IREDES
INTERNATIONAL ROCK EXCAVATION
DATA EXCHANGE STANDARD

IREDES and OPC/UA
Essential standards for mining digitalization:
Architecture and applications

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AGENDA

"*Digitalization*" in mining started in 2000 with the first definitions in IREDES

Long time before the buzzwords were created!

1) About IREDES

2) About OPC UA

3) IREDES as OPC/UA payload

4) Application Examples

5) Conclusion

IREDES

International Rock Excavation Data Exchange Standard

IREDES

IREDES is an IT standard designed to exchange content along the mining process, so connected **IT systems** are not only able to talk, they also **understand each other.** It is an agreement among machine manufacturers, IT system providers and mining companies. It enables cost effective IT - integration of equipment in mining environments of any size.

Some IREDES Principles

Profiles in IREDES are developed by professionals from different parts of the mining industry. It allows to cover all aspects of works.

IREDES provides a flexible version handling with the aim to prevent from regular updates of field equipment.

Any IREDES Data Set can be extended by additional, not (yet) standardized information which however may not be essential to operate the equipment.

IREDES is object oriented to prevent from frequent redefinition of commonly used information. It uses modern web based technology (XML schemas)

APPLICATIONS

- production plans
- performance reports
- maintenance reports
- quality reports
- machine status information
- and more...

>>>>

for:
- drill rigs
- LHD trucks
- chargers
- scalers
- any device tracking
- … and more

TECHNIQUE

- XML (eXtensible Markup Language) and its schemas (XSD) are the basis of the IREDES standard

- A well known, mature IT standard applied to mining process optimization

- Human-readable and machine readable

- Supporting software, programming libraries and tools available

INFORMATION EXCHANGE
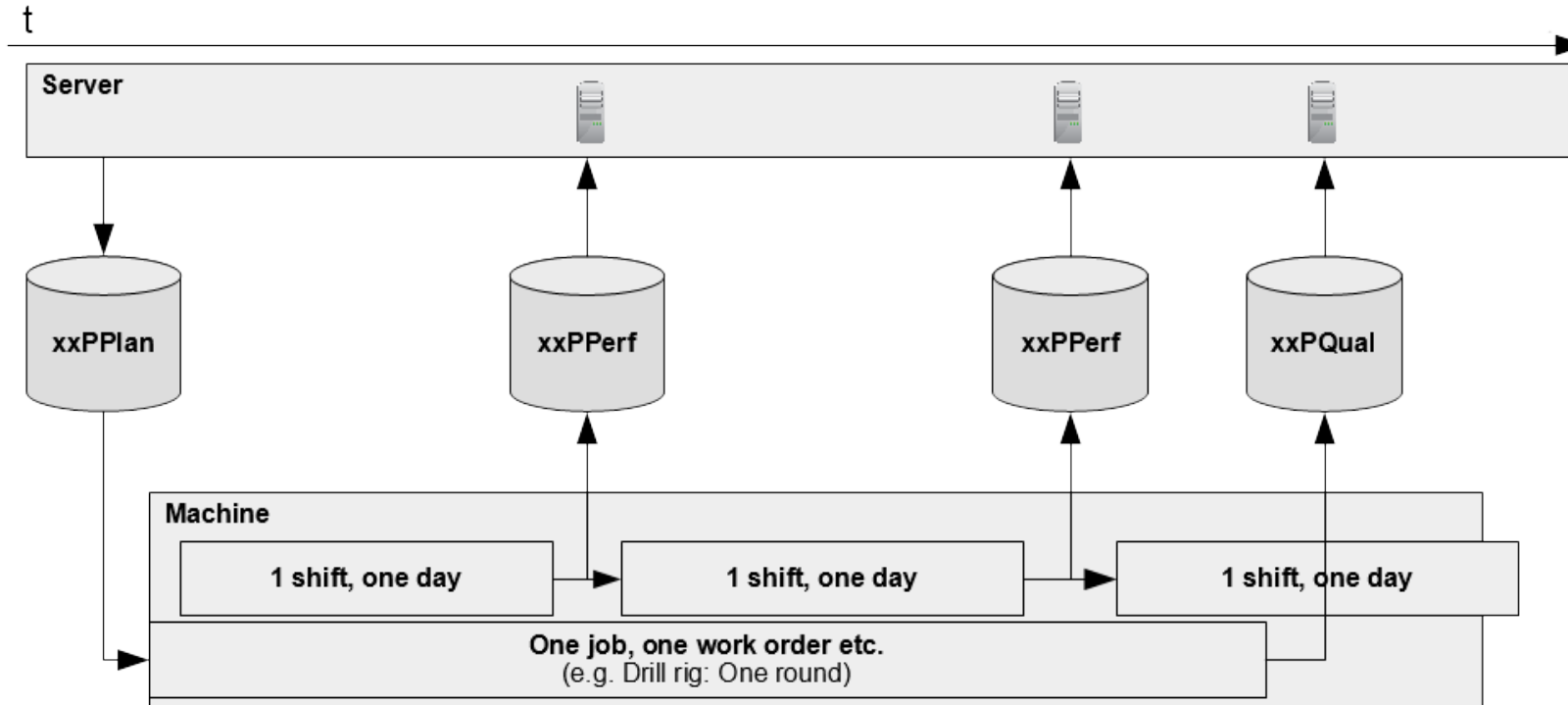
IREDES DATA SET

What information is it?
How to process it?
Where does it come from?

Application / Equipment profile

Use in several profiles

Not (yet) standardized...

What information is it?

IREDES Data Set

Application Profile Generic Data

> IREDES Type:
> General Header,
> Site Header

Commonly Used Objects

Application Profile extention
from the applicable
Equipment Profile

Non standarized extensions

General Trailer

COMMUNICATION CHANNELS

**1. Files on physical media (e.g USB-Stick, memory card)
for not network connected equipment**

2. File transfer via an TCP/IP based network environments

3. Web Services

4. OPC/UA Web Services

OPC UA

Unified Architecture of Open Platform Communications

OPC UA

- OPC UA-defined and vendor-defined data types

- Servers define object models that clients can dynamically discover.

- Servers can provide access to both current and historic data, as well as alarms and events to notify clients of important changes.

- OPC UA can be mapped onto a variety of communication protocols and data can be encoded in various ways to trade off portability and efficiency.

Leitner S.-H., Mahnke W., OPC UA - Service-oriented Architecture for Industrail Applications, ABB Germany
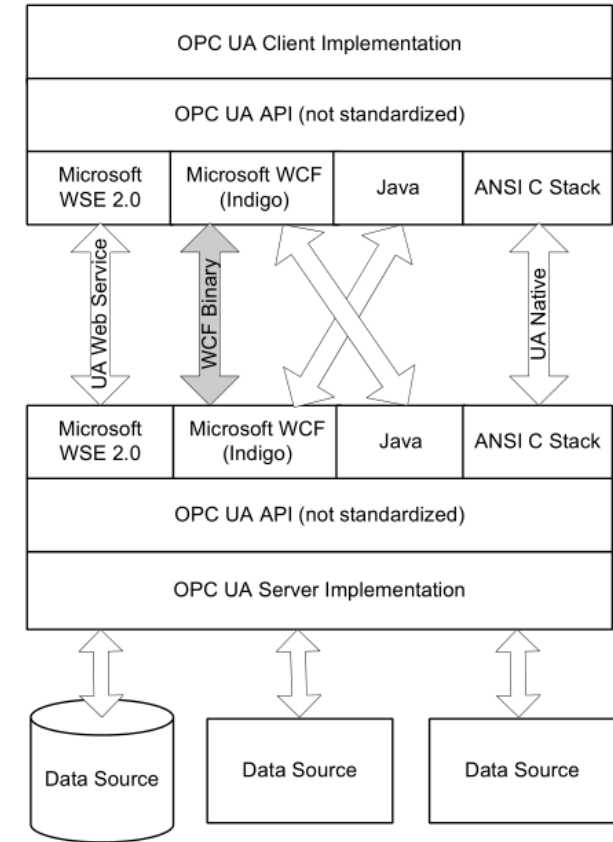
OPC UA

- All OPC servers are able to publish data and Event Notifications.

- OPC UA provides mechanisms for Clients to quickly detect and recover from communication failures associated with these transfers without having to wait for long timeouts provided by the underlying protocols.

- OPC UA is designed to support a wide range of Servers, from plant floor PLCs to enterprise Servers.
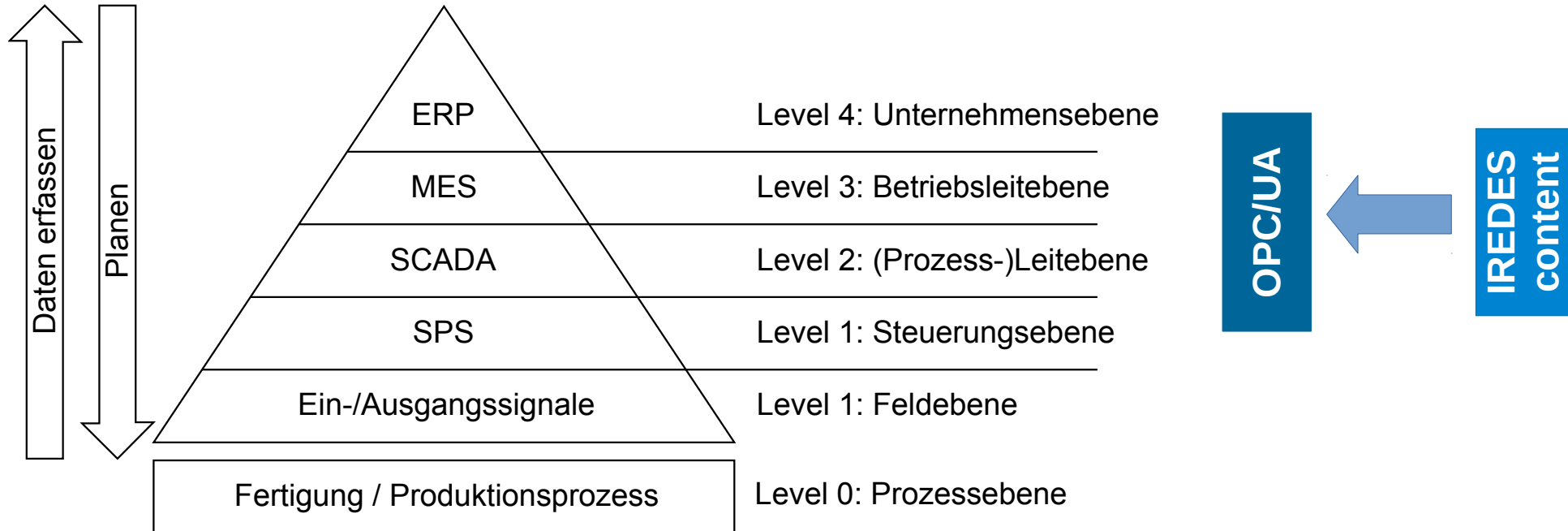
IREDES and OPC UA

IREDES was already in 2000 developed basing on XML schemas

Since OPC turned from proprietary into open and to XML schemas, it provides another standardized way of exchanging IREDES information.

Now, IREDES information can be exchanged as industry specific content "on top of" OPC/UA without binding the use of IREDES to OPC/UA.
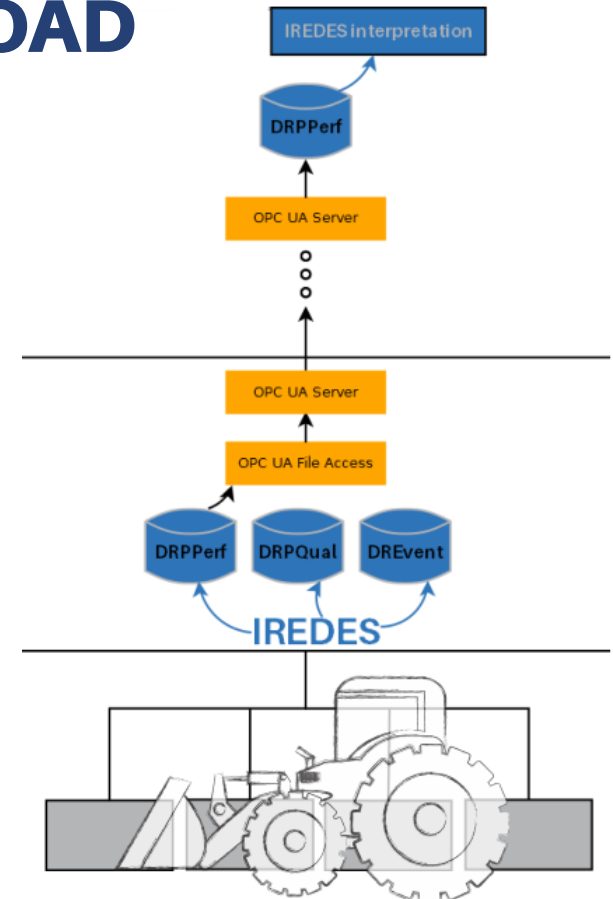
OPC UA

ERP — Level 4: Unternehmensebene

MES — Level 3: Betriebsleitebene

SCADA — Level 2: (Prozess-)Leitebene

SPS — Level 1: Steuerungsebene

Ein-/Ausgangssignale — Level 1: Feldebene

Fertigung / Produktionsprozess — Level 0: Prozessebene

Daten erfassen

Planen

OPC/UA ← IREDES content

Quelle: UlrichAAB - Eigenes Werk, CC BY 3.0,
https://commons.wikimedia.org/w/index.php?curid=16208781

IREDES REPORTS AS OPC UA PAYLOAD

- exchange of whole xml files

- sending reports per hour, per shift, per event

- machine and end user in IT department can create and read IREDES xml files and OPC UA is used only for whole files

IREDES ONLINE IN OPC UA

OPC UA uses the same technology as IREDES - basic of both standards is XML, so sending IREDES elements via OPC UA real-time objects is possible.
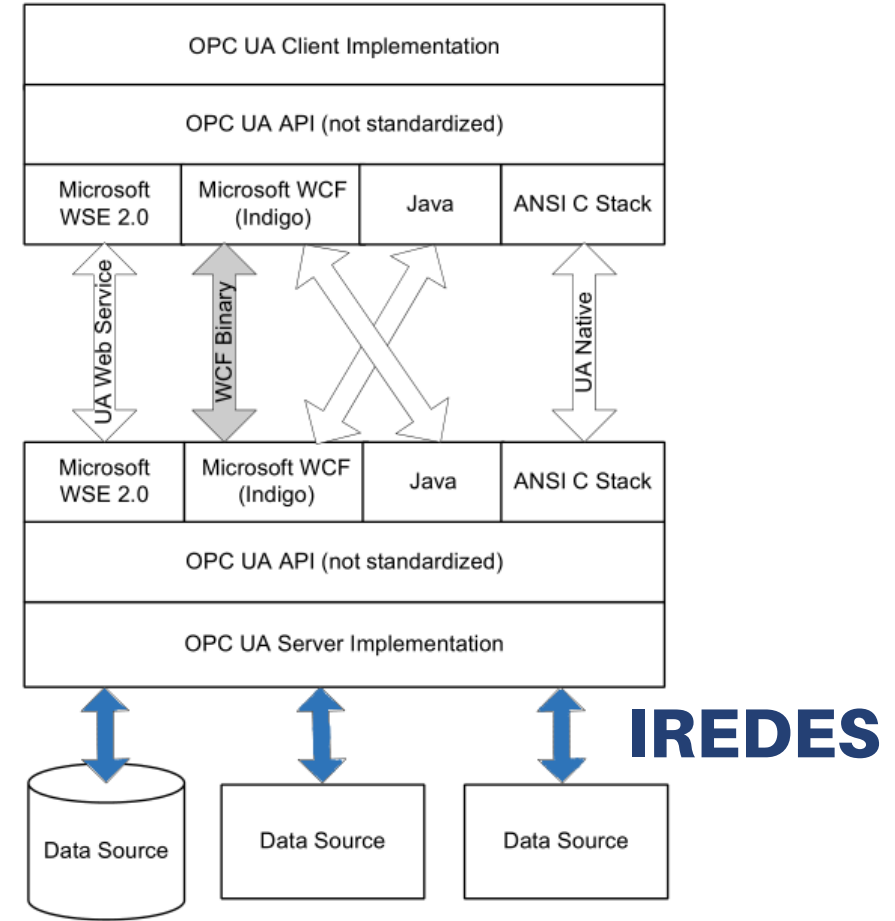
IREDES ONLINE IN OPC UA

IREDES can be sending in real time by OPC UA as an API standard
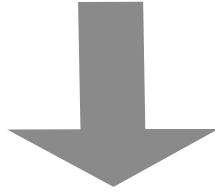
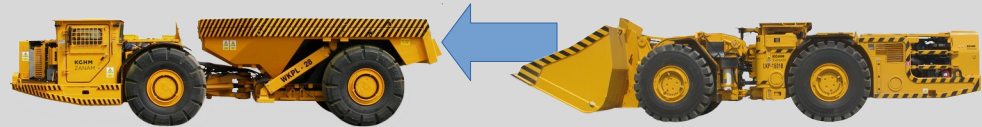Thanks to IREDES entire mobile machine profiles can be "*standardized*" even in OPC UA

IREDES

Examples

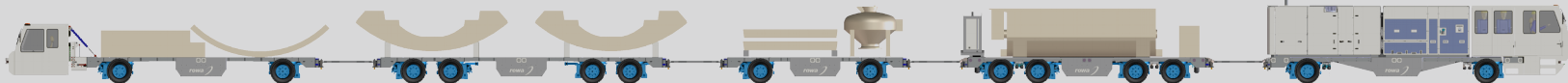IREDES on standard equipment

IREDES reports on KGHM – Zanam machines

M2M communication LHD - Truck

Off board communication on VirtuRail® Trains

IREDES on standard equipment

In use since 2001 on Drill Rigs,Trucks, Bolters etc. by major producers

Profiles supporting a variety of equipment:
Drill Rigs, Bolters, LHD's, Trucks, Chargers and others

Additional Profiles available for e.g.
structured messaging, open device tracking

Standardization organized by not-for-profit organization supported
by over 30 major global companies

IREDES AND OPC UA

IREDES Reports on KGHM-ZANAM machines

Standardized reporting for production follow up and service optimization

IREDES Server on the machine aggregates data and communicates ready-to-use information

Information stored in open databases accessible via IREDES for analysis and visualization

M2M communication LHD- Truck

Real Time automatic wireless exchange of load information from LHD to truck

Automatic recognition of the "*right*" truck to receive load information

Aggregated information to be transferred by truck to next WLAN node. LHD status may be added.

Off board communication on VirtuRail® Trains

VirtuRail® Trains are mechanically interconnected cars with all axles electronically steered to follow the first axle "*track-in-track*"

Radar / Laser assisted autonomous guidance in tunnel, even around 90° curve on 30m radius

On board data analysis and standardized communication to server in MobileTronics VPN

Once-a-week summary to operator for optimization of service

VirtuRail® is registered trademark of MobileTronics GmbH

CONCLUSION

- Standardization is the key to digitalization to keep interface cost at bay

- IREDES is a well established international up-to-date standard for mining

- OPC/UA is well suitable to integrate the mining specific IREDES schemas, which makes it obsolete to individually agree and interpret mining equipment specific content

- IREDES is open to any stakeholder in the industry to participate in standardization work

- Future work now covers the establishment of real time status profile definitions and the maintenance / extension of existing profiles

![IREDES - International Rock Excavation Data Exchange Standard]

THANK YOU

Get involved in IREDES!

Contact us for more information
and for implementations:
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www.iredes.org