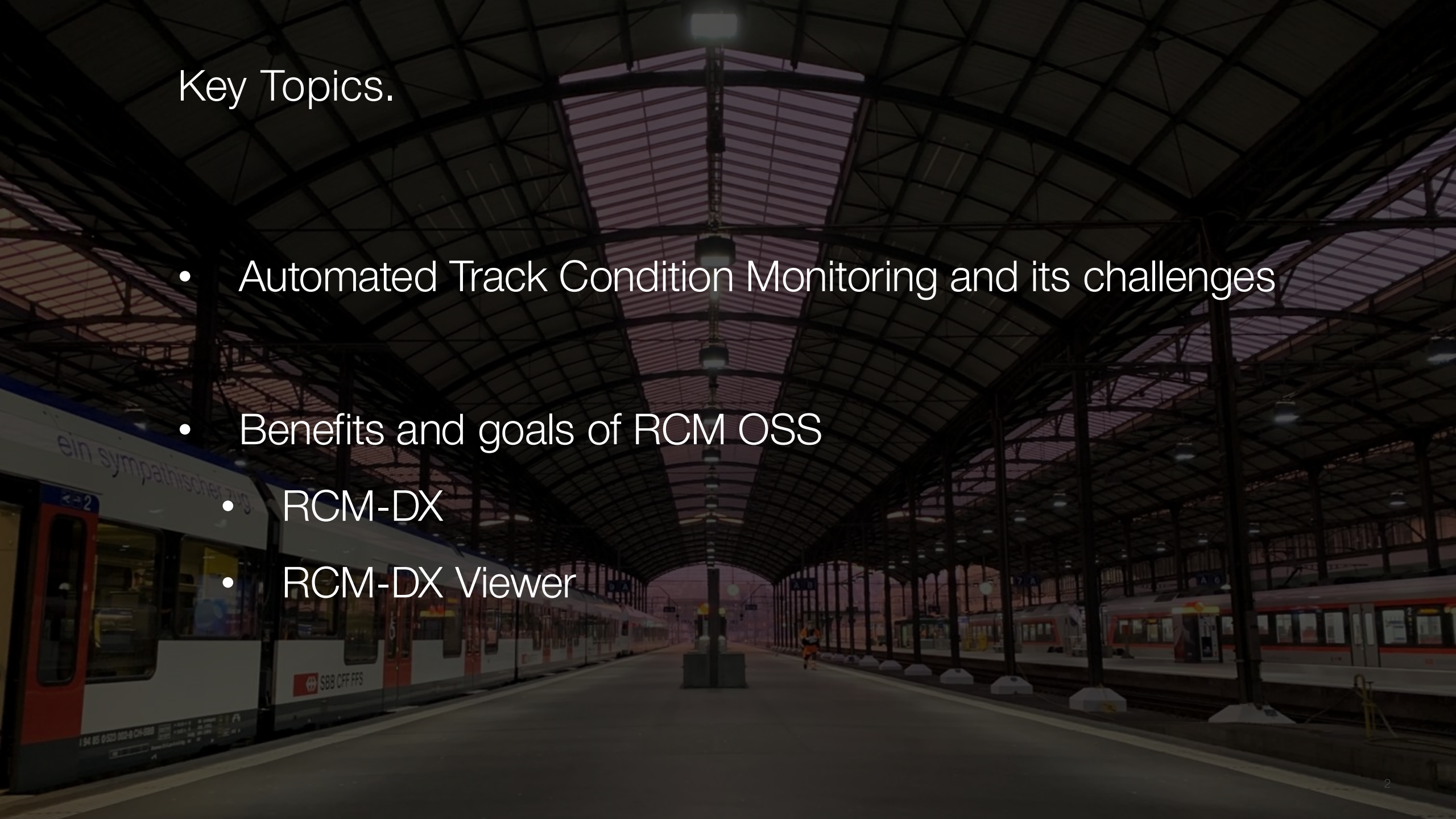
RCM OSS

Rail Condition Monitoring – Open Source Software

Open tools for condition-based maintenance (RCM-DX)

Swiss



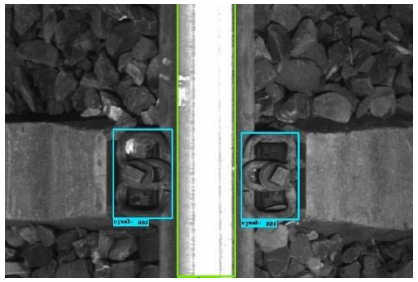
Key Topics.

- Automated Track Condition Monitoring and its challenges
- Benefits and goals of RCM OSS
  - RCM-DX
  - RCM-DX Viewer

Condition monitoring is changing.
From manual to automated condition monitoring.

Developments

Using new technologies and methods to further develop the condition monitoring infrastructure.



Automation

Existing manual activities by means of known and proven Automate technologies.

Data management

Offering an integrated and end-to-end data chain from production to the end user.

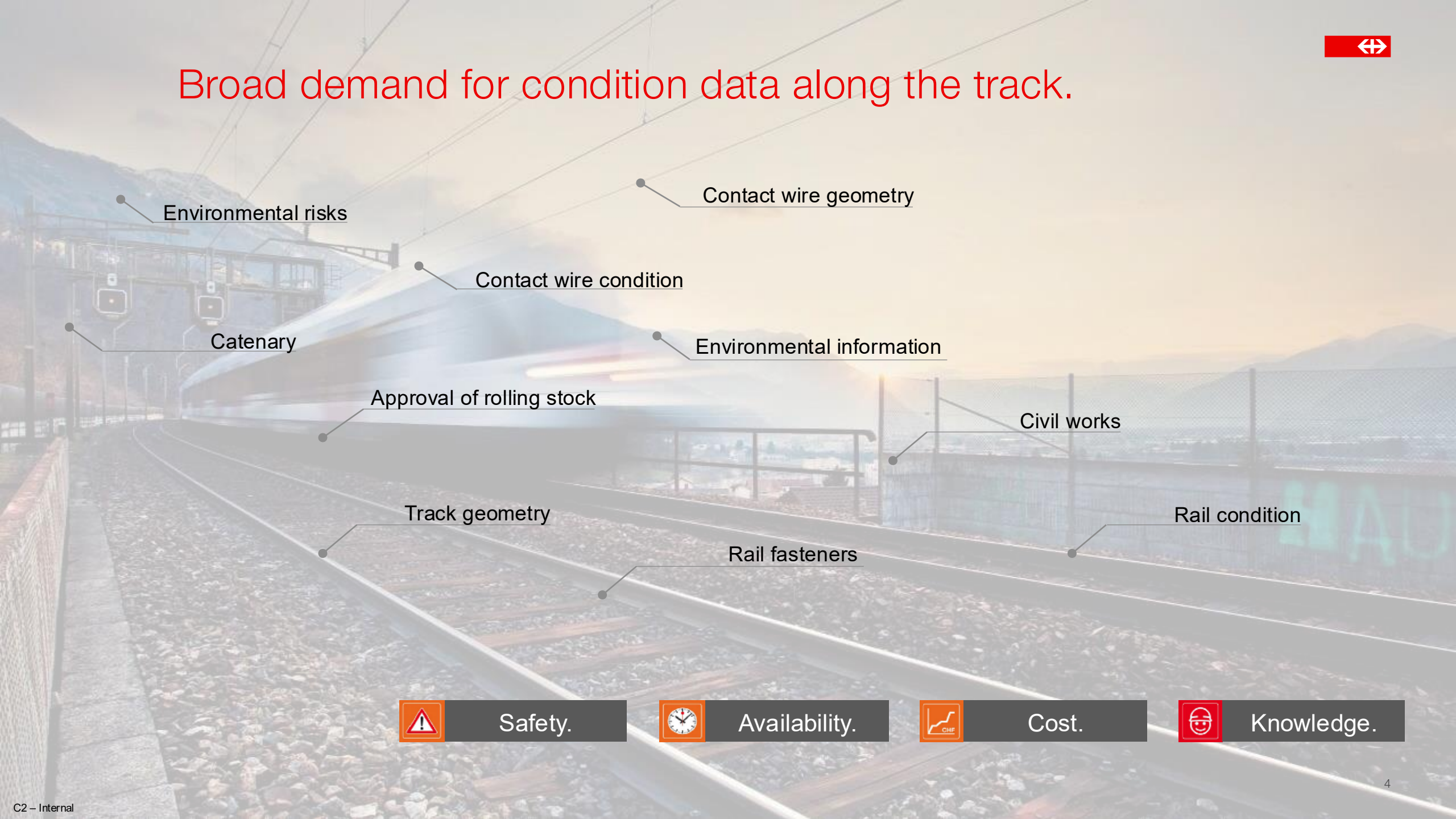
Life-cycle

Ensure the automatic condition monitoring of the infrastructure and keep the operational systems up to date with the latest technology.

- Increasing efficiency and increasing the degree of automation
- Reduction of risk exposure and increase of occupational safety during monitoring activities
- Enable more efficient and proactive asset management through continuous condition data

C2 – Internal

Broad demand for condition data along the track.



Safety. Availability. Cost. Knowledge.

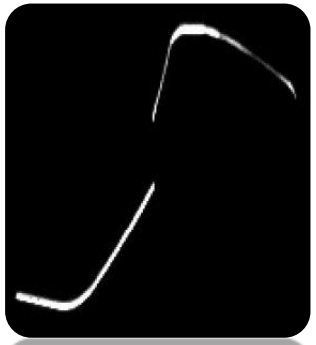
C2 – Internal

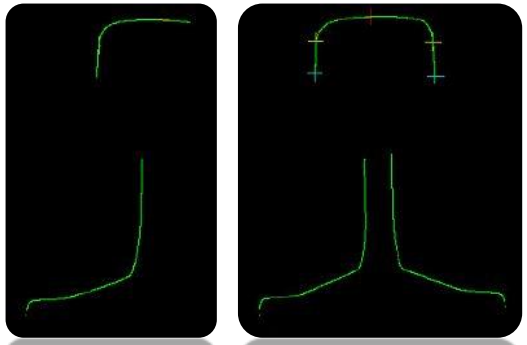
From Sensor Data to Information.

Data acquisition.

Automated cleansing, quality control & processing.

Visualisation in software applications.





Sensor Data → Information

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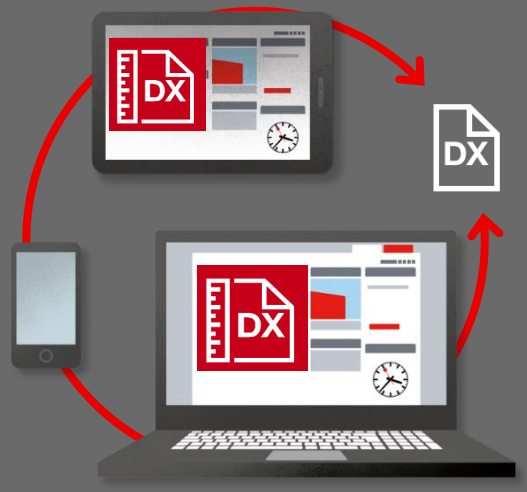
Challenges with proprietary data formats and software.

- Dependencies on proprietary software tools
- Compliance topics – Storage of data over time with guaranteed accessibility
- Requirement of specific knowledge for software and data formats
- Data exchange has to overcome the difficulty of limited readability

RCM-DX Format.

Easy and open data exchange.

RCM-DX: Rail Condition Monitoring Data Exchange



C2 – Internal

First steps to open-source in Data Management.

With RCM-DX we step away from proprietary data formats which require specialized software and know-how, towards a self-contained and open format.
The RCM-DX Viewer provides easy to use and powerful presentation layers to analyse and compare railway diagnostic data.

RCM-DX.

Open-source format to store railway diagnostic data.

RCM-DX Viewer.

Easy to use and powerful standalone software.
Currently available as freeware.

C2 – Internal

RCM-DX @ SBB-MUD and in Europe.

- RCM-DX is the **official standard data format** for automated track condition monitoring at SBB since **2020**.

- RCM-DX is used for **data exchange** within Switzerland and across Europe
  - Railway companies are showing interest in RCM-DX
  - Private companies in the railway sector
  - Universities (international exchange)

- RCM-DX is an **open-source** data format since 2022 and is part of the RCM OSS project at the **OpenRail Association** since 2024 - OpenRail Association

- Release Cycles:
  Releases are managed within the community and currently governed by SBB.

C2 – Internal

HDF5 ↔ RCM-DX.

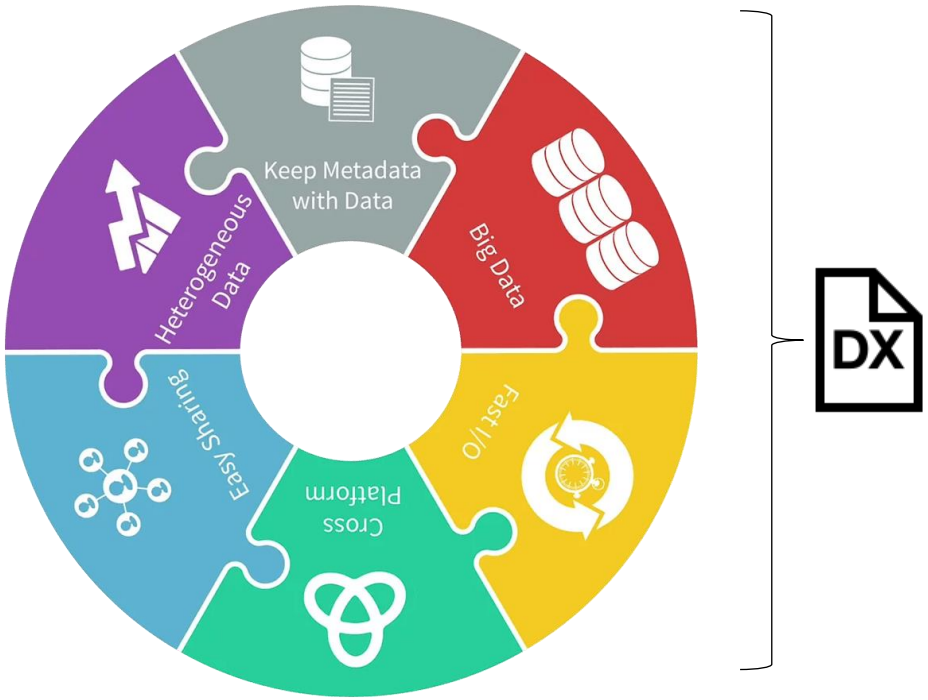


Image: https://www.hdfgroup.org/solutions/hdf5/

Self-contained

- Includes Metadata like configurations
- Includes Positioning data
- Toplogy information (currently SBB standard, in future could be RailTopoModel/RSM as European standard desirable)
- Store one file and access it in 20 years

Accessible through HDF5 tools

- Read/write with existing libraries in most languages and open-source software (e.g. HDFView)
- Freeware RCM-DX Viewer
- Wrapper-library available from SBB in Java and C#

Highly generic

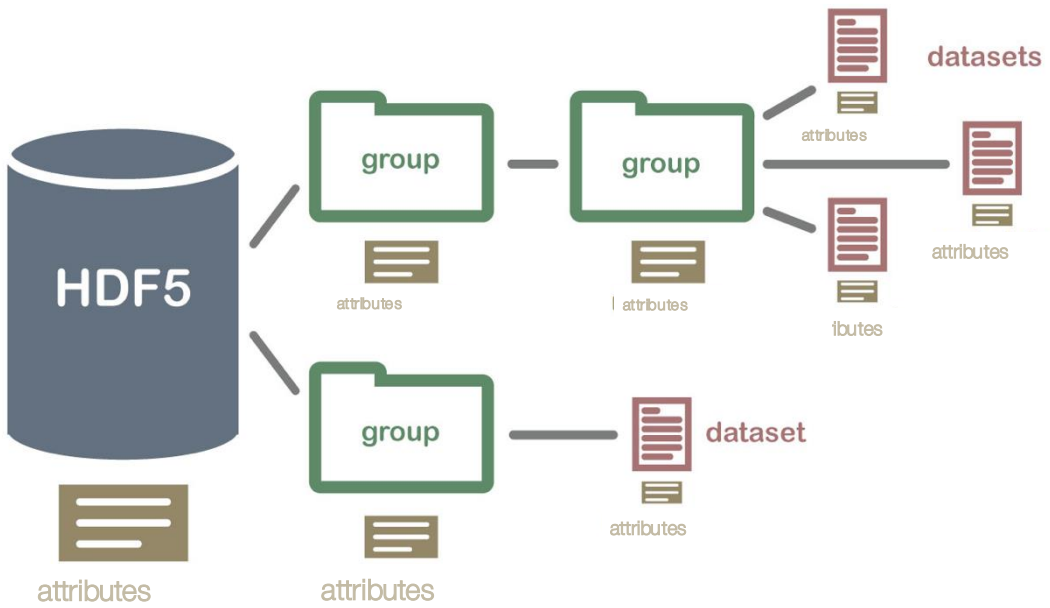
- Store all your measurement datatypes (1D, 2D, videos, images, events etc.)

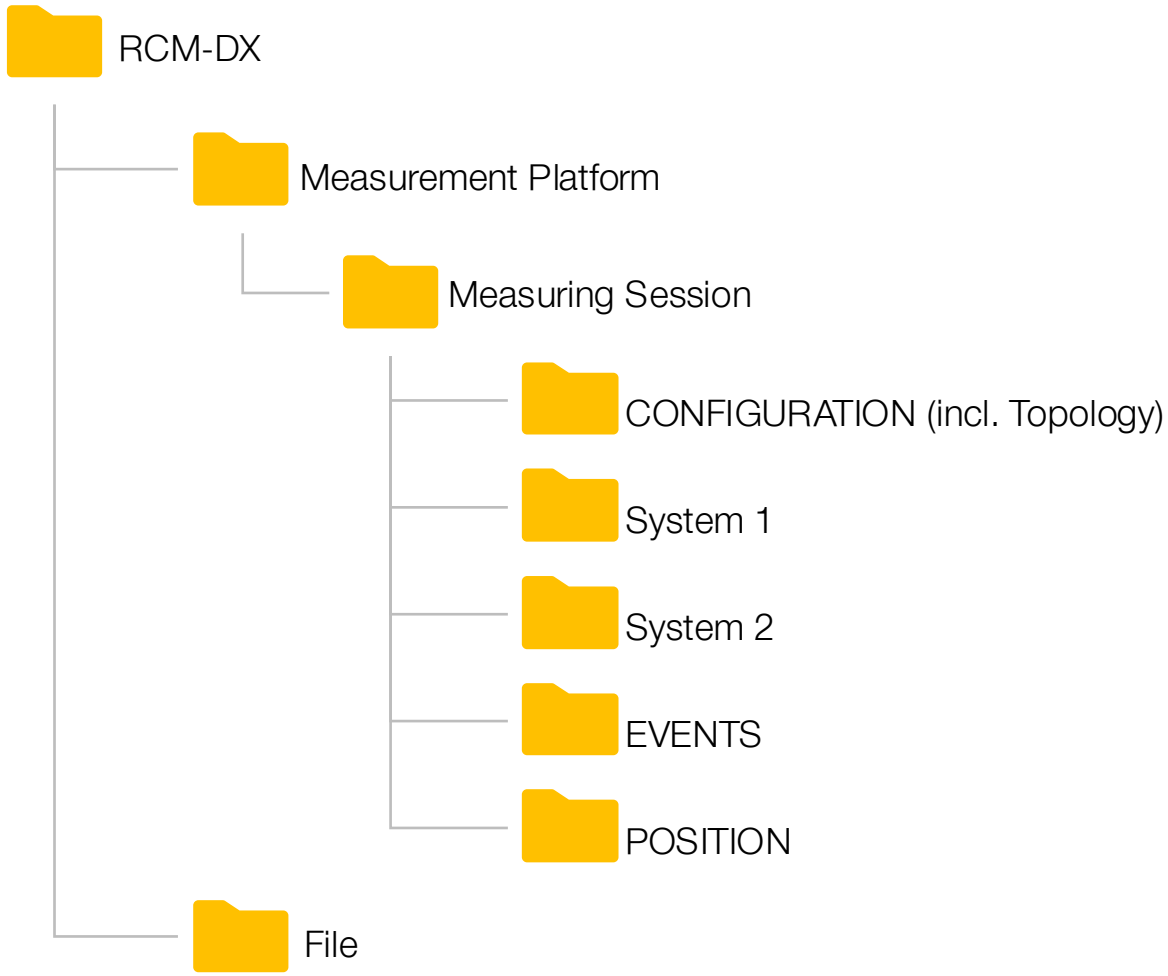
Boost potential for collaboration and data exchange

- Compare data from different countries

C2 – Internal

RCM-DX – Structure and Content.



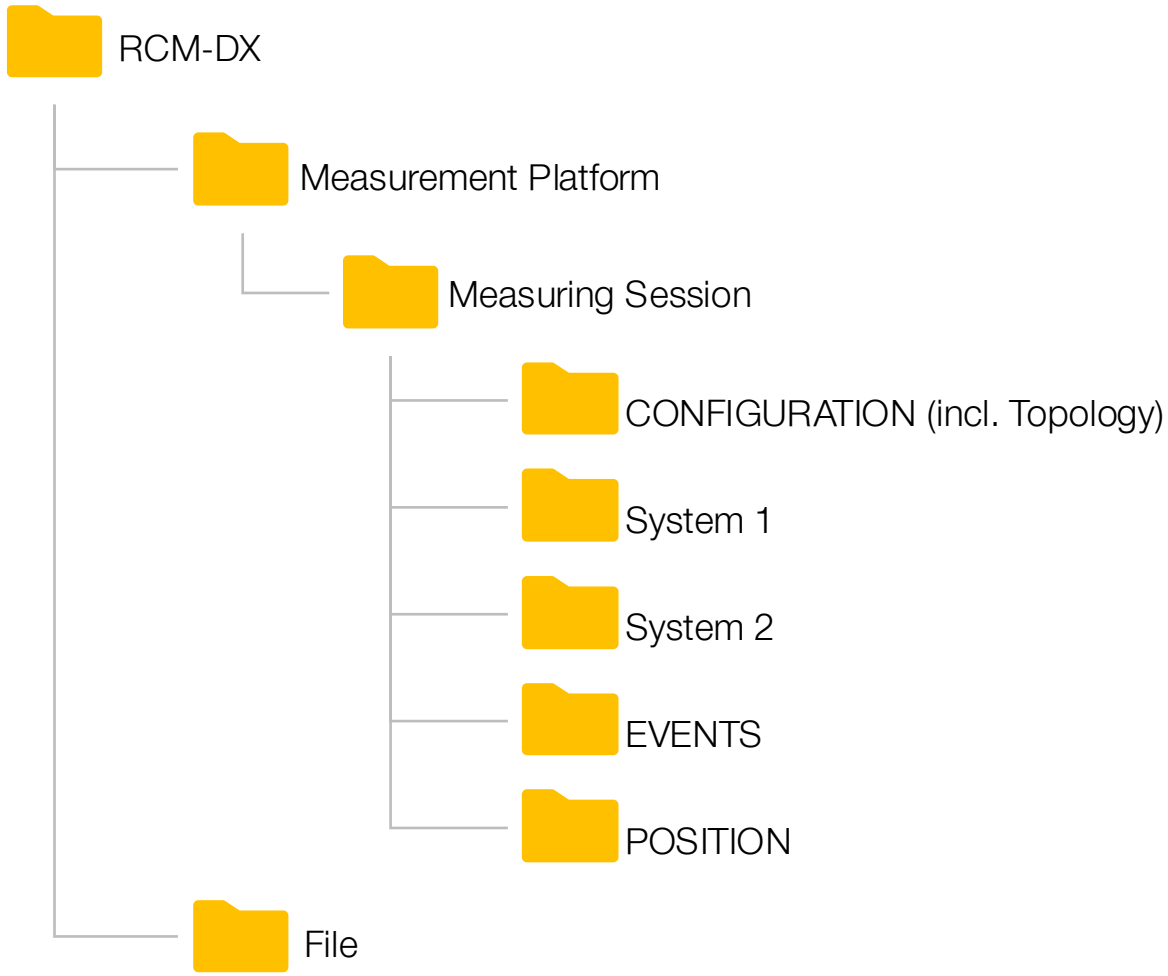


C2 – Internal

Abgeändert von Quelle: Hierarchical Data Formats - What is HDF5? | NSF NEON | Open Data to Understand our Ecosystems(neonscience.org)

RCM-DX – Structure and content.

- 20240704-131433_DFZ01_TGMS_v003_created-20240704-145201.rcmdx
  - RCMDX
    - DFZ01
      - 20240704_131433.777
        - CONFIGURATION
          - TOPOLOGY
          - global
          - network
        - DFZ01.TGMS
          - CONFIGURATION
          - DFZ01.TGMS.SWITCH
          - DFZ01.TGMS.TG_PARAMETERS_1-1000M
          - DFZ01.TGMS.TG_PARAMETERS_DERIVED
          - DFZ01.TGMS.TG_PARAMETERS_EN_13848
          - DFZ01.TGMS.TG_PARAMETERS_IN_STANDSTILL
          - DFZ01.TGMS.TG_STATISTICS_SECTION
          - DFZ01.TGMS.TG_STATISTICS_SECTION_GROUP
          - LOGGING
          - MEASUREMENTMODE
        - DFZ01.TLS
        - EVENTS
        - POSITION
          - CONFIGURATION
          - LOGGING
          - MEASUREMENTMODE
          - POSITION.SOURCE
        - SECTIONS
    - FILE
      - DATAPROCESSING
        - CLEARANCE
        - PROCESSINGLOG



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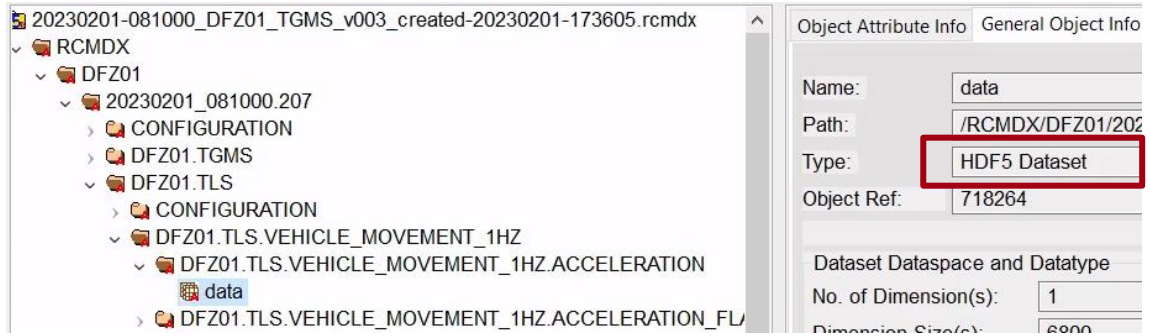
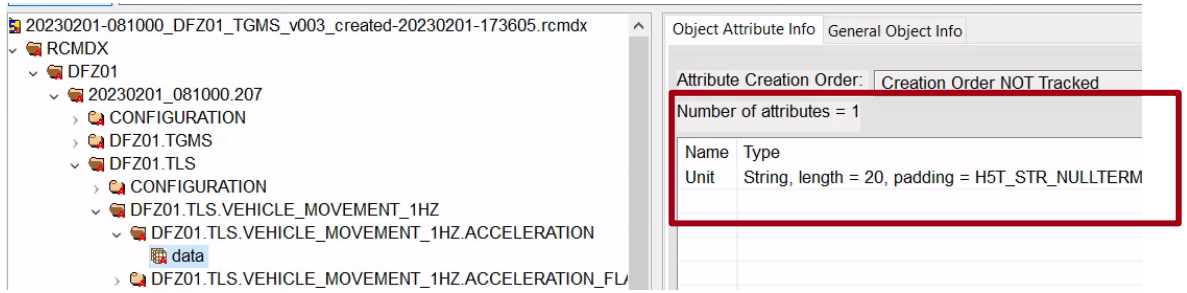
RCM-DX – Structure and Content.

RCM-DX defines a structure of HDF5 groups, datasets, and attributes.
Groups contain additional **Groups** or **Datasets**.



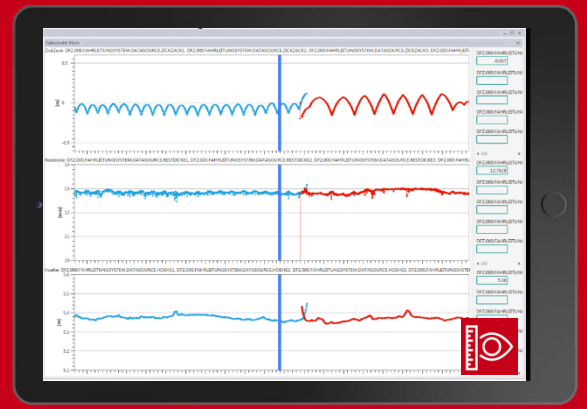
Datasets contain data stored in arrays, images or videos.
Groups and **Datasets** can have additional metadata stored as **Attributes**.



C2 – Internal

RCM-DX Viewer.

Easy and powerful presentation layer.



C2 – Internal

RCM-DX Viewer – comprehensive and powerful presentation layer.

C2 – Internal

Key messages.

- RCM-DX is an **open-source** data format for railway infrastructure diagnostic data.
- Currently in use at SBB for **diagnostic data** acquired by diagnostic vehicles (track geometry (1D), rail profiles (2D), images, video). This includes internal and external measurement platforms.
- RCM-DX is part of the RCM OSS project at the **OpenRail Association**.
- RCM-DX allows to store a **variety** of measurement and diagnostic data including **positioning** information and **metadata**, such as configurations and topology.
- RCM-DX Viewer is available for free to visualize and analyse railway infrastructure diagnostic data stored in the RCM-DX format.

C2 – Internal


Thank you for your attention.
Become part of the
RCM-DX community!
https://github.com/OpenRailAssociation/rcm-dx

OPENRAIL

Merci.

RCM OSS Team

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