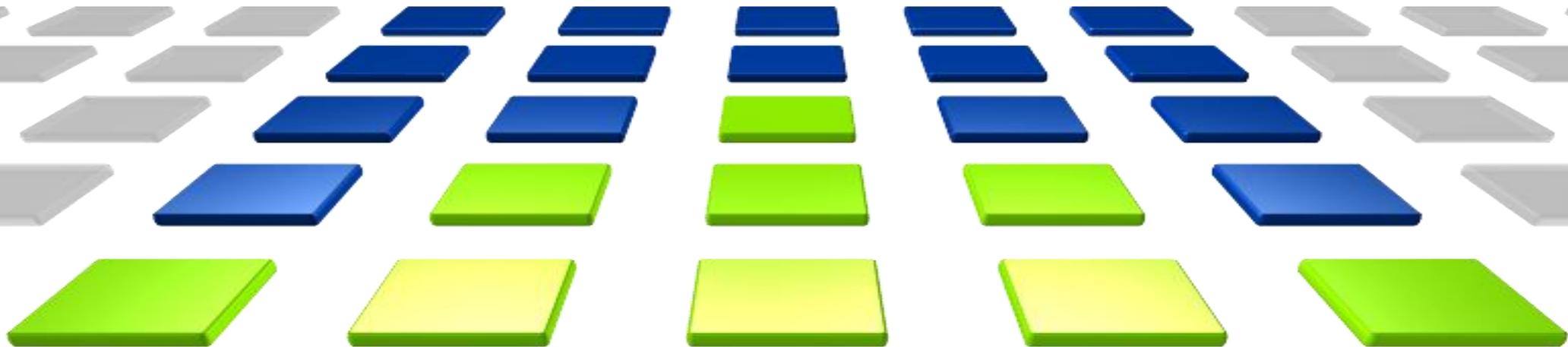# DINO: From IMS/DB to DB2

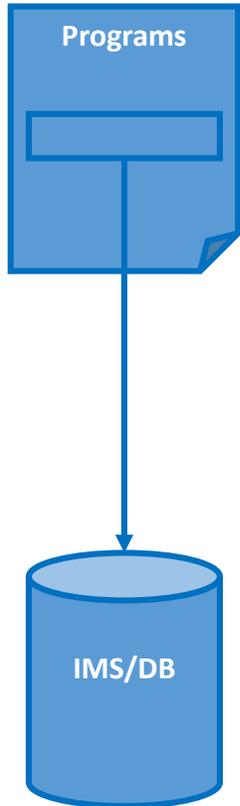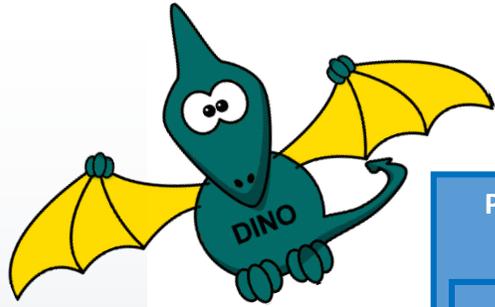## Provinzial realizes complete migration

Ablösung von IMS-Datenbanken

(Replacement of IMS databases)

The Perfect Way to Better Software

1

IMS-Guide: 14th May 2016

LVM, Münster, Germany

Programs

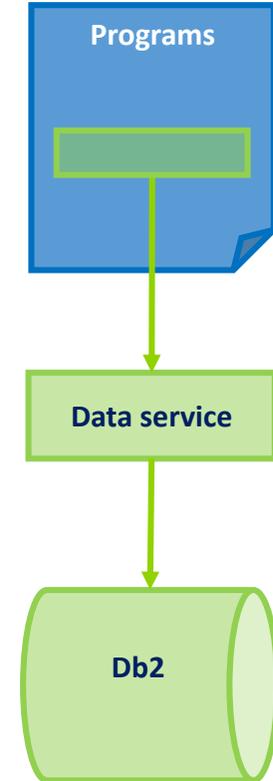**Automated transformation**

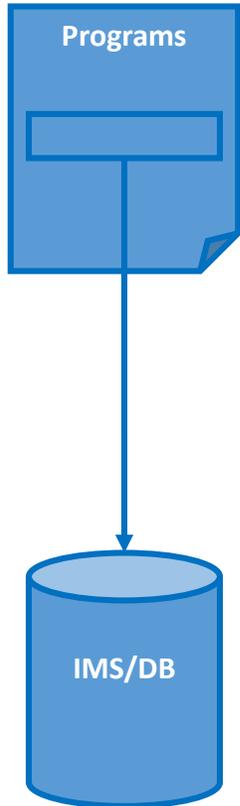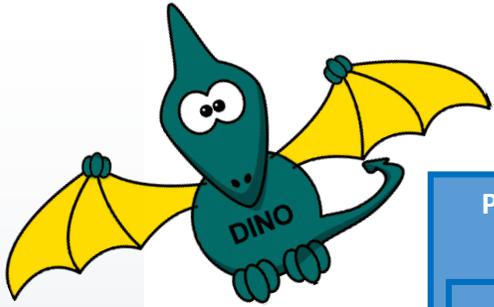**Programs**

IMS/DB

Data service

Db2

New data model according to Provinzial's requirements

No change to the application logic or the data structures

No disruption of regular maintenance and daily business!

Programs

Automated

Programs

Project data

> 16,500 COBOL programs
> 20,000 copybooks
> 25 million lines primary code
> 70 million lines expanded code
> 16,000 database accesses
> 75 IMS databases

Data service

New

Prov

No c   gic or
the c

N   enance
and daily business!

IMS/DB

Db2
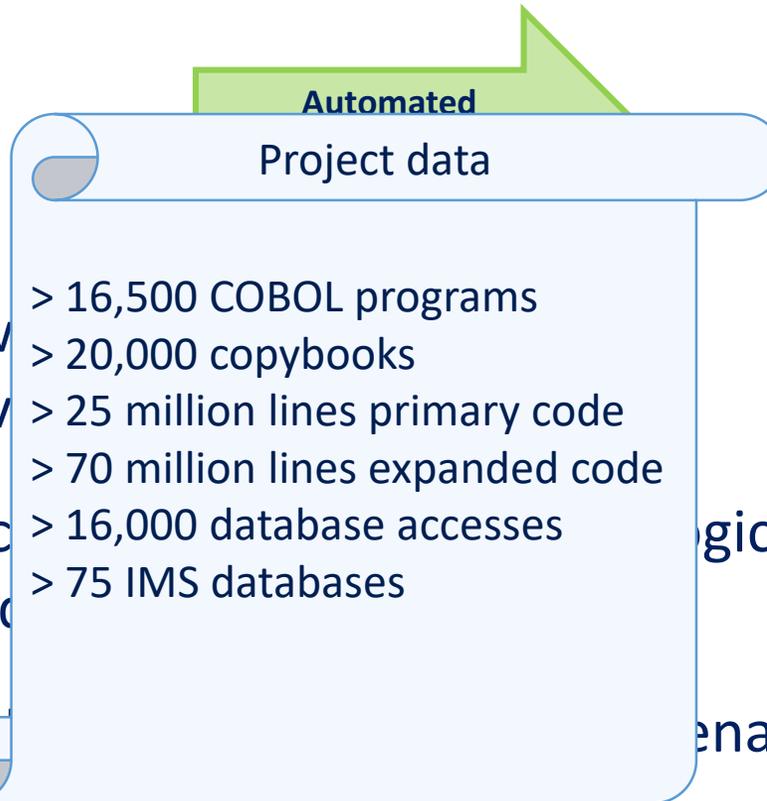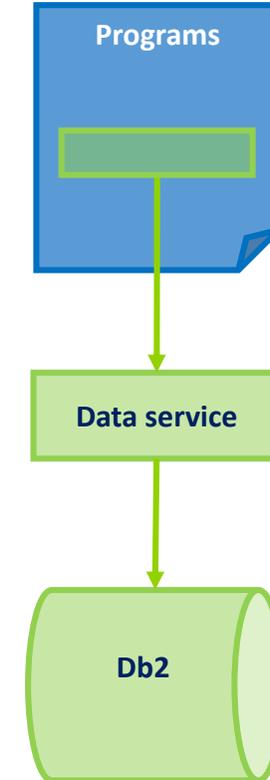
"Peopleware"

If you can tell the rules to somebody somewhere,

you should be able to define them for a computer.

If you don't know the rules,
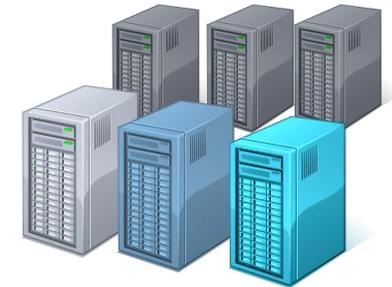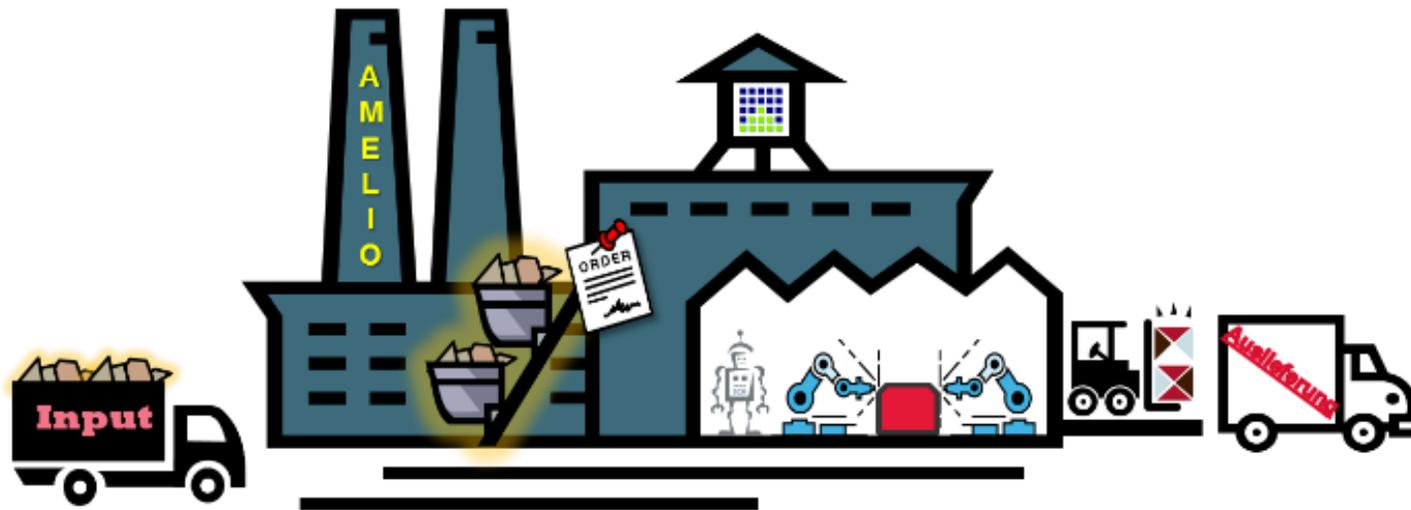
you would better hesitate to do anything at all.

Hard- and Software

Fully automated modernization production line
- Individually built with prefabricated configurable components
- Integrated - not a loose collection of "useful tools"
- Model-driven and rule-based

AMELIO Modernization Platform

Input
- COBOL
- PSB / DBD etc.
- IMS/DB

Detection IMS usage

Analysis- & transformation rules
- Specification
- Setup

Transformation
- Application of the rules

Datamodel
- Old → New

Coordination with Provinzial

Generation

Incremental development

Output
- Migrated sources
- Data accesses
- Test / Roll-out
- DDL
- Db2

Data-transformer
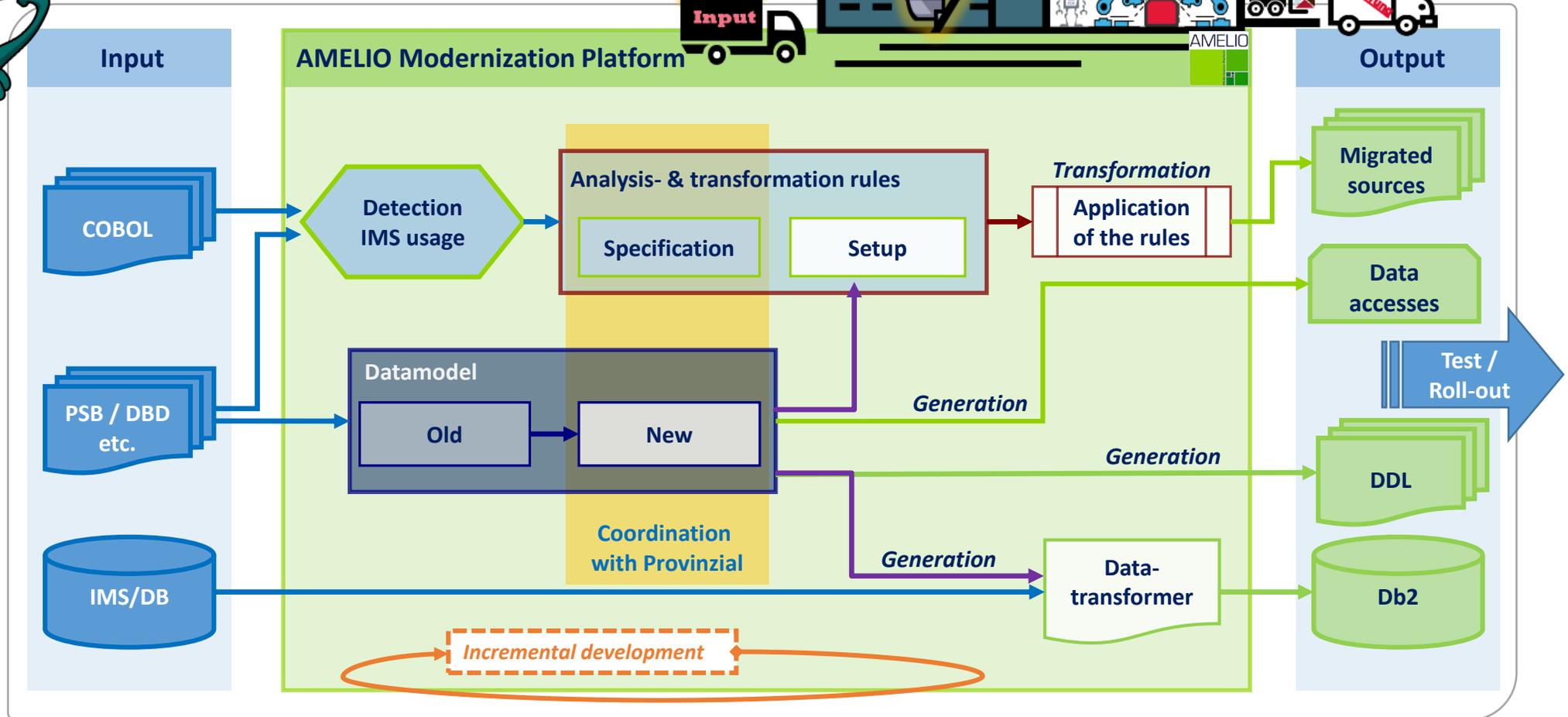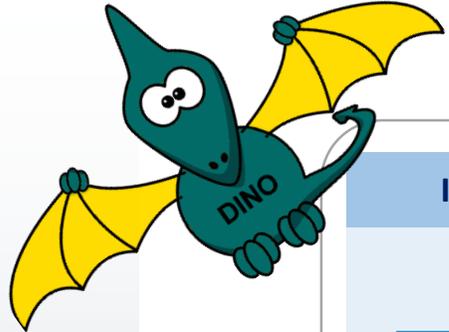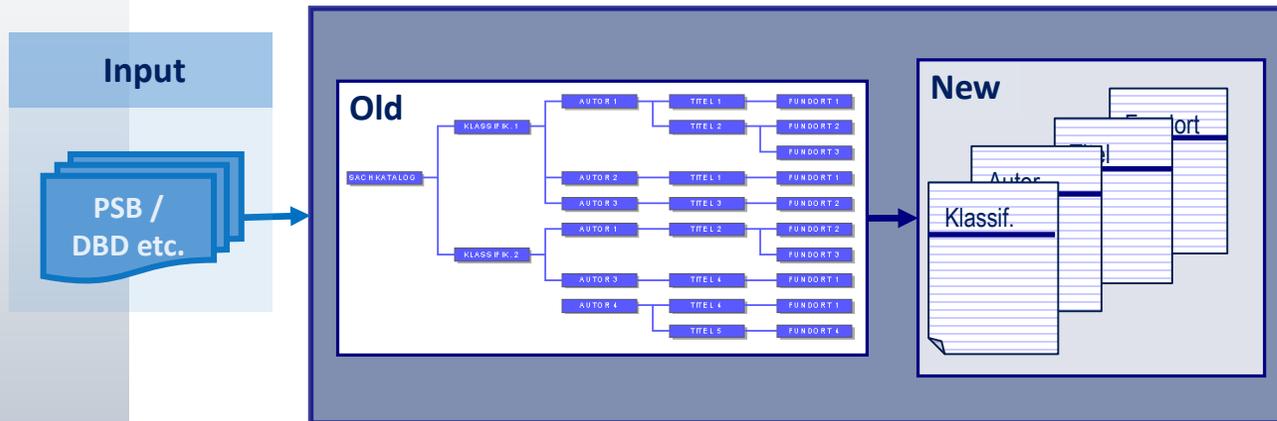
Creation of the new data model and the implementation rules

- Proposal was automatically derived from the knowledge of
  - existing database structures
  - possible segment contents
  - Specifications for the implementation of arrays, redefinitions, etc.
- Proposal was subsequently discussed and adapted together with Provinzial

During the project

- Adaptation of the data model
  - Technical specifications from the AE
  - Performance optimisation

Input

- COBOL
- PSB / DBD etc.

Detection IMS usage

Analysis- & transformation rules
- Specification
- Setup

Data model

Coordination with Provinzial

Transformation
- Application of the rules

Output
- Migrated sources
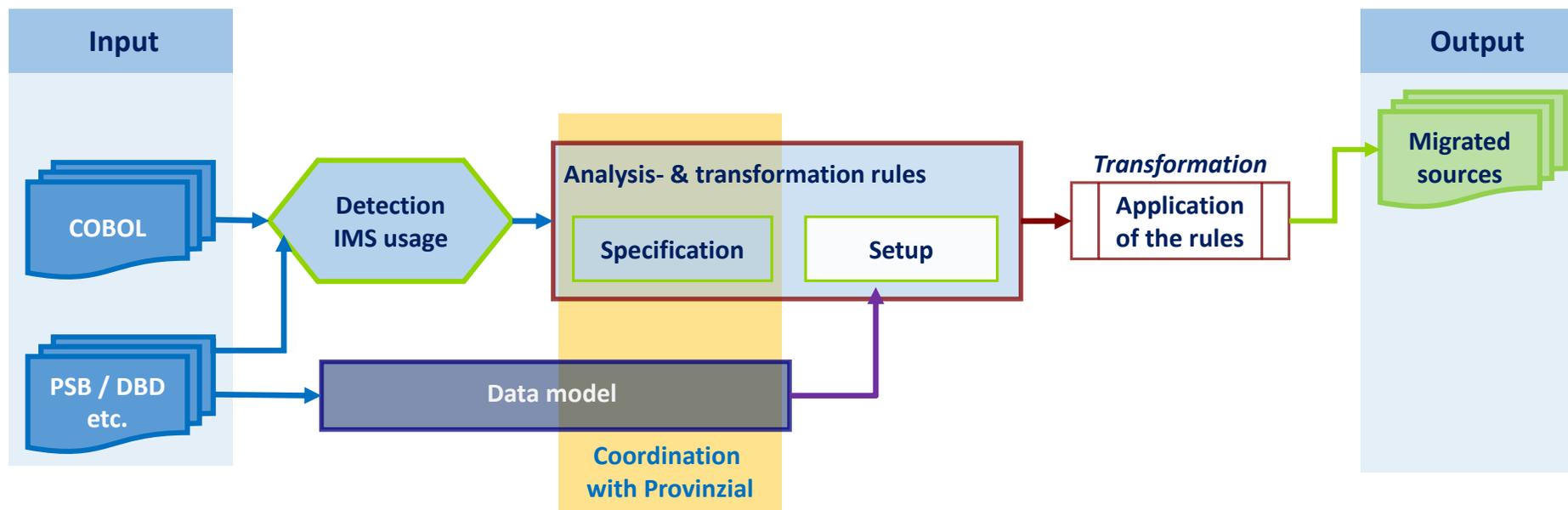
- Transformation of the database accesses in the programs and copybooks
  - Depending on the context and the new data model
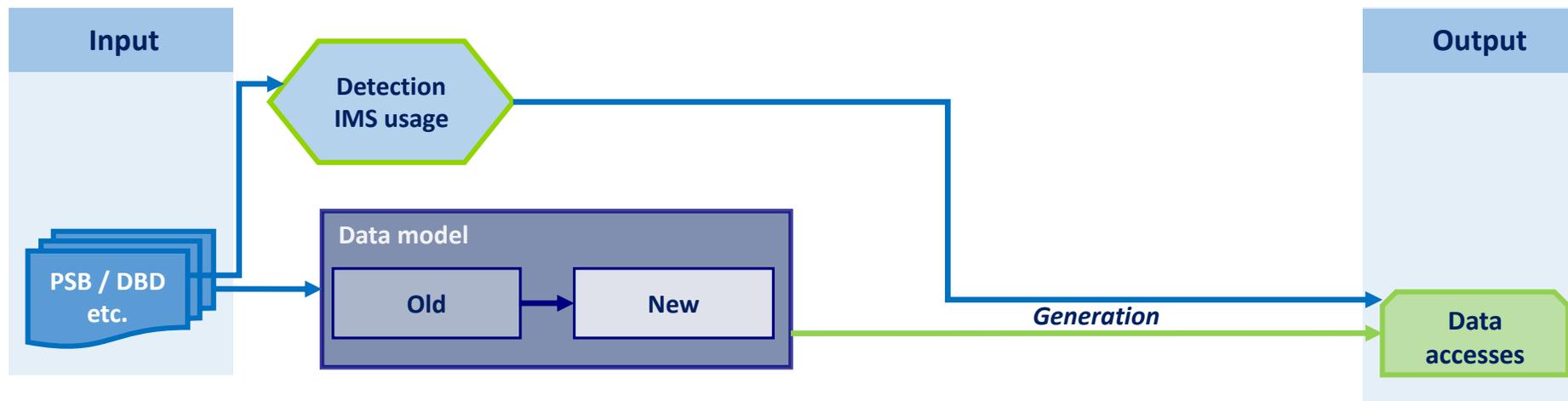
Challenge
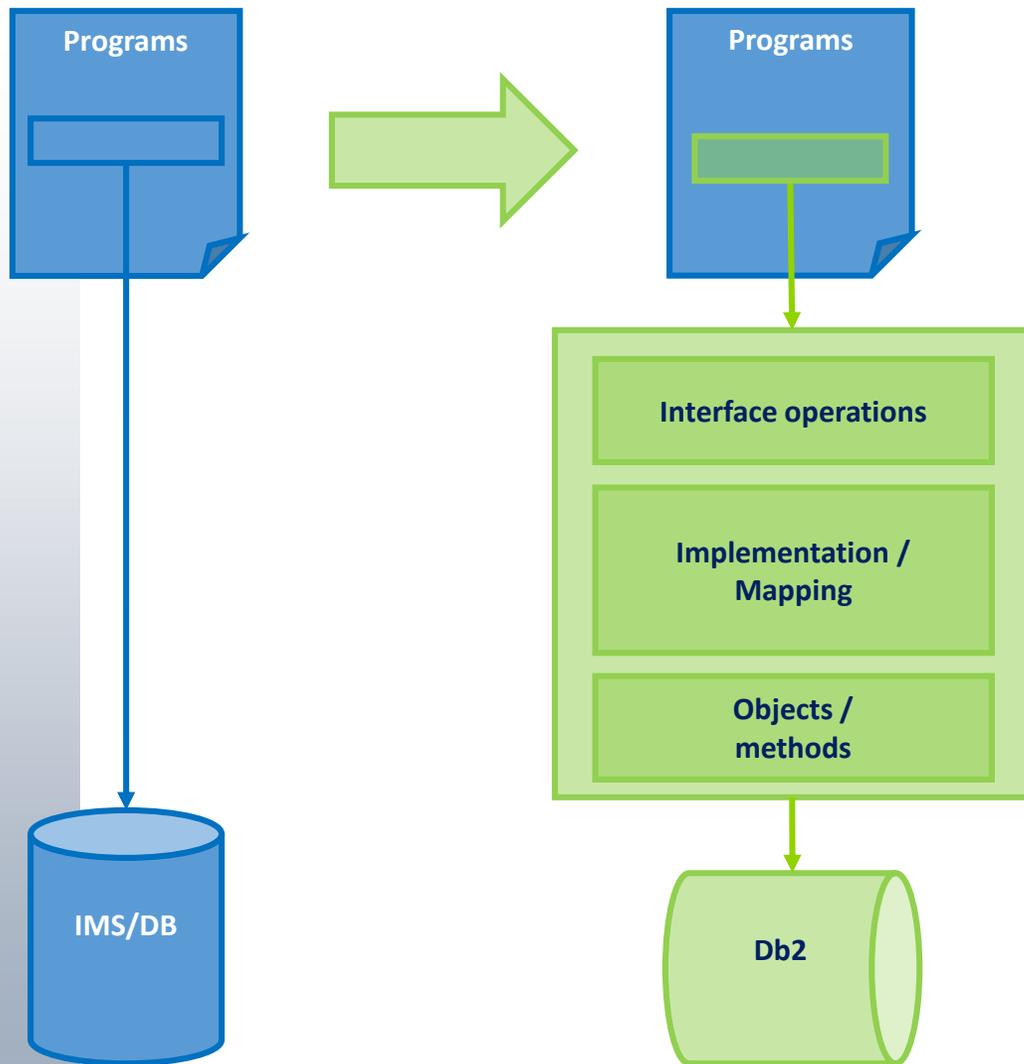
- Paradigm change: from hierarchical to relational
- Implicit definition of accesses vs. explicit language for formulating accesses
- Structural features such as ARRAYS, REDEFINES,...
- ➢ No 1:1 implementation possible
- BUT: Application logic and used data structures should not be changed!

- Services provide data from relational DB – as expected by the program
  - despite paradigm change
- SQL-specific coding completely encapsulated in the service
- IMS usage in the program determines accesses of the service
- IMS PCB information is emulated (e.g. ReturnCode, ConcatKey)
- Static SQL if possible
- Standardised error handling
- Automatically generated, manually maintainable, compliance with Provinzial-specific coding guidelines

Programs

Programs

Interface operations

Implementation / Mapping

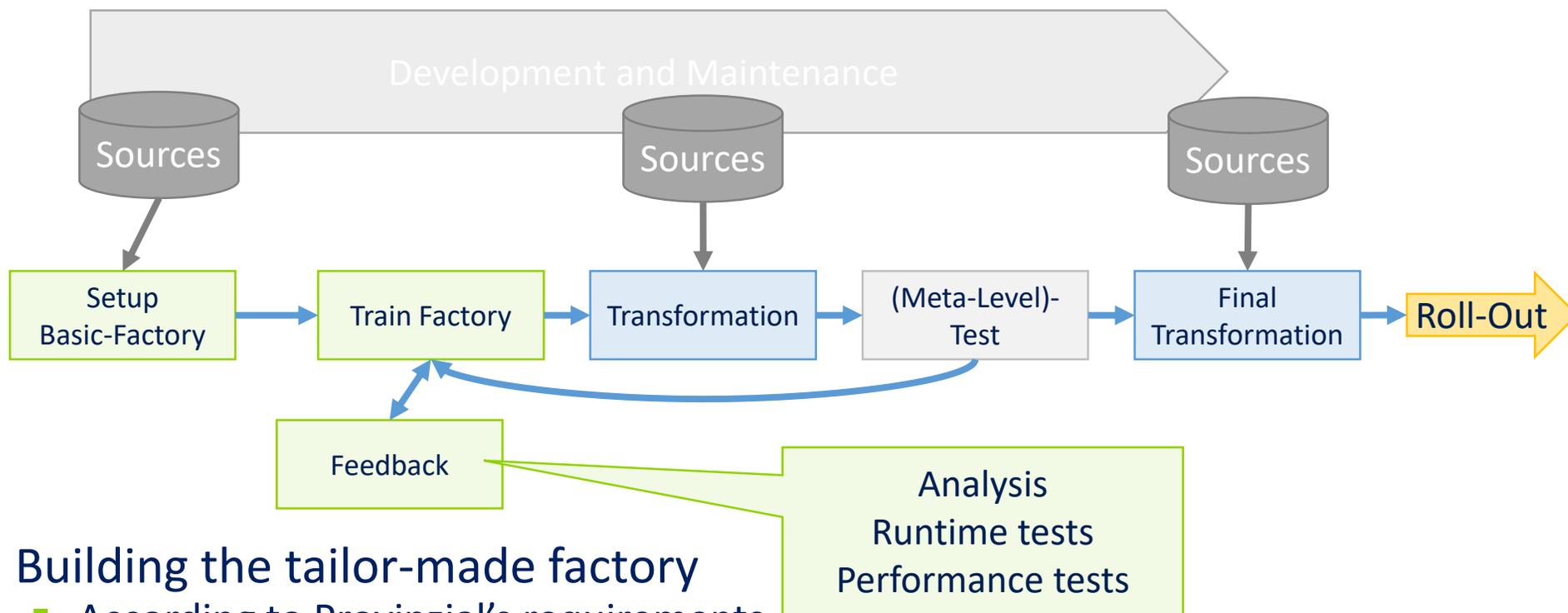**Objects / methods**

IMS/DB

Db2
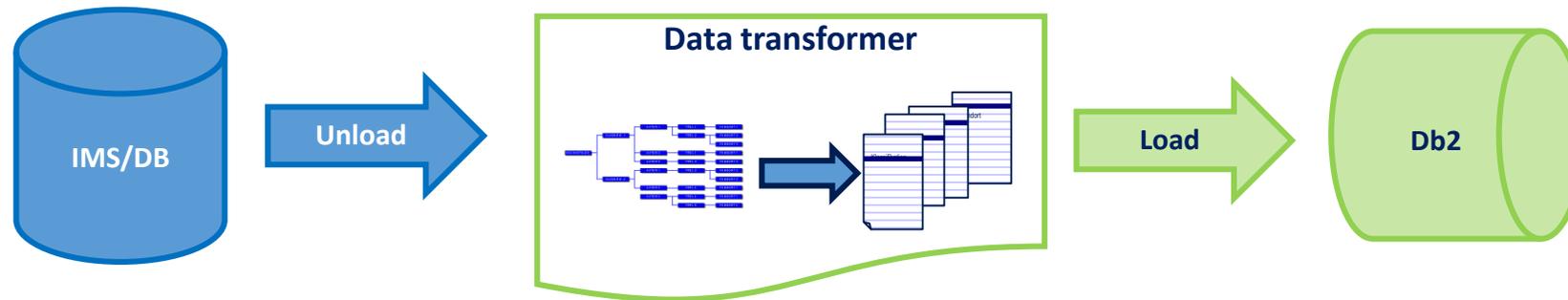
Task

- Transfer hierarchically stored data into a relational database
- Adaptation according to the new data model
    - No 1:1 transformation, instead individual for each IMS file

Generation of programs for the transformation of the data sets

- On the basis of existing mapping rules

Advantages

- Application and data transformation use the same data models
    - Changes to the data models have automatically and identically affected the application and data transformation

PROVINZIAL

Development and Maintenance

Sources

Sources

Sources

| Setup Basic-Factory | → | Train Factory | → | Transformation | → | (Meta-Level)-Test | → | Final Transformation | → | Roll-Out |

Feedback

Analysis
Runtime tests
Performance tests

Building the tailor-made factory

- According to Provinzial's requirements
- parallel to regular development and maintenance
- Packet-wise according to Provinzial's specifications
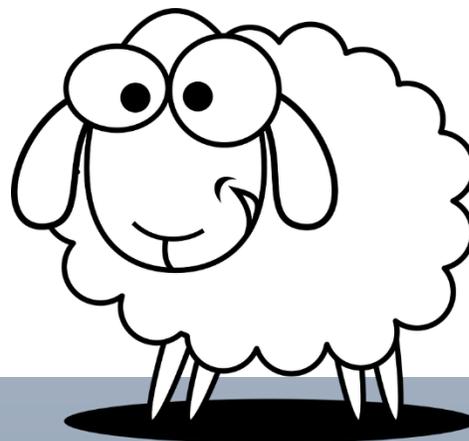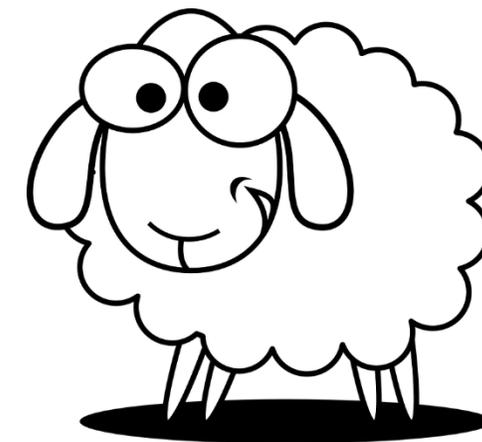- strategy can be changed or adapted at any time
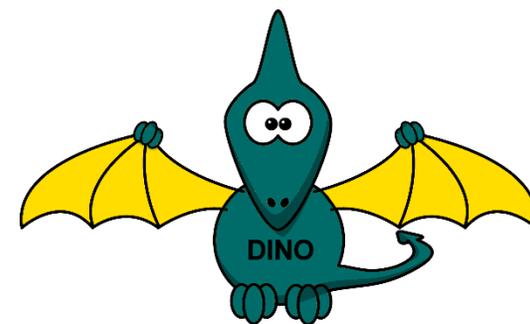
DINO

The principle:

If a factory implements a rule correctly once,
it will always implement it correctly

Tests of all change rules
- … <u>not</u> of all changed programs

Performed with a selected, complete test set
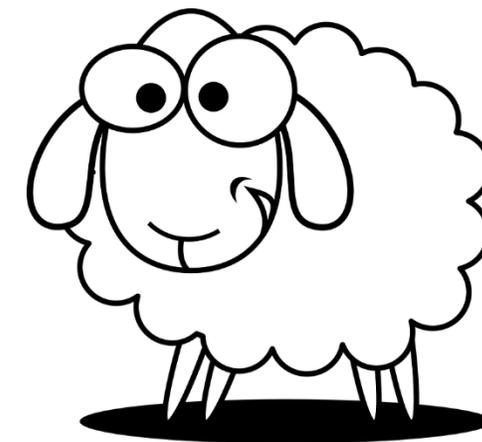- Test set automatically determined
- Combination of all rules

Name	Datenban	Funktion	OperationName	
Prog1	DBA	DLET	DELETEOBJECT	
Prog1	DBA	GHU	GU-QU-PK-EQ-LOCK	
Prog2	DBA	GHU	GU-QU-PK-EQ-LOCK	
Prog3	DBA	GHU	GU-QU-PK-EQ-LOCK	
Prog1	DBA	GN	GN-NQ	
Prog2	DBA	GN	GN-NQ	
Prog2	DBA	GN	GN-QU-SE3-EQ	
Prog1	DBA	GU	GU-NQ	
Prog1	DBA	GU	GU-QU-PK-EQ	
Prog2	DBA	GU	GU-QU-PK-EQ	
Prog3	DBA	GU	GU-QU-PK-EQ	
Prog1	DBA	ISRT	INSERTOBJECT	
Prog1	DBA	REPL	UPDATEOBJECT	

The principle:

If a factory implements a rule correctly once,
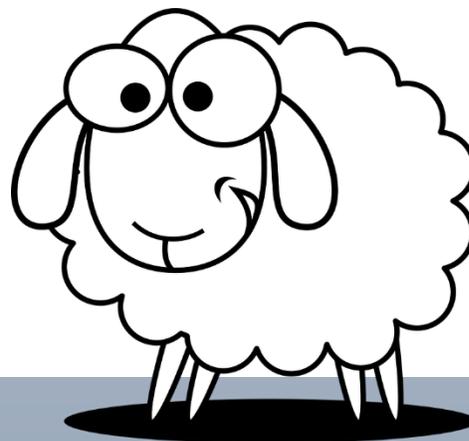it will always implement it correctly

Tests of all change rules
- ~~set of all changed programs~~

Per...

Factory performs coverage analysis
- Which artefacts were transformed?
- Which transformation variant was applied to which artefact?

| Name	Datenban	Funktion	OperationName
Prog1	DBA	DLET	DELETEOBJECT
Prog1	DBA	GHU	GU-QU-PK-EQ-LOCK
Prog2	DBA	GHU	GU-QU-PK-EQ-LOCK
Prog3	DBA	GHU	GU-QU-PK-EQ-LOCK
Prog1	DBA	GN	GN-NQ
Prog2	DBA	GN	GN-NQ
Prog2	DBA	GN	GN-QU-SE3-EQ
Prog1	DBA	GU	GU-NQ
Prog1	DBA	GU	GU-QU-PK-EQ
Prog2	DBA	GU	GU-QU-PK-EQ
Prog3	DBA	GU	GU-QU-PK-EQ
Prog1	DBA	ISRT	INSERTOBJECT
Prog1	DBA	REPL	UPDATEOBJECT

Security and quality

- Due to 100% complete automation
- Clean room concept
    - Fully automated and controlled processes
    - No "contamination" due to manual intervention
- No personal style, no dependence on daily form
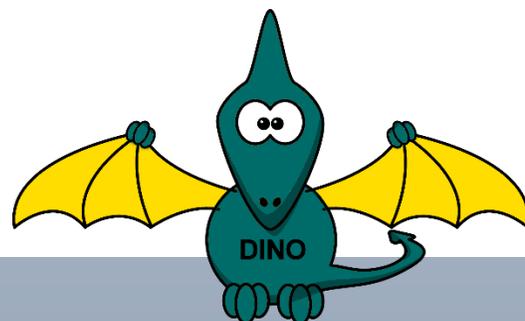- Reproducible, comprehensible

Security mechanisms

- Documentation
- Switches
- Verify
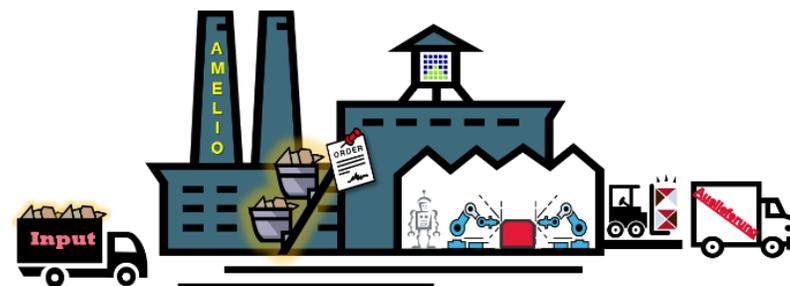
"The rule-based transformation with the concept of parallel operation of data storage in production supplemented by deviation controls also convinced our auditors and fulfilled all regulatory requirements."

Stephan Kaiser, Program'sponsor' Provinzial

Every implemented change is marked in the code by means of a special comment

```
*A_DOUBLE_VARNAME : C_CONFIRM: T_DOUBLE_VARNAME [RhHOyo_sU_113]    AM=REF
*         DISPLAY ' VNR PRUEFEN VERS.-SUMME ' BHS-0102-VNR-X        AM=UDL
          DISPLAY ' VNR PRUEFEN VERS.-SUMME ' BHS-0102-VNR-X OF     AM=UIN
          DBOE2100-1-G                                              AM=UIN
     END-IF.                                                        INS-C1C2
```

Name changing rule

Replacing
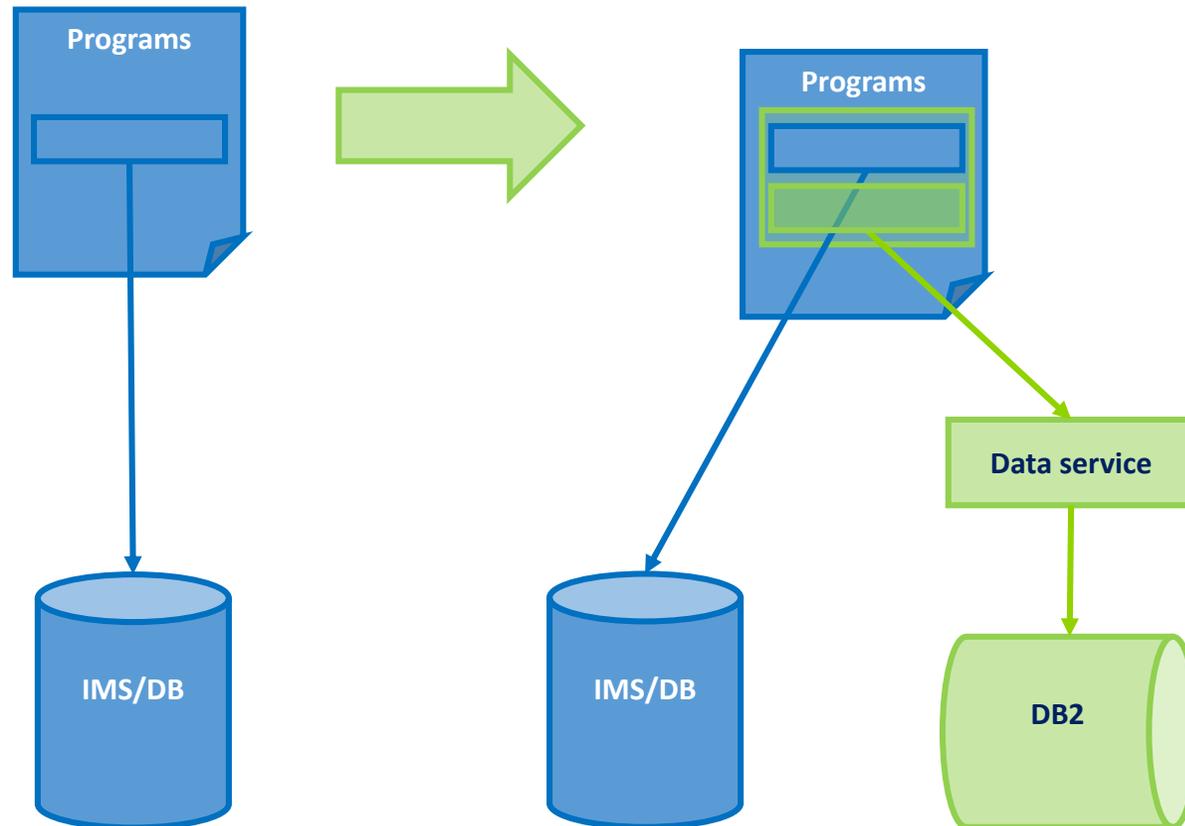
```
*A_DLI_CALL_CBLTDLI : C_CONFIRM: T_CBLT [IhH7cnxsF_79]             AM=REF
*    CALL 'CBLTDLI' USING GHU-X BK2-NN2-PHY-PCB-G STATISTIK-G       AM=DEL
*                    SSA-BK2-Q-G                                    AM=DEL
     MOVE 2 TO PROG-NOOFIMSCALL-D                                   AM=INS
     MOVE 'STATISTIK' TO PROG-SECNAME-X                            AM=INS
```
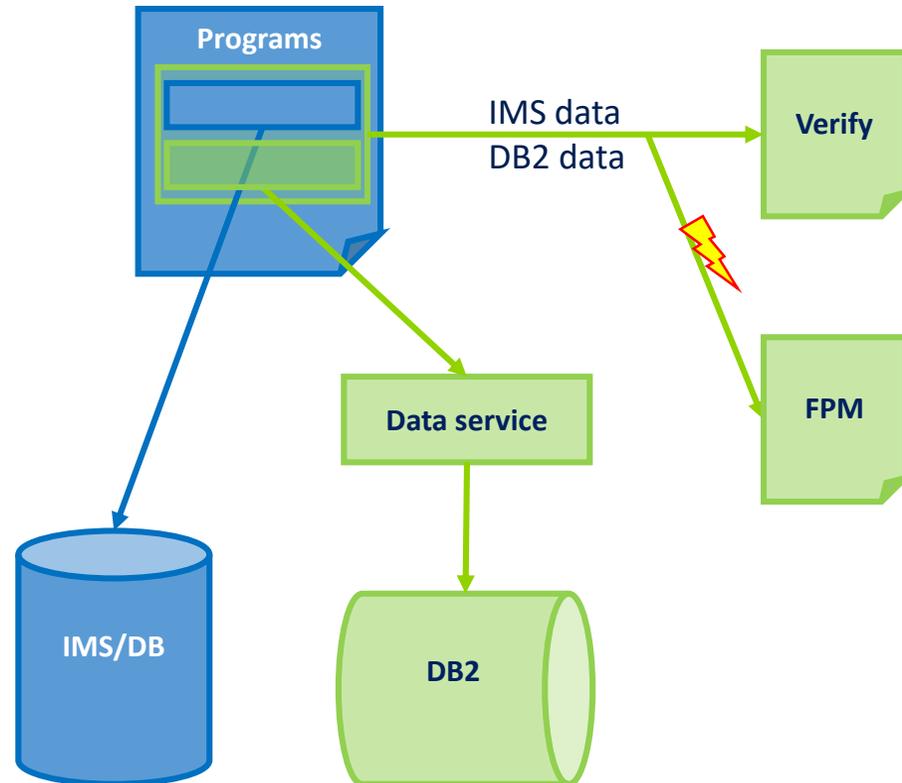
Line(s) deleted

Line(s) inserted

Switch

- Parallel accesses to IMS/DB and Db2
- Switch settings
  - 1: Only IMS/DB access
  - 2: IMS/DB- and Db2 access, IMS/DB leading
  - 3: IMS/DB- and Db2 access, Db2 leading
  - 4: Only Db2 access
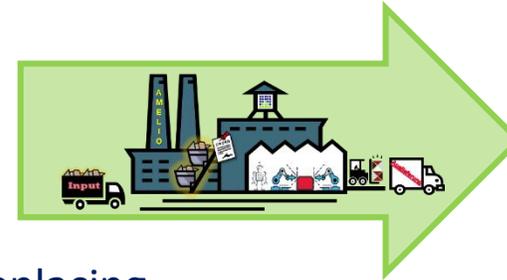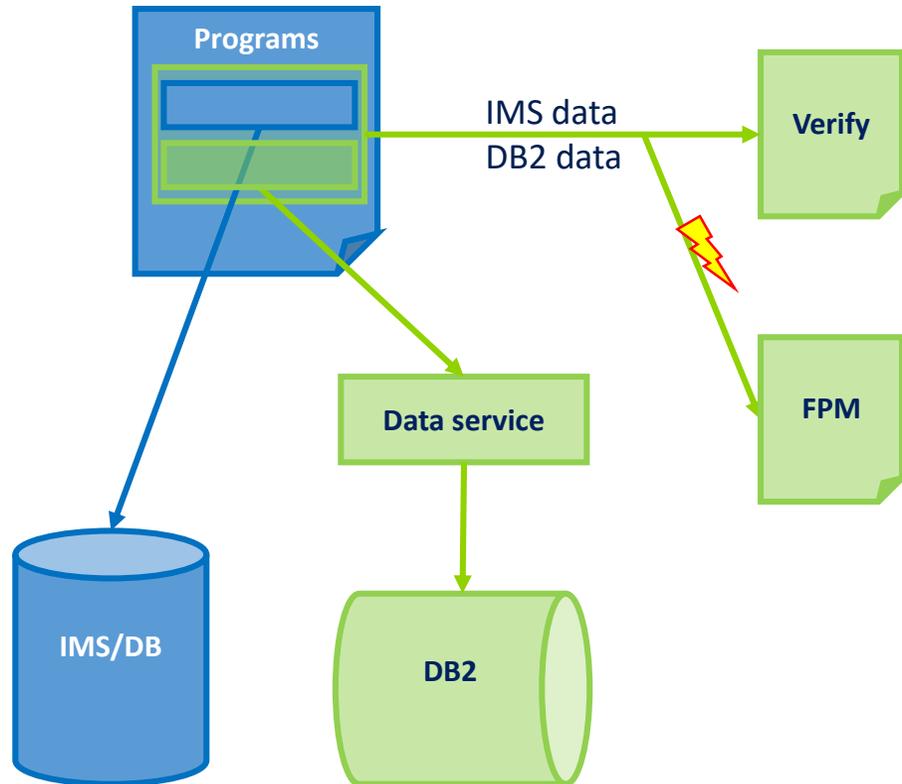- One separate switch per IMS/DB

Verify
- During parallel performance of IMS/DB and DB2 (switch setting 2 und 3)
- Automatic comparison of the data to be processed
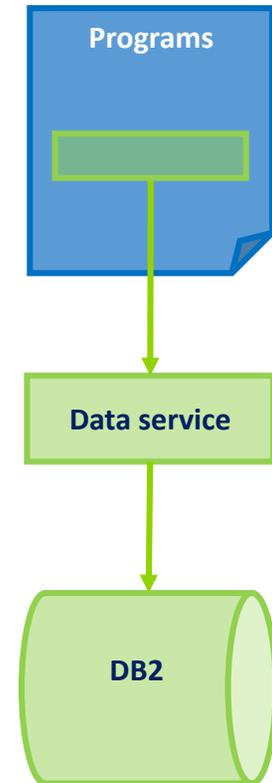 - Incl. consideration of special cases (e.g. low-value vs. zero)
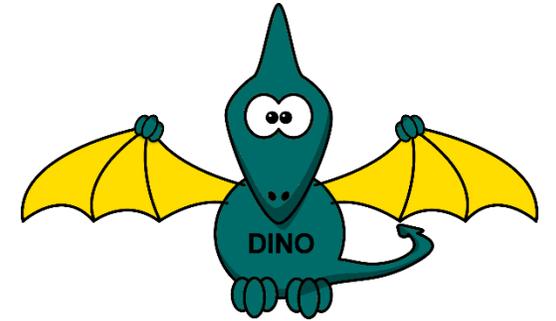
Error Protocol Module (EPM)
- Complete and detailed documentation of the differences

Replacing
- Coding for switch/Verify etc.
- IMS/DB specific coding e.g. AIB calls
- PCB structures in the main programs are copied from the LINK area into the working storage and equipped with the corresponding default values.
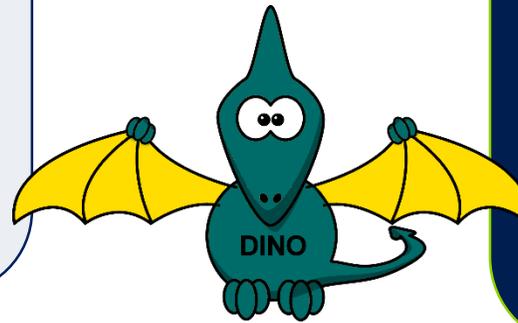- …..

Through automation

- ✓ Tailor-made: solution and processes adapted to Provinzial's requirements
- ✓ Flexibility: strategy changes regarding solutions and process during the project
- ✓ Security: Reproducible, testable and comprehensible (also for auditors)
- ✓ Performance: Provinzial and Delta were able to achieve defined performance goals together
- ✓ No disruption to maintenance, further development and day-to-day operations

… and above all thanks to the great cooperation!

"We were impressed by the efficiency and flexibility the AMELIO factory was set up and continuously optimised with. The very good and close cooperation with the Delta managers and employees also contributed significantly to the success of the project."
Ralf Prediger, Provinzial Project Manager

"The Delta solution has its advantages in two points that are particularly important to us: Due to the complete automation of the transformation, the ongoing development of the system, as requested by the business, was uninterrupted during the entire project. Due to the in-place migration and a parallel operation concept, we achieved absolute security and quality during the migration. The guaranteed operational "smoothness" in the project, despite the complex modernization, is certainly a unique feature of the solution."
Stephan Kaiser, Program'sponsor' Provinzial

"Thanks to Delta's transformation strategy, Provinzial succeeded in migrating absolutely securely from IBM IMS to IBM Db2. At the same time, this solution gave us absolute flexibility, as components that had already been transformed and those that had not yet been transformed could be used productively together without any problems."
Ralf Prediger, Provinzial Project Manager

- **Provinzial realizes complete migration from IBM IMS/DB to IBM Db2 with Delta**
  https://delta-software.com/link.php?en=7329

You can find further information on our website:
delta-software.com
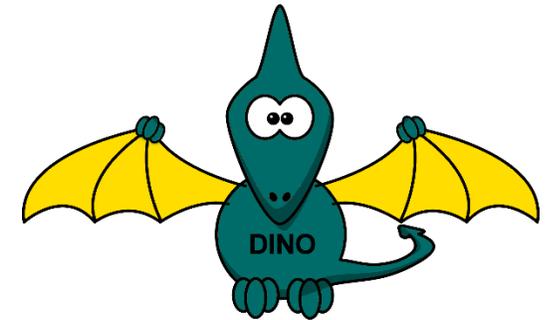
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