

# PROPERTY GRAPH STANDARDS, PROCESS & TIMING

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# Introduction

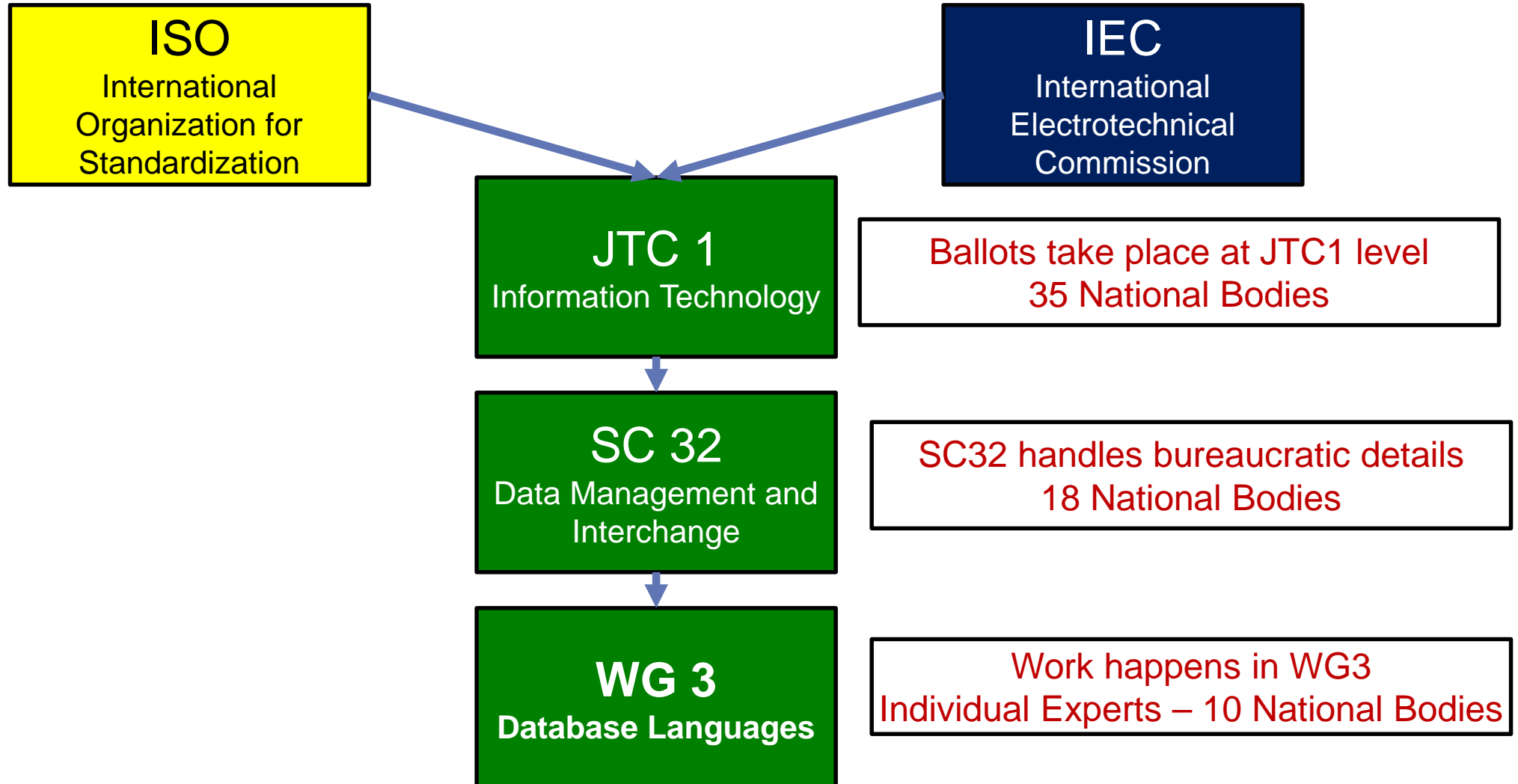
- Database Language Standards Structure and Process
  - International Standards Hierarchy
  - ISO/IEC JTC1 Standardization Process
  - USA Standards Structure
  - Who participates?
- Property Graph Standards – SQL/PGQ & GQL
  - Brief History of SQL and GQL
  - SQL/PGQ & GQL expected dates
- Summary

# Database Language Standards Working Group

## ISO/IEC JTC1 SC32 WG3 Database Languages

- ISO – International Organization for Standardization
- IEC – International Electrotechnical Commission
- JTC 1 – Joint Technical Committee 1 – Information Technology standards
- SC 32 – Sub Committee 32 – Data Management and Interchange
- WG 3 – Working Group 3 – Database Languages

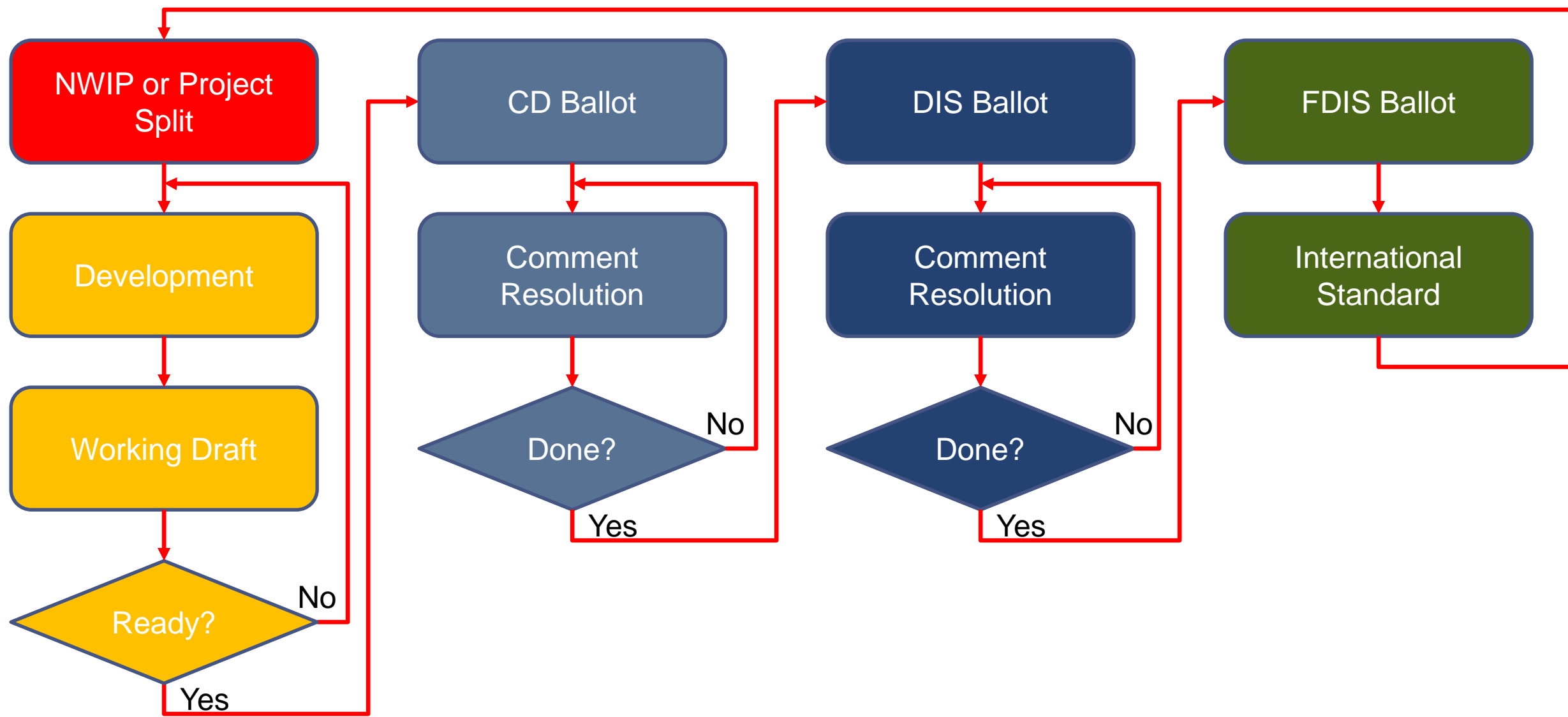
# International Standards Hierarchy



# Standardization Steps and Acronyms

- New Work Item Proposal – NWIP
- Working Draft – WD
- Committee Draft – CD
- Draft International Standard – DIS
- Final Draft International Standard – FDIS
- International Standard – IS

# ISO/IEC JTC1 Standardization Process



# Who participates – SC32 WG3?

Experts from the following national bodies participate in SC32 WG3:

1. China
2. Denmark
3. Finland
4. Germany
5. Japan
6. Korea
7. Netherlands
8. Sweden
9. United Kingdom
10. United States

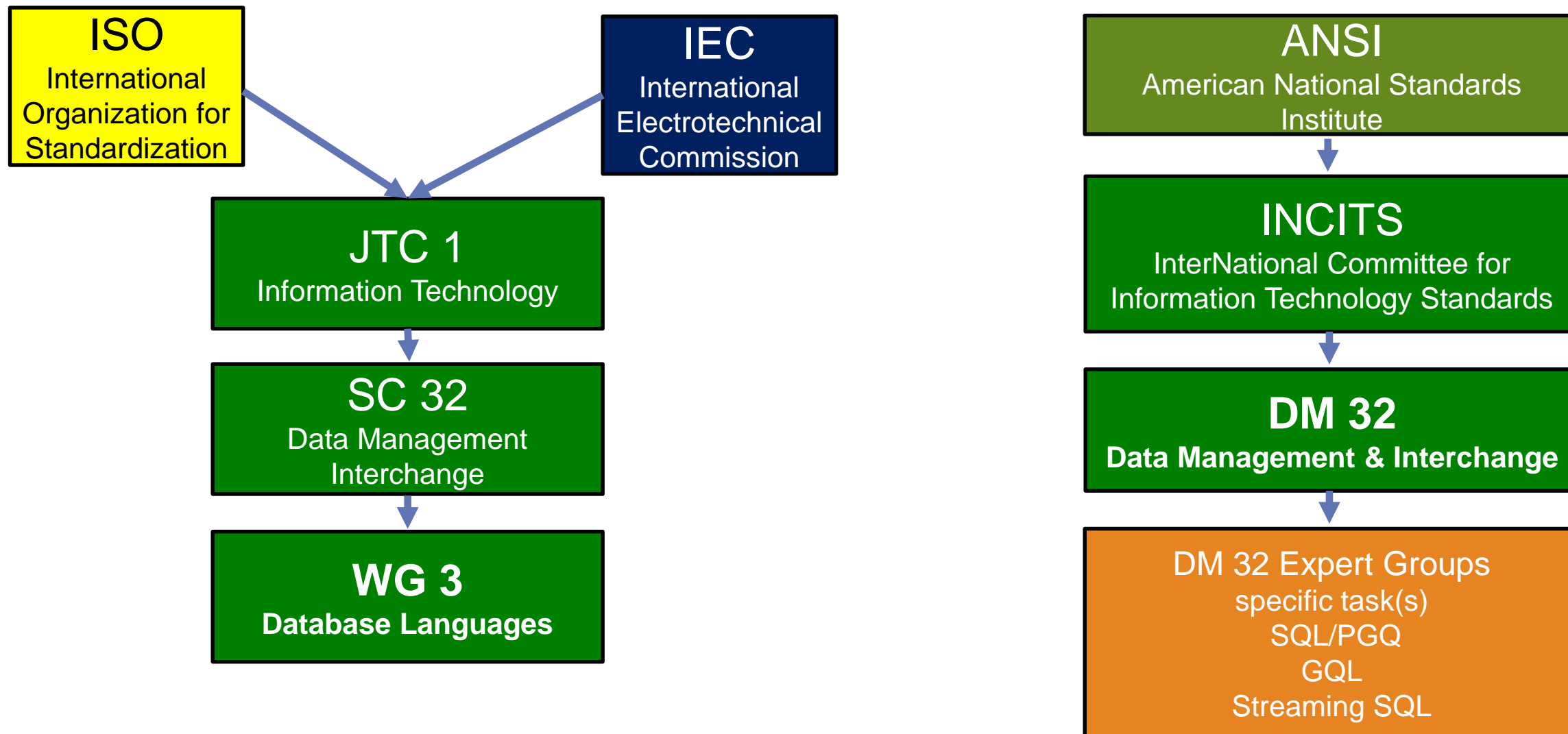
# Organizations Participating in National Bodies

- China
  - Ant Financial
  - Boray Data
  - CESI
  - Huawei
- Denmark
  - TF Informatik
- Finland
  - Profium
- Germany
  - 2nd Quadrant
  - Oracle
  - Rasdaman
- Japan
  - Hitachi
  - Tokyo Metropolitan University
- Korea
  - Bundang Hospital
  - CnTechSystems
- Netherlands
  - Cannan Consultancy
- Sweden
  - Neo4j
- United Kingdom
  - PR Brown
  - University of Edinburgh
- USA (see later slide)

Note: This list is probably incomplete



# International Hierarchy mirrored in the US



# Who participates – INCITS DM32?

## Mostly SQL

- Actian Corporation
- IBM Corporation
- Intersystems Corporation
- Microsoft Corporation
- Oracle
- SAP
- Teradata

## Mostly GQL

- ArangoDB Inc
- FairCom USA
- Google
- JCC Consulting Inc
- Katana Graph
- Neo4j Inc
- Optum Technology
- Redis Labs
- TigerGraph

## Mostly Streaming SQL

- Alibaba Group
- Amazon Web Services
- Boray Data
- Confluent
- Hazelcast
- Materialize
- Snowflake
- SQLstream, a Thales Company

## Mostly Metadata

- Farance Inc
- Institute for Defense Analyses
- William McCarthy
- National Cancer Institute
- Nurocor
- United States Dept of the Army - CERDEC-I2WD

# Working In INCITS DM32

- Work done by interested parties in the Expert Groups groups
  - Property Graph Queries in SQL
  - GQL
  - PGQ & GQL have 2-hour web conferences on alternate weeks
- The Expert Groups agree on designs
- DM32 reviews papers from the Expert Groups
- Discussions in the Expert Groups is based on written papers
  - Concrete change proposals
  - Discussion papers
    - Basis for discussion of designs or alternatives
    - Discussion will eventually lead to a Change Proposal

# Working In ISO/IEC JTC1 SC32 WG

- International Committee
  - Participants from national standards bodies
  - Participants operate as individual experts
- Monthly web conferences
  - Times offset by 8 hours every month
  - Was week-long meetings two to three times a year
- Written papers
  - Concrete change proposals
  - Discussion papers
- Final decisions are made in WG3
  - Decisions recorded in minutes
  - Editors apply approved papers to drafts

# SC32 WG3 Formal Liaison Relationships

- LDBC (Linked Data Benchmark Council) — liaison since 2017
  - Industry/Academic consortium focused on graphs
  - Started with benchmarks & has evolved to model, language, and other topics
  - Working Groups of interest to SC32 WG3 focus on property graph language – PGQ & SQL
    - Existing Languages, Property Graph Schema, GQL Formal Semantics working groups
  - Support/strengthen WG3 standards
    - Review of WG3 documents
    - Contribution of papers to WG3 (critique/corrections, feature suggestions)
  - Property graph theory
    - ACM SIGMOD/PODS 2021 paper & presentation “PG-Keys: Keys for Property Graphs”
  - An evolving bi-directional process for collaboration
- OGC (Open Geospatial Consortium)
  - Requirements for supporting spatial data in GQL (v2 or later)

# SQL Standards – a brief history

## ISO/IEC 9075 Database Language SQL

- SQL-87 – Transactions, Create, Read, Update, Delete
- SQL-89 – Referential Integrity
- SQL-92 – Internationalization, etc.
- SQL:1999 – User Defined Types
- SQL:2003 – XML & OLAP
- SQL:2008 – Expansions and corrections
- SQL:2011 – Temporal
- SQL:2016 – JSON, RPR, PTF, MDA (2019)
- **SQL:202x – SQL/PGQ, Property Graph Queries in SQL**
  - ISO/IEC 9075-16 *Information technology — Database languages SQL — Part 16: SQL Property Graph Queries (SQL/PGQ)*
  - SQL/PGQ project initiated September, 2017

# GQL Standards – a brief history

ISO/IEC 39075 *Information Technology — Database Languages — GQL*

- Create, Read, Update, Delete, Transactions, Schema
- GQL project initiated September, 2019

# Property Graphs – SQL/PGQ and GQL

## SQL/PGQ

- Property Graph views of SQL tables
- **Graph Pattern Matching queries**
  - GRAPH\_TABLE() in SQL FROM
  - Supports Reads
- Common foundation with SQL and graph query languages
- Does not support schema-flexible graphs

## GQL

- Full DB language
  - DML – Create, Read, Update, Delete
  - DDL – Create Type, Create Graph
- **Graph Pattern Matching queries**
- Leverages common foundation from SQL and property graph languages
- Supports schema-fixed and schema-flexible variants



# Expected Dates – Detailed

Date	SQL/Foundation (and four other parts)	SQL/PGQ	GQL
2021-02-07	SQL/Foundation CD Ballot Ended	SQL CD Ballot Ended	
2021-10-03		SQL/PGQ CD2 Starts (8 weeks)	
2021-11-27		SQL/PGQ CD2 Ends	
2021-11-28			GQL CD Ballot starts
2022-02-19			GQL CD Ballot ends
2022-03-04	SQL/Foundation DIS preprocessing starts	SQL/PGQ DIS Preprocessing Starts	
2022-04-24	SQL/Foundation DIS Ballot starts	SQL/PGQ DIS Ballot Starts	
2022-07-04			GQL CD2 ballot starts
2022-07-17	SQL/Foundation DIS Ballot ends	SQL/PGQ DIS Ballot Ends	
2022-08-28			GQL CD2 ballot ends
2022-09-04	Final text to ISO	Final text to ISO	
<b>2022-10-16</b>	<b>SQL/Foundation Published</b>	<b>SQL/PGQ Published</b>	
2022-12-25			GQL DIS Preprocessing Starts
2023-02-19			GQL DIS Ballot starts
2023-05-21			GQL DIS Ballot Ends
2023-07-30			Final text to ISO
<b>2023-09-10</b>			<b>GQL Published</b>

# Expected Dates – Summary

- SQL/PGQ
  - CD Ballot completed – February 2021
  - **DIS Ballot starts – March 2022**
  - DIS Ballot completes – July 2022
  - Published standard – October 2022
- GQL V1
  - CD Ballot completes – February 2022
  - **DIS Ballot Starts – December 2022**
  - DIS Ballot completes – May 2023
  - Published standard – September 2023
- Draft Standards are stable by DIS ballot start

# Summary

- Standards Process
  - Iterative, collaborative process
  - Some amount of standards bureaucracy
  - Tedious at times
  - Results are pretty good
- Property Graph Standards
  - SQL/PGQ published October 2022
  - GQL published September 2023