

# Databases Overview

Richard Park



# Databasics

What is a database

Types of databases

Relational databases

Dyalog ↔ Database

# Databasics

A database is a system for storing data

Previously:

Filing Systems

Nowadays:

Databases → Database Management System  
(DBMS)

# Database Management System

1. A structured arrangement of data

2. Query language

a domain specific language (DSL) for:

- reading
- writing
- manipulating data

# Organisation

## Relational

Tables

## Non-relational (the rest)

Time series

Key-value

Document / Object (e.g. JSON)

Graph

...

# Organisation

PCode	Name	Type
P234	Gruel	Food
P695	Water	Drink

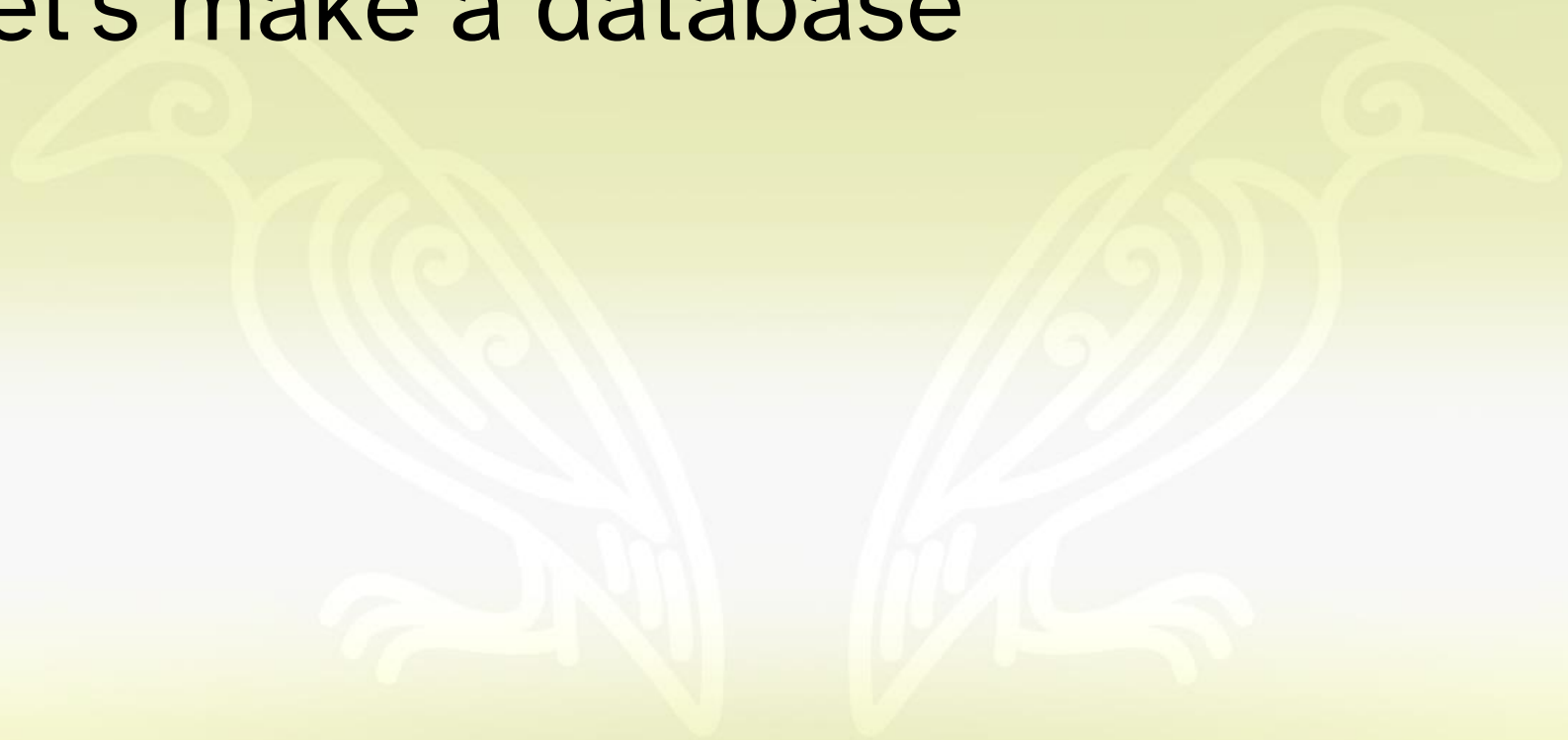
CID	Address	Name
C4124	2 Main St.	Alice
C3156	54 Nice Rd.	Bob

RID	Name	Address
SH01	Shoppz	Shoppz.uk
SH02	Buyaz	Buyaz.com

TID	PCode	CID	RID	Price	Qty	DateTime
354	P234	C3156	SH02	\$5.04	3	2020-05-16
355	P695	C4124	SH01	\$4.95	4	2020-06-03
356	P234	D3156	SH01	\$2.59	2	2020-06-04

...

# Let's make a database



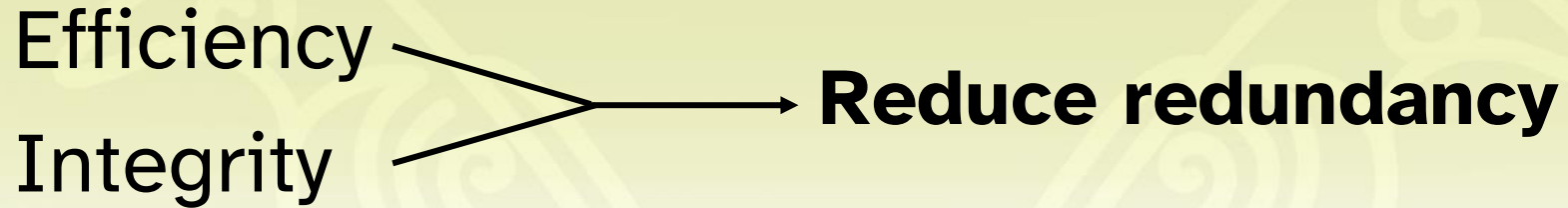
# Database creation

Efficiency

Integrity



# Database creation

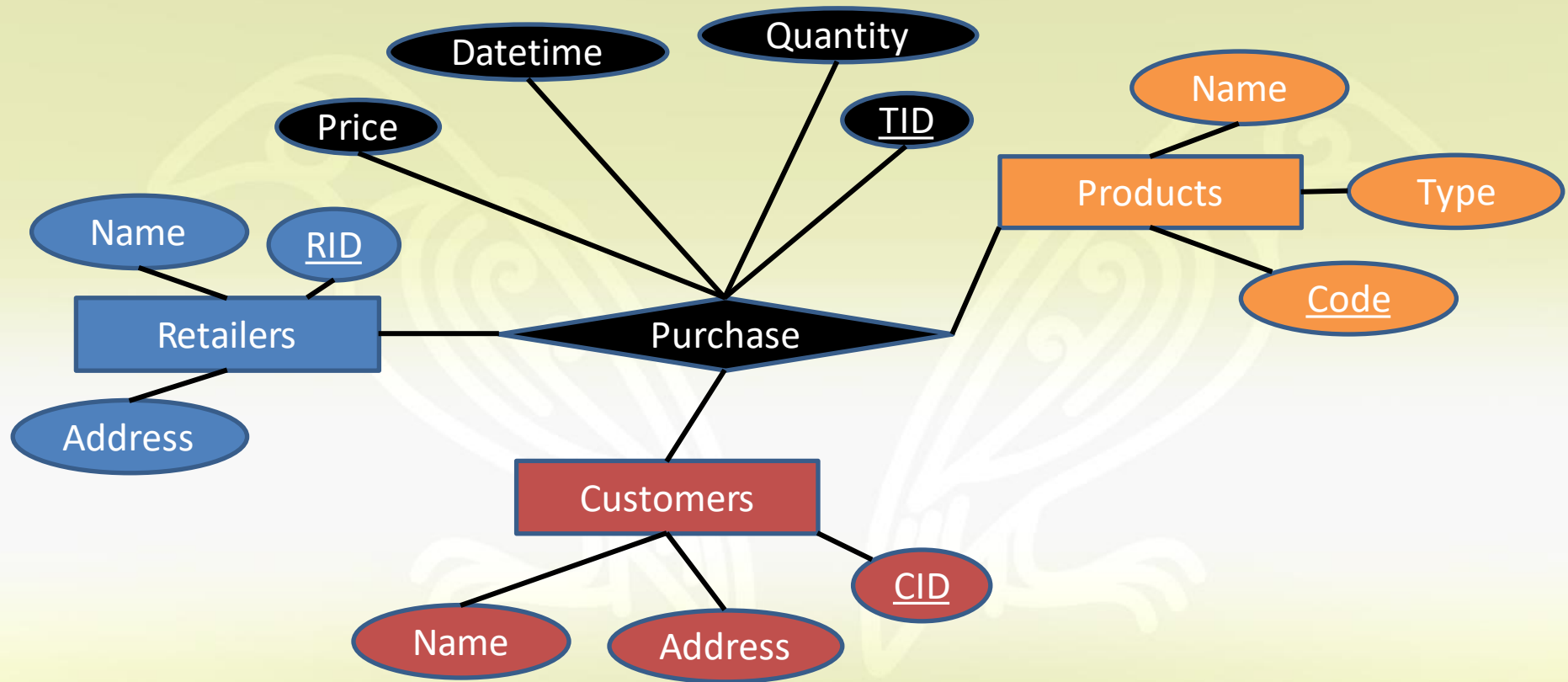


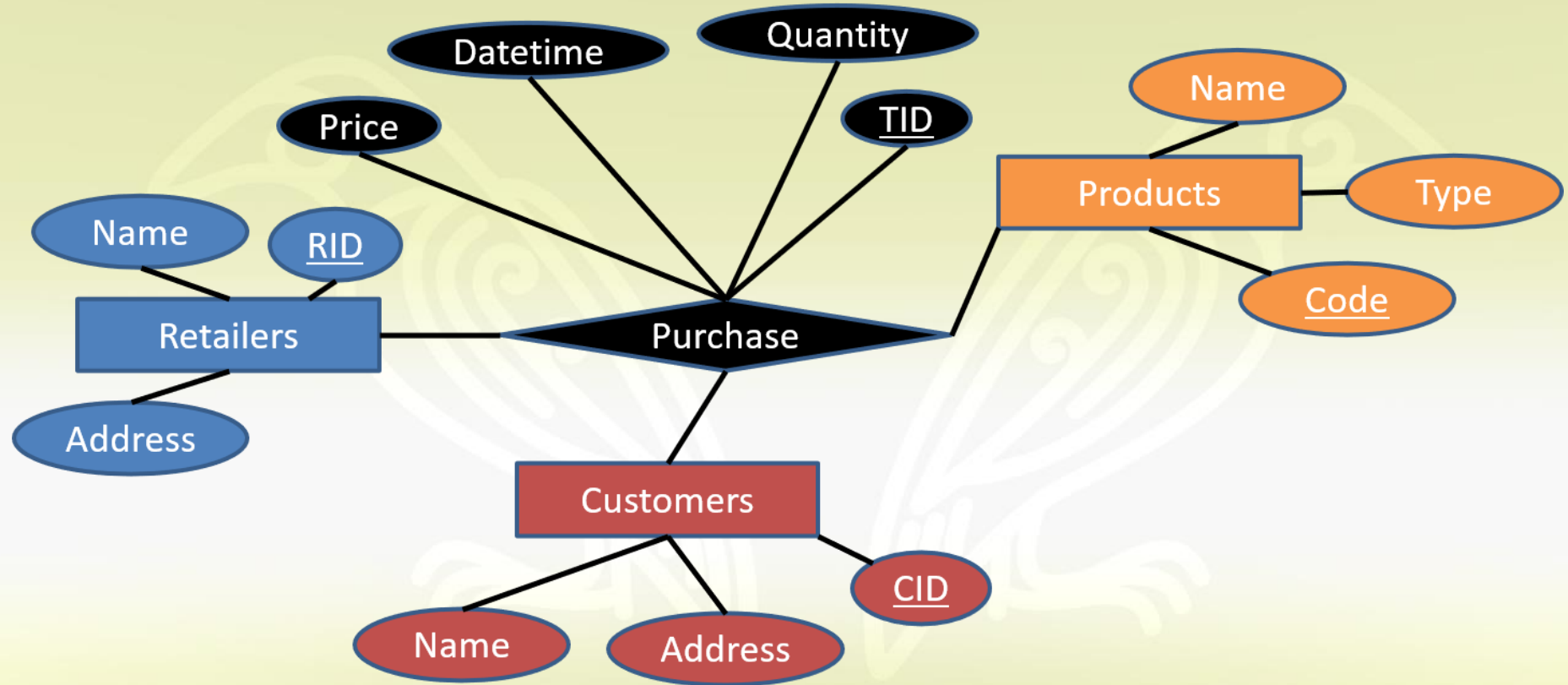
## Example: Entity-Relationship Diagram

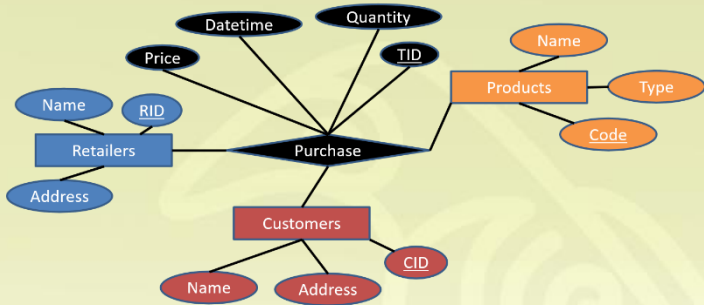
Retailers

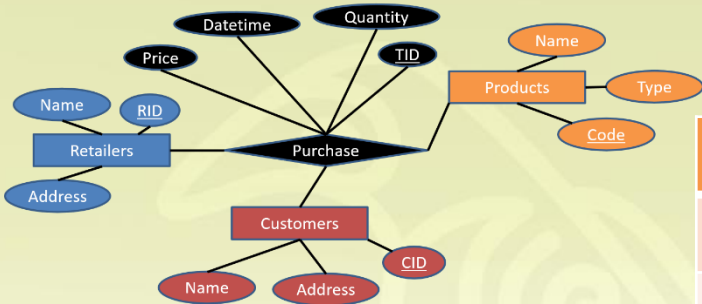
Customers

Products









PCode	Name	Type
P234	Gruel	Food
P695	Water	Drink

RID	Name	Address
SH01	Shoppz	Shoppz.uk
SH02	Buyaz	Buyaz.com

CID	Name	Address
C4124	Alice	2 Main St.
C3156	Bob	54 Nice Rd.

TID	PCode	CID	RID	Price	Qty	DateTime
354	P234	C3156	SH02	\$5.04	3	2020-05-16
355	P695	C4124	SH01	\$4.95	4	2020-06-03
356	P234	D3156	SH01	\$2.59	2	2020-06-04

# Query Language

Relational

Structured Query Language (SQL)

Non-relational AKA NoSQL (misnomer-ish)

GraphQL

RESTful APIs

Also sometimes SQL

# APL Arrays

Data fits in WS

Single-user update

Update from APL



# Advantages over "just APL arrays"

Lots o' data

Data integrity

Query optimisers

Multi-user access

Access control / security

Compatibility

# Relational Database Paradigms

## **OLTP (OnLine Transactional Processing)**

Inserts, updates, deletes

Simultaneous writes from multiple users

## **OLAP (OnLine Analytical Processing)**

Write less, read more

Better suited for vectorised operations

# Options

APL Matrix

APL Inverted Table

Dataframe system

DBMS

# Dataframes

Python + Pandas + Py'n'APL

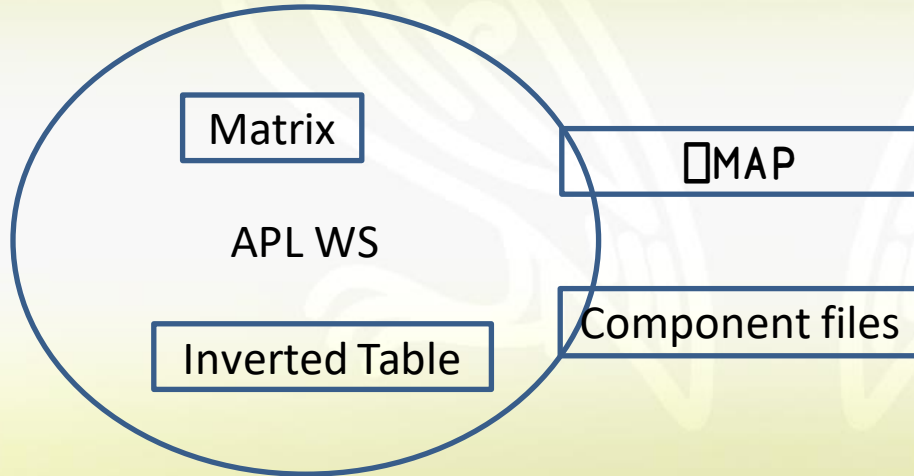
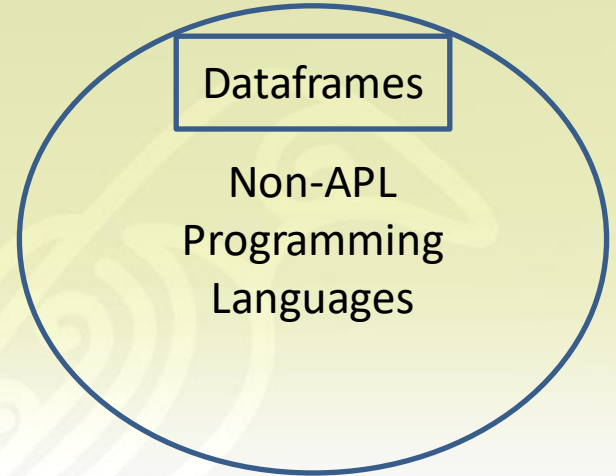
**[github.com/Dyalog/pynapl](https://github.com/Dyalog/pynapl)**

R + data.tables + RSCONNECT

**[github.com/kimmollinna/rsconnect](https://github.com/kimmollinna/rsconnect)**

# Data locality

DBMS



# Examples

APL

Nested Matrix

# Nested Matrix

Query Language: APL

Intuitive

Convenient

Performance suffers with lots of data

# Examples

APL

Nested Matrix

Inverted Table



# Inverted Table

AKA column-oriented or "columnar database"

Query Language: APL

Slightly more complex DSL (might use  $\delta\mathbb{I}$ )

Relatively convenient

Good analytical performance

# Inverted Table

Inverted Tables / Roger Hui / Dyalog '18

[dyalog.tv/Dyalog18/?v=IOWDkqKbMwk](https://dyalog.tv/Dyalog18/?v=IOWDkqKbMwk)

**vecdb**

[github.com/Dyalog/vecdb](https://github.com/Dyalog/vecdb)

**FlipDB**

[carlislegroup.com/products/flipdb](https://carlislegroup.com/products/flipdb)

# Examples

## APL

Nested Matrix (OLTP)

Inverted Table (OLAP)

Flat Inverted Table (Fast OLAP)

## DBMS

MariaDB (OLTP)

ClickHouse (OLAP)

# Usage examples

APL Arrays

SQAPL

LOADDATA.dws

SQA.Do

Low level interface

DYALOG

The tool of thought for expert programming

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# Dyalog APL SQAPL Interface Guide

Version 6.3

[Knowledge Base](#) » [Server & Client Software](#) » [Client Libraries](#) » [Application Programming Interfaces](#)[Home](#)[Open Questions](#)[MariaDB Server](#)[MariaDB MaxScale](#)[MariaDB ColumnStore](#)[Connectors](#)

Ask a  
question here

View 17  
questions

## Application Programming Interfaces



### C & C++ Connectors

*The Client Library for Developing MariaDB Applications with the C Programming Language.*



### Java Connector

*Information on the JDBC Driver for MariaDB.*



### .NET Connector

*Connecting to MariaDB from .NET applications.*



### Node.js Connector

*Information on javascript Node.js connector*



### ODBC Connector

*MariaDB Connector/ODBC is a standardized ODBC database driver.*



### Perl DBI

*Connecting to MariaDB using the Perl DBI Module.*



### PHP

*Connecting to MariaDB from PHP Applications*

[↑ Client Libraries ↑](#)[Client/Server Protocol](#)[libmysqld](#)**Application  
Programming Interfaces**[Proxy Protocol Support](#)



MariaDB Platform

Cloud

apt/yum

Connectors

Tools

Data Access

Data Analysis

Lightweight, advanced connectors for high-performance data access and data streaming.

MariaDB Connector/ODBC is a standard ODBC 3.5 driver for building cross-platform applications on top of MariaDB Platform, complete with encrypted connections via TLS/SSL. MariaDB Connector/ODBC is LGPL.

Product

ODBC connector



OS

MS Windows 64-bit



Release Notes

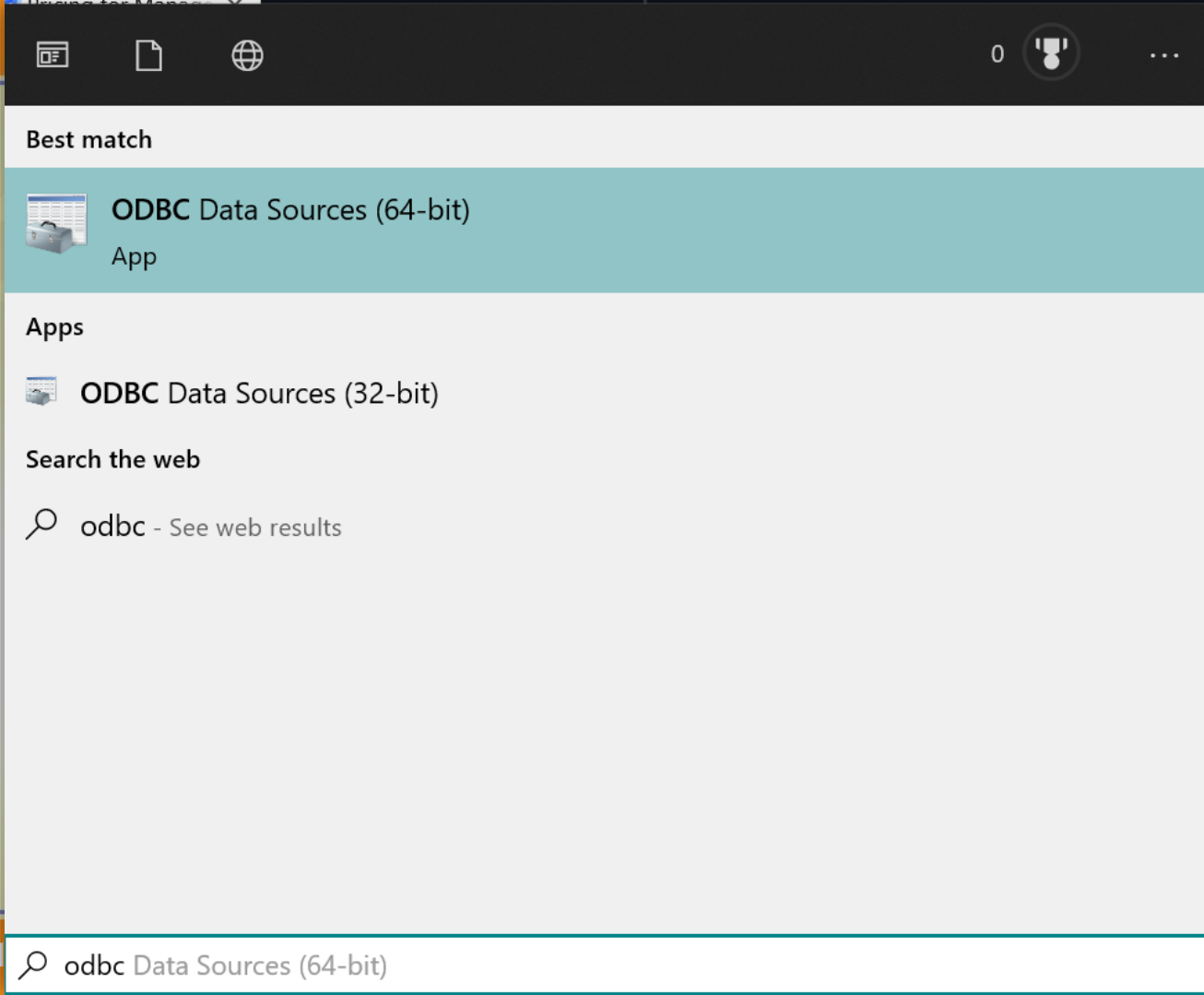
Show All Files

ODBC Connector

<https://dlm.mariadb.com/1671860/connectors/odbc/connector-odbc-3.1.13/mariadb-connector-odbc-3.1.13-win64.msi>


11.21 MB

Download




Windows Start menu search results for 'odbc'. The interface shows a search bar at the top with the text 'odbc Data Sources (64-bit)'. Below the search bar, the results are categorized into 'Best match', 'Apps', and 'Search the web'. The 'Best match' section highlights 'ODBC Data Sources (64-bit)' as an App. The 'Apps' section lists 'ODBC Data Sources (32-bit)'. The 'Search the web' section shows a search result for 'odbc - See web results'.


Best match

 **ODBC Data Sources (64-bit)**  
App

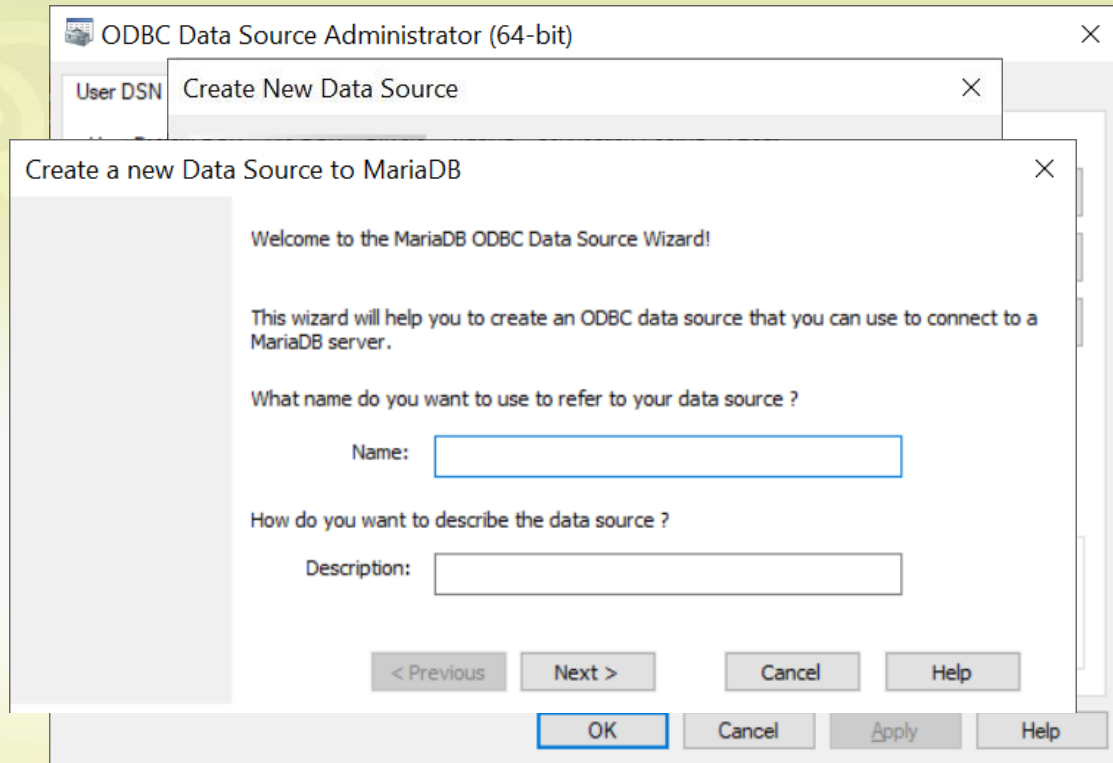
Apps

 **ODBC Data Sources (32-bit)**

Search the web

 odbc - See web results





# Database

A system of organised data

+

A Query Language

# Types

Organisation & Query Language

Relational

Non-relational

# Options

APL Matrix

Inverted Tables

Dataframes

DBMS

# So much more to cover...

## Relational databases

- Inverted tables

- Permanent storage (component files, memory mapped...)

- SQAPL and related tools

## Non-relational databases

- Time series

- Key-value (dictionaries)

- Document / Object

- Graph

- ...

## Non-ODBC interaction

# [dyalog.com/dates-for-your-diary.htm](https://dyalog.com/dates-for-your-diary.htm)

July 15

**BAA Open Session**

[britishaplassociation.org/webinar-schedule-2021](https://britishaplassociation.org/webinar-schedule-2021)

July 30

**APL Problem Solving Competition Closes**

[dyalogaplcompetition.com](https://dyalogaplcompetition.com)

August 01

**APL Campfire**

[apl.wiki/campfire](https://apl.wiki/campfire)

August 05

**Error Handling Part 4**

[dyalog.tv](https://dyalog.tv)