

Tableau Platform for Deploying Data Science

TC22 Hands-On Training
Amir Meimand & Larry Clark



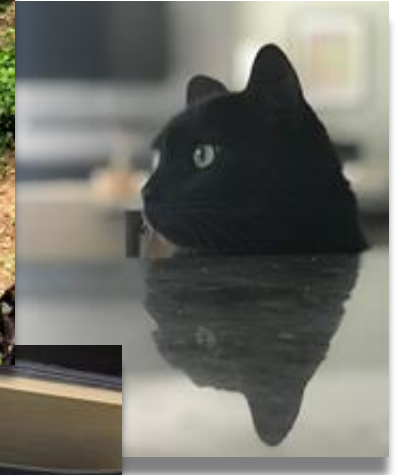
Amir Intro

- Live in San Jose, CA
- Joined Tableau in October, 2019
- Not a real doctor (some people may say)
- Big fan of 'The Office'



Larry Intro

- Live in Austin, TX
- Joined Tableau in October, 2018
- We have two dogs (on purpose) and three cats (by luck)
- [YouTube video](#) with 1.2MM views



TC22 AI/ML Workshops

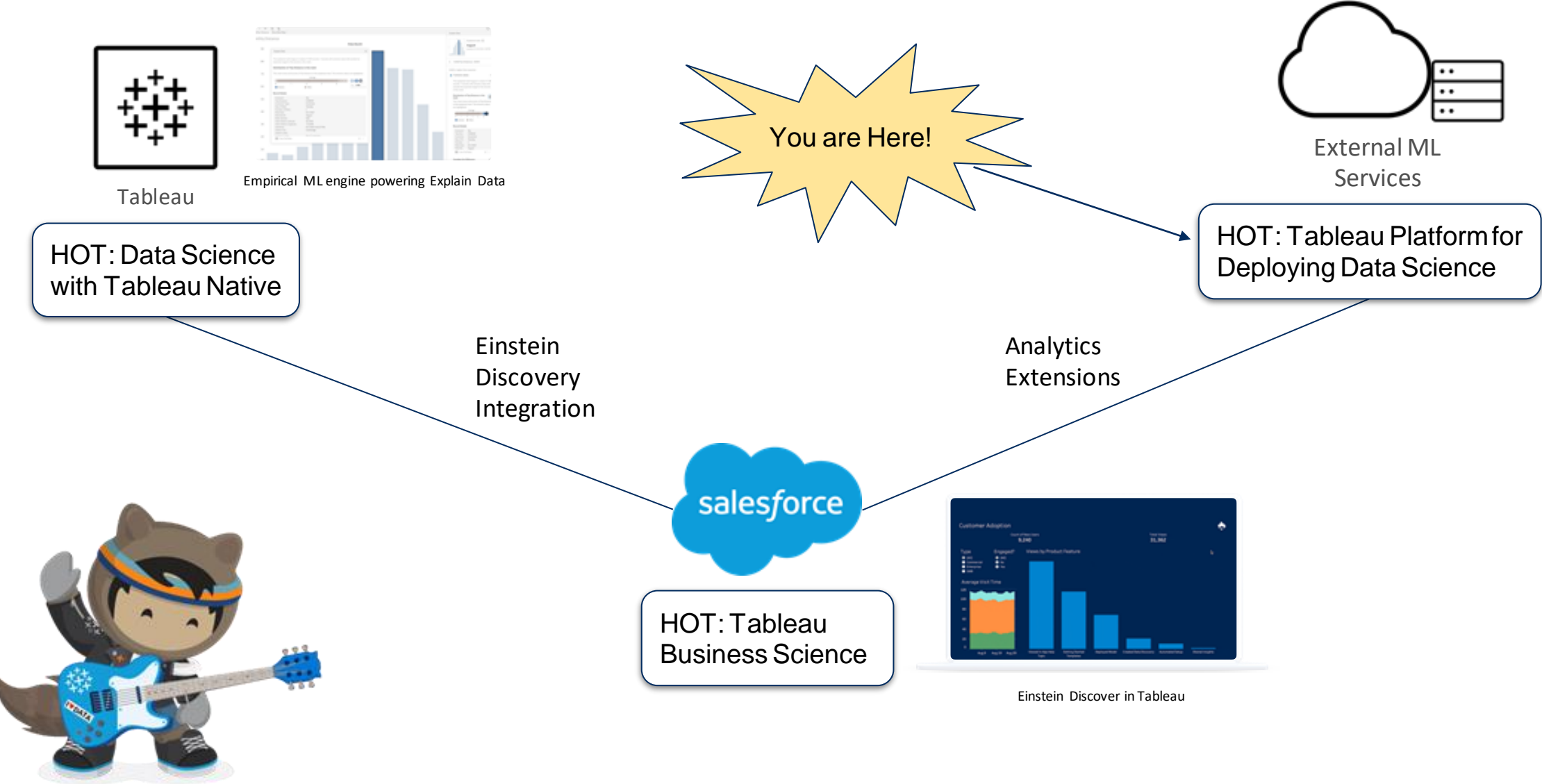
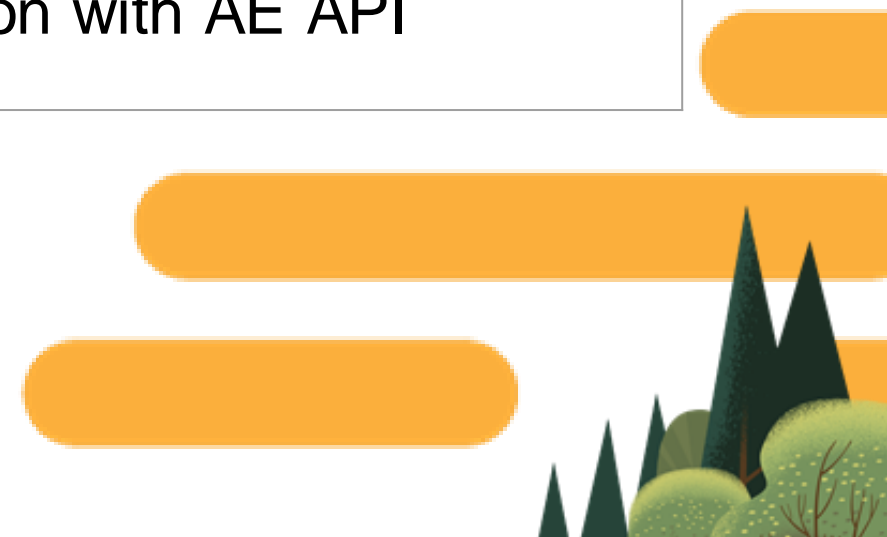


Tableau Platform for Deploying Data Science

Agenda

:00 - :05	Introductions
:05 - :25	TabPy example, demo & hands-on
:25 - :50	Analytics Extension API demo & hands-on
:50 - :60	Third-party ML (ex: SageMaker) integration with AE API



What is the Analytics Extensions API?

- Extend Tableau calculations to dynamically include popular data science programming languages and external tools and platforms
- Create integrations similar to Tableau's integrations with TabPy and MATLAB
- TabPy API expanded to make it more generalizable to any external analytics engine

Analytics extensions can receive data from Tableau in real time and return data after it has been scored, transformed, or augmented

Use Cases:

- Add a new programming language as a calculation engine to Tableau
- Call a web service directly from a calculation



Augmented Analytics & Data Science Strategy

Leveraging AI Across the User Spectrum

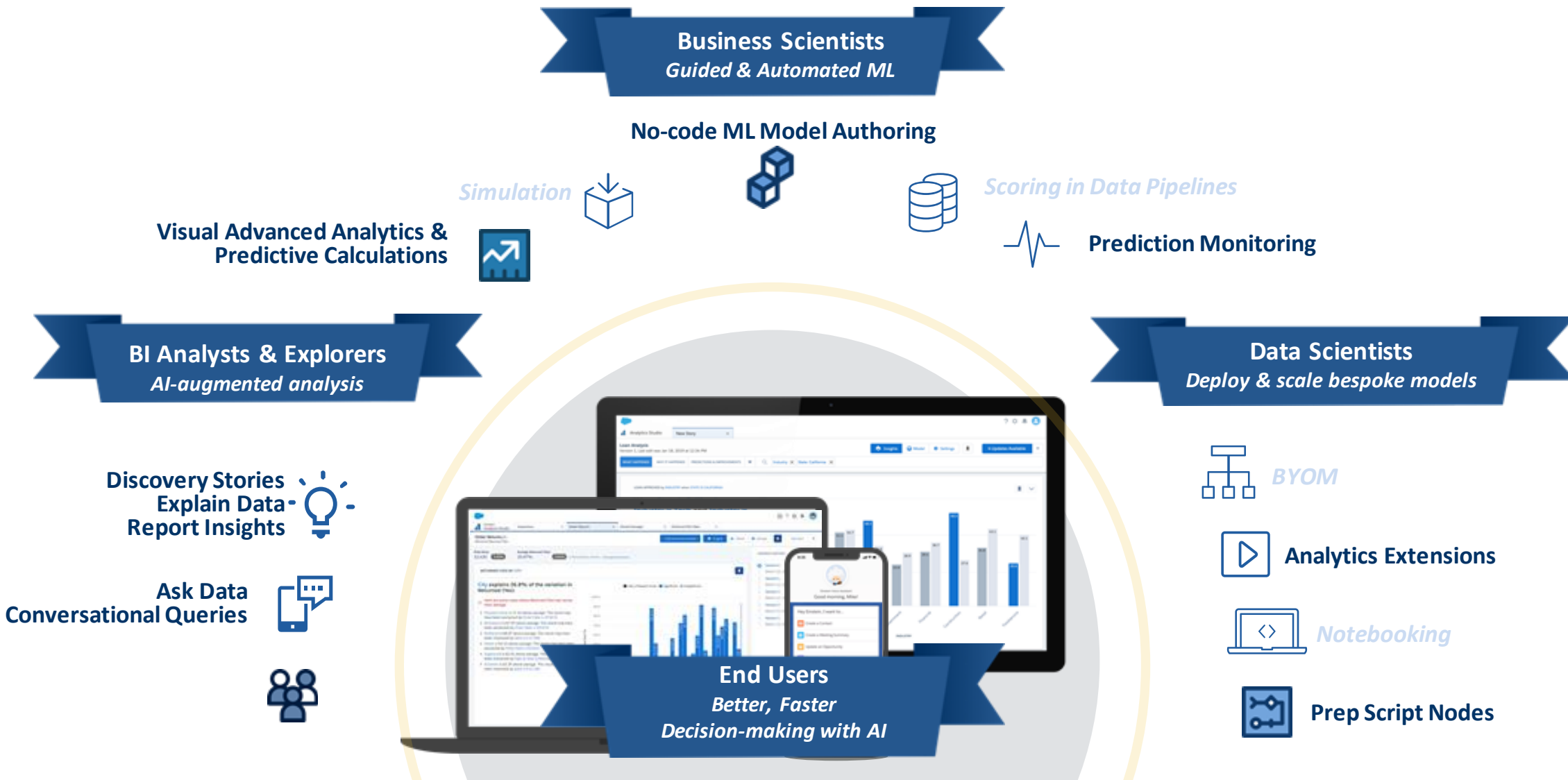


Tableau Native DS Capabilities

TC22 HOT Session: “Hands-on: Advanced Analytics with Tableau Native Functions”

Predictive Modeling Functions - Tableau

Function	Syntax	Description
MODEL_QUANTILE	<pre>MODEL_QUANTILE(model_specification (optional), quantile, target_expression, predictor_expression(s))</pre>	<p>Returns a target numeric value within the probable range defined by the target expression and other predictors, at a specified quantile. This is the Posterior Predictive Quantile.</p> <p>Example:</p> <pre>MODEL_QUANTILE(0.5, SUM([Sales]), COUNT([Orders]))</pre>
MODEL_PERCENTILE	<pre>MODEL_PERCENTILE(model_specification (optional), target_expression, predictor_expression(s))</pre>	<p>Returns the probability (between 0 and 1) of the expected value being less than or equal to the observed mark, defined by the target expression and other predictors. This is the Posterior Predictive Distribution Function, also known as the Cumulative Distribution Function (CDF).</p> <p>Example:</p> <pre>MODEL_PERCENTILE(SUM([Sales]), COUNT([Orders]))</pre>

How Predictive Modeling Functions Work in Tableau - Tableau

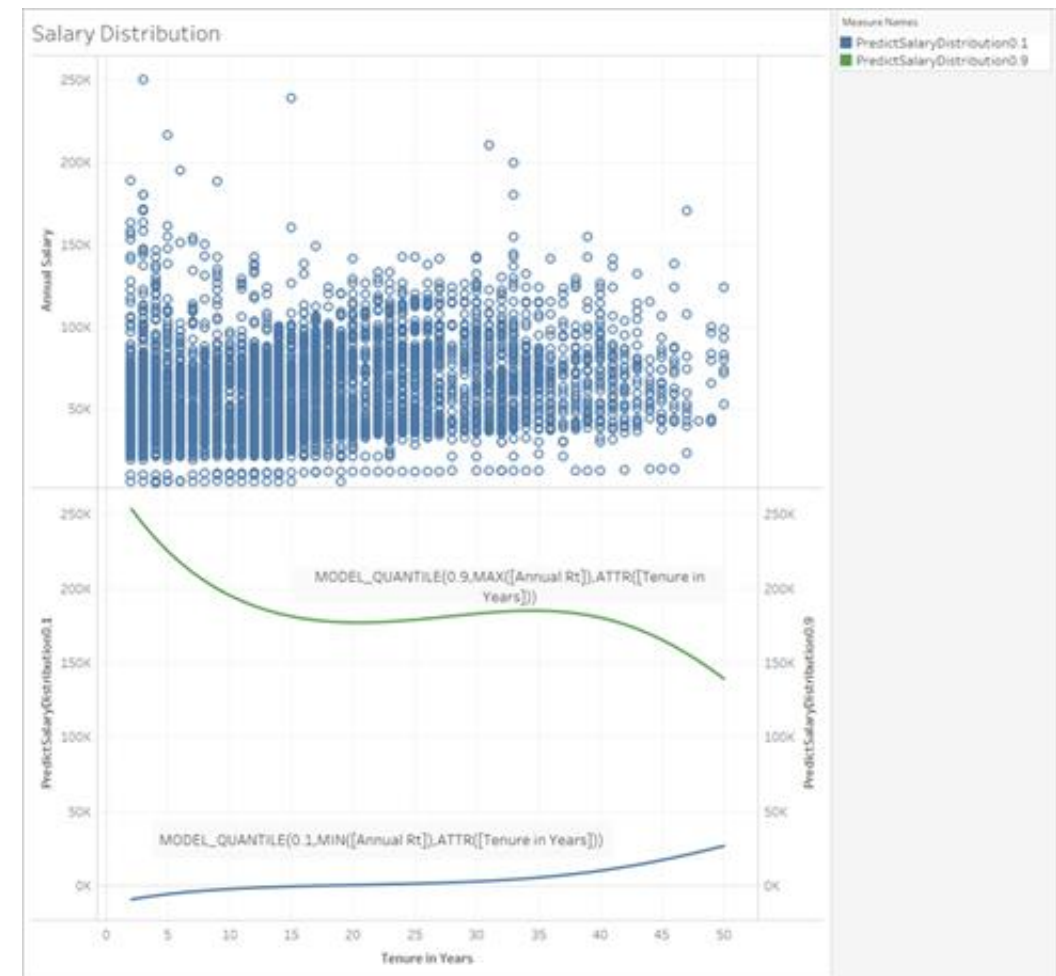


Tableau Data Science Integration

Bring your Data and ML model together

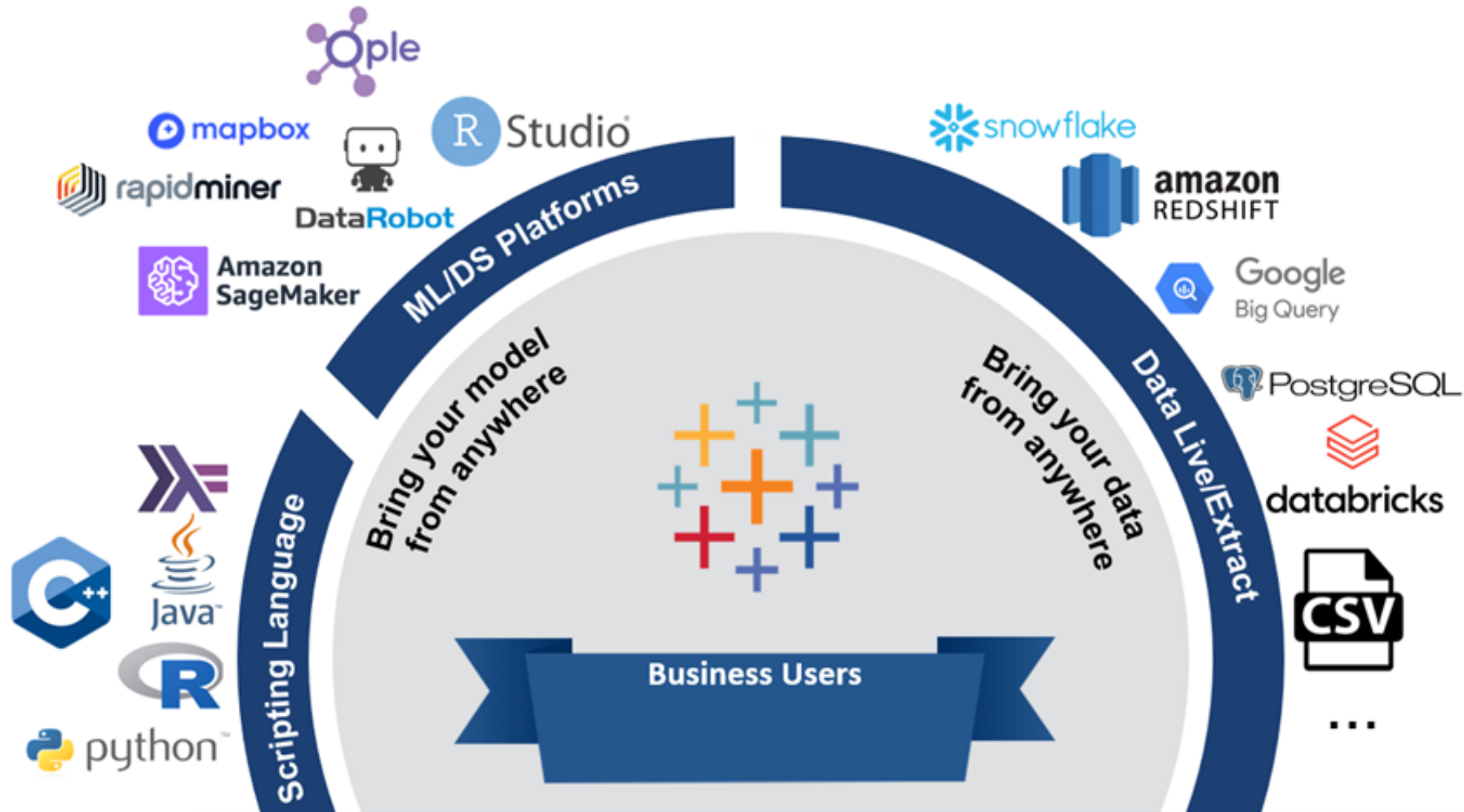
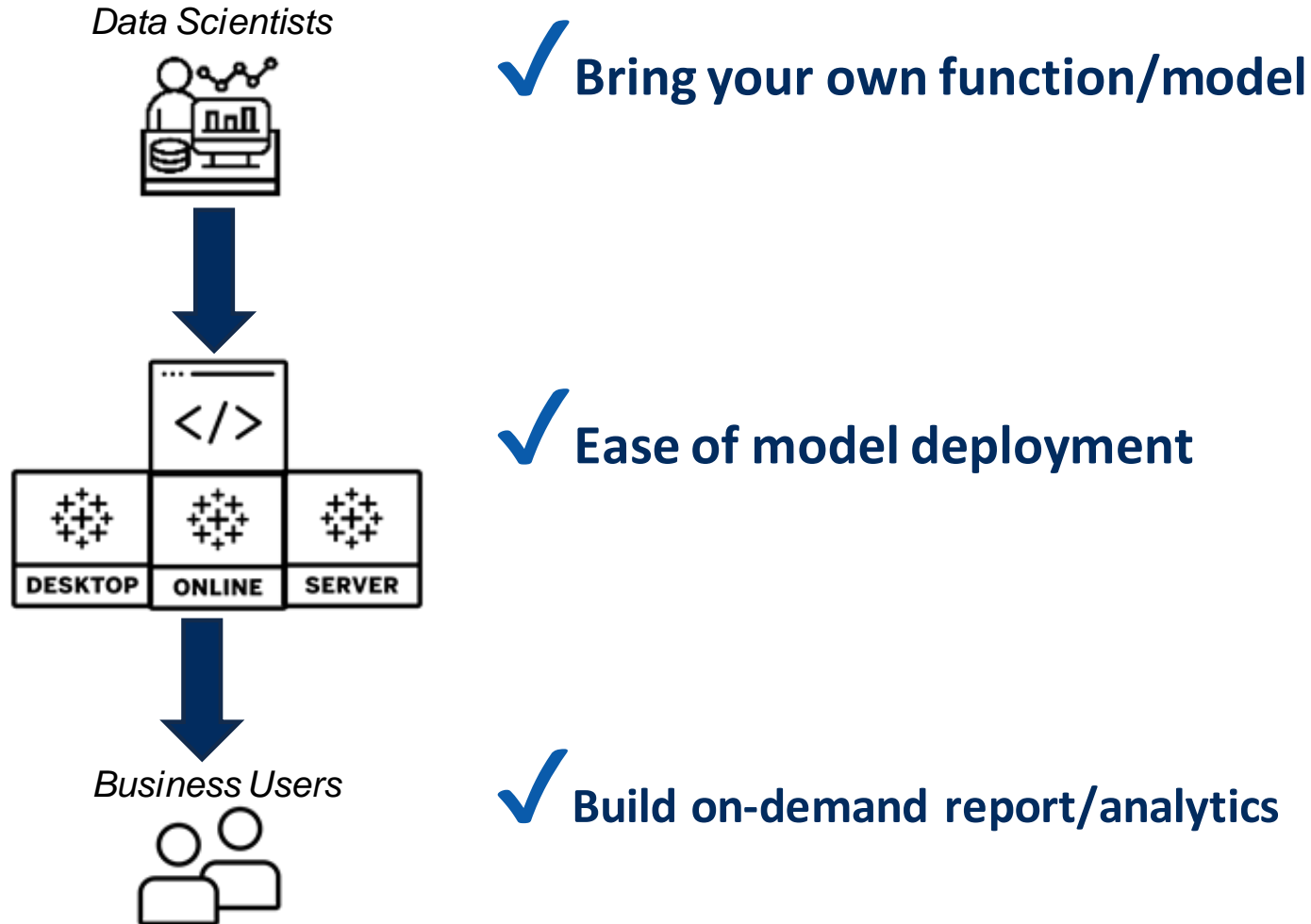


Tableau Data Science Integration

Bridging the gap between data science and business users



Business Problem

Maxima Coverage Telcomm Company

- Low Growth in **Profitability**
 - Low **Customer Acquisition**
 - Low **Coverage Rate**



Business goal is to **improve coverage rate** across the country

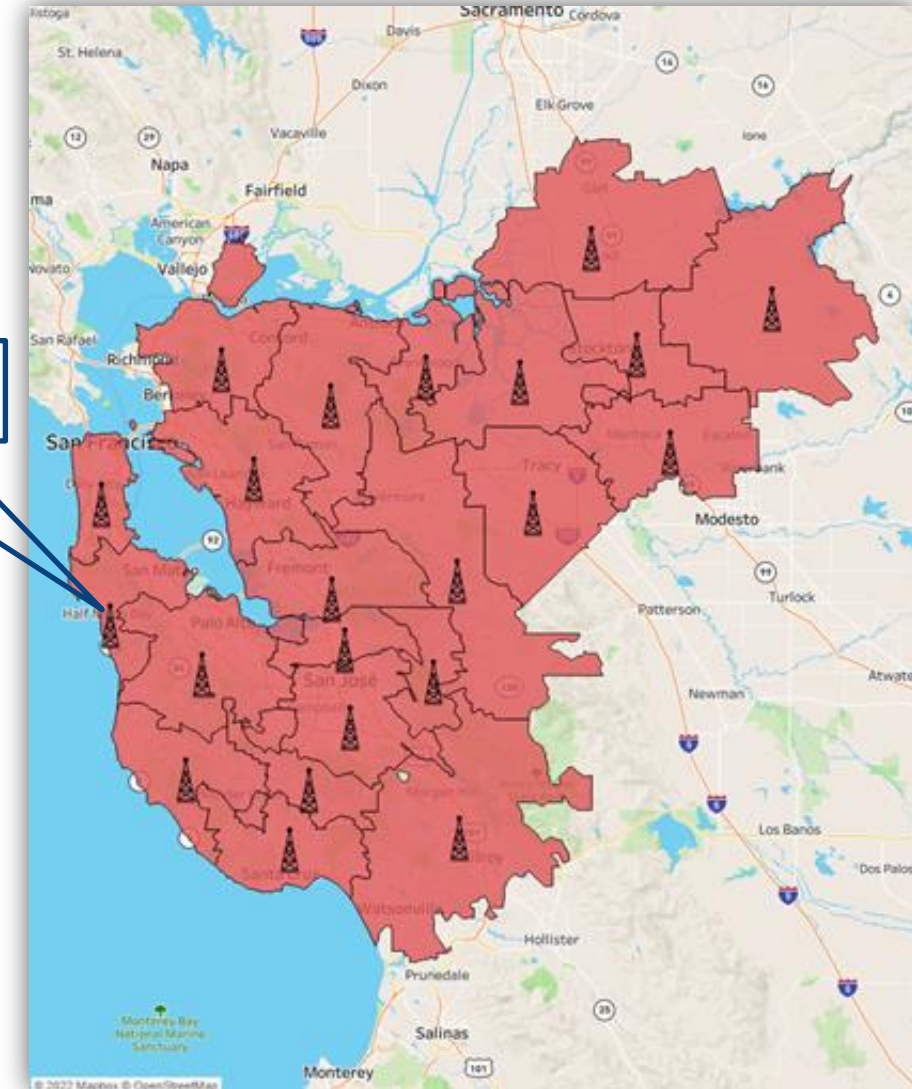
Use Case: Telecom Site Selection

Maxima Coverage Company



- **Business Goal:** Improve the coverage rate
- **Business Solution:** Install towers in low coverage areas
- Multiple potential locations:
 - Installation Cost
 - Covered Population
- **Constraint(s):** Budget constraint

Installation Cost: \$6,522K
Population: 283,013



Hands-On: Telecom Site Selection in Tableau

The screenshot displays a Tableau interface for a telecom tower installation problem. The main view shows a map of the San Francisco area with various zip codes highlighted in red. Tower locations are marked with black icons. The interface includes a sidebar with instructions and a Python script, and a main area with a map and a table of tower data.

Tableau - Telecom Tower Installation (Python Integration) - Start

Region: Santa Clara Area | Total Budget: \$105,000,000 | **Best Assignment**

Installation Cost

Covered Population

Instruction

Solution with only Tableau

Explore different scenarios for tower installation:

- 1- Select a zip code / group of zip codes.
- 2- Click on "Tower installation" to see the impact of installation on both cost and coverage.
- 3- You can uninstall a tower by clicking on zip code and selecting "Uninstall tower".

Challenges:

- There are countless scenarios to explore.
- It is almost impossible to find the optimum solution.

Instructions:

1. Go to the "Documents" then "Python Script" and open the "Optimization.py" file.
1. Run the notebook by clicking on "Run" button.

Next: Lab 2 of 2: Currency...

Meet Jon

Chief Data Scientist

Jon's Data Science team developed a **machine learning model to find the optimum locations for towers installation** to maximize the total coverage while considering budget limit. Although it is **powerful model** to solving the business problem, it **can not generate any value unless business users be able incorporate it into heir analytical workflow.**

On the business side, Field managers need to run **what-if analysis** to estimate the required budget for different levels of coverage. At the operational level, considering the **business dynamic**, field engineers need to **interact with the model in the real-time** to get answer relevant to the business circumstances.


Jon's team has a need for an **easy-to-use deployment platform to operationalize their models** and enable business users to **build their own analytics** empowered by the ML model in **self-service manner.**



Hands-On Lab 2: Analytics Extension Samples

https://www.tableau.com/developer/tools/analytics-extensions-api

salesforce

 + a b l e a u


Why Tableau ▾ Products ▾ Solutions ▾ Resources ▾ Partners ▾ Tableau Conference ▾

Developer Program Portal Tools, APIs, SDKs ▾ Events Learning Resources Community

Analytics Extensions API

Extend Tableau calculations to dynamically include popular data science programming languages, tools and platform integrations similar to Tableau's integrations with TabPy and MATLAB.

[DOCUMENTATION](#)



LEVEL OF SUPPORT
Tableau-supported

PRODUCTS
Tableau Server, Tableau Online, Tableau Desktop

Supported By: Tableau Server: at least 2021.2 & Tableau Online

The Analytics Extensions API can be used to extend Tableau calculations to dynamically include popular data science programming languages and external tools and platforms. Use it to create

[GITHUB REPO](#)

Examples

- **TabPy** - Execute Python code and saved Python functions in Tableau.
- **MATLAB integration** Use MATLAB models in Tableau visualizations.
- **Ople.ai ML predictive modeling** - Score data with predictive models built in Ople.ai
- **Haskell language integration** - Execute Haskell code in Tableau.
- **AltTabPy** - Simplified TabPy that executes Python code with no additional features.
- **Plumbertableau** - plumbertableau lets you call external R code from Tableau workbooks
- **Einstein Discovery**: Access Einstein Discovery predictions in Tableau calculated fields.
- **Additional Tableau Functions** - Example functions that can be added to Tableau calculations with the AE API.

Hands-on: Analytics Extensions Sample

The image displays a hands-on session for Tableau Analytics Extensions. It features three main components:

- Glitch Project:** A code editor showing a JavaScript file named `functions.js`. The code includes functions for currency conversion and translation, using `node-fetch` and `openexchangerates.org` API.
- Tableau Desktop:** A screenshot of the Tableau interface showing a scatter plot titled "Sheet 22". The plot displays "Gulder Profit" (Y-axis) against "Profit" (X-axis). The data is categorized by "Category" and "Sub-Category". The plot shows a positive correlation between Profit and Gulder Profit.
- Calculation Editor:** A pop-up window showing the calculation editor for "Gulder Profit". The calculation is defined as `SCRIPT_REAL('convert', SUM([Profit]), "USD", "GULDER")`. The editor also shows a list of available functions and a "Default Table Calculation" button.

Analytic Extensions - Web API Details

The screenshot displays the Postman web interface. The top navigation bar includes 'Home', 'Workspaces', 'API Network', 'Reports', and 'Explore'. The left sidebar shows the 'My Workspace' section with a list of collections, including 'Tableau Analytic Expressions'. The main panel shows a 'POST' request to the endpoint `http://tableau-analytics-api-samples.glitch.me/evaluate`. The request body is a JSON object: `{ "data": { "_arg1": [1], "_arg2": ["BTC"], "_arg3": ["USD"] }, "script": "convert" }`. The response is a JSON array: `[30685.409560309377]`. The status is '200 OK' with a response time of '222 ms' and a size of '311 B'.

Postman interface showing a successful POST request to the Tableau Analytics API endpoint `http://tableau-analytics-api-samples.glitch.me/evaluate`. The request body is a JSON object containing arguments for evaluation. The response is a JSON array containing the result of the evaluation.

Request Details:

- Method: POST
- URL: `http://tableau-analytics-api-samples.glitch.me/evaluate`
- Body (JSON):

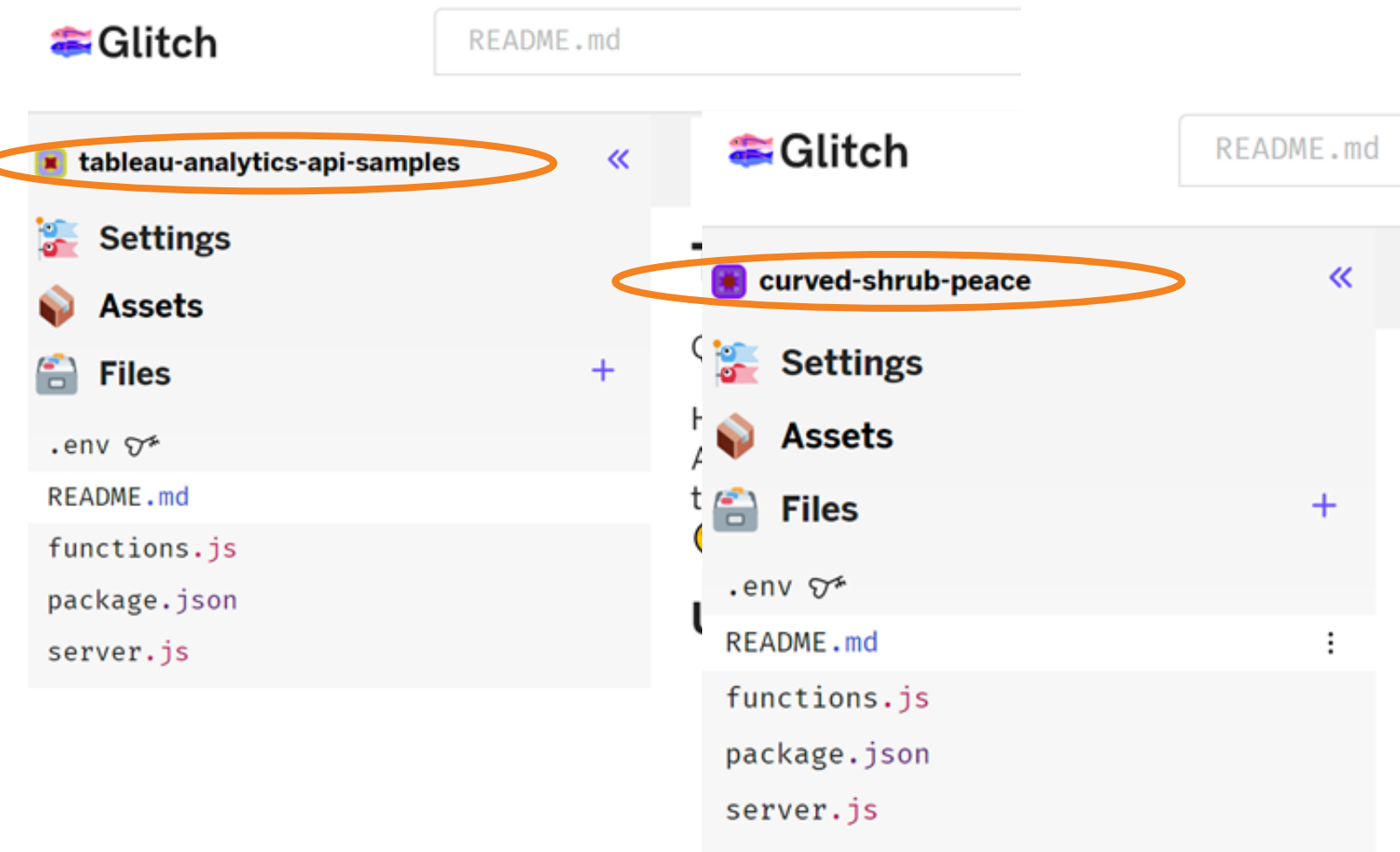
```
{  "data": {    "_arg1": [1],    "_arg2": ["BTC"],    "_arg3": ["USD"]  },  "script": "convert"}
```

Response Details:

- Status: 200 OK
- Time: 222 ms
- Size: 311 B
- Body (JSON):

```
[  30685.409560309377 ]
```

Glitch Remix (in case we overwhelm glitch)



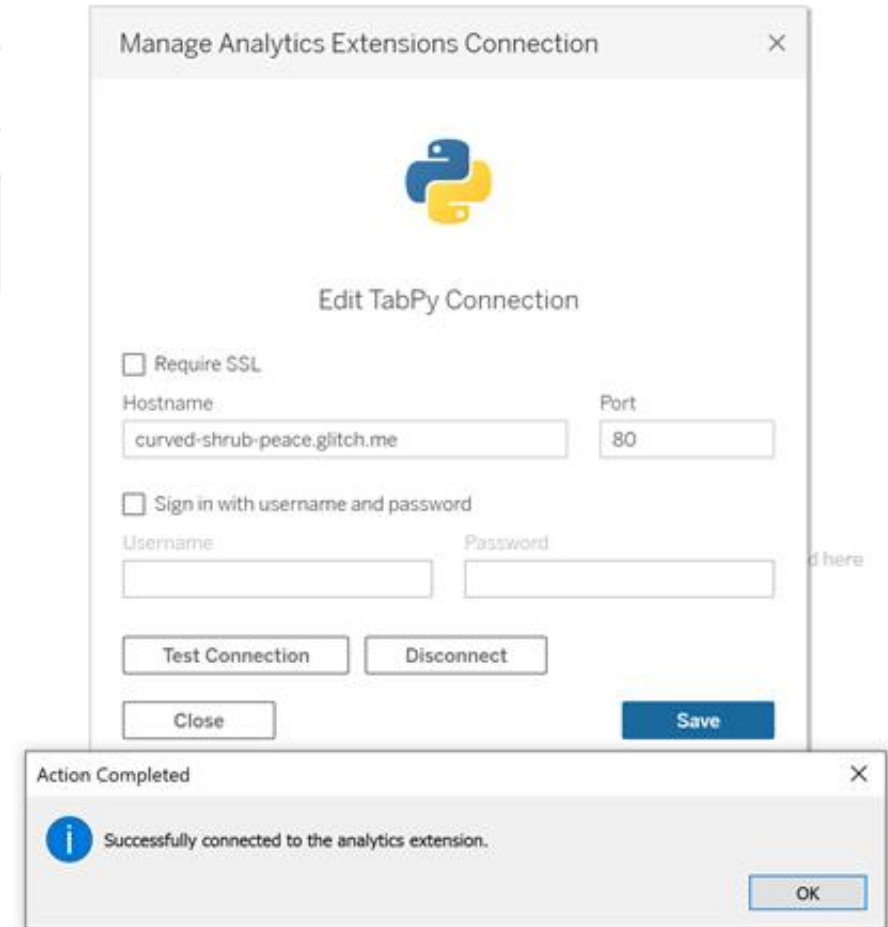
The image displays two side-by-side screenshots of the Glitch website interface. Each interface shows a sidebar with navigation links: Settings, Assets, and Files. The main area displays a file list for a specific project.

Left Interface:

- Project name: **tableau-analytics-api-samples** (circled in orange)
- File list: `.env`, `README.md`, `functions.js`, `package.json`, `server.js`

Right Interface:

- Project name: **curved-shrub-peace** (circled in orange)
- File list: `.env`, `README.md`, `functions.js`, `package.json`, `server.js`



The image shows a 'Manage Analytics Extensions Connection' dialog box and an 'Action Completed' notification.

Manage Analytics Extensions Connection

Edit TabPy Connection

☐ Require SSL

Hostname: Port:

☐ Sign in with username and password

Username: Password:

Test Connection Disconnect

Close Save

Action Completed

Successfully connected to the analytics extension.

OK

<https://www.tableau.com/developer/tools>

Tableau Developer Tools

Extend Tableau with developer tools and APIs to meet your organization's needs.

Developer Program Portal

Tools, APIs, SDKs

Events

Learning Resources

Community

Category

All



EMBEDDED ANALYTICS

Embedding JavaScript API

Use the Tableau Embedding API to integrate Tableau visualizations into your own web applications.



AUTOMATION / INTEGRATION

REST API

Programmatic access to work with your content, users, sites, and more.



EXTENSIBILITY

Dashboard Extensions API

With our Dashboard Extensions API, developers can create dashboard extensions that enable customers to integrate and interact with functionality or data from other applications directly in Tableau.



AUTOMATION / INTEGRATION

Metadata API

Open and discover metadata about Tableau content and external assets.



AUTOMATION / INTEGRATION, DATA

CONNECTIVITY

Hyper API

Automate your interactions with Tableau extract (.hyper) files. You can use the API to create new extract files, or to open existing files, and then insert, update, delete, or read data from those files.



DATA CONNECTIVITY

Connector SDK

Build a new connector that you can use to visualize your data from any database through an ODBC or JDBC driver.

Tableau Developer Tools

Extend Tableau with developer tools and APIs to meet your organization's needs.

Developer Program Portal

Tools, APIs, SDKs

Events

Learning Resources

Community

Category

Advanced Analytics



ADVANCED ANALYTICS, GENERAL

Analytics Extensions API

Extend Tableau calculations to dynamically include popular data science programming languages, tools and platforms and create integrations similar to Tableau's integrations with TabPy and MATLAB.



ADVANCED ANALYTICS

R Integration

Import R packages, libraries or any of your saved data models into Tableau.



ADVANCED ANALYTICS

TabPy

TabPy framework allows Tableau to remotely execute Python code and saved functions.

Resources

- <https://www.tableau.com/developer/tools/analytics-extensions-api>
- **YouTube:** [Using the Tableau Analytics Extension API to Integrate with Julia](#)
- **YouTube:** [Tableau Developer User Group: Learn more about Analytics Extensions](#)
- **Webinar:** [Analytics Extensions API Webinar - Tableau Developer Preview](#)
- **Examples:**
- [Tableau External Services API: Haskell Expressions as CalculationsDataboss \(starschema.net\)](#)
- [README.md – tableau-analytics-api-samples \(glitch.com\)](#)
- [Build Predictive Analytics in Tableau Using Machine Learning Models Deployed on Amazon SageMaker](#)
- **Tutorial:** [Getting Started with the Analytics Extensions API \(tableau.com\)](#)

Tableau Integration with Third-Party ML Platforms

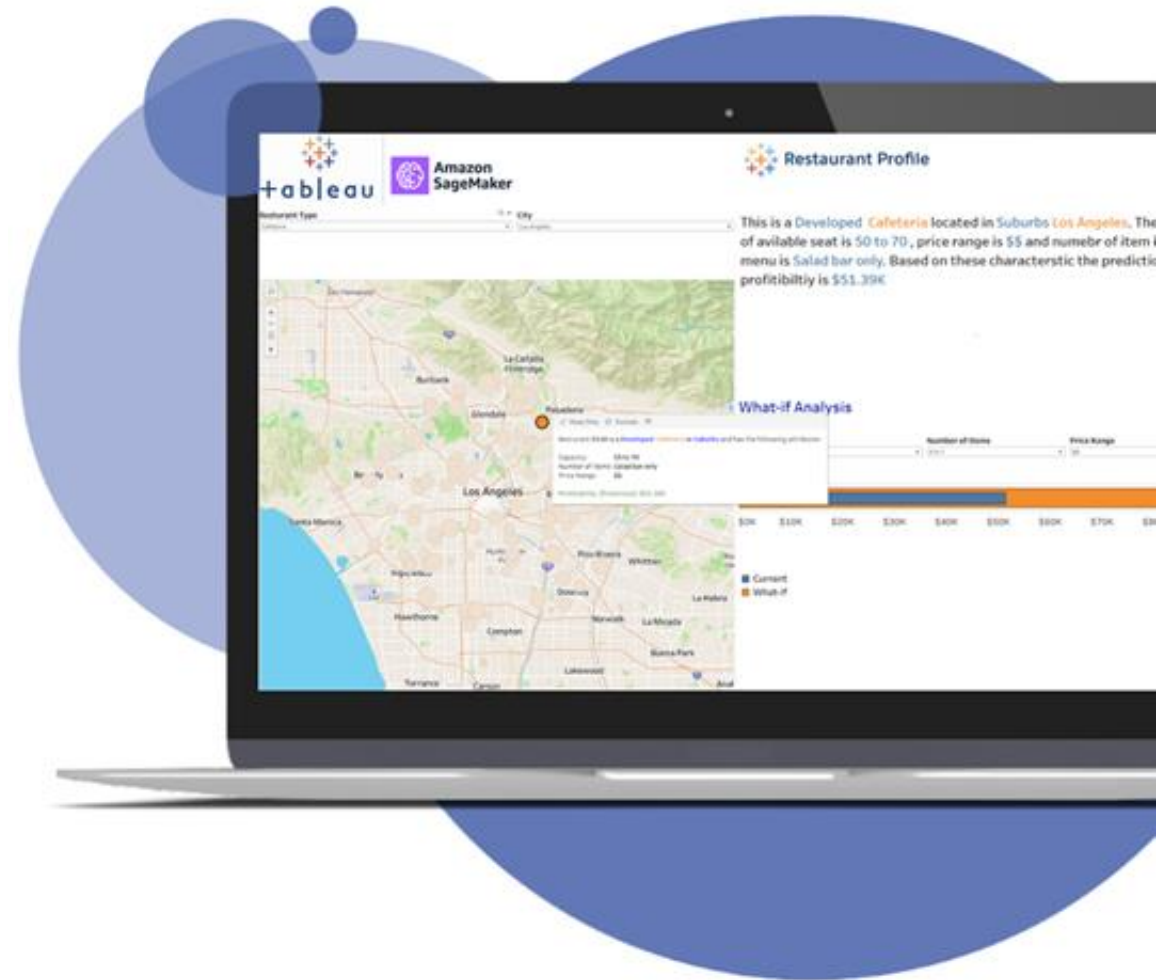


Tableau Data Science Integration

Amazon SageMaker

Foundation:

- ✓ Tableau' Analytics Extensions API
- ✓ AWS CloudFormation
- ✓ Amazon Cognito Authentication

Pre-requisitions:

- Domain by Amazon Route 53
- SSL certification by AWS certificate
- ACM provisioned in us-east-1 region

Amazon SageMaker for Tableau

Connect Tableau with Amazon SageMaker machine learning models to power predictive analytics.

[View deployment guide](#)

This Quick Start sets up an Amazon Web Services (AWS) architecture that allows you to integrate Amazon SageMaker machine learning (ML) models in Tableau's calculated fields. The serverless application it deploys is based on Tableau's analytics extension framework. With it, you can connect SageMaker ML models to Tableau workbooks in both Tableau Desktop and Tableau Server.

This Quick Start uses AWS CloudFormation templates to deploy a REST API managed by Amazon API Gateway and Lambda functions to connect Tableau and SageMaker. With Amazon Cognito, it also provides a user authentication based on AWS best practices.

Tableau Data Science Integration

Amazon SageMaker



AWS Quick Start

- One time deployment
- No code, just click
- New, existing or no VPC



Amazon SageMaker

- Any type of model
- SageMaker autopilot
- Custom model



Tableau Platform

- Desktop/Server/Online
- Table Calculation
- Real time prediction

Contact us

larry.clark@salesforce.com

<https://www.linkedin.com/in/lwclark>

ameimand@salesforce.com

<https://www.linkedin.com/in/amirmeimand>

