A DATA QUALITY ASSESSMENT AND MANAGING TOOL FOR THE OMOP COMMON DATA MODEL

DQUEEN

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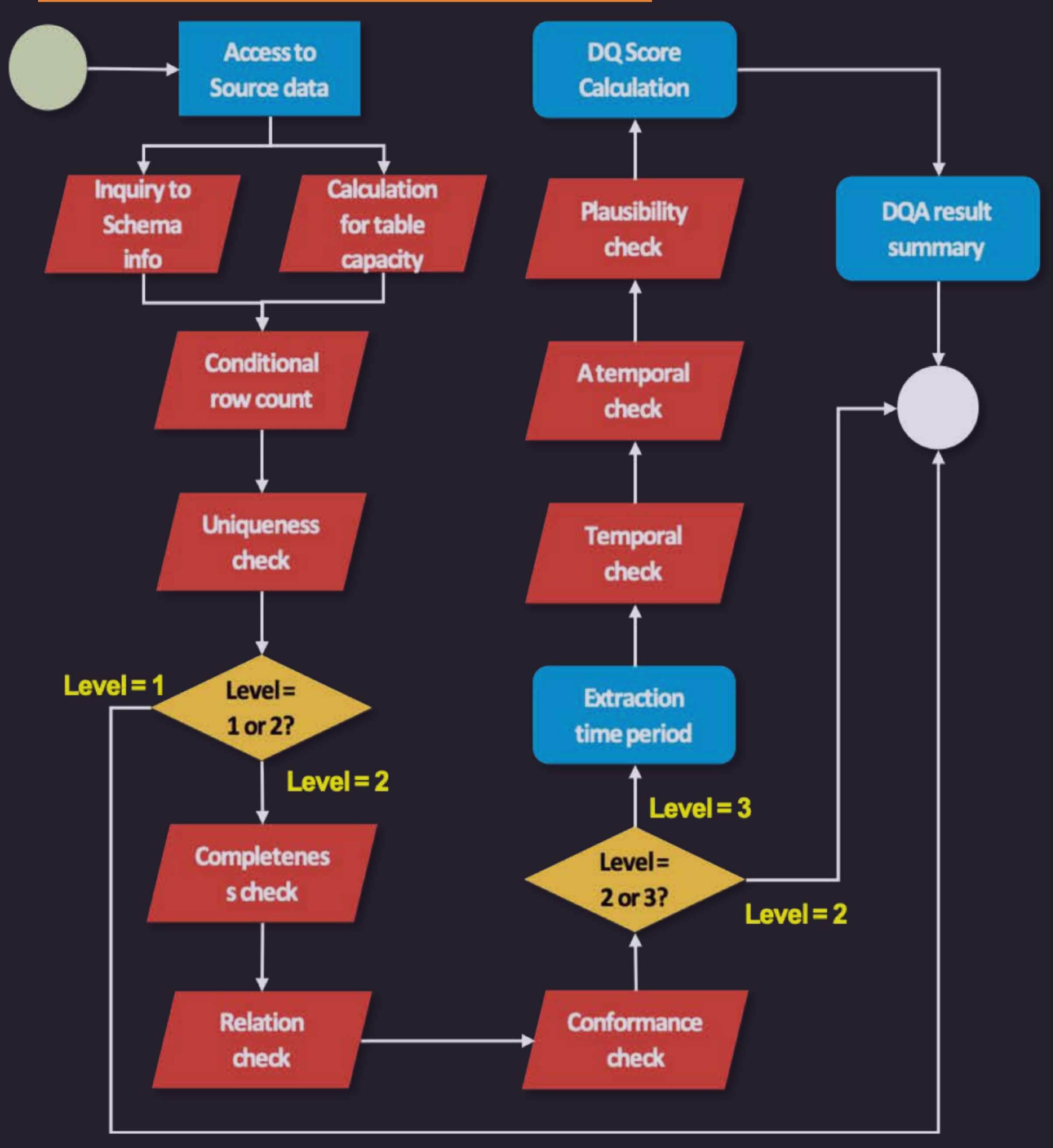
Introduction of DQUEEN

- Each distributed research network (DRN) makes considerable effort to confirm the data quality (DQ) by providing their own DQ tools to ensure that the CDM data is "high-quality" or "ready for research use
  - However, although not significantly different, the existing DQ tools have different terminology, validation scope, and DQ checks and criteria.
  - Furthermore, for most DQ tools, the source data are not regarded well; therefore, they suffer from limitations for confirming the quality of source data.
- The purpose of this study is to confirm **the generalization possibility of DQA** by applying the existing **DQ checks and In-house DQ checks to the source data and OMOP-CDM.**
  - Moreover, we propose **a DQ tool that can perform DQ evaluation between the source data and OMOP-CDM by providing DQA for the source data.**

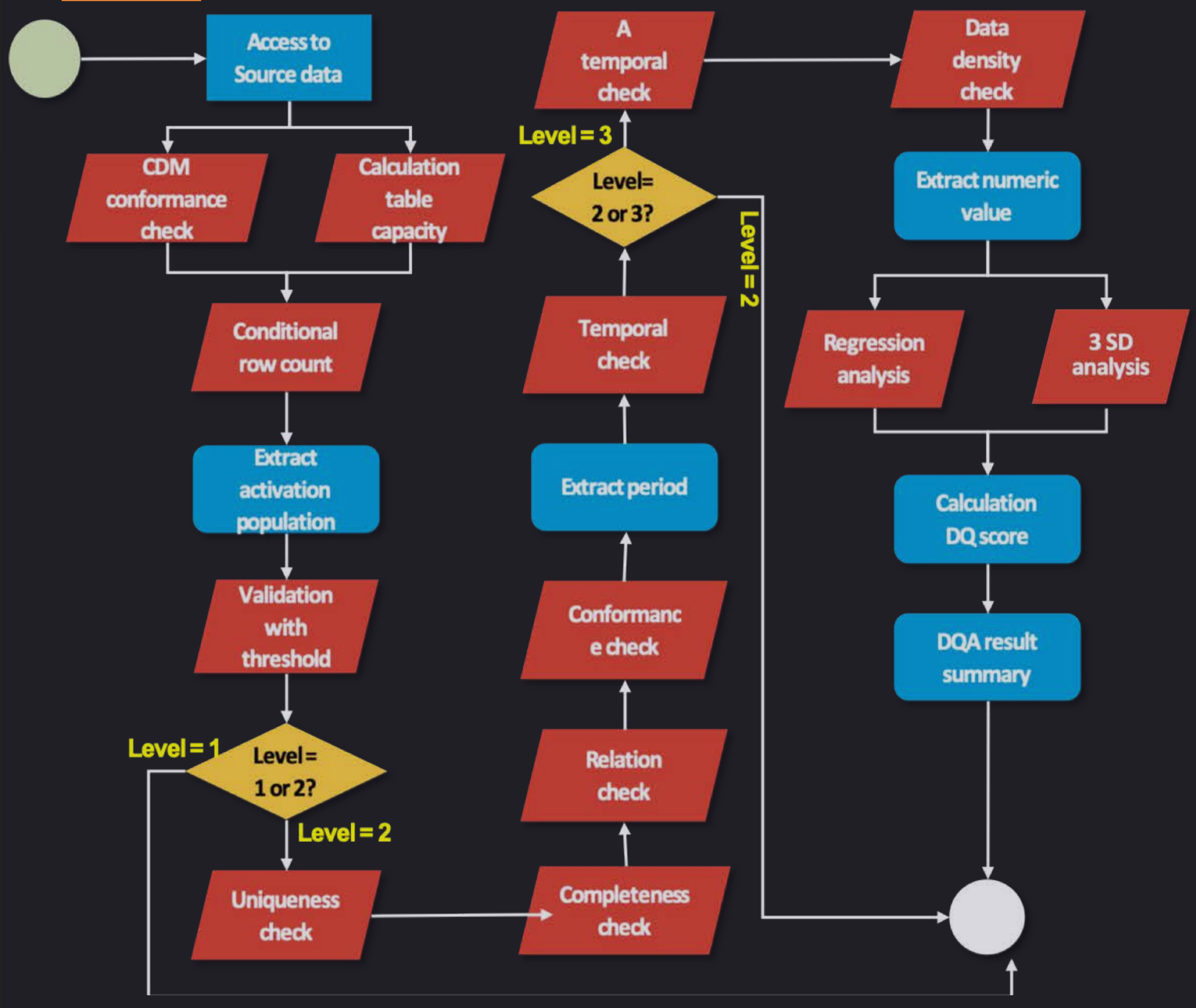
Data Quality Assessment process of DQUEEN

- The system process is designed from the low to high complexity DQ concept, which identifies data errors.
- This tool provides three levels of DQ , and the user can perform a desired level of DQA.

Meta(source data)



CDM



What is metadata?

- Metadata is a structure of elements for each CDM table attribute of source data required for CDM conversion.
  - This structure is not used CDM properties, such as the CDM concept id so It can be assessed the source data

<Source data>

<Meta data>

<Meta_person>

-> person_id, birthday, Sex, location info ..

<Meta_visit>

-> person_id, visit_type, visit date, discharge date ..

<Meta_condition>

-> person_id, diagnosis date, diagnosis code ..

<Meta_procedure>

-> person_id, procedure date, procedure code ..

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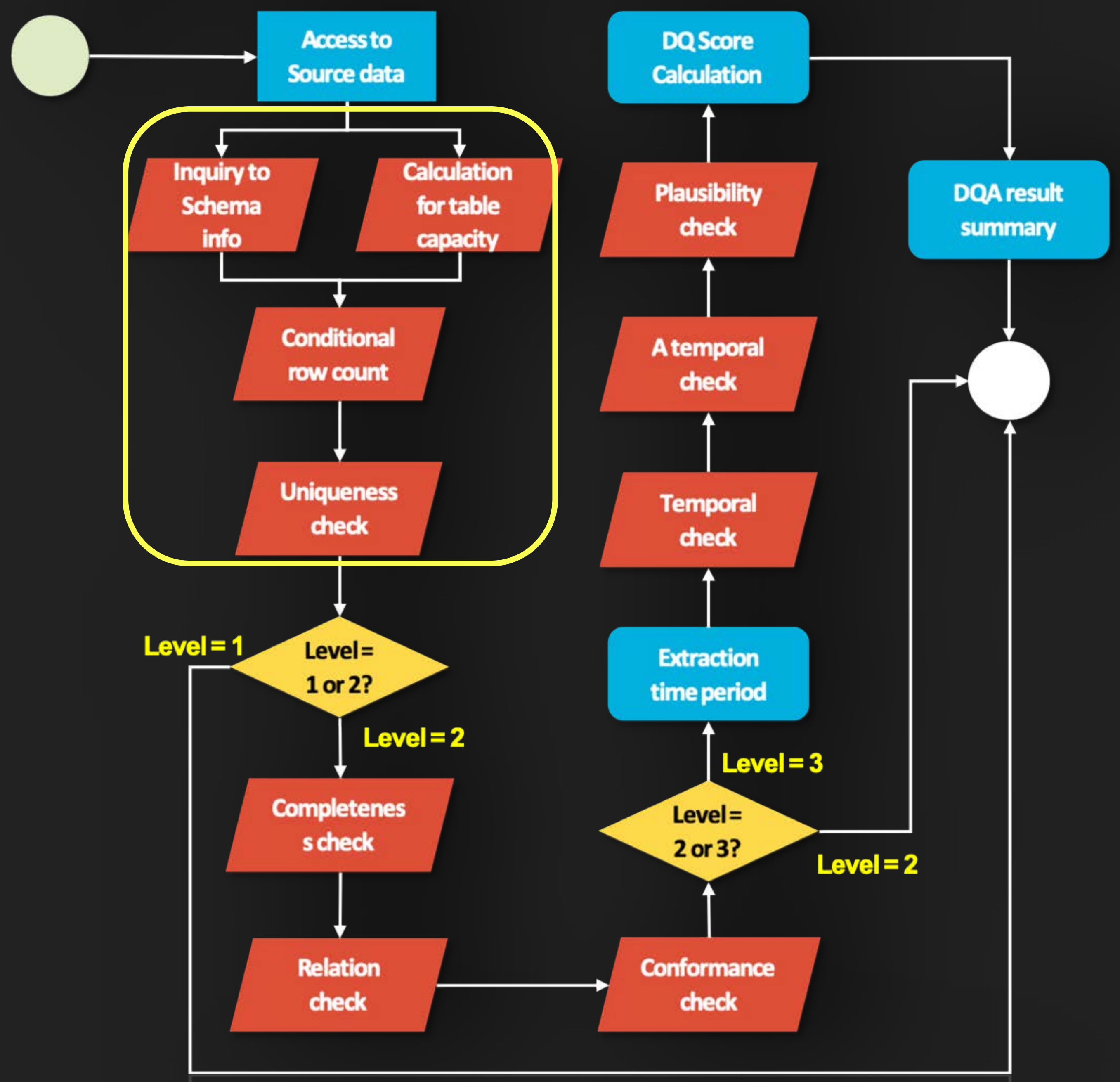
Data Quality Assessment process (meta part)-1

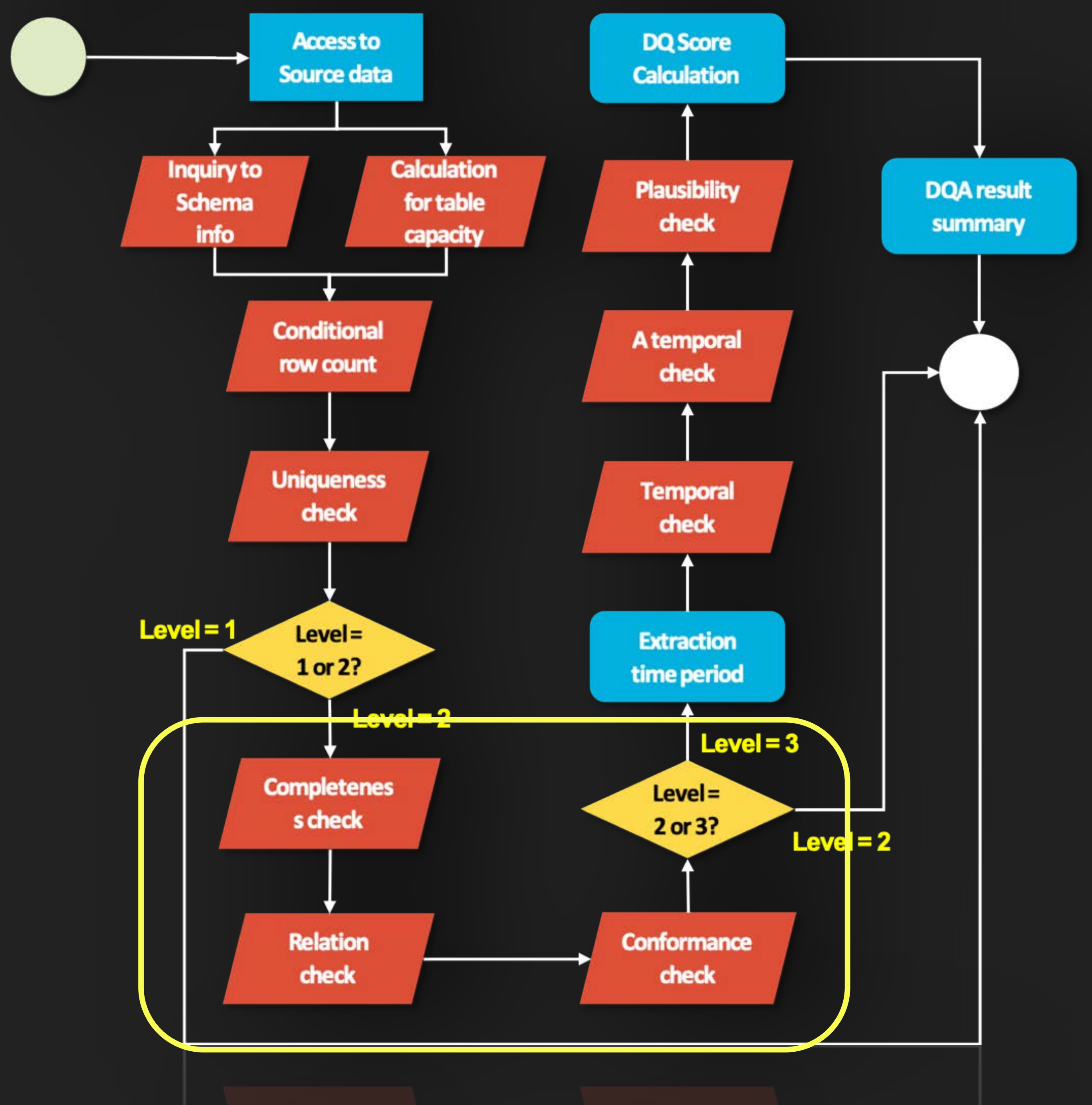
Meta module (Source data)



- DQA Level 1
  - Inquiry to Schema information (E.g. Table list, Table rows, Data type, etc.)
  - Calculation of data table volume size
  - Conditional row count (E.g. Duplicate row check, Missing data, Special char)
  - Data uniqueness check

Data Quality Assessment process (meta part)-2

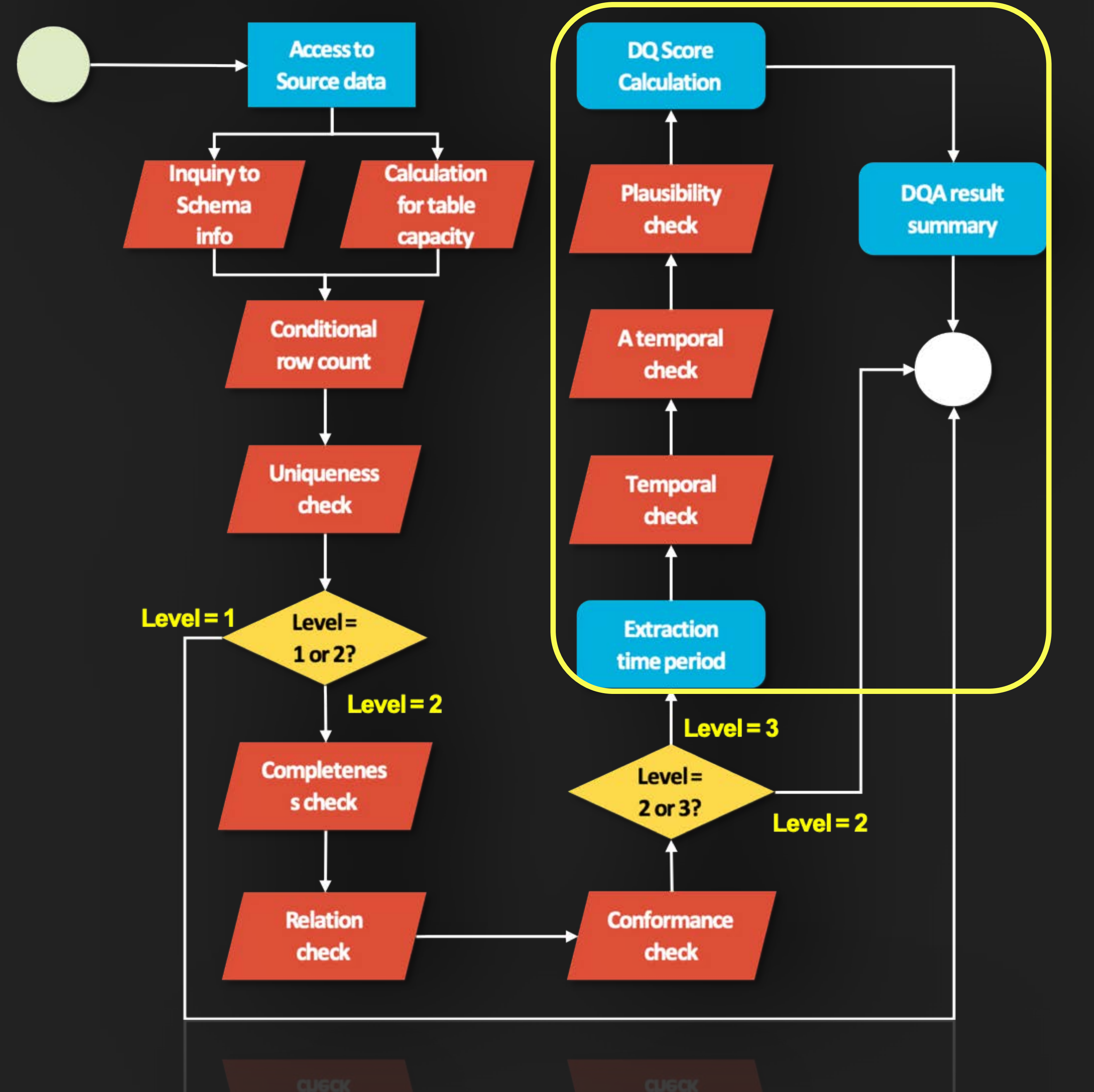
Meta module (Source data)



- DQA Level 2
  - Data completeness check (E.g. Missing data, measurement result value, etc.)
  - Data relation check (E.g. Primary key, Foreign key, etc.)
  - Data conformance check (E.g. Valid with Data type and column type, etc.)

Data Quality Assessment process (meta part)-3

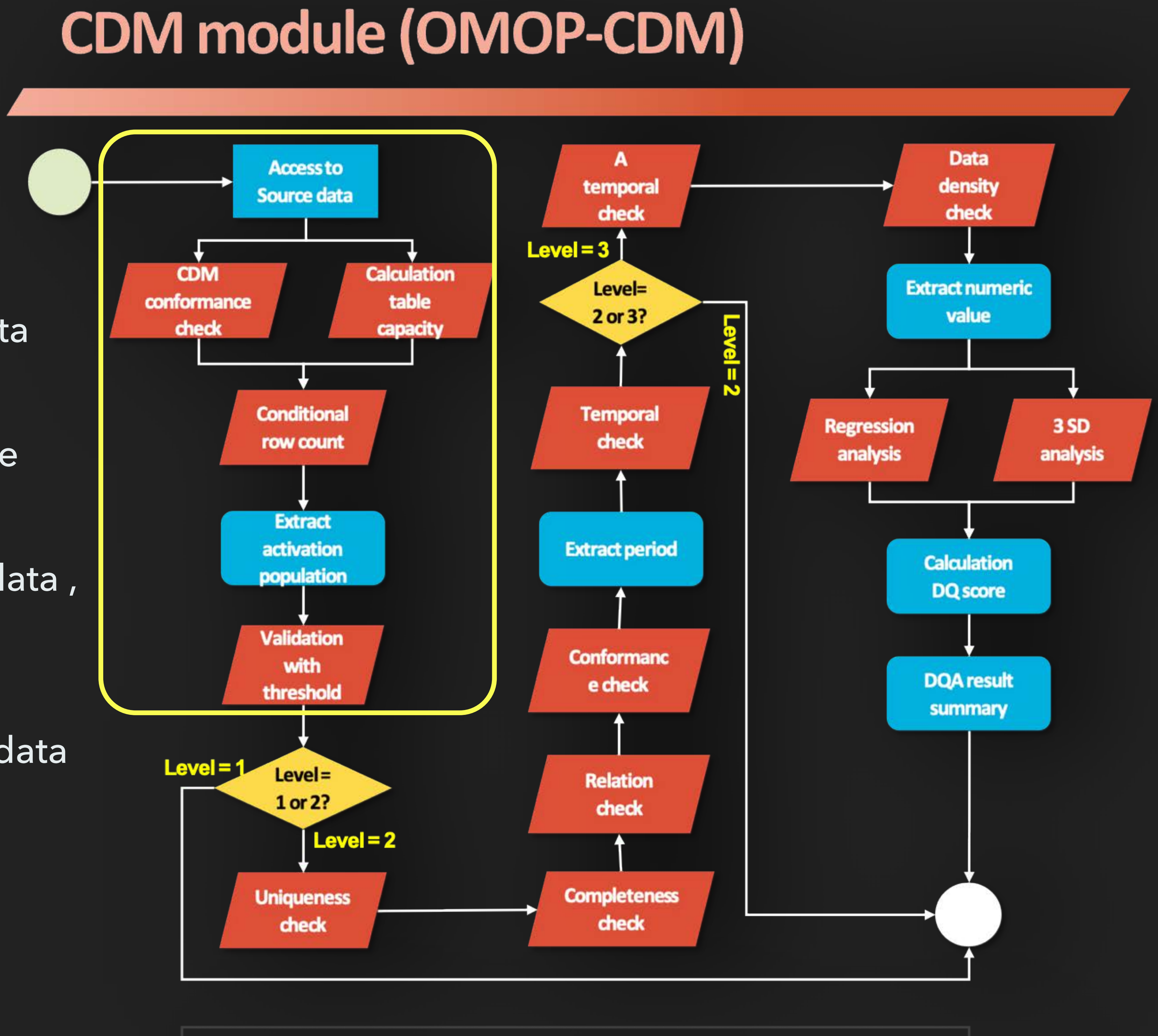
Meta module (Source data)



- DQA Level 3
  - Temporal data error check (E.g. Other suppliers cannot prescribe any order, etc.)
  - Atemporal data error check (E.g. Start date > end date, death date < birth date, etc.)
  - Data quality score calculation with DQA result

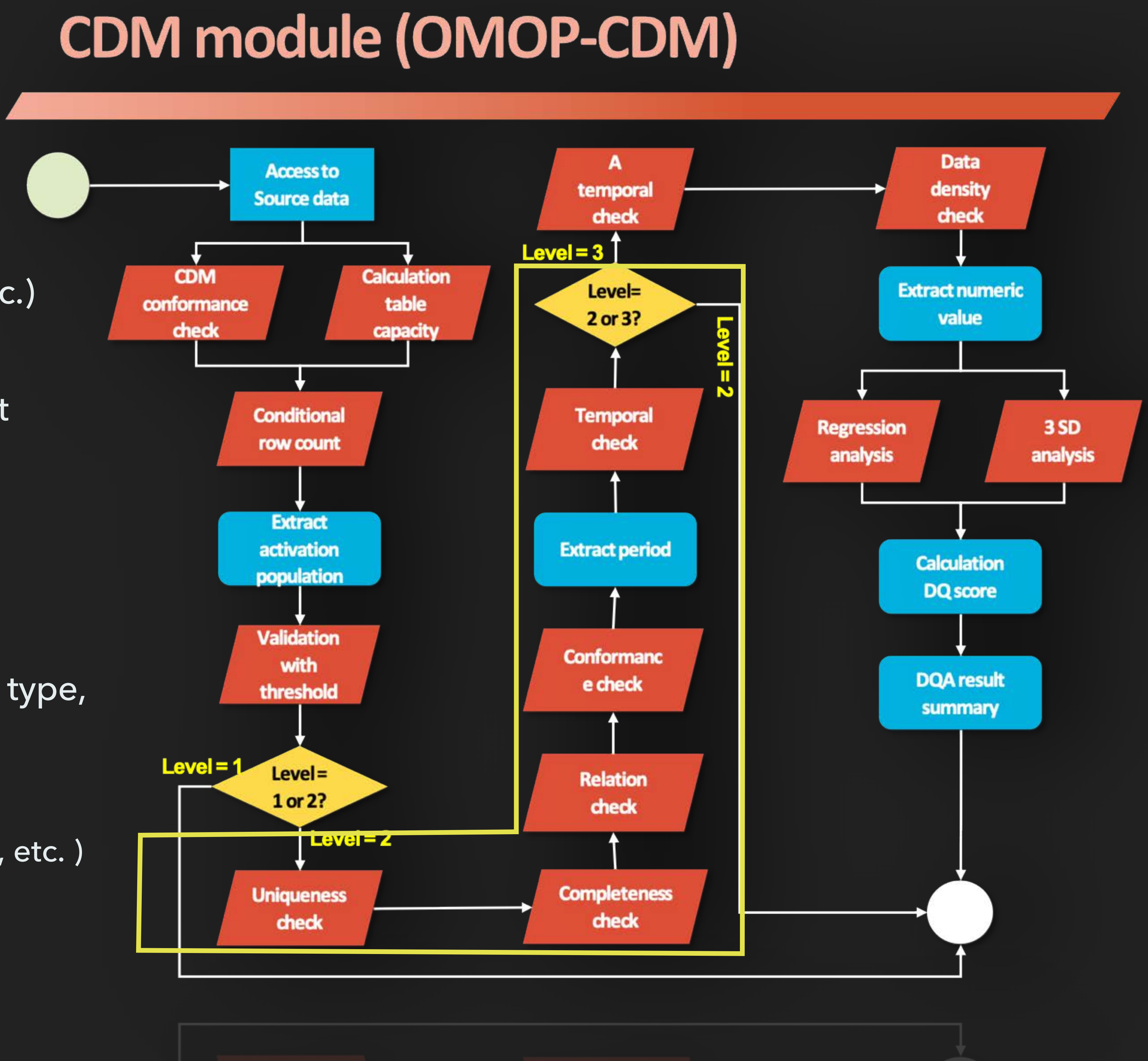
Data Quality Assessment process (CDM part)-1

- DQA Level 1
  - CDM Conformance check (E.g. Table name, column name, Data type, etc.)
  - Calculation of data table volume size
  - Conditional row count (E.g. Duplicate row check, Missing data , Special char)
  - Validation with threshold (E.g. Row count result > number of data population)



Data Quality Assessment process (CDM part)-2

- DQA Level 2
  - Data uniqueness check
    (E.g. Primary key duplicated check, etc.)
  - Data completeness check
    (E.g. Missing data, measurement result value, etc.)
  - Data relation check
    (E.g. Primary key, Foreign key, etc.)
  - Data conformance check
    (E.g. Valid with Data type and column type, etc.)
  - Atemporal error data
    (E.g. Visit_start_date > visit_start_datetime, etc.)



CDM module (OMOP-CDM)

Access to Source data

CDM conformance check

Calculation table capacity

Conditional row count

Extract activation population

Validation with threshold

Level = 1

Level = 1 or 2?

Level = 2

Uniqueness check

Completeness check

Relation check

Conformance check

Extract period

Temporal check

Level = 2 or 3?

Level = 2

Level = 3

A temporal check

Data density check

Extract numeric value

Regression analysis

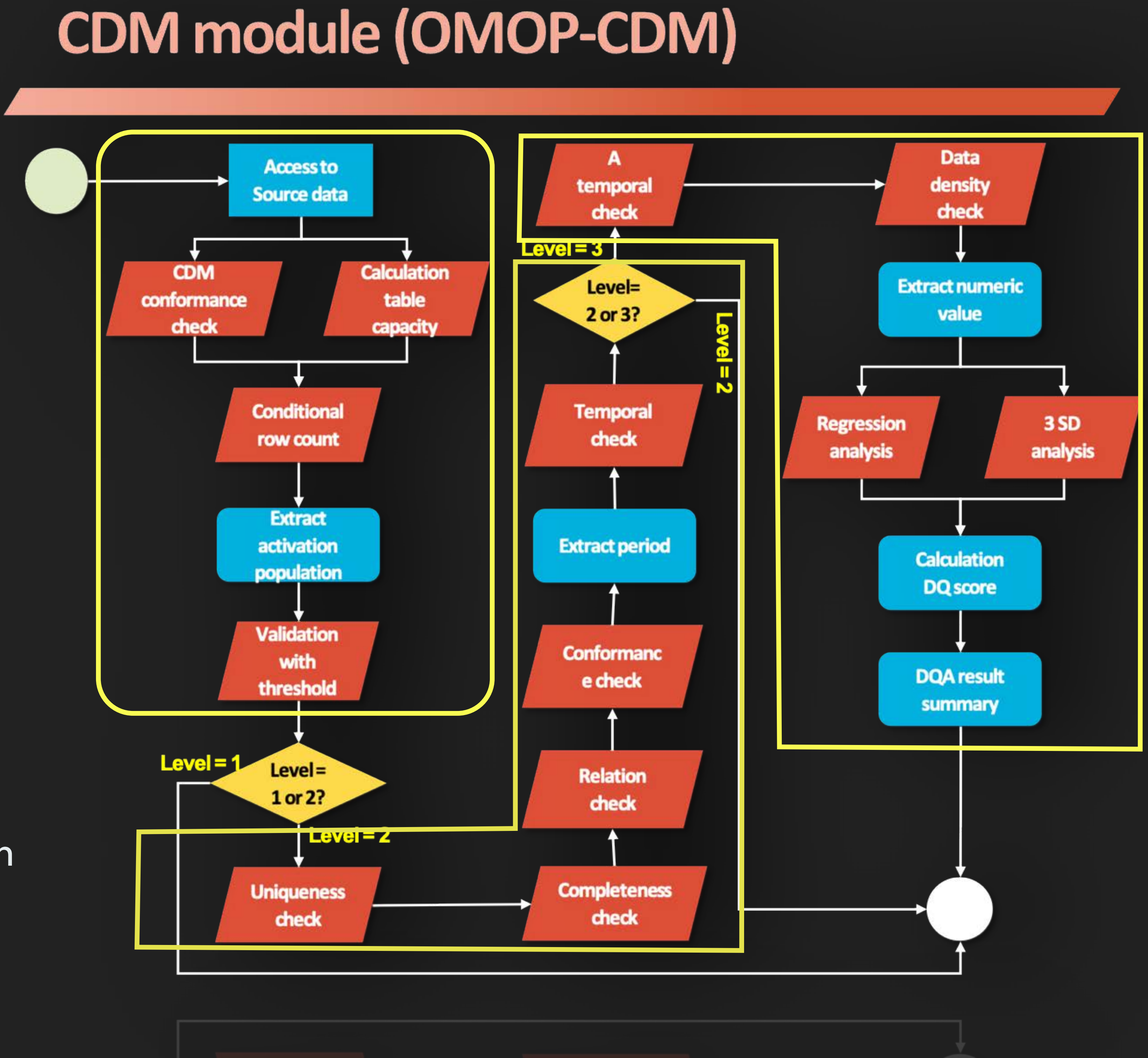
3 SD analysis

Calculation DQ score

DQA result summary

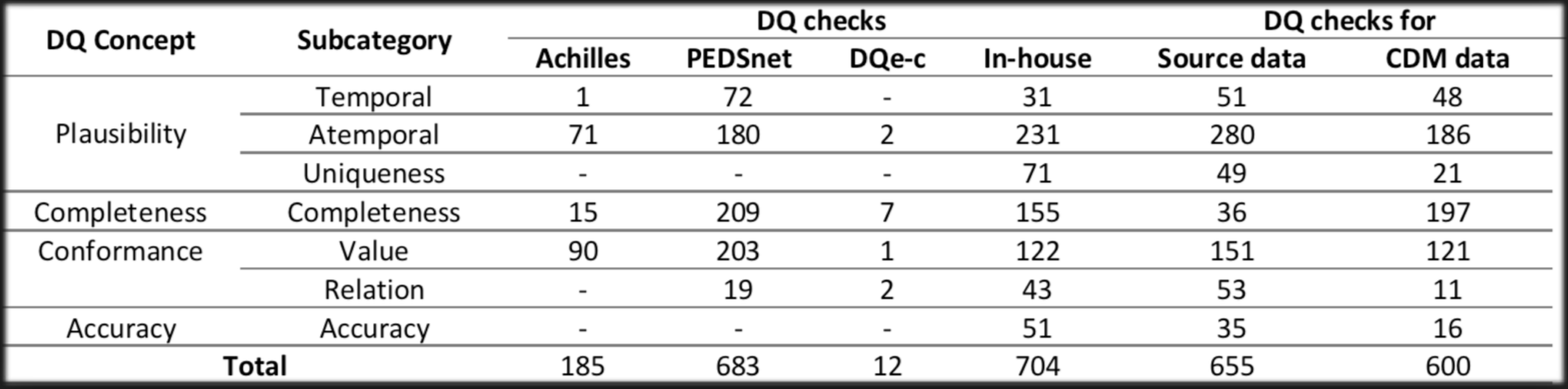
Data Quality Assessment process (CDM part)-3

- DQA Level 3
  - Temporal data error check (E.g. Drug quantity cannot be more than 600 , etc.)
  - Data density check (E.g. Note or Note nlp data density, etc.)
  - Data check for measurement value outlier
    - Linear regression with continuous variable
    - 3 Standard deviation with categorical variables
  - Data quality score calculation with DQA result



DQUEEN's DQ check

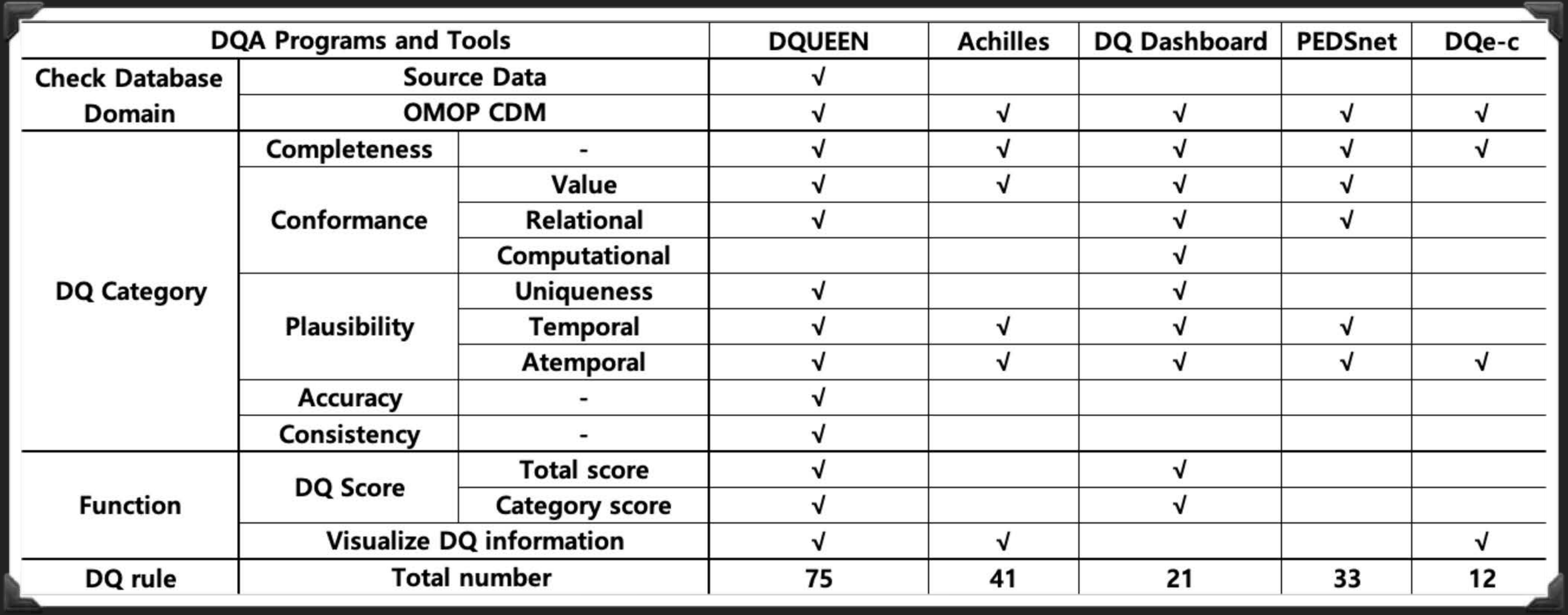
- The total number of DQ checks is 1,255 (742 checks by the three DQ tools and 513 In- house checks).
  - 321 duplicate DQ checks were excluded.
  - We adopt '**Accuracy**' for additional DQ concept
- Table 1 shows the DQ checks applied to each field for DQA.



DQ Concept	Subcategory	DQ checks				DQ checks for	
		Achilles	PEDSnet	DQe-c	In-house	Source data	CDM data
Plausibility	Temporal	1	72	-	31	51	48
	Atemporal	71	180	2	231	280	186
	Uniqueness	-	-	-	71	49	21
Completeness	Completeness	15	209	7	155	36	197
Conformance	Value	90	203	1	122	151	121
	Relation	-	19	2	43	53	11
Accuracy	Accuracy	-	-	-	51	35	16
Total		185	683	12	704	655	600

Table 1. Integrated Data Quality Concept and check- in OHDSI, PEDSnet and DQe-c DQA Process of DQUEEN

Compare with Other DQ tools



DQA Programs and Tools			DQUEEN	Achilles	DQ Dashboard	PEDSnet	DQe-c
Check Database Domain	Source Data		√				
	OMOP CDM		√	√	√	√	√
DQ Category	Completeness	-	√	√	√	√	√
	Conformance	Value	√	√	√	√	
		Relational	√		√	√	
		Computational			√		
	Plausibility	Uniqueness	√		√		
		Temporal	√	√	√	√	
		Atemporal	√	√	√	√	√
	Accuracy	-	√				
	Consistency	-	√				
Function	DQ Score	Total score	√		√		
		Category score	√		√		
	Visualize DQ information		√	√			√
DQ rule	Total number		75	41	21	33	12

Thank you!