Replacing IBM IMS/DB
–
Fully Automated and with Highest Security

Delta Software Technology
13.02.2024

The perfect Way to better Software

About me

Daniela Schilling

- Master and PhD in computer science – University of Paderborn
- Several years in automotive industries
- Delta Software Technology
  - 2011: Product owner
  - 2013: CEO
- My fields of interest
  - Automated reengineering, modernization and software evolution
  - Concepts
  - Projects
  - Presentations, e.g. Guide Share Europe

Why replacing IMS/DB?

Reasons meantioned by our customers

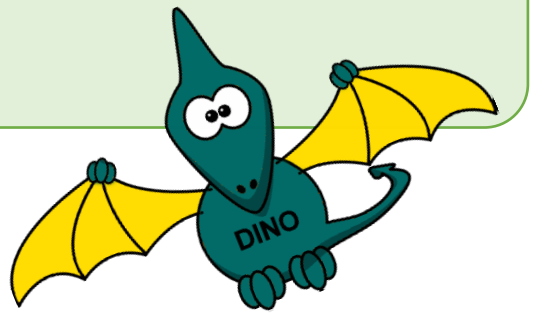
- Parallel usage of different technologies
  - Effort and costs
  - Complexity and restrictions
- Limited availabilty of data
- Platform change
- Dwindling knowhow
- …

Two customer examples: DINO and GoBIMS

PROVINZIAL

DINO: Project facts

- 36.500 Sources (COBOL-programs + copybooks)
- 70 Mio Lines expanded code
- 16.000 database accesses
- 75 IBM IMS-databases



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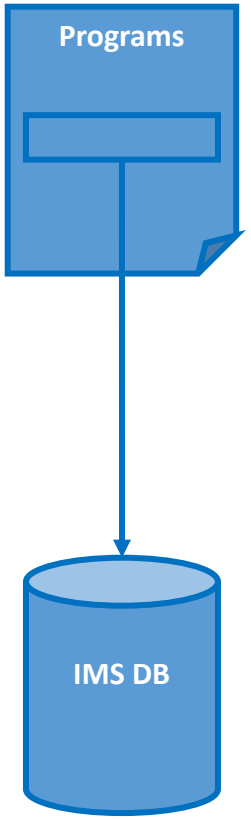
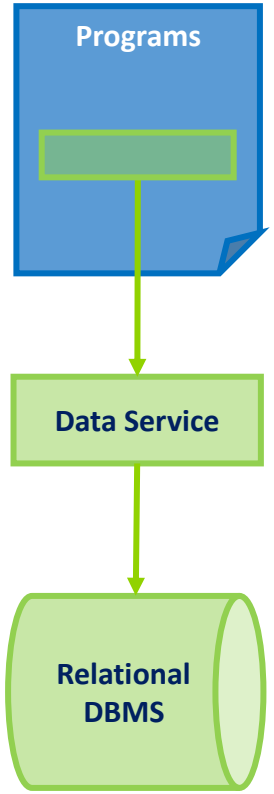
Gothaer

GoBIMS: Project facts

- 45.000 Sources (COBOL & Delta ADS)
- 50 Mio Lines expanded code
- 5.500 database accesses
- 447 IBM IMS-databases (incl. history)
  - 358 replaced by Delta

Challenges and Requirements





New data model according to customer‘s requirements

Despite of paradigm change:
No change of application logic or datastructures

No restrictions of regular maintenance and daily business!

Automation Assumption

“Peopleware”

If you can explain the rules
to somebody somewhere,

you should be able to define
them for a computer.

If you don't know the rules,

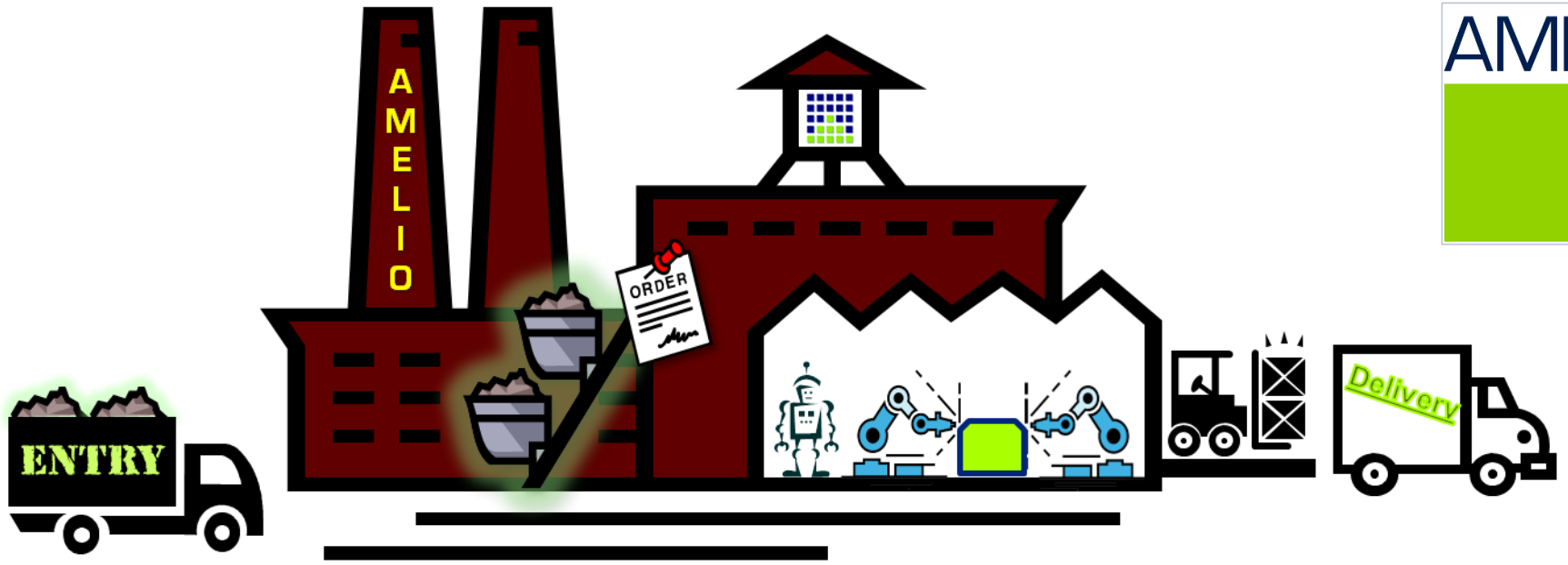
you would better hesitate
to do anything at all.

Hard- and Software

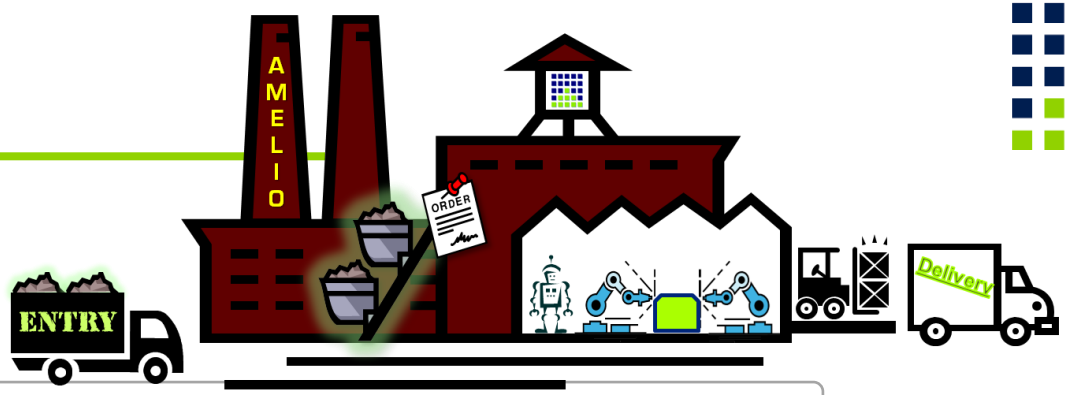
AMELIO Modernization Platform

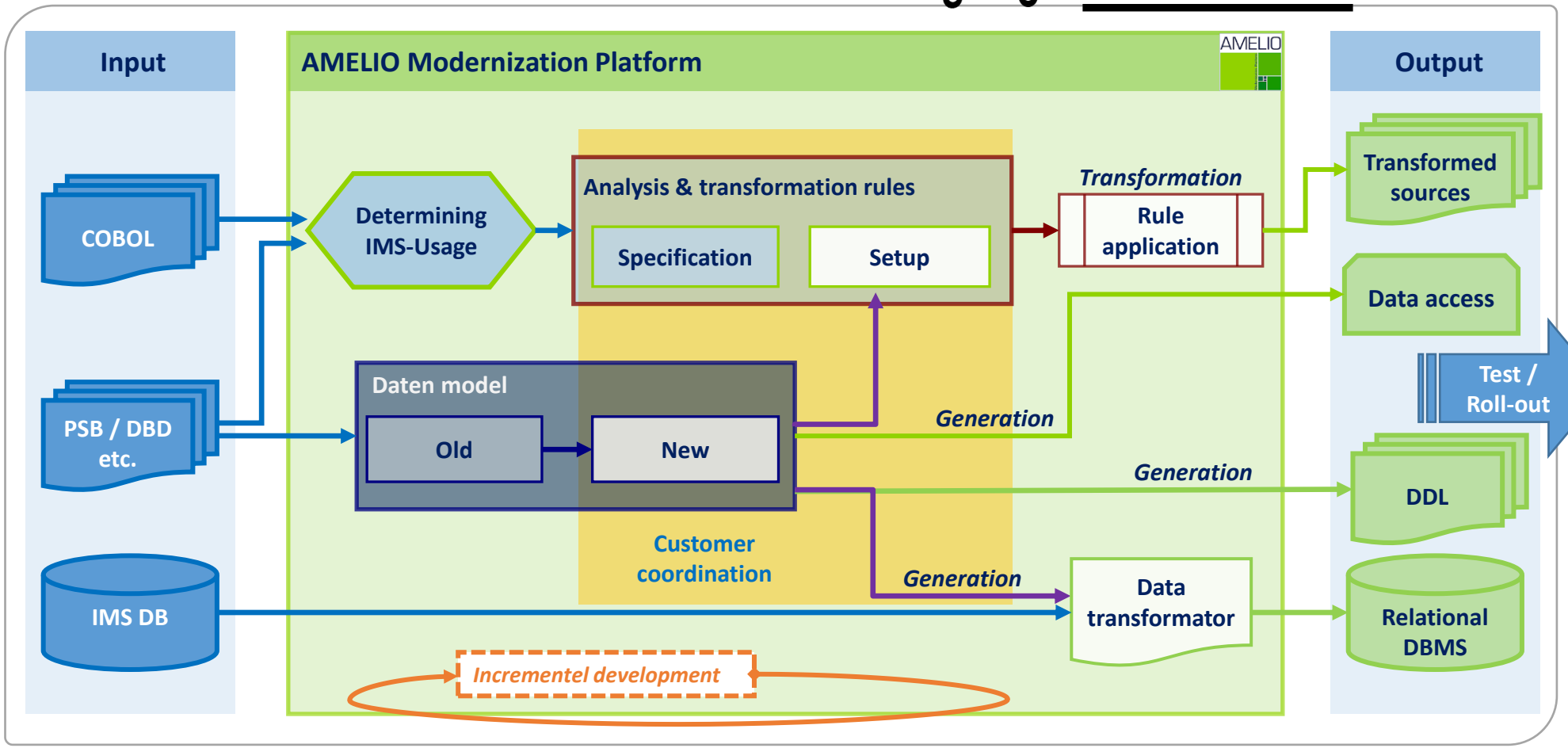
Fully automated modernization factory

- Individually made from prefabricated configurable components
- Clean Room-concept
  - Completely automated and controlled processes
- Model-driven and rule-based

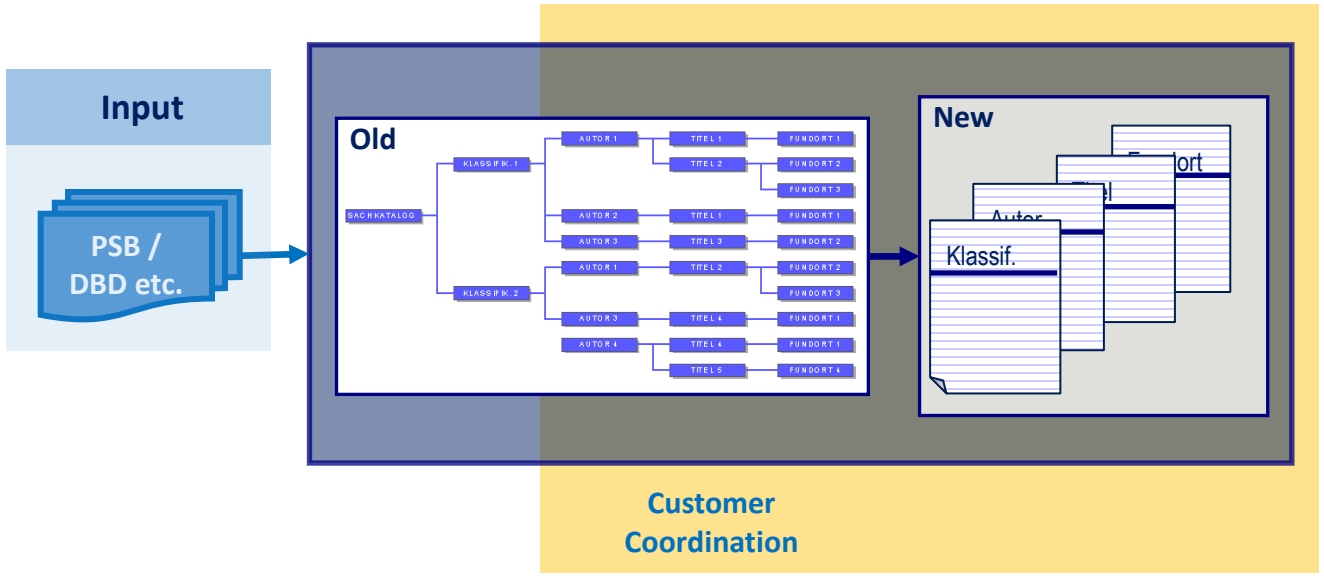


The Factory


AMELIO
ORDER
ENTRY
Delivery


Input
AMELIO Modernization Platform
AMELIO
Output
COBOL
PSB / DBD etc.
IMS DB
Determining IMS-Usage
Analysis & transformation rules
Specification
Setup
Daten model
Old
New
Customer coordination
Transformation
Rule application
Generation
Generation
Generation
Data transformator
Incrementel development
Transformed sources
Data access
Test / Roll-out
DDL
Relational DBMS

Defining the new Data Model



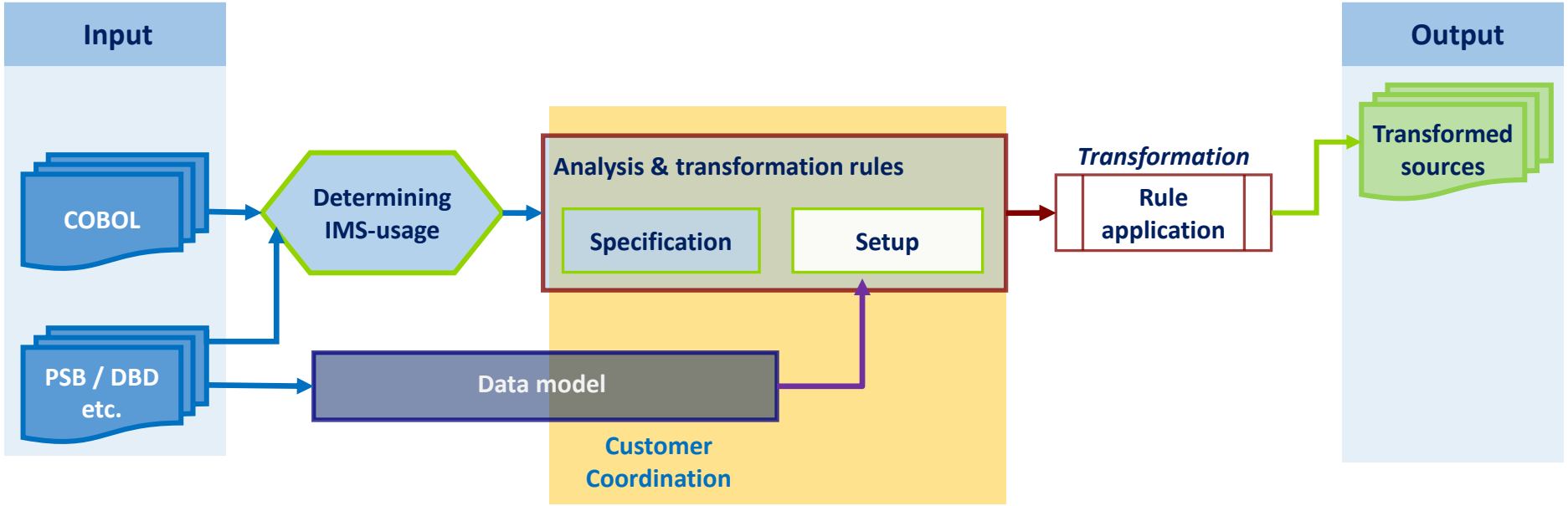
Defining the new data model and implementation rules

- Automated derivation of a proposal for a new data model using knowledge about
  - Existing database structures
  - Possible segment content
  - Demands for implementation of arrays, redefines, etc.
- Proposal will be discussed and adapted with customer

During the project

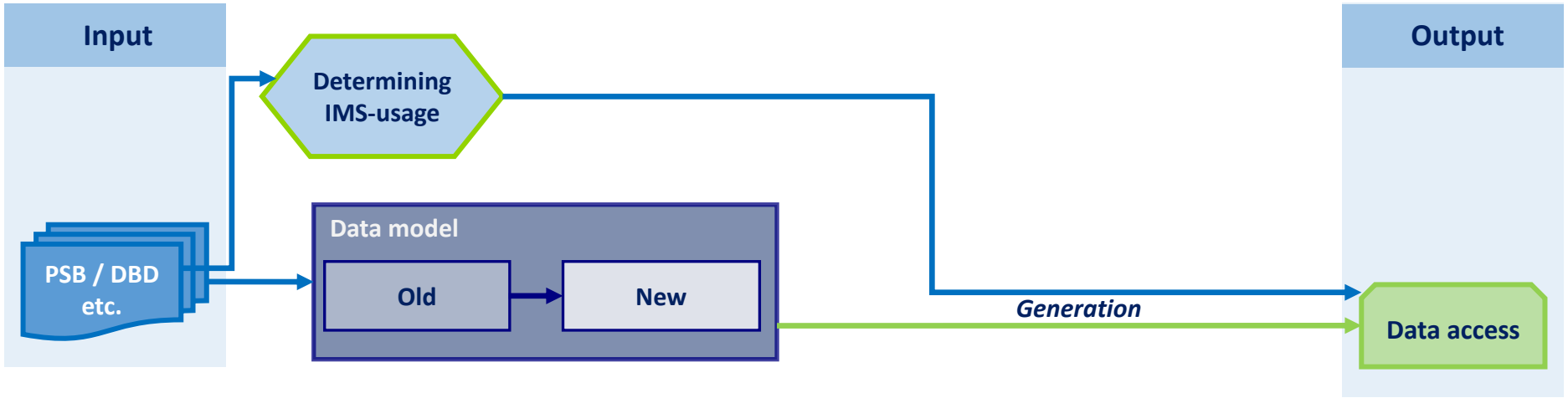
- Adaptation of the data model
  - Technical demands of application development
  - Performance optimization
  - …

Application transformation



- Transformation of database accesses within programs and copybooks
  - Dependent on the context and the new data model

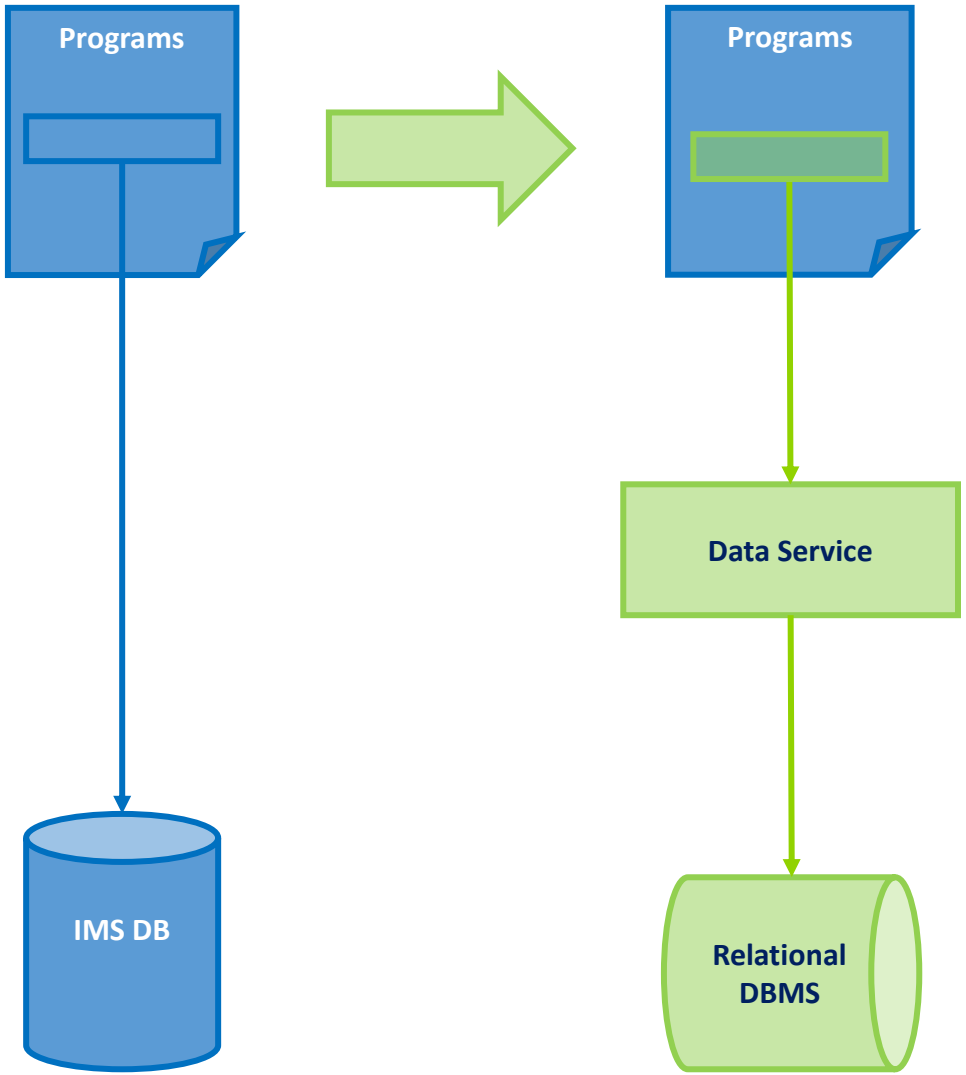
Generating database accesses



Challenges

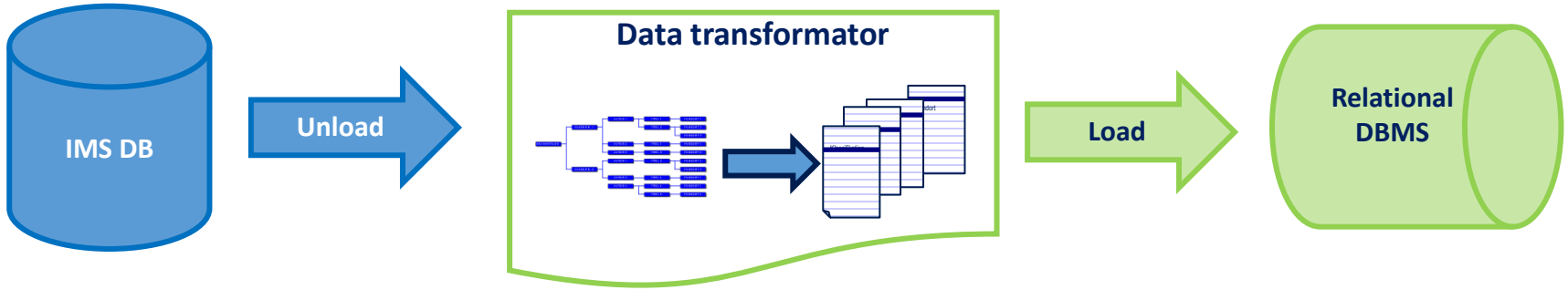
- Paradigm change: from hierarchical to relational
- Structural characteristics as ARRAYS, REDEFINES,…
- ➢ 1:1-transformation not possible
- BUT: application logic and used data structures may not be changed!

Data services



- Services handle data from relational database as expected by the program
  - Despite change of paradigm
- SQL-specific coding completely encapsulated within the service
- IMS-usage in programs determine accesses contained in the service
- IMS PCB informationen get emulated (e.g. ReturnCode, ConcatKey)
- Static SQL if possible
- Standardised error-handling
- Can be generated automatically, have to be maintainable manually, have to fullfill customer-specific coding standards

Optional: Data Migration



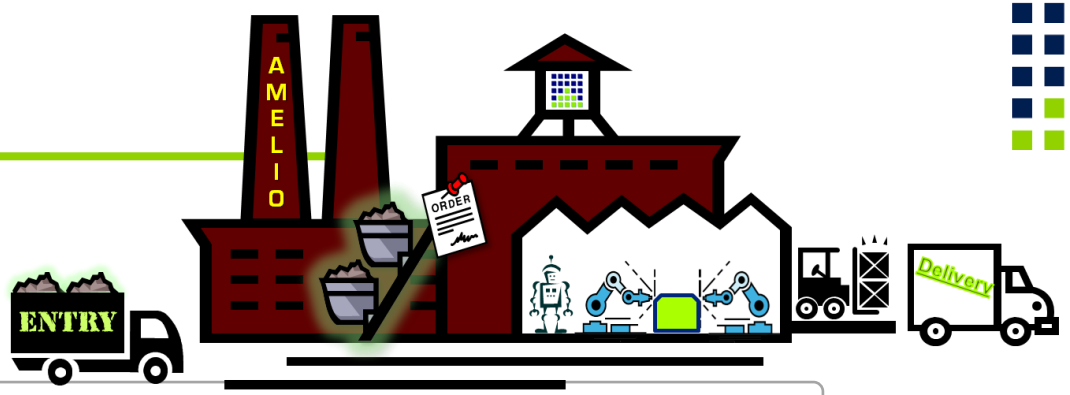
Program generation to transform the data sets

- Using existing mapping rules

Advantages

- Usage of the same data models for application and data transformation
  - Changes to the data model update the application and data transformator synchronously
- Documentation of data transformation
  - Numbers
  - Errors

The Factory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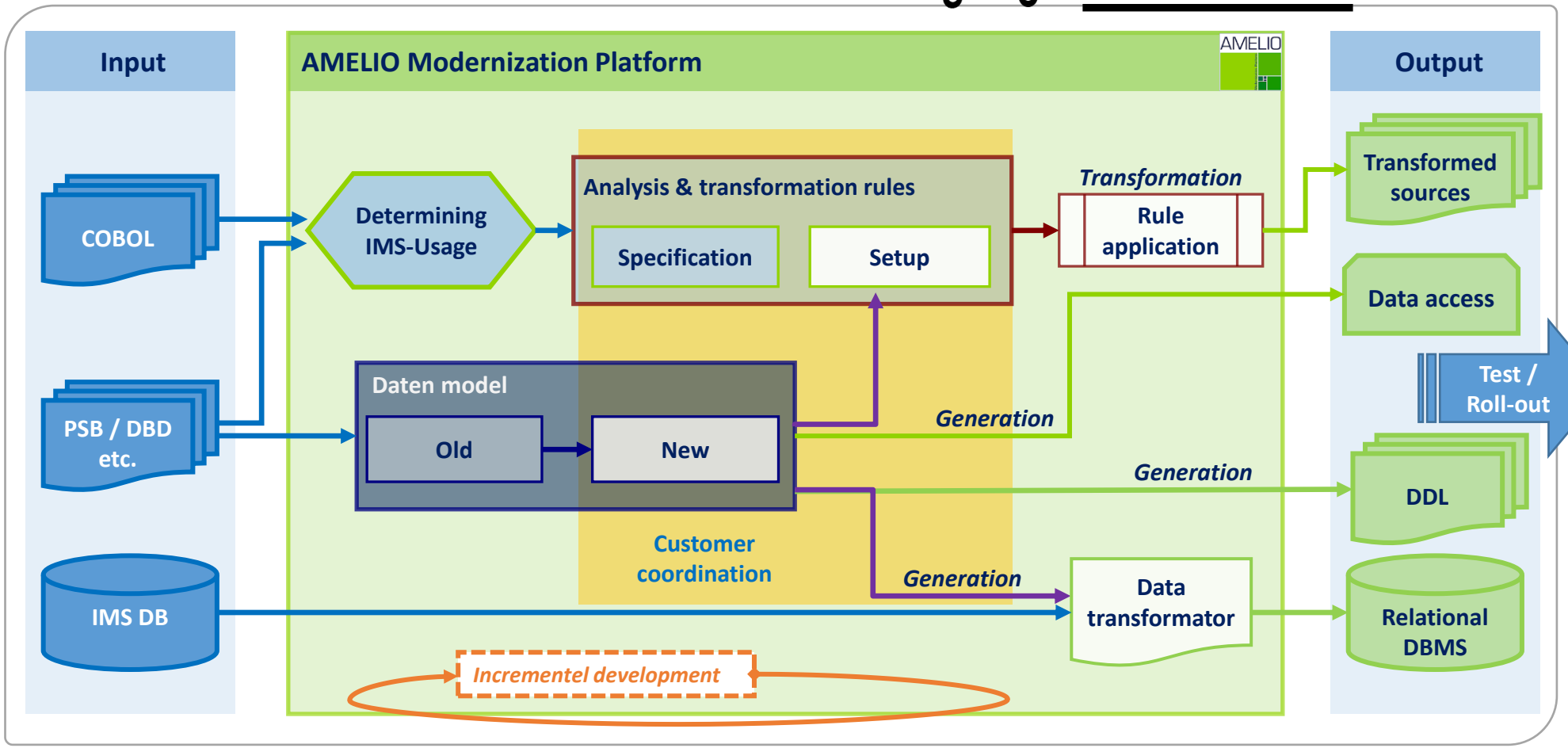
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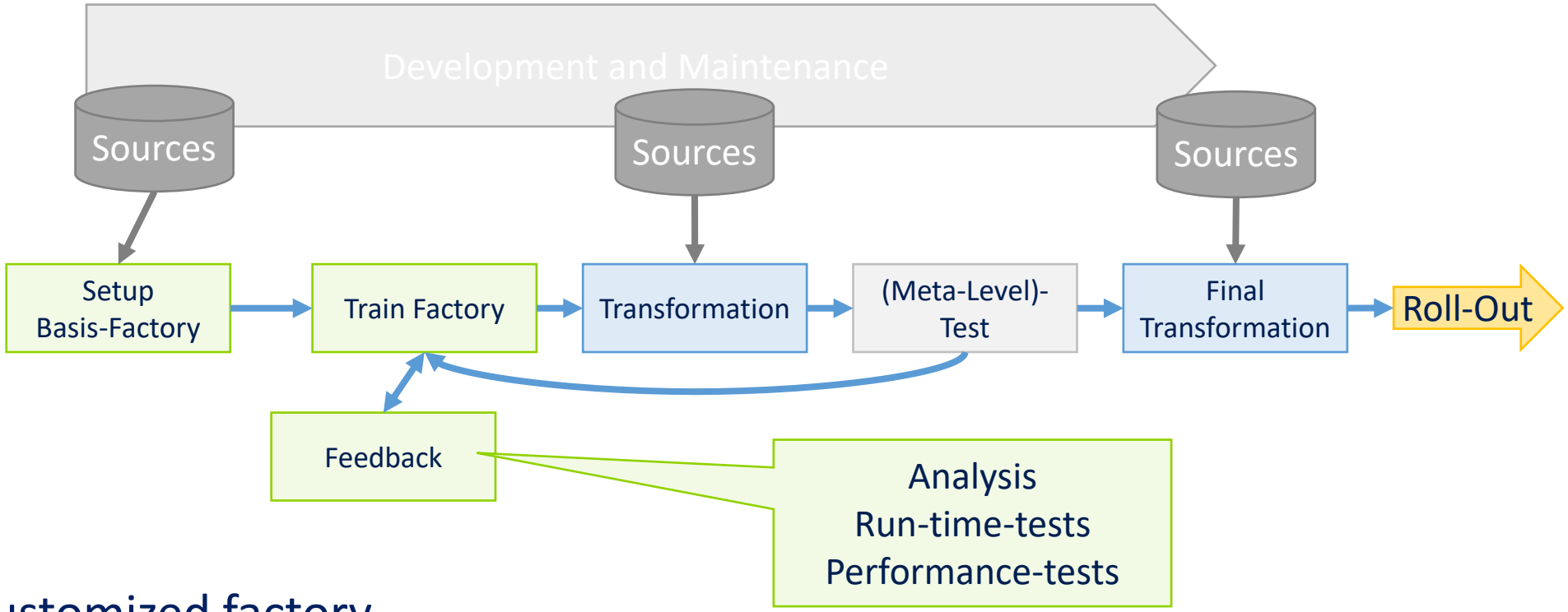
Setup the Factory



Setup a customized factory

- According to customer‘s requirements
- Parallel to ongoing development and maintenance
- Package-wise according to customer‘s demands
- Strategy change or adaptation possible at any time of the project

Test strategy: Meta-Level-Test

The principle:

if an automaton applies a rule correctly once,
it will always apply it correctly

Tests of all transformation rules

- … not of all changed programs

Performed on a selected, complete test-set

- Automatically determined test-set
- Combination of all rules

Name	Data Base	Function	Operation Name
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-LOCK
Prog2	DBA	GU	GU-QU-PK-EQ-LOCK
Prog3	DBA	GU	GU-QU-PK-EQ-LOCK
Prog1	DBA	ISRT	INSERTOBJECT
Prog1	DBA	REPL	UPDATEOBEJCT

Factory performs coverage-analysis

- Which artifacts got transformed?
- Which transformation rule was applied to which artifact?

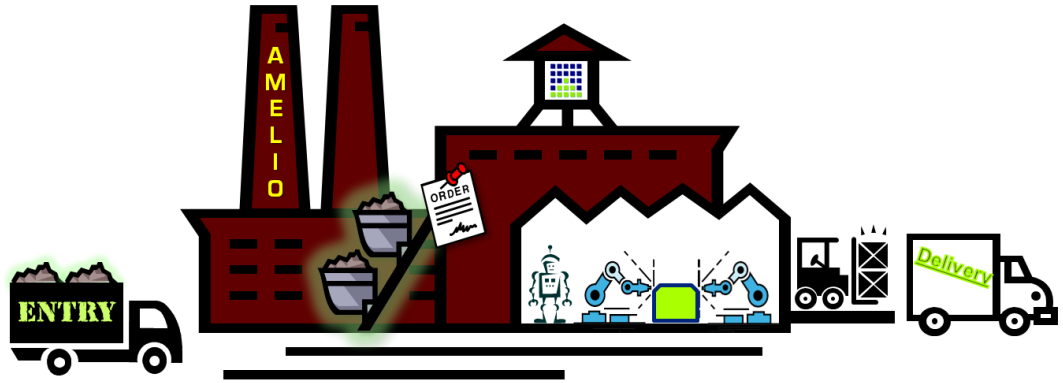
Quality and Security

Quality and Security

- By 100% automation
- Clean-Room-Concept
  - Completely automized and controlled processes
  - No „contamination“ by manual intervention
- No personal style, no dependency of daily form
- Reproducable, comprehensible

Security Mechanisms

- Documentation
- Optional: Switches and Verify



Documentation of Changes

Each performed code change can be automatically marked

```
*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 of the change rule

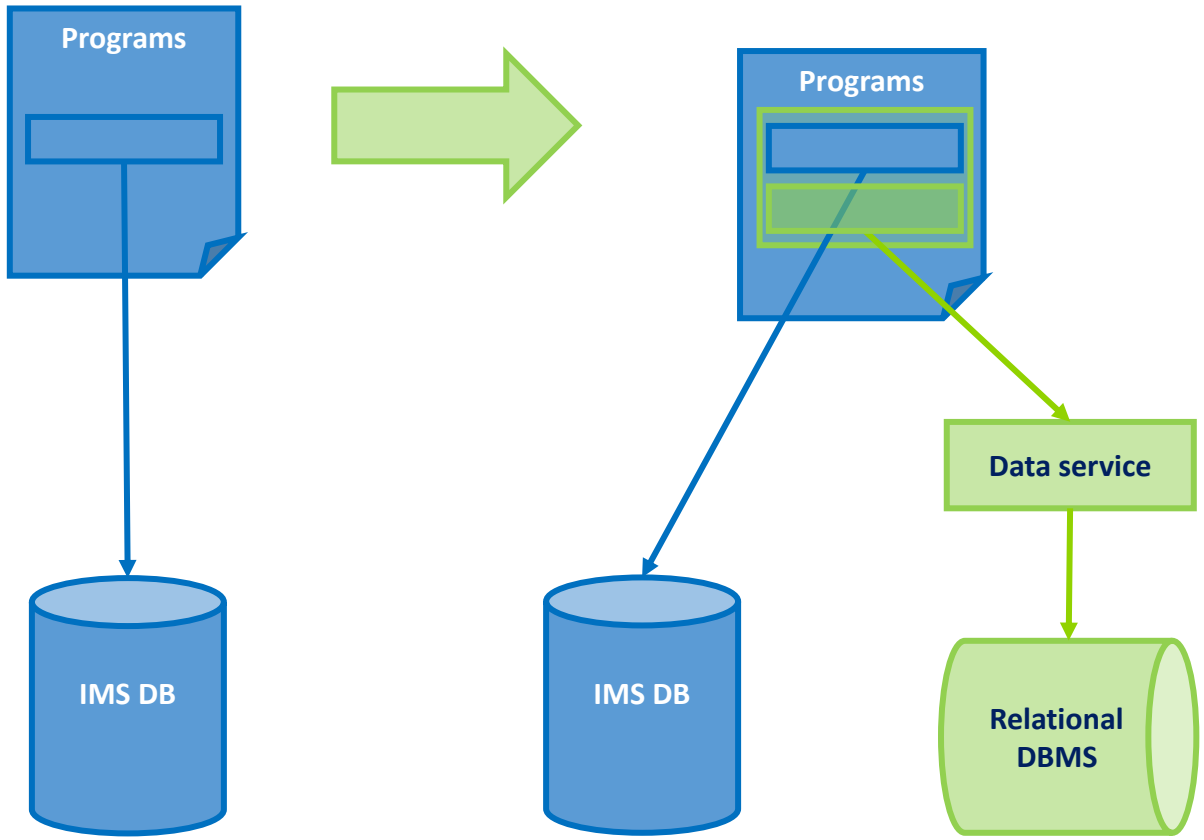
Replacing

```
*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

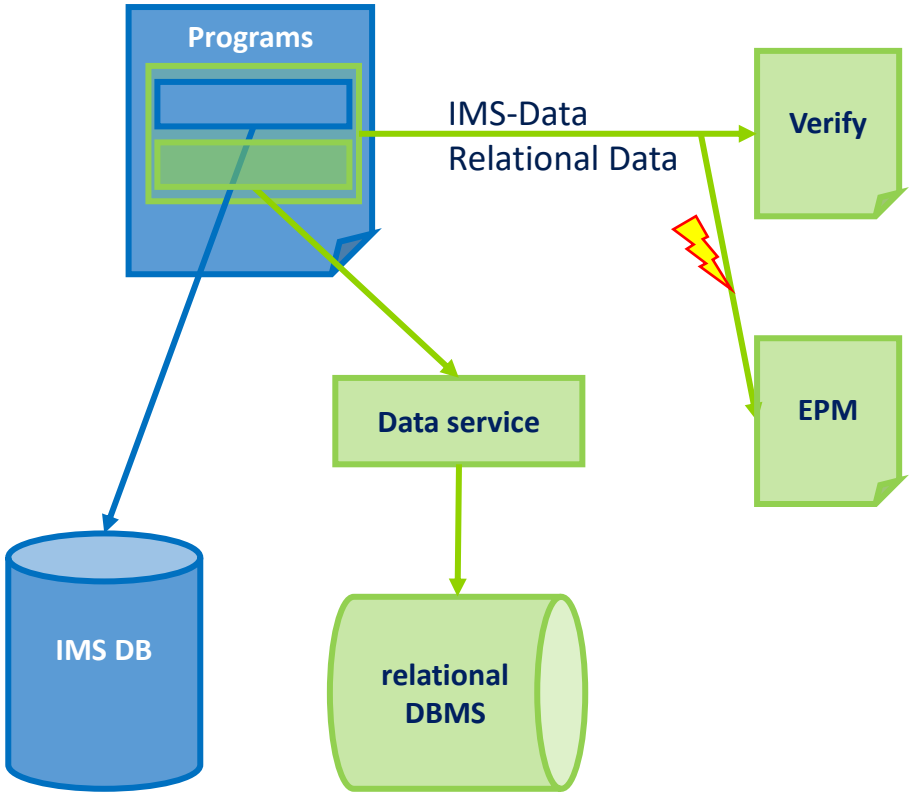
Optional: Switch



Switch

- Parallel access to IMS DB and relational database
- Switches (example)
  - 1: only accessing IMS DB
  - 2: accessing IMS DB and relational database,
    IMS DB leading
  - 3: accessing IMS DB and relational database,
    relational database leading
  - 4: only accessing relational database
- One switch per IMS DB table

Optional: Verify and error protocol



Verify

- While accessing IMS DB and relational database in parallel (switches 2 and 3)
- Automated comparison of the data
  - Incl. Consideration of special cases (e.g. Low-Value vs. Zero)

Error protocol (EPM)

- Complete and detailed documentation of revealed differences

Replacing IMS DB successfully

By automation

- ✓ Customized: adaptation of solution and processes to customer‘s requirements
- ✓ Flexibility: strategy changes with regard to solution and process possible at any time during the project
- ✓ Security: reproducable, testable and comprehensible (also for auditors)
- ✓ Performance: optimization possible together with the customer
- ✓ No restrictions to regular maintenance and daily business!

… and by close interaction with the customer!

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Modernization Platform

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