



VOLTRON DATA

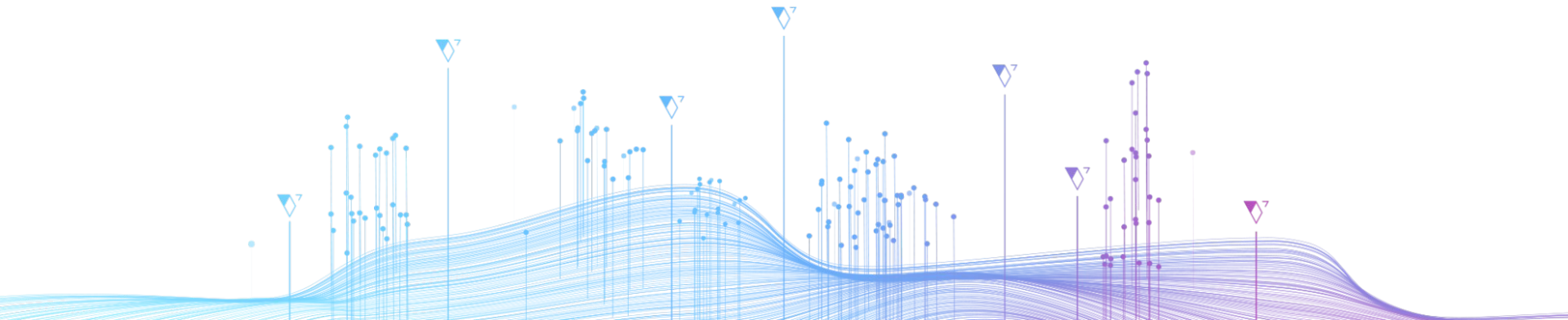




Making Moves with Arrow Data: Introducing Arrow Database Connectivity (ADBC)

March 29th, 2023

Matthew Topol



Who am I?

Email

matt@voltrondata.com

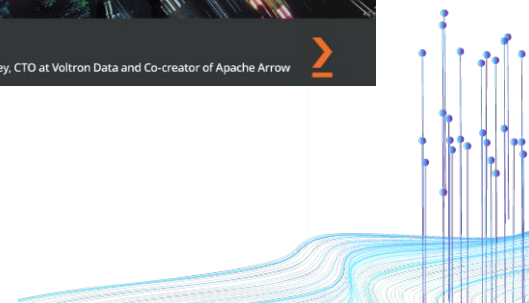
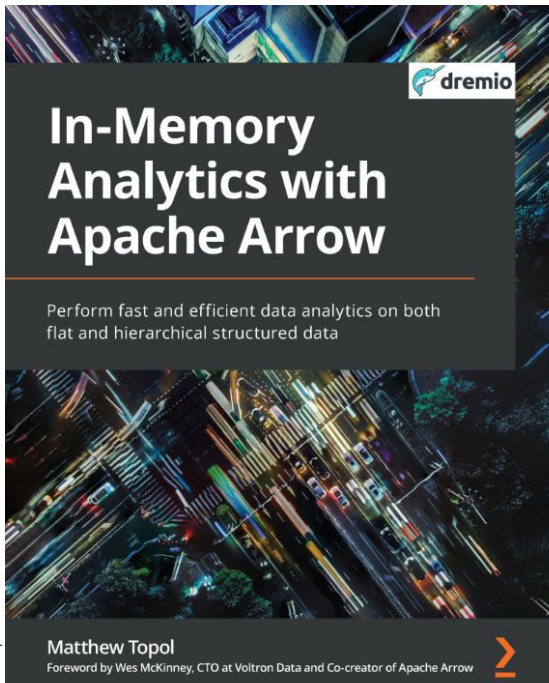
Author Of

["In-Memory Analytics With Apache Arrow"](#)

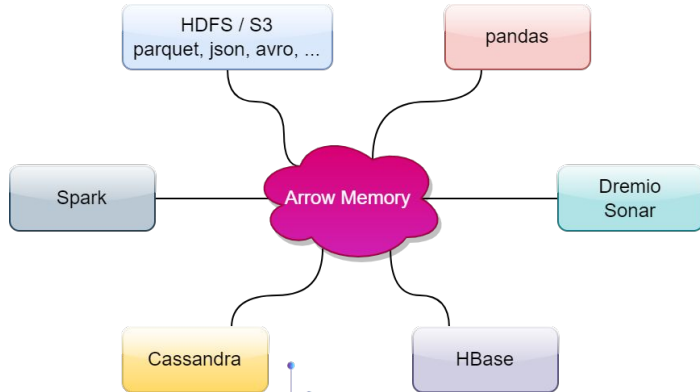
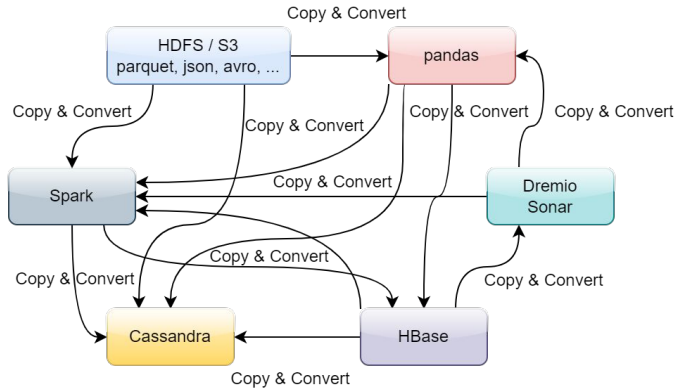
Staff Software Engineer at Voltron Data
Apache Arrow Contributor



@zeroshade



A quick primer on



High Performance, In-Memory Columnar Format

No Data Serialization / Deserialization required!

Polyglot! Implementations in many languages

Go, C++, Rust, Python, R, Java, Julia, MATLAB, and more...



What is Columnar?

Table of Data

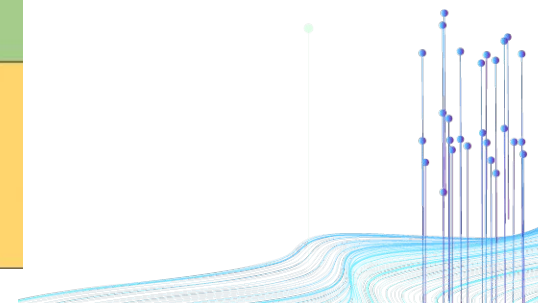
	ARCHER	LOCATION	YEAR
ROW 1	Legolas	Mirkwood	1954
ROW 2	Oliver	Star City	1941
ROW 3	Merida	Scotland	2012
ROW 4	Lara	London	1996
ROW 5	Artemis	Greece	-600

Row Oriented Memory Buffer

Row 1	Legolas	Mirkwood	1954
Row 2	Oliver	Star City	1941
Row 3	Merida	Scotland	2012
Row 4	Lara	London	1996
Row 5	Artemis	Greece	-600

Arrow Columnar Memory Buffer

archer	Legolas	Oliver	Merida	Lara	Artemis
location	Mirkwood	Star City	Scotland	London	Greece
year	1954	1941	2012	1996	-600



Why Columnar?

Memory Locality

I/O

Vectorization

A Less I/O, lower memory usage, fewer page faults

Get All Archers in Europe:

Only need two columns! (Archer, Location)

1. Spin through Locations for indexes
2. Get Archers at those indexes

B Significantly faster computation!

Calculate mean for Year column:

Only need the one column! (Year)

1. Vectorized operations require contiguous memory
2. Our column is already contiguous memory!

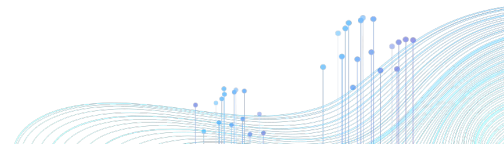




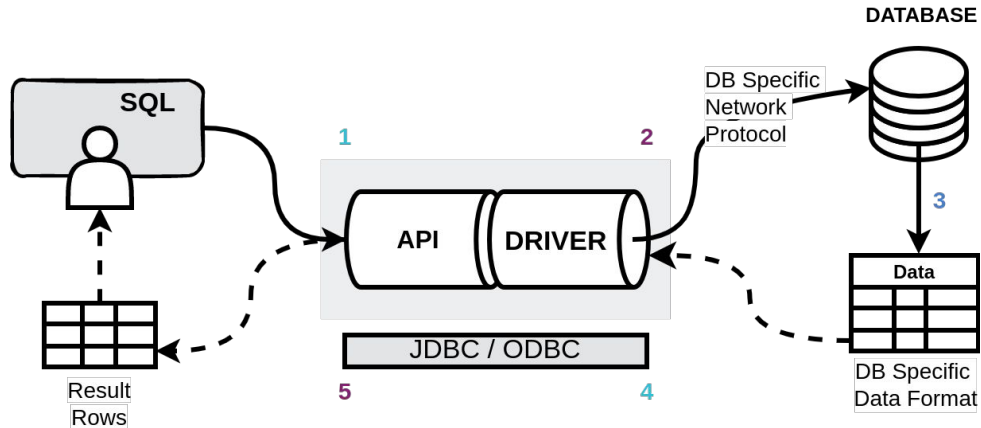
I'm a JDBC Driver

Most Common Interaction with Databases

JDBC/ODBC



Using JDBC/ODBC



01.

Submit Query

Application submits an SQL query via the JDBC/ODBC API

02.

Driver Translation

Driver translates query to database specific protocol and sends it

03.

Database

Query is executed and result set is returned in a database-specific format

04.

Driver Translation pt. 2

The driver translates the result set into the format required by JDBC/ODBC

05.

Iterate Results

The application iterates over the result rows using the JDBC/ODBC API



Pros and Cons...

JDBC/ODBC aren't easy

JDBC/ODBC aren't going anywhere

Existing usage: e.g. PostgreSQL, SQL Server, OLTP/CRUD applications, etc.
They handle nearly every use case you can think of

Conversion Costs

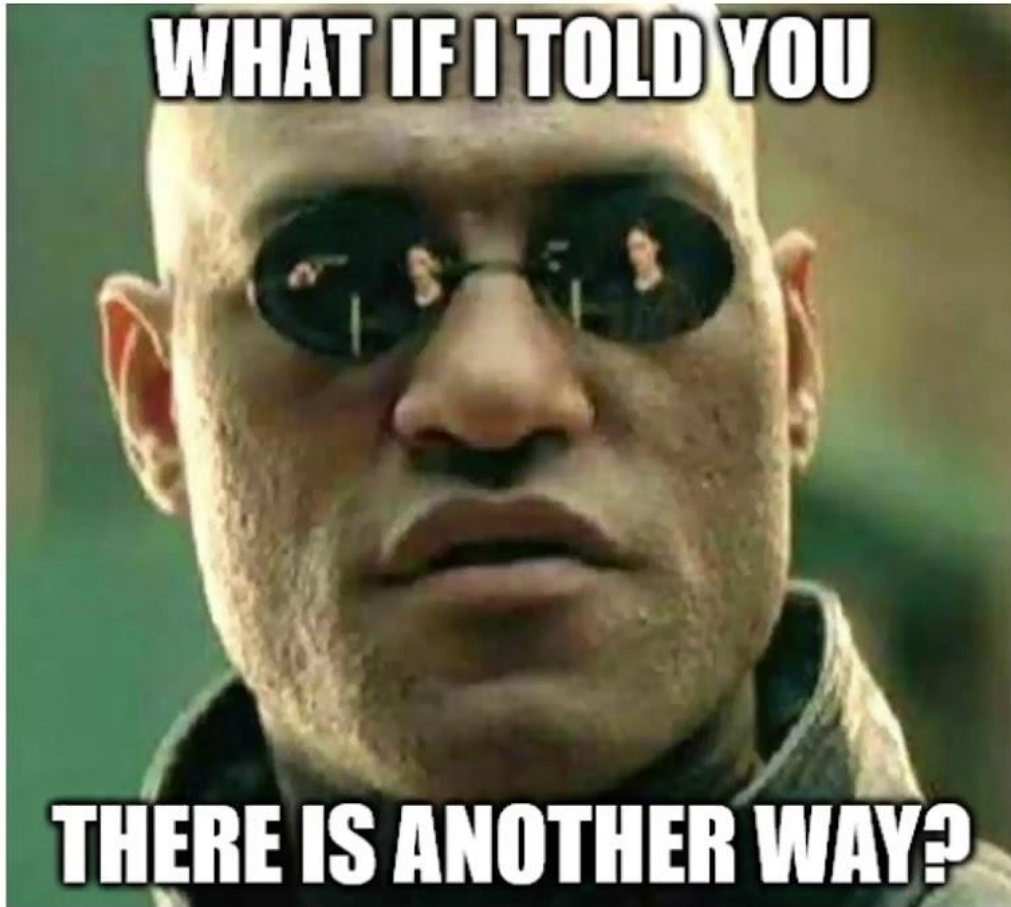
Columnar native databases: e.g. DuckDB, ClickHouse, Google BigQuery, Dremio, etc.
Conversion libraries: e.g. Turbodbc, arrow-jdbc

Integration Costs

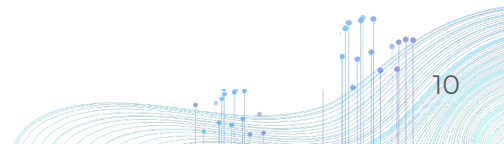
Integrate specific SDKs to avoid conversion costs...
Multiple complex integrations with varied connectors: e.g. Look at all Trino's connectors!



WHAT IF I TOLD YOU



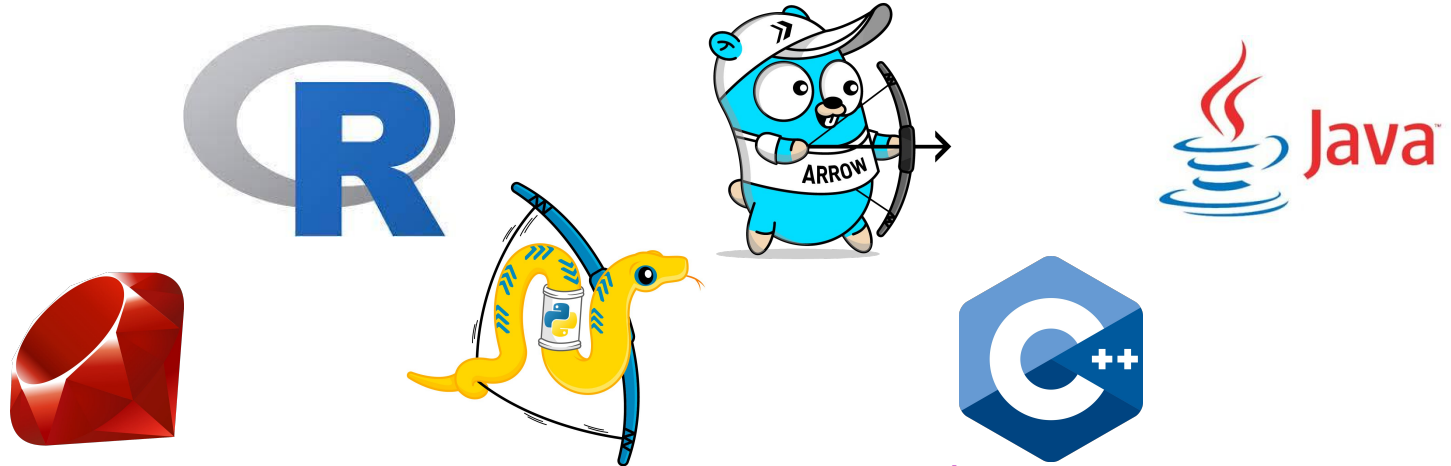
THERE IS ANOTHER WAY?



Arrow Database Connectivity (ADBC)

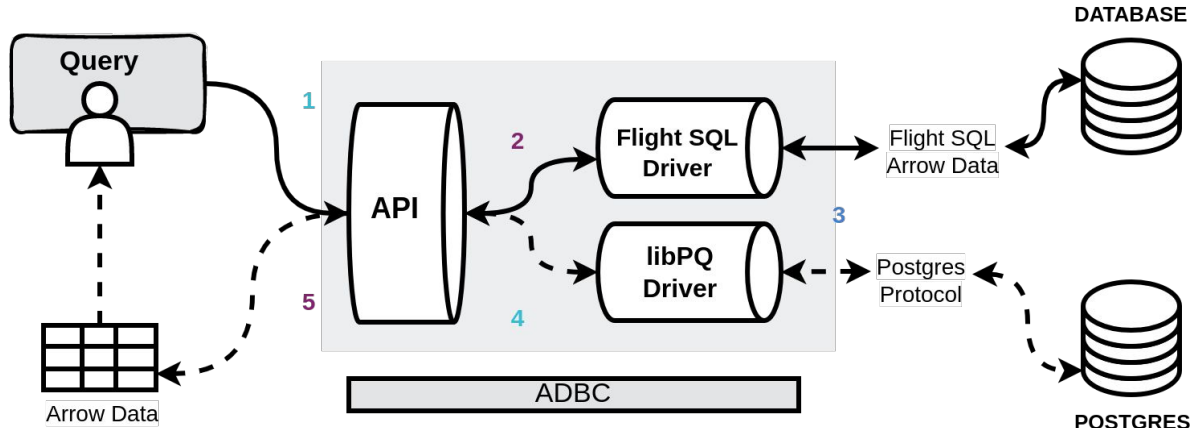
A single API for getting Apache Arrow data in and out of different databases.

<https://arrow.apache.org/adbc/>



A columnar, vendor-neutral, minimal-overhead alternative to JDBC/ODBC for analytical applications

Let's see that again...



01.

Submit Query

Application submits an SQL query via the ADBC API

02.

Driver Translation

Driver translates query to database specific protocol and sends it

03.

Database

Query is executed and result set is returned in a database-specific format, ideally Arrow data

04.

Driver Translation pt. 2

If needed: The driver translates the result set into Arrow data, otherwise it is just passed through

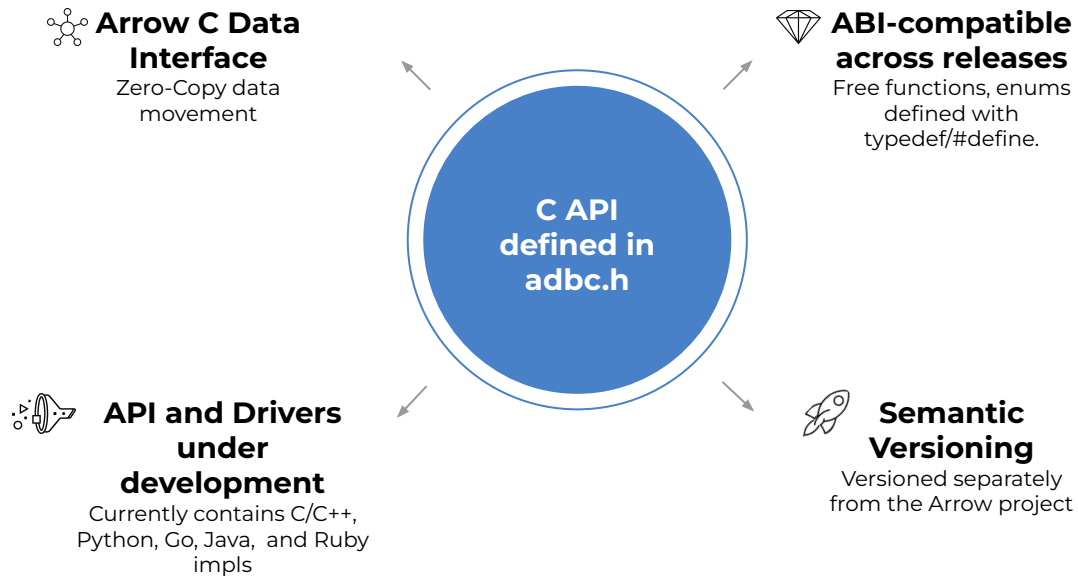
05.

Iterate Results

The application iterates over batches of Arrow data



ADBC Specification



Where does ADBC fit?

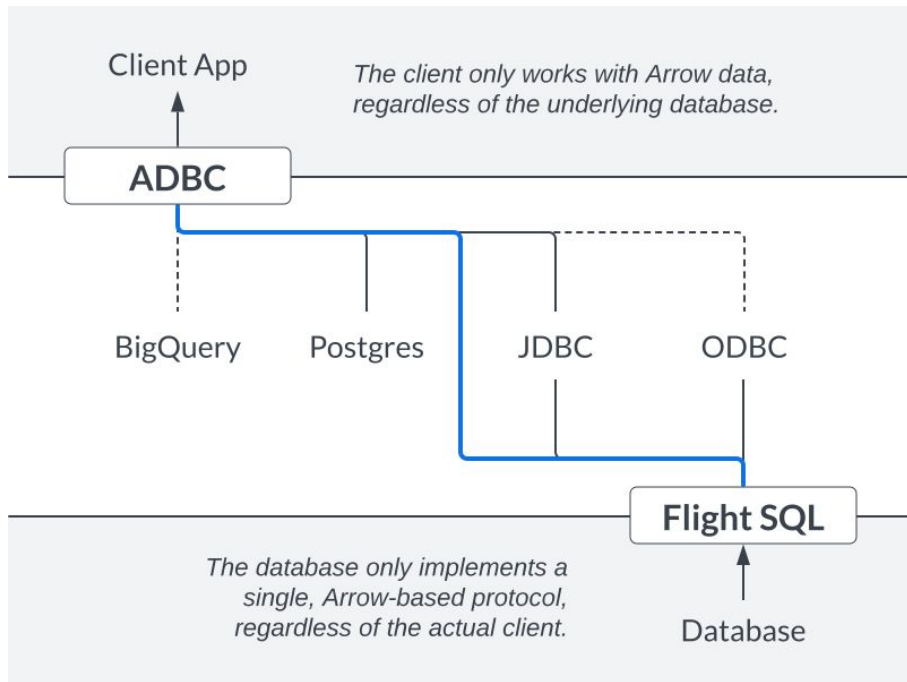
What about Flight SQL and other technologies?

	Vendor Neutral (DB APIs)	Varies by Vendor (DB Protocols)
Arrow-native	ADBC	Arrow Flight SQL BigQuery Storage gRPC Protocol
Row-oriented	JDBC ODBC (typically row-oriented)	PostgreSQL wire protocol Tabular Data Stream (MS SQL Server)

ADBC doesn't intend to replace JDBC or ODBC for general use, just for applications that want bulk columnar data access.



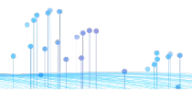
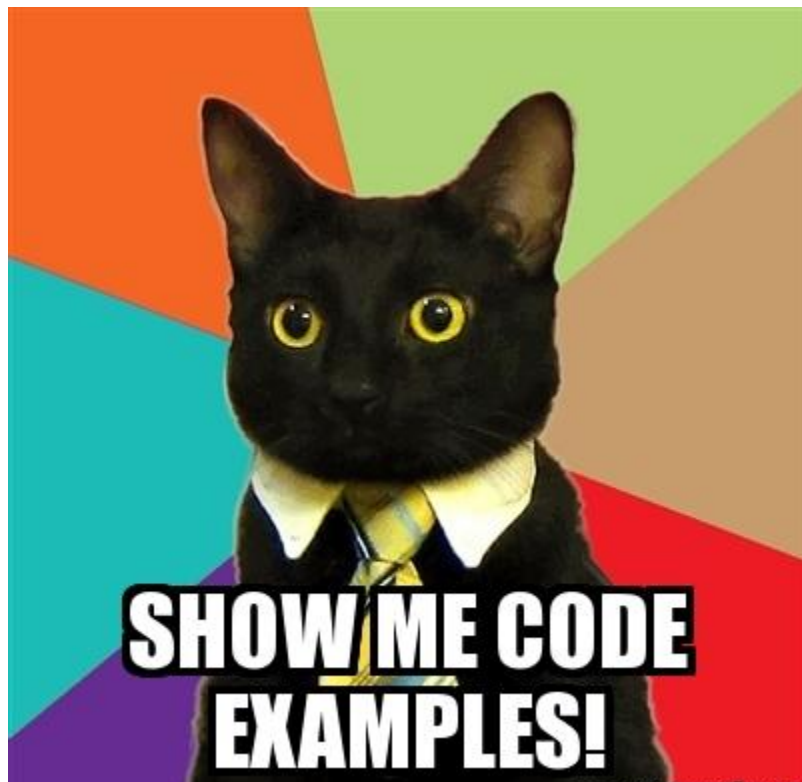
API vs Protocol



ADBC complements Flight SQL

Database developers can support Flight SQL to simultaneously support ADBC, JDBC and ODBC users





Python ADBC (DBAPI 2.0)

```
import adbc_driver_sqlite.dbapi

uri = "file:mydb.sqlite"
with adbc_driver_sqlite.dbapi.connect(uri) as conn:
    with conn.cursor() as cur:
        cur.execute("SELECT * FROM customer")
        table = cur.fetch_arrow_table()
        # Process the results
```

```
import adbc_driver_postgresql.dbapi

uri = "postgresql://localhost:5433"
with adbc_driver_postgresql.dbapi.connect(uri) as conn:
    pass
```

ex: **SQLite3**
PostgreSQL

pip install adbc_driver_sqlite adbc_driver_postgresql

optionally:
pip install pyarrow

Python ADBC (Low-level API)

```
import adbc_driver_manager
with adbc_driver_manager.AdbcDatabase(driver="adbc_driver_sqlite") as db:
    with adbc_driver_manager.AdbcConnection(db) as conn:
        pass
```

Driver Manager

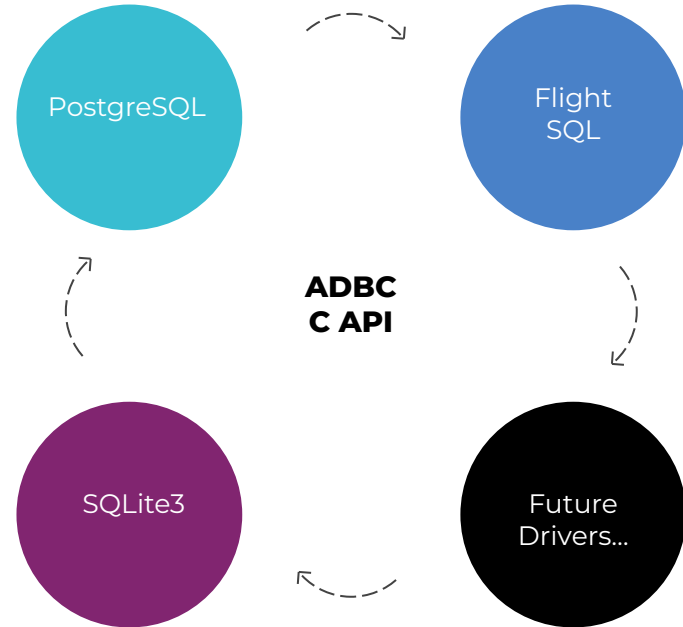
Provides both low-level bindings and high-level DBAPI bindings



Driver Manager

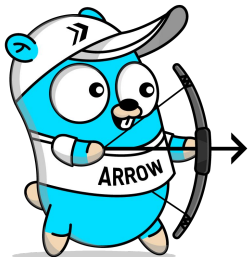
Implements the ADBC API and delegates to dynamically-loaded drivers

- ▶ Use multiple drivers simultaneously
- ▶ Decouple from specific drivers
- ▶ Makes drivers reusable in multiple environments
 - *ex: Go via CGO*



Go ADBC

```
import (  
    "database/sql"  
    "fmt"  
  
    "github.com/apache/arrow-adbc/go/adbc/drivermgr"  
    "github.com/apache/arrow-adbc/go/adbc/sqldriver"  
)  
  
func Example() {  
    sql.Register("adbc", sqldriver.Driver{&drivermgr.Driver{}})  
  
    // AdbcDriverInit is the assumed entrypoint by default, but i'll keep  
    // it specified explicitly here for demonstration purposes.  
    // this also assumes that libadbc_driver_sqlite.so is on your LD_LIBRARY_PATH  
    db, err := sql.Open("adbc", "driver=adbc_driver_sqlite;entrypoint=AdbcDriverInit")  
    if err != nil {  
        panic(err)  
    }  
  
    rows, err := db.Query("SELECT 1")  
    if err != nil {  
        panic(err)  
    }  
    defer rows.Close()  
}
```



1

ADBC Interface

- ▶ Interfaces to implement
- ▶ Enums
- ▶ Anyone can implement, all can use
- ▶ Generic Arrow-native interactions

2

Wrappers for ease of use

- ▶ [adbc/sqldriver](#) - wrap any ADBC driver to be compatible with standard database/sql pkg
- ▶ [adbc/drivermgr](#) - CGO connection to dynamically load any ADBC shared library

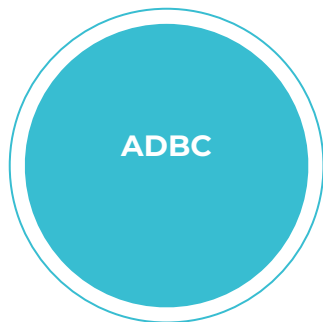


Equivalent Concepts

Compare with other APIs

Concept	ADBC	database/sql (Golang)	DBAPI 2.0 (PEP 249)	Flight SQL	JDBC	ODBC
Database Connection	AdbcConnection	Conn	Connection	FlightSqlClient	Connection	SQLHANDLE (connection)
Query State	AdbcStatement	–	Cursor	–	Statement	SQLHANDLE (statement)
Prepared Statement	AdbcStatement	Stmt	Cursor	Prepared Statement	Prepared Statement	SQLHANDLE (statement)
Result Set	ArrowArrayStream	*Rows	Cursor	FlightInfo	ResultSet	SQLHANDLE (statement)





Bulk Ingestion

Explicit facilities to ingest batches of Arrow Data into a database table

Partitioned Result Sets

Drivers can explicitly expose partitioned and/or distributed result sets for performance

Transactions

Specification defines transaction handling for rollback/commit if supported by databases



Want more info?

<https://arrow.apache.org/adbc/>

More on Apache Arrow: <https://arrow.apache.org/docs/>

Or get my book!

Examples in multiple
languages: Python / C++ / Go

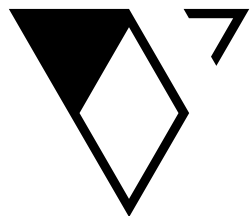
Practical Examples for Arrow
Flight and other Data Science
workflows



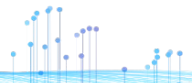
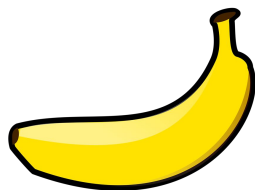
Amazon Link for the Book: buff.ly/30coxyB

"In-Memory Analytics with Apache Arrow"





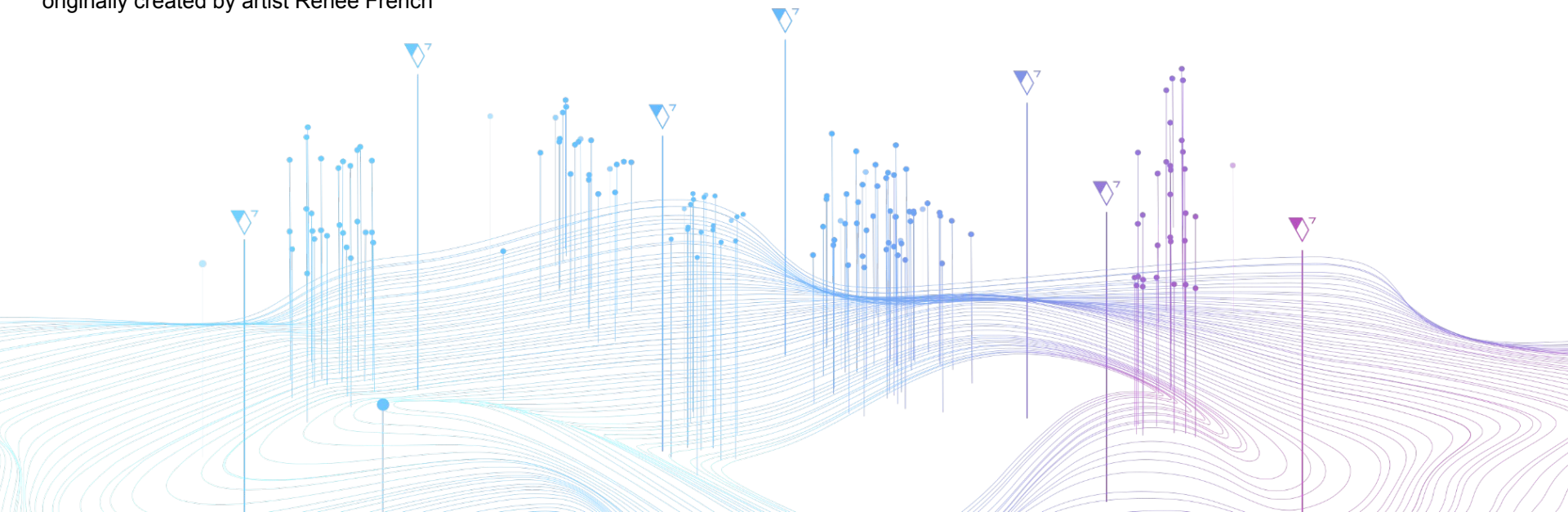
Questions?





Thank You!

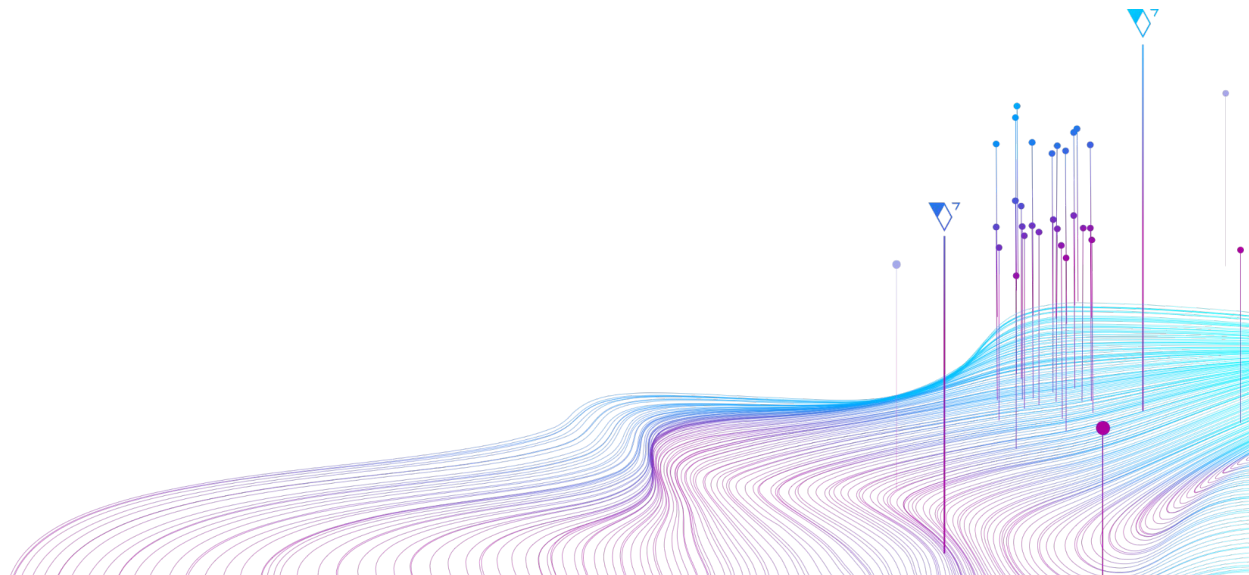
The Go Gopher image is released
under the Creative Commons Attribution 3.0 License,
originally created by artist Renee French



Title Here

XX Month, 2022

By:
Design Team



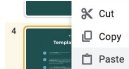
Template Guidelines

1

Create **new slides** and copy any element for your presentations.

2

To copy the footer you must copy/import the **complete slide** and if you'd like to change the background, **just apply the layout** that fits the most to your content.



3

All of this **text boxes are editable**. You can modify their content, however **you can't use new styles**. Here's you'll find from simple text, titles and diagrams.

4

You must respect the color palette, default style, typography and location of the main titles for a presentation with **sequential design**.

5

When you hide a slide, **move it to the end** of the reel to avoid numbering errors.

6

If you need an organizer, graphic, iconography or Headshot that adapts to the format of your presentation, tag me in a comment with the mail luis@voltrondata.com

7

Check the resources to create slides included at the end of the presentation. Let's keep the Voltron Data style to be aligned with the brand.

8

Review the version of the templates > [Voltron Data Template Green](#)

Title

Subtitles or short description here.

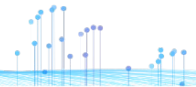
01. Subtitles
Or short description here.

02. Subtitles
Or short description here.

03. Subtitles
Or short description here.

04. Subtitles
Or short description here.

05. Subtitles
Or short description here.



Title

Subtitles or short description here.

Add important fact.



Agenda

Subtitles or short description here.

- ▶ **Item 01**
- ▶ **Item 02**
- ▶ **Item 03**
- ▶ **Item 04**
- ▶ **Item 05**

- ▶ Item 01
- ▶ Item 02
- ▶ Item 03
- ▶ Item 04
- ▶ Item 05



Title

Subtitles or short description here.

1 Add Title

Subtitles or short description here.

2 Add Title

Subtitles or short description here.

Add important fact.



Title

Subtitles or short description here.

1 Add Title

Subtitles or short description here.

2 Add Title

Subtitles or short description here.

3 Add Title

Subtitles or short description here.

Add important fact.



Title

Add subtitle or
phrase...

1 Add title...

- ▶ Item 01
- ▶ Item 02
- ▶ Item 03
- ▶ Item 04

2 Add title...

- ▶ Item 01
- ▶ Item 02
- ▶ Item 03
- ▶ Item 04



Title

1

Add title...

- ▶ Item 01
- ▶ Item 02
- ▶ Item 03
- ▶ Item 04

2

Add title...

- ▶ Item 01
- ▶ Item 02
- ▶ Item 03
- ▶ Item 04

3

Add title...

- ▶ Item 01
- ▶ Item 02
- ▶ Item 03
- ▶ Item 04

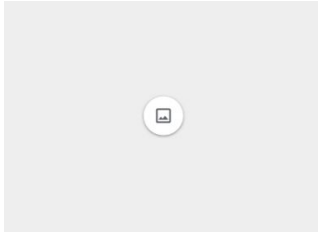
4

Add title...

- ▶ Item 01
- ▶ Item 02
- ▶ Item 03
- ▶ Item 04

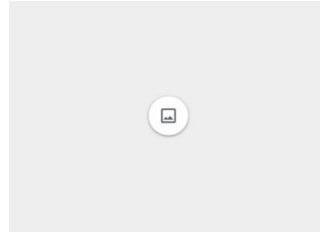


Title



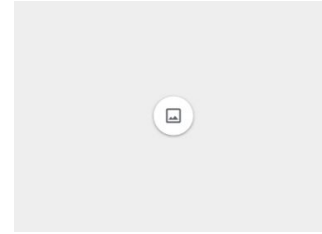
Title or Subtitle

Short Description...



Title or Subtitle

Short Description...

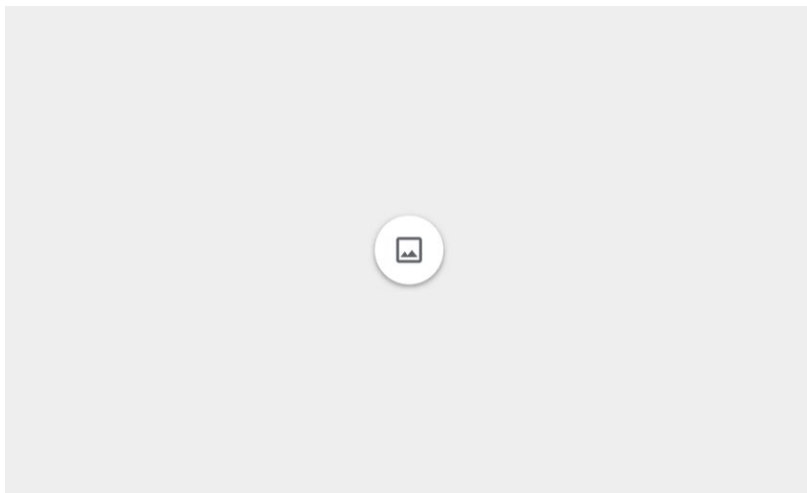


Title or Subtitle

Short Description...



Title



Add Subtitle

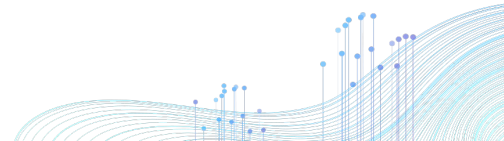
Add phrase...





Add Title

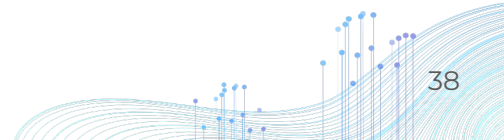
Add phrase...





Add Title

Subtitles or short description here.



Team

Subtitles or short description here.



Josh Patterson

Chief Executive
Officer (CEO)

—
Short Description



Wes McKinney

Chief Technology
Officer (CTO)

—
Short Description



Rodrigo Aramburú

Chief Product
Officer (CPO)

—
Short Description



Darren Haas

Head of
Engineering

—
Short Description



Team

Here more [headshots](#).



Rich Kizer

VP Sales



Hussain Sultan

Field Engineering



Ian Cook

Product Manager



Sekou McKissick

Senior Account Executive



Mike Wendt

VP Enterprise Technologies



Weston Pace

Software Engineer



Phillip Cloud

Principal Engineer, Languages



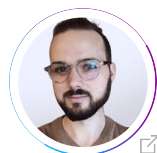
Bob Dill

Distinguished Engineer



Philip Moore

Field Engineering



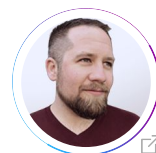
Will Jones

Open Source Support Engineer



Fernanda Foertter

Director of DevRel



Jonathan Keane

Engineering Manager



Alessandro Molina

Director of Software Engineering



Anja Boskovic

Open Source Support Engineer



Main Title

Subtitles or short description here.

Or paragraph description here.

Or paragraph description here.

Main Title

Subtitles or short description here.

- ▶ Fact 01
- ▶ Fact 02
- ▶ Fact 03
- ▶ Fact 04



Main Title

Subtitles or short description here.

Or paragraph description here.

Or paragraph description here.



 **110.000.000** 

Numbers and short description here.



Title

Subtitles or short description here.

**Title or
Subtitle**

Item / Description
Some text or
paragraph.

**Title or
Subtitle**

Item / Description
Some text or
paragraph.

**Title or
Subtitle**

Item / Description
Some text or
paragraph.



Title

Subtitles or short description here.

**Title or
Subtitle**

Item / Description
Some text or
paragraph.

**Title or
Subtitle**

Item / Description
Some text or
paragraph.

**Title or
Subtitle**

Item / Description
Some text or
paragraph.

**Title or
Subtitle**

Item / Description
Some text or
paragraph.

**Title or
Subtitle**

Item / Description
Some text or
paragraph.



Title

Subtitles or short description here.

Title or Subtitle

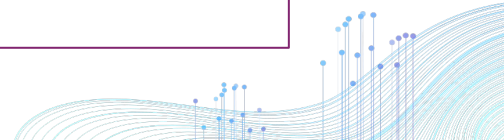
- ▶ Fact 01
- ▶ Fact 02
- ▶ Fact 03
- ▶ Fact 04

Title or Subtitle

Or paragraph description
here.
Or paragraph description
here.

Title or Subtitle

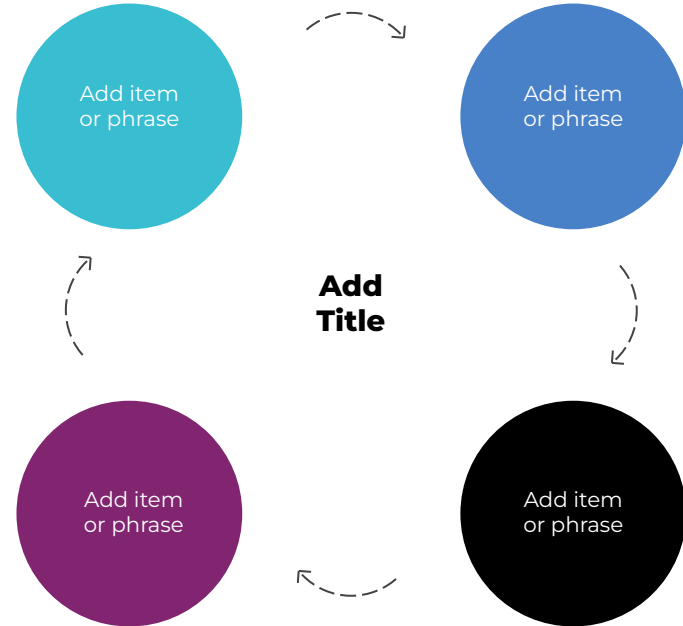
- ▶ Fact 01
- ▶ Fact 02
- ▶ Fact 03
- ▶ Fact 04



Title

Add phrase...

- ▶ Item 01
- ▶ Item 02
- ▶ Item 03
- ▶ Item 04





**Add
Item...**



Add phrase
or description...



**Add
Item...**



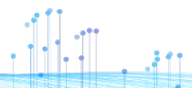
Add phrase
or description...



**Add
Item...**



Add phrase
or description...





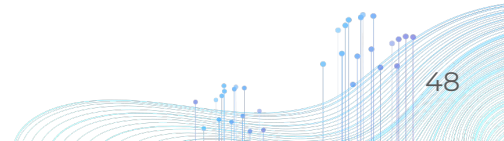
- ▶ Item 01
- ▶ Item 02
- ▶ Item 03



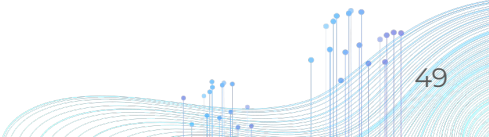
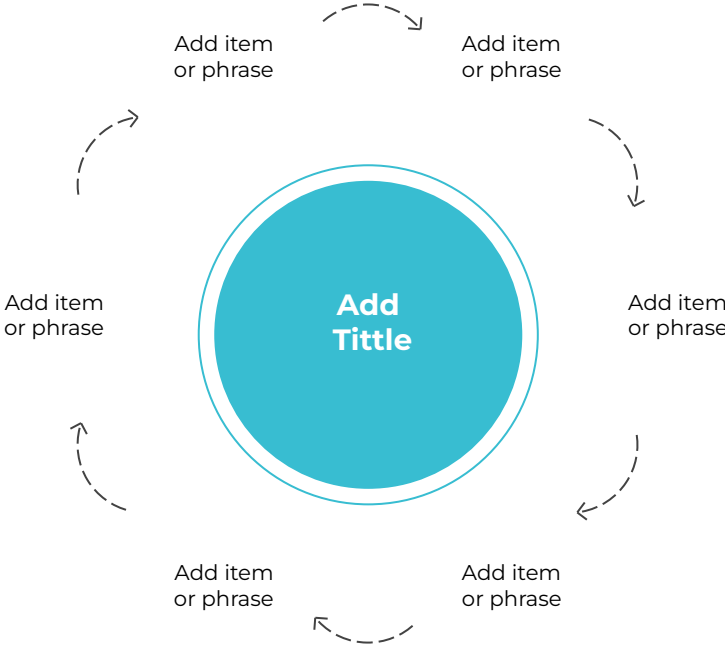
Add phrase
or subtitle



- ▶ Item 01
- ▶ Item 02
- ▶ Item 03



Title



Title

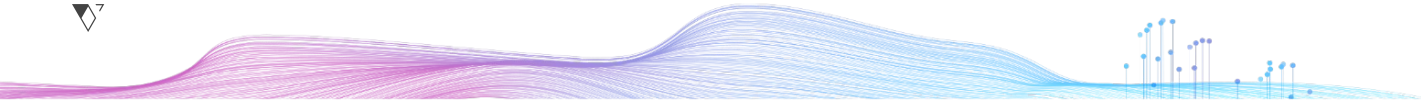
Add Title
Short description here.

Add Title
Short description here.



Add Title
Short description here.

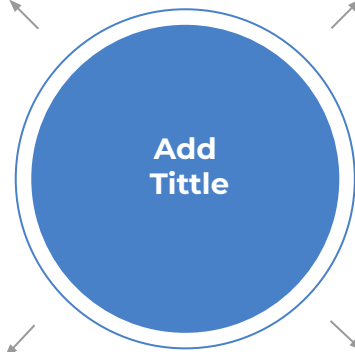
Add Title
Short description here.



Title

Add Title
Short description here.

Add Title
Short description here.



Add Title
Short description here.

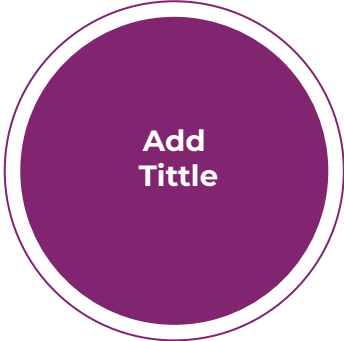
Add Title
Short description here.



Title

Add Title
Short description here.

Add Title
Short description here.

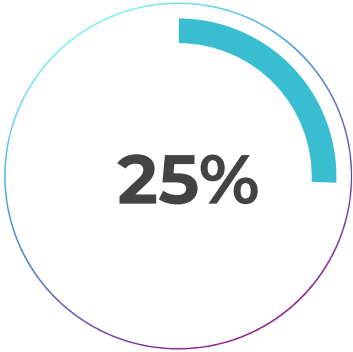


Add Title
Short description here.

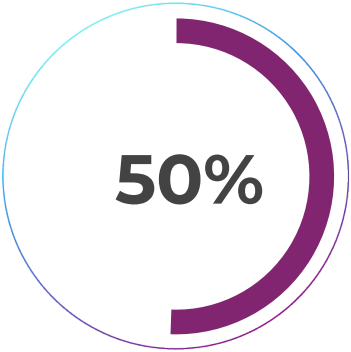
Add Title
Short description here.



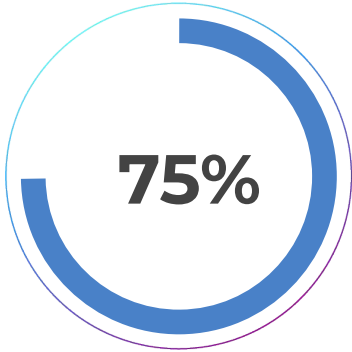
Title



Subtitles or short description here.



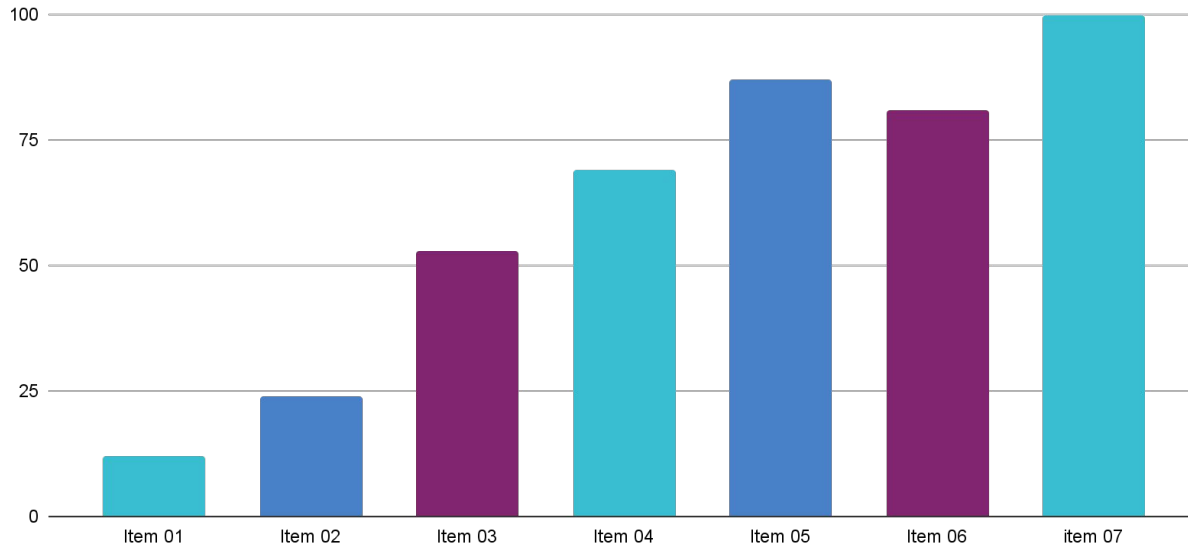
Subtitles or short description here.



Subtitles or short description here.



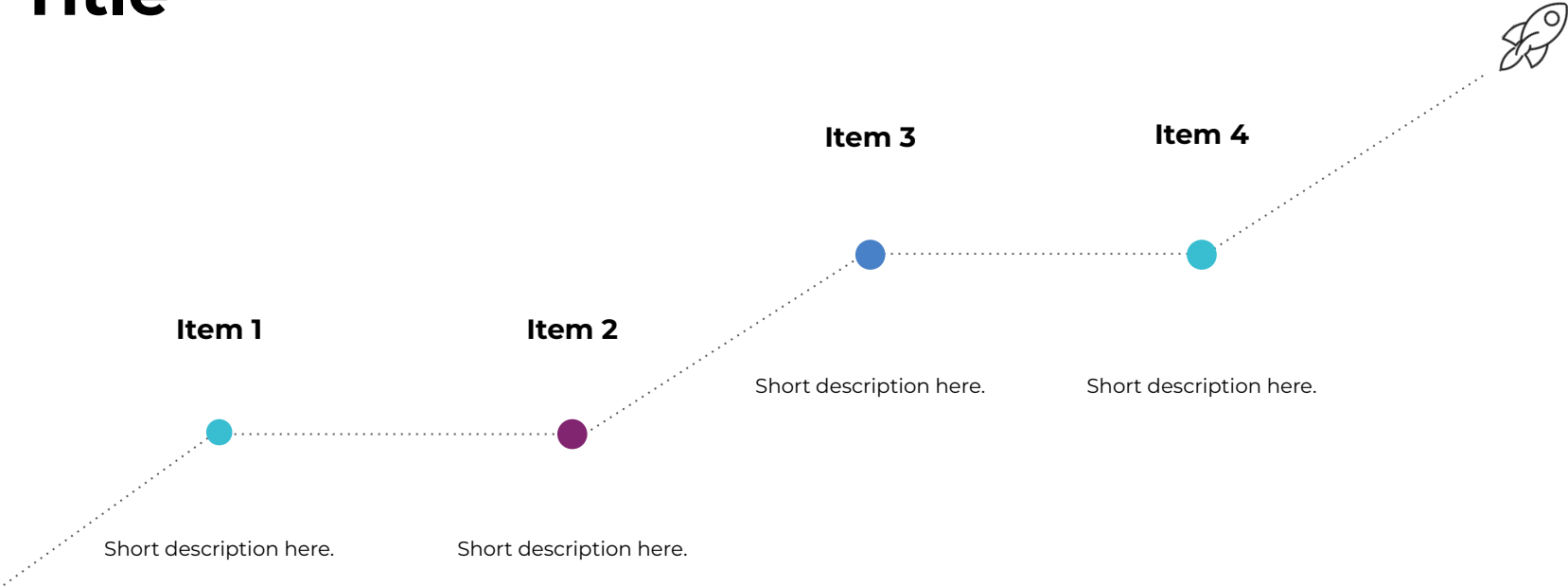
Title



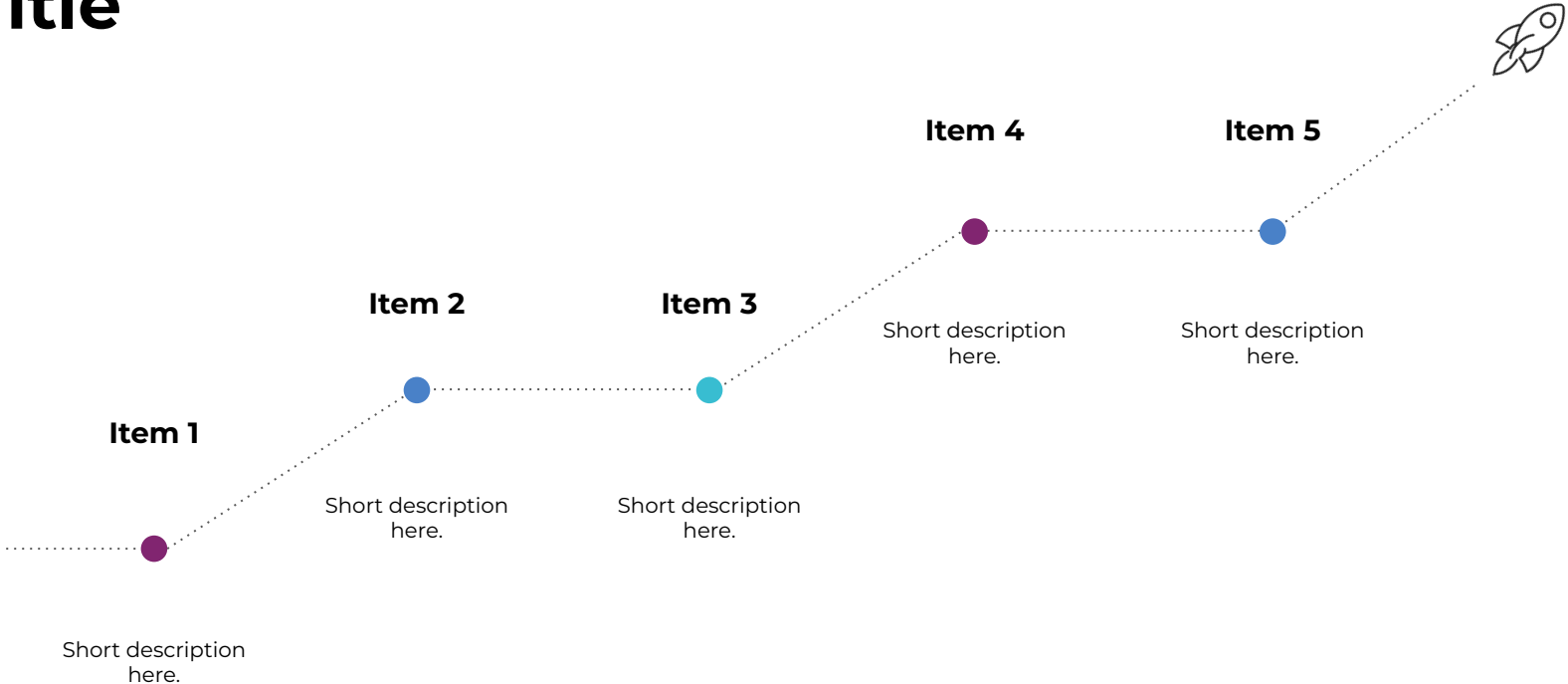
Bottom text or short description here.



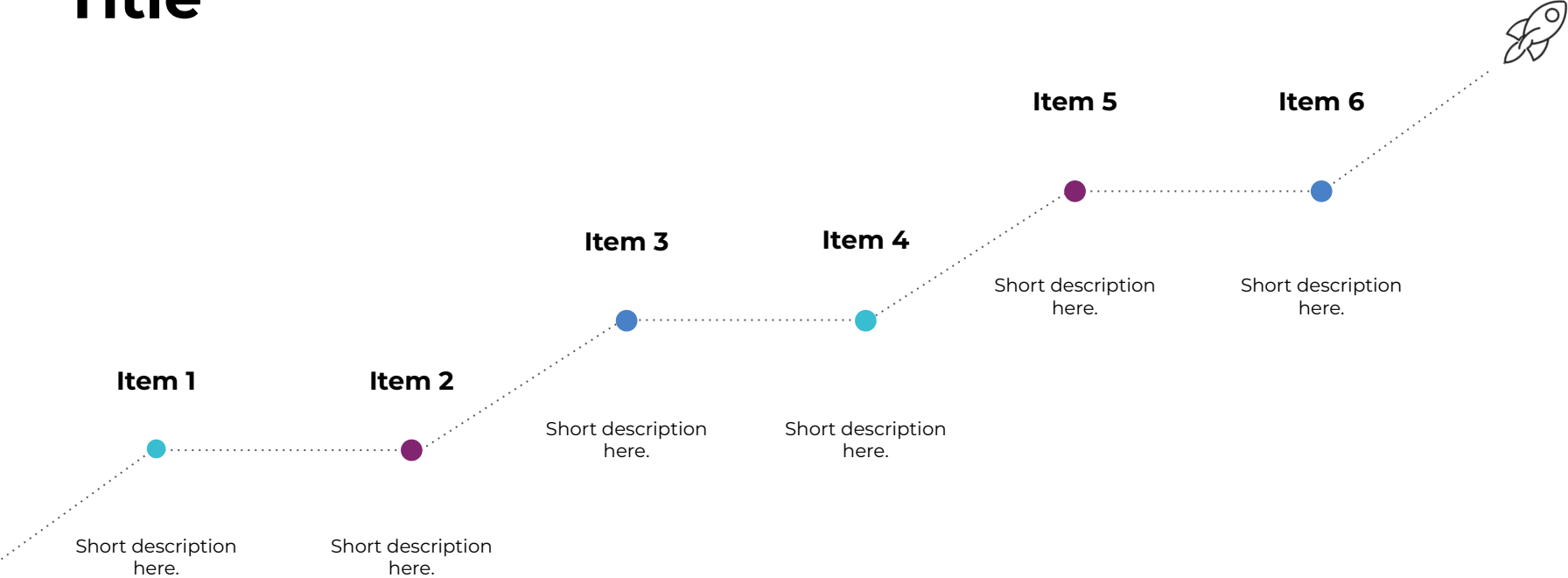
Title



Title



Title



Title

Item 1

Item 2

Item 3

Item 4



Short description here.

Short description here.

Short description here.

Short description here.



Title

Item 1

Item 2

Item 3

Item 4

Item 5



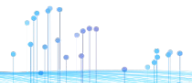
Short description here.

Short description here.

Short description here.

Short description here.

Short description here.



Title

Item 1

Item 2

Item 3

Item 4

Item 5

Item 6



Short description here.

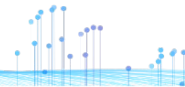
Short description here.

Short description here.

Short description here.

Short description here.

Short description here.



BASIC

\$ 99.99

Per month

- ✓ Short description here.
- ✗ Short description here.
- ✗ Short description here.
- ✗ Short description here.
- ✗ Short description here.

Select

STANDARD

\$ 399.99

Per month

- ✓ Short description here.
- ✓ Short description here.
- ✗ Short description here.
- ✗ Short description here.
- ✗ Short description here.

Select

PREMIUM

\$ 599.99

Per month

- ✓ Short description here.
- ✓ Short description here.
- ✓ Short description here.
- ✓ Short description here.
- ✓ Short description here.

Select



BASIC

\$ 99.99

Per month

- ✓ Short description here.
- ✗ Short description here.
- ✗ Short description here.
- ✗ Short description here.
- ✗ Short description here.

STANDARD

\$ 399.99

Per month

- ✓ Short description here.
- ✓ Short description here.
- ✗ Short description here.
- ✗ Short description here.
- ✗ Short description here.

PREMIUM

\$ 599.99

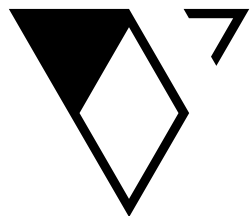
Per month

- ✓ Short description here.
- ✓ Short description here.
- ✓ Short description here.
- ✓ Short description here.
- ✓ Short description here.

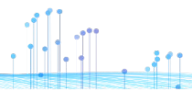
“

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Pellentesque a consequat est. Donec scelerisque mi sit amet arcu porta congue. Nulla sed iaculis risus. Maecenas faucibus, nunc in condimentum luctus, turpis ipsum sagittis dolor, in laoreet lacus neque vitae justo. Curabitur id quam pretium, consequat nunc sed.



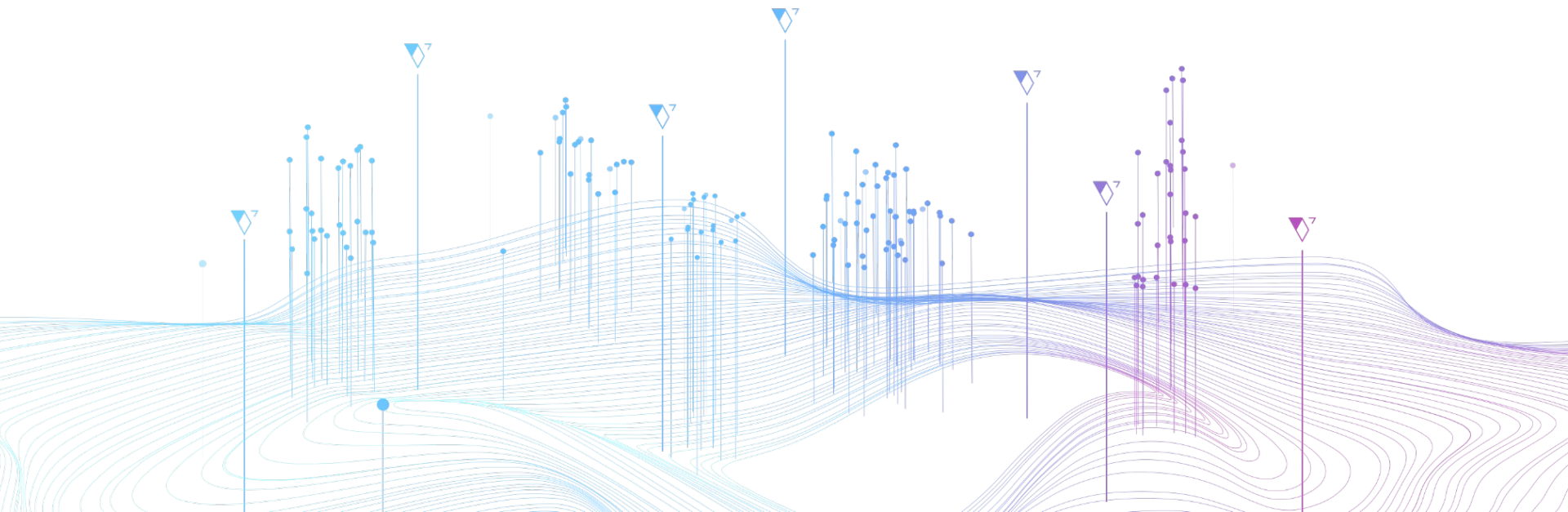


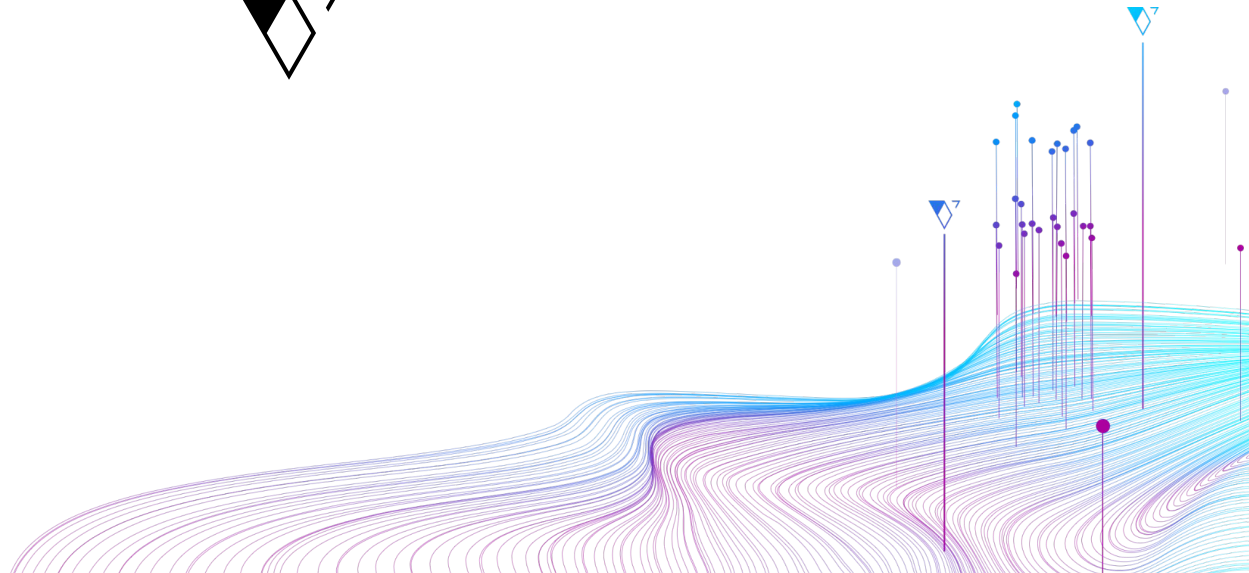
Questions?





Thank You!





Resources to Create Slides

August, 2022

By:
Design Team



Transitions

Click on the slideshow mode to view the animation in the image and text.



- 1 **In Animate section > Object animations,** use the option 'Fade In' (On Click) with 0.5 seconds of timing (fast)
- 2 **If you need help** with this part send me an email to luis@voltrondata.com



Primary Font

Available on Google Slides.



Montserrat Font

abcdefghijklmnopqrstuvwxy
ABCDEFGHIJKLMNOPQRSTUVWXY
!@#%&*()_+=[],./{}:"<>?~`

Secondary Fonts

Available on Google Slides.



Work Sans Font

abcdefghijklmnopqrstuvwxy
ABCDEFGHIJKLMNOPQRSTUVWXY
!@#%&*()_+=[],./{}:"<>?~`

Arial Font

abcdefghijklmnopqrstuvwxy
ABCDEFGHIJKLMNOPQRSTUVWXY
!@#%&*()_+=[],./{}:"<>?~`

Weights and sizes

Maintain the font sizes pairing, leading and paragraph headlines while doing a presentation:

- Size for Title Intro : 32 px
- Size for Title Slides : 26 px
- Size for Text box : 8 and 11 px



#005050

#000000

#812570

#4981C8

#38BDD1

Colors Palette

1st color

Dark Green

2nd colors

Black, magenta, blue and sky-blue

Check the correct use of colors [here](#).

Graphics A

You can copy/paste.

Use these custom graphics if you need a backup image for your content.

You can find the icons in the formats:

[SVG](#)
[PNG](#)



Developer



Devs



Client



Reduce Long Rewrites



Cloud



Public Cloud



Data Science



Processor Brands



Developer Man



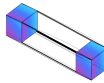
Developer Woman



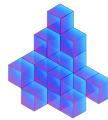
Servers 1



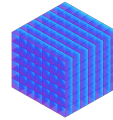
Servers 2



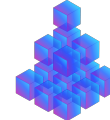
Conector Cubes



Stacked Cubes



Cubes



Scattered Cubes



Compute



Monitors

Graphics B

You can copy/paste.

Use these custom graphics if you need a backup image for your content.

You can find the icons in the formats:

[SVG](#)
[PNG](#)



Advance your priorities



De-risk Upgrades



Simplify issue reporting



Get fixes fast



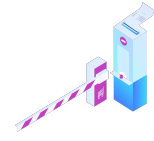
Deploy Fearlessly



Get a seat at the table



Workstation



Entry check



Icons









































You can copy/paste.

Use these custom icons if you need a backup image for your content.

You can find the icons in the formats:

SVG
PNG

For more icons check this [resource](#).

	Add		Alert		All Hands		Archive		Attach
	Benefits		Binary		Box		Brandbook		Business Card
	Calendar		Chart		Check List		Check Mark		Code
	Color		Comment		Commitment		Connect		Contributing Guide
	Core Tenets		Covid 19		Data		Database		Day 1 Tools
	Delete		Deploy		Design		Develop		Digital Signature
	Directory		Docs		Doc Retention		Dollar		Download
	Enterprise		First Day		Flow 1		Flow 2		Fonts / Typography



Icons

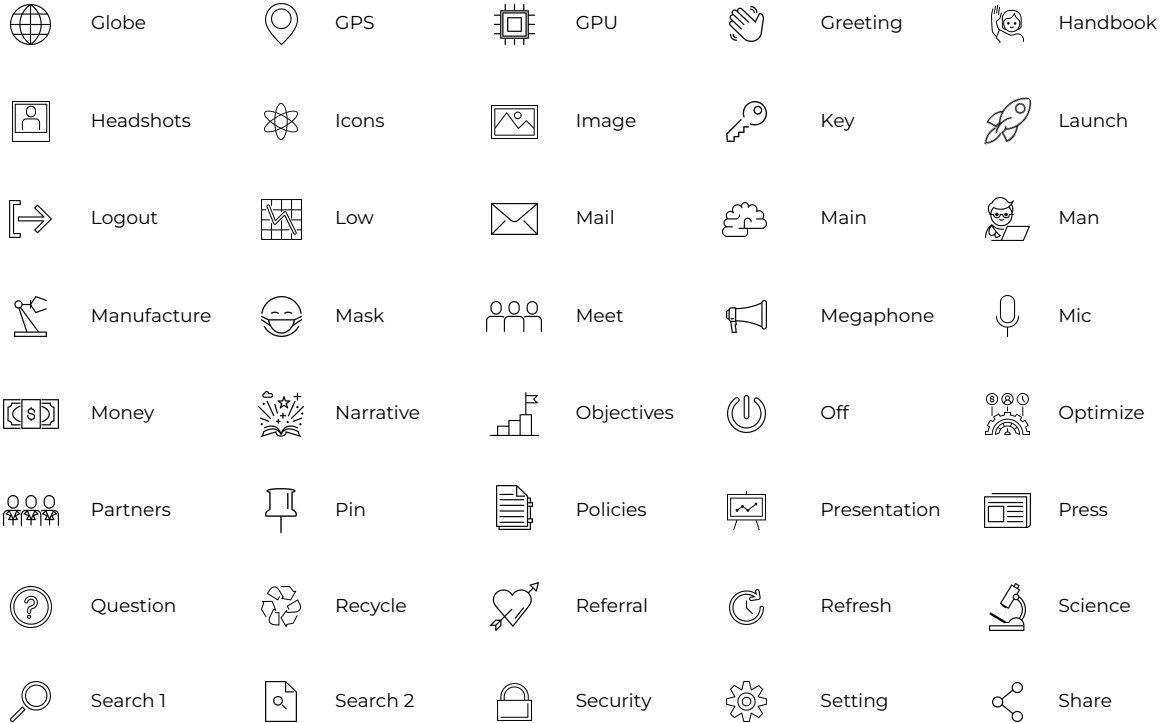
You can copy/paste.

Use these custom icons if you need a backup image for your content.

You can find the icons in the formats:

SVG
PNG

For more icons check this [resource](#).



Icons

You can copy/paste.

Use these custom icons if you need a backup image for your content.

You can find the icons in the formats:

[SVG](#)
[PNG](#)

For more icons check this [resource](#).



Social Media



Speech



Speed



Staging Queue



Stewardship Guide



Strengthen



Target



Teach



Team Directory



Terms



Time



Time Away



Tools



Trash



Upload



Usage Guide



Verify



Voltronaut



Woman



Works



Computer Power



Structured Data



Semi Structured Data



Unstructured Data



Data Ingestion



Data Storage



Data Cleanup



Data Transformation



Machine Learning



Model Deployment

Social Media



Github



Gmail



LinkedIn



Twitter



Medium



Youtube



How to use graphics and icons

The iconography and graphics you'll find as resources will do an impact and visual support to your texts. With that right use you'll be able to communicate in the simplest and clearest way.

Or to complement a concept o text:



A big launch is coming!

The outlined icons should not be very large when accompanying the texts or concepts.

*Icon used : Launch.



Charts

All icon sizes should be the same.

*Icon used : Chart



New meeting

Lorem ipsum dolor sit amet, ut sit amet.

*Icon used: Meet



Stay safe

Lorem ipsum dolor sit amet, ut sit amet.

*Icon used: Mask.



Open Code

Lorem ipsum dolor sit amet, ut sit amet.

*Icon used: Code.



Business goals

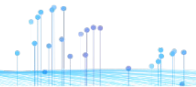
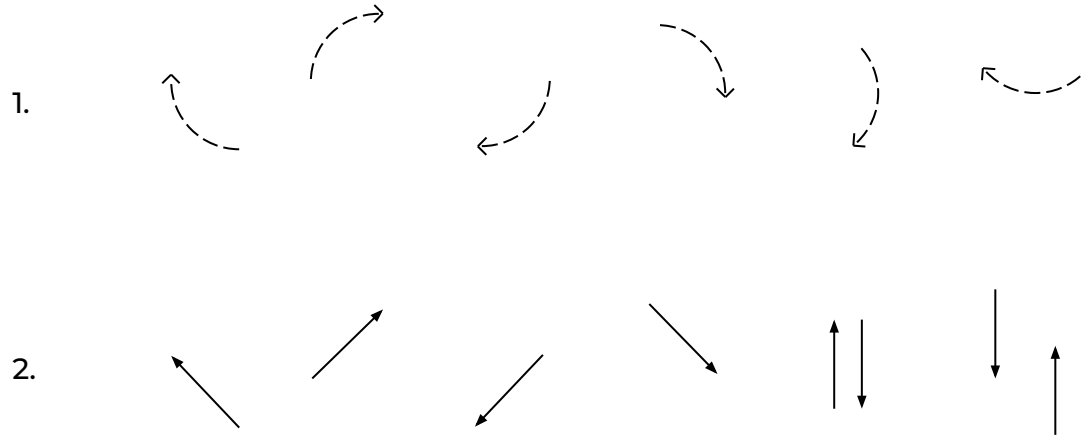
Lorem ipsum dolor sit amet, ut sit amet

*Icon used: Enterprise.

Arrows

You can copy/paste.

You can use and adjust these arrows as needed.

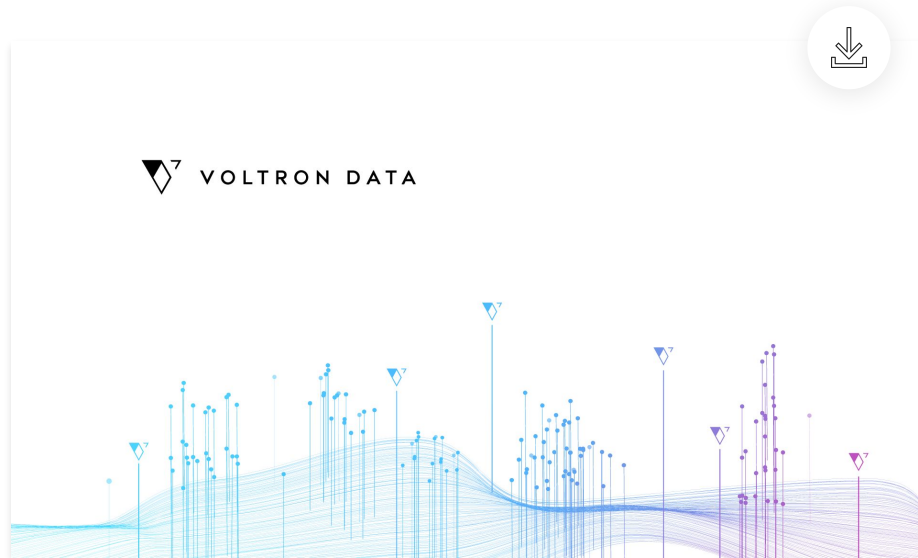


Background

Download it
in high resolution.

Sizes:

- [3840 x 2160 px](#)
- [1920 x 1080 px](#)
- [1280 x 720 px](#)



Size : 1920 x 1080



Questions? We have answers.

- ▶ **Where can I find the logos?**
Download the logos [here](#).
- ▶ **Where can I find the color palette?**
Check the correct use of the Color Palette [here](#).
- ▶ **Where can I find the fonts used?**
Download the fonts [here](#).

Contact Us

Write us if you have any questions or need a specific design:

luis@voltrondata.com

Or write us on the

Slack Channel: [#design](#)

