner. The data hunter shares and makes sense of the findings. Questions: «How is this important to the case?», «Is this data reliable?», «Does this data ring true with the business?».

Design thinking is often the preferred methodology of the hunter. Design thinking is a problem-solving and innovation approach that emphasizes empathy for users, creativity, and iterative prototyping. It involves understanding user needs, brainstorming creative solutions, and rapidly testing and refining ideas to develop user-centric and effective solutions.

EIRIK CEO/LEAD SHEPHERD

HÅVARD **CREATIVE DIRECTOR/ LEAD DATA HUNTER**

MARKUS **DATA SCIENTIST/ LEAD HACKER**

Digital Tvilling Norge is part of the Digital Tvilling group. We specialize in scoping, collaboration, data science, creativity, and business development.

We focus on decision-making in complex organizations. We firmly believe in a hybrid approach to enable data driven businesses. Thus, we employ diverse methods like design thinking, systems thinking and data analytics to solve today's emerging problems.

Decision-making occurs in recurring cycles of Observe, Orient, Decide and Act steps (OODA-loops). An entity that can process this cycle more rapidly than an opponent, will get inside the opponent's decision cycle and gain advantage. With our partners we provide tools for hacking the loops and gaining the digital upper hand.

Our sister companies in Sweden focus on analysis, platform development, governance and technology. We are both data driven and human centric – our love for visual evidence that drive decisions unites us.

29 P

Digital Tvilling / Lead Data Hunter

Håvard Legreid **Creative Director**

I make the call for human centered design backed by evidence, and a poetic sense creativity, where good solutions by necessity are elegant and for people. I believe in the power of beautiful questions and the liberation in telling by showing.

I'm an artist-wannabe gone academic, turned designer. Reborn draughtsman in my late 20s and haven't looked back since. The scenic route is my preferred path and my curiosity drive my exploration of the world. I thrive in the intersection between art, design and business.

Follow Håvard on Linkedin and Instagram

EDUCATION

- production (2000)

WORK EXPERIENCE

- NHH (2018)
- (2006 2016)

COURSES

EXPERTISE

- Coaching
- Creativity
- Visual storytelling
- Innovation

– NHH, Executive mastercourse in Design thinking - strategy for innovation (2017) – UiB, Masters degree Media studies (2003) – UiB, Cand. Mag. Social science and television

- Creative Director, Digital Tvilling (2023 -) – Senior designer, frog Bergen (2022 - 2023) - Advisor/art director/lead library development Bergen Offentlige Bibliotek (2016 - 2022) - Design thinking coach/ visualisation tutor,

– Personal designfirm; Leketøys (2008 -) – Illustrator and web-designer, Vox Publica

– Behavioral science in design (2022) – Google design sprint (2019) – Design thinking coach (2018)

PROJECTS

- Grip 1 (social science for foreigners) Fagbokforlaget Illustrator (2023)

- Improved invioce handling, design phase Norgesgruppen Lead designer (2022)

Data driven valuechain Lerøy Seafood Group Innovation lead (2022)

- New markets for circular bottles Tomra Visualisation user journeys (2022)
- Modenisation of the main library Bergen Offentlige Bibliotek Project manager/coordinator (2020 - 2022)

- 3 new library brances Bergen Offentlige Bibliotek Development lead (2019 - 2022)

 Design thinking (executive master module) NHH/UiB/HVL Coach/visualisation tutor (2018 -)

Digital Tvilling / Lead Shepherd

Eirik Solberg CEO

I love to connect people and make them feel great. When new connections are made, sparks of creativity and curiosity explode in my synesthetic brain, which is my superpower. Synesthesia has given me extra creativity and the ability to store large datasets & connections that helps me think in systems and discover interesting patterns.

The perfect day in my life combines creativity with others, reading a good book, exploring the outdoor, cooking a long meal and share it with people I care about. I collect happy memories and relationships.

Follow Eirik on Linkedin and Instagram

EDUCATION

WORK EXPERIENCE

- Gemini (2020 2022)
- 2014)

INTERNATIONAL EXPERIENCE

- 2011)

EXPERTISE

- Business Development
- Innovation
- Creativity

– NITH, Bachelor of Science – Information System (2003) - BI Bergen, Logistics, microeconomics, macroeconomics, statistics, change management, marketing (1996-1997)

– CEO, Digital Tvilling (2022 -) - Director Technology and Business design, Cap

– Leading Advisor SCM/IT. Equinor (2014 - 2020) – Senior Analyst IT architecture, Statoil (2011 –

– Project Manager, Odfjell SE (2008 – 2011) – SAP consultant, Bouvet (2007 – 2008) – SAP consultant, IBM (2006 – 2007) – SAP consultant, R5 Consulting (2004 – 2006)

– Expat in Houston, Texas (2012-2014) - Projects in Netherlands and Houston (2009 -

PROJECTS

 Data driven valuechain Lerøy Seafood Group Project Lead (2022)

- Next Gen Management System Equinor Program Lead (2019 - 2020)

NCS Logistics Collaboration

Offshore Norge Stream lead Digitalisation (2018 - 2019)

- Digital Supply Chain Incubator Equinor Tribe Lead (2017 - 2019)

- US Onshore OBOS project Equinor (Houston) Team Lead IT (2012 - 2014)

 Operation & Maintenance implementation Odfjell SE Project Leader (2010 - 2011)

– LOS Program Norwegian Armed Forces Stream lead logistics (2006 - 2008)

Digital Tvilling / Lead Hacker

Markus Hittmeir **Data Scientist**

I have a lifelong passion for Philosophy and Mathematics, and a fascination for problems that are easy to understand, but hard to solve. My interest in algorithms led me to the rich field of Data Science, where learning never stops. I love to combine creativity with abstract concepts and to observe the results of this process in the real world.

EDUCATION

- (2018)

WORK EXPERIENCE

- (2019-2023)
- Guest Researcher, Selmer Senter, University of Bergen (2021-2022)
- PostDoc Researcher, Computer Science Department, University of Vienna (2021)
- External Lecturer, Philosophy Department, University of Salzburg (2018-2019)
- Research Assistant, Mathematics Department, University of Salzburg (2014-2018)

SCIENTIFIC PUBLICATIONS AND TALKS

- ORCID Overview

– University of Salzburg, Ph.D. in Mathematics (Summa cum laude / Sub auspiciis, 2018) – University of Salzburg, B.A. in Philosophy

- Senior Researcher, Machine Learning and Data Management Group, SBA Research gGmbH

- 19 peer-reviewed research papers - 8 talks at international conferences

PROJECTS

- FFG Bridge "GASTRIC"

Developing privacy-preserving solutions for the analysis of microbiome data, together with an industrial partner (myBioma GmbH) Role: Principal Investigator (2020-2023)

- FWF "Arithmetic primitives for U.D.M. 1"

Working on integer factorization and related problems in Number Theory and Cryptography Role: Research Assistant, Ph.D. student (2014-2018)

EXPERTISE & INTERESTS

- Data Analysis (Statistics, Machine Learning)
- Data Privacy (Synthetization, Anonymization)
- Algorithmic Design, Optimization
- Number Theory
- Philosophy and Writing

Why choose **DIGITAL TVILLING?**

Integrated Solutions for a Connected World

Utilize advanced technology, methodologies, and a dedicated team to bridge organizations and data

Generate a comprehensive, unified real-world model to support diverse use cases and empower actionable business insights

Scalable and customizable to fit specific organizational needs Built on cutting-edge technology and industry best practices

Proven Ability to Execute

Positioned to immediately engage and support our clients

Assemble cross-disciplinary teams with deep experience in navigating large, complex value chains

Leverage an extensive network of industry experts and thought leaders

Proactive and innovative approach ensures timely delivery and responsiveness to evolving organizational requirements

Credible and Verified References

Demonstrated success and robust references in multi-organizational, distributed system environments

Solutions grounded in rigorous research

Trusted by prominent organizations, including, but not limited to: Swedish Transport Agency: Leading the way in multi-organizational data sharing (https://www.digitaltvilling.se/aktuellt/pressrelease-datadelning)

LKAB: Partnering with the largest iron ore producer in the EU to innovate future logistics solutions (<u>https://www.digitaltvilling.se/aktuellt/lkab-i-samarbete-mot-</u> <u>framtidens-logistiklsningar</u>)

