ArcGIS Python Overview

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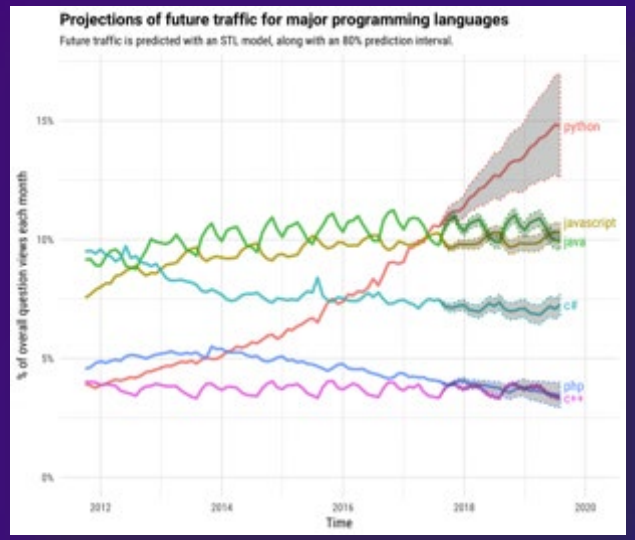
2021 ESRI USER CONFERENCE

Outline

- Explosive growth of Python
- Python in the ArcGIS Ecosystem
- Python in the Desktop Stack
- Python in the Enterprise Stack
- Python in the Runtime Stack
- Python in PaaS
- Road ahead

Explosive growth of Python

- Glue language / automation / server-side scripting
- Meteoric rise of Python
- An explosion in # of scientific computing packages
- Python everywhere – astronomy to finance to genomics
- Python anywhere – platform agnostic, micropython, Pythonista



pandas

TensorFlow

OpenCV

matplotlib

scikit learn

machine learning in Python

jupyter

NumPy

f.fn()

astropy

Zipline

biopython

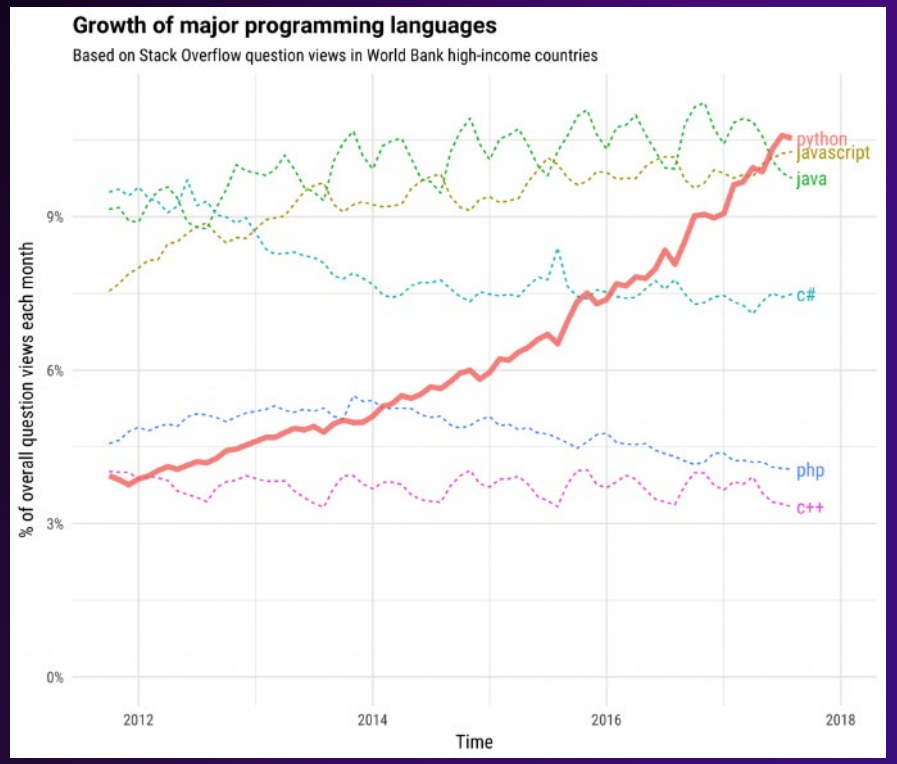
SCIKIT-BIO

python Package Index

CONDA

Why Python Matters

It's what people know

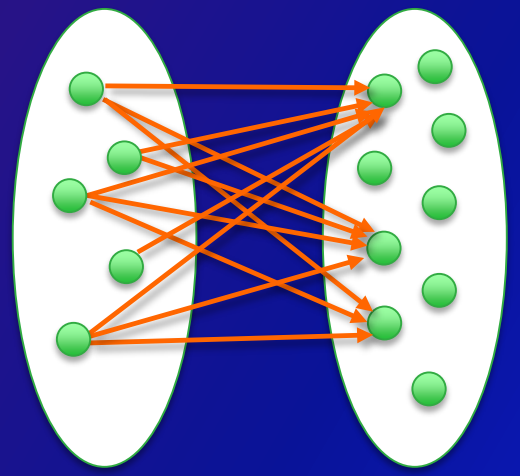


https://stackoverflow.blog/2017/09/06/incredible-growth-python/

Learn once, use everywhere

Language and API consistency mean less cognitive load

Minimize maintenance costs



Problems Technology

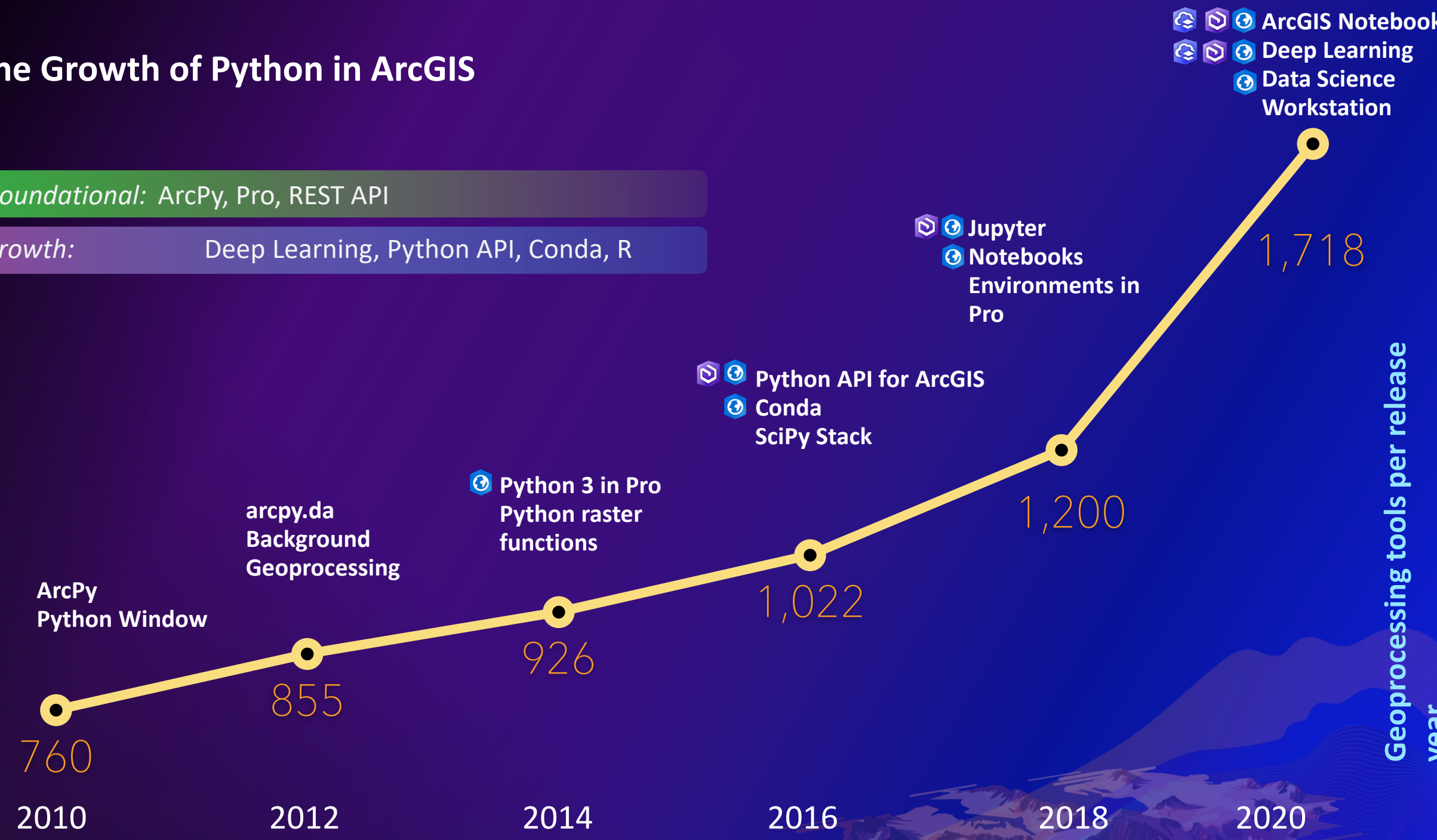
Python Everywhere

ANACONDA

The Growth of Python in ArcGIS

Foundational: ArcPy, Pro, REST API

Growth: Deep Learning, Python API, Conda, R



ArcGIS Python Libraries

ArcPy

- Maps and projects
- Deep access to Pro with simple code
- 1700+ geoprocessing tools

Comprehensive and powerful library for spatial analysis, data management, and conversion.

ArcPy + ArcGIS API for Python

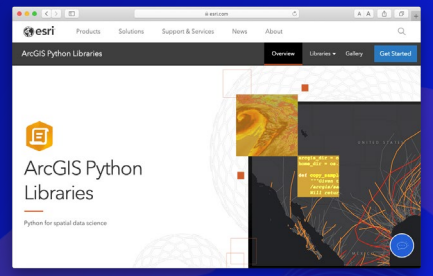
- Do everything with Python
- Jupyter Notebook rich integration
- Seamlessly blend web layers and local analysis

ArcGIS API for Python

- Manage web layers, maps, and tools
- Deploy anywhere
- Build geospatial deep learning models

Lightweight library for analyzing spatial data, managing your Web GIS, and performing spatial data science.

Pro Enterprise Cloud



https://www.esri.com/pythonlibraries

Python in the Desktop stack

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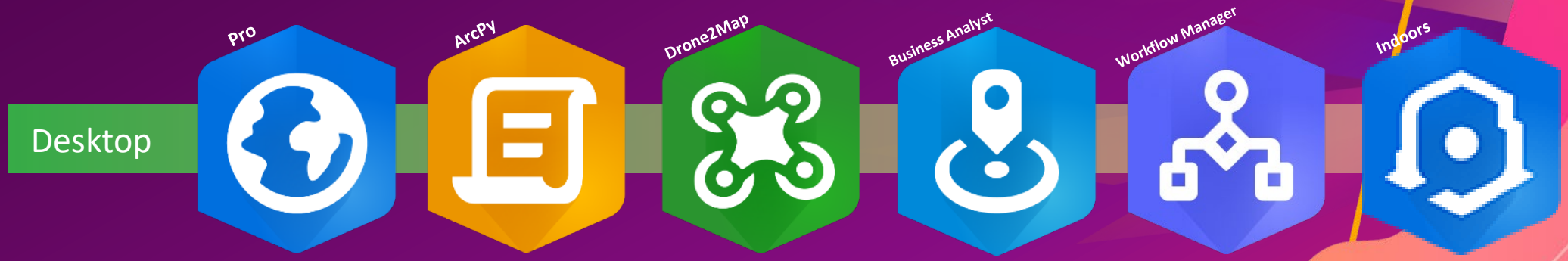


ArcPy

- Supported in Desktop, Pro, Server and Notebooks
- Maps and Projects:
  - `arcpy.mp`
  - CIM access
- Access the work of most Pro teams, such as:
  - `arcpy.nax`
  - `arcpy.ia`
  - `arcpy.metadata`
- Build Python tools and toolboxes which control all aspects of Pro
- Integrate everything locally, publish to Services
- Schedule jobs (Geoprocessing Scheduler, Windows Tasks)

A public service announcement on Python versions

- Python 2:
  - Python.org support has ended

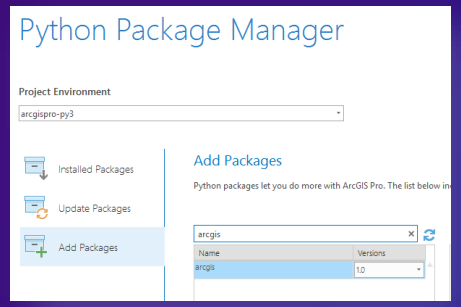
  - Upstream package support has largely ended
  - ArcGIS 10.x Desktop
  - ArcGIS Server 10.x is deprecated
  - Esri: Long term support for security only

- Python 3:
  - Pro, ArcGIS API for Python, Server Pro Runtime, Hosted Notebooks
  - All current and future development work
  - Have ArcMap / Python 2 code? Analyze Tools for Pro

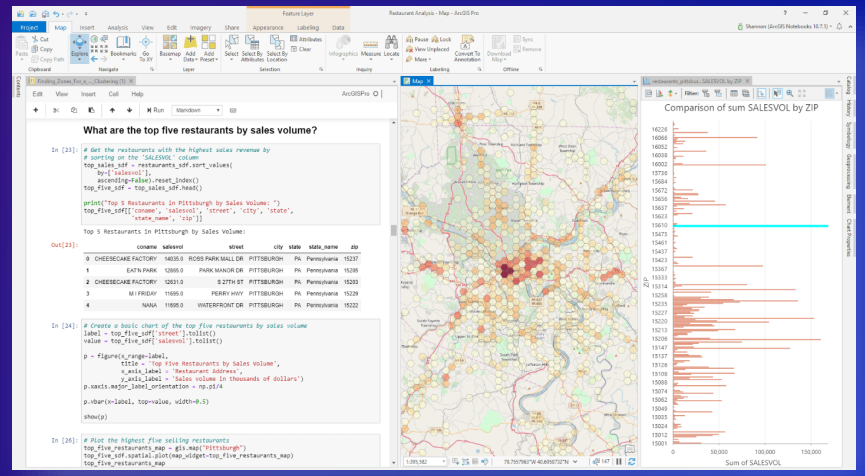
The premiere programming environment across all stacks

- Spatial Data Science Workstation
- Tie together with the Python ecosystem

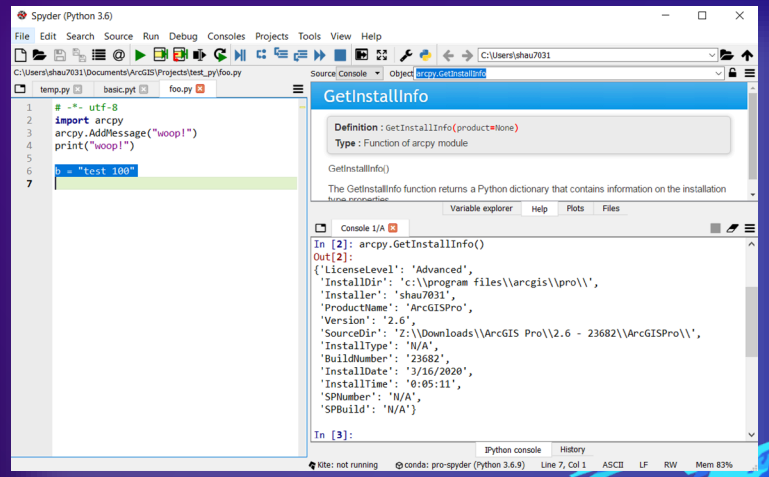
  https://anaconda.org/esri
- Pro components you can use:
  - **Notebooks**
  - **ModelBuilder**
  - **Deep Learning Libraries Installer**
  - **Python and R script tools**
  - **ArcGIS Python distribution**
  - **Conda Environments**



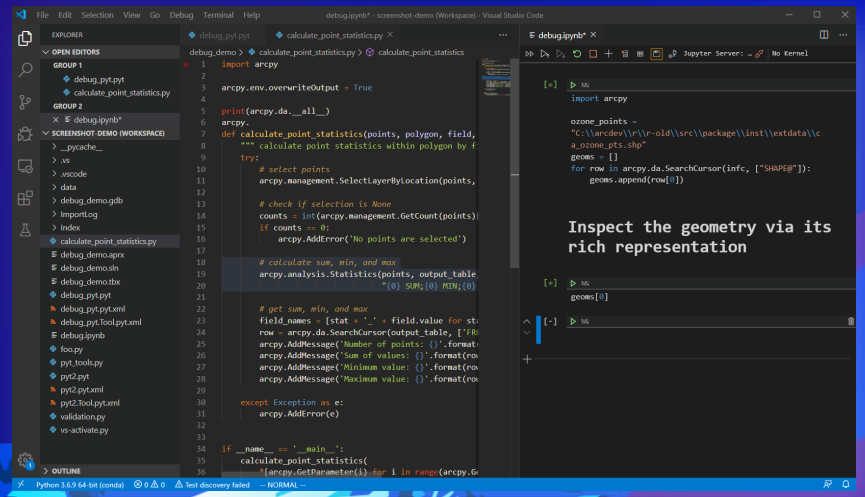
Conda



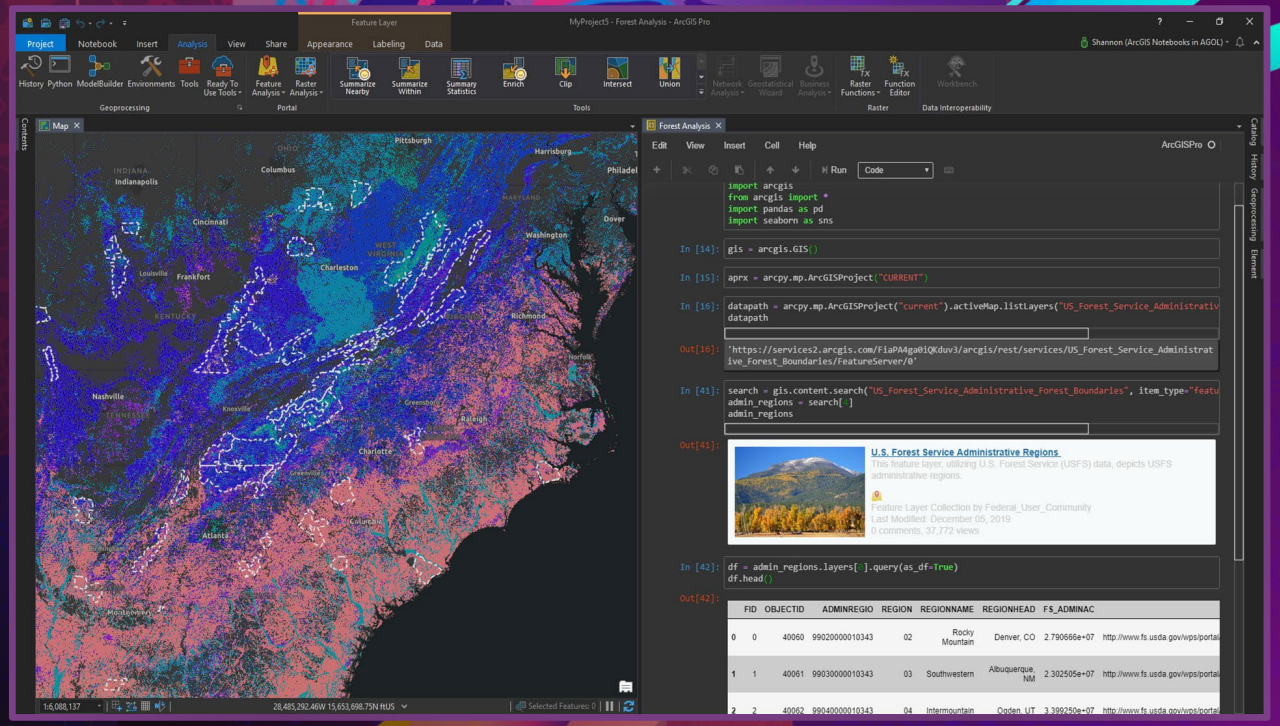
ArcGIS Pro with Notebooks + Charts



Spyder



Visual Studio Code



Demo – Python in Desktop stack

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Python in the Enterprise stack

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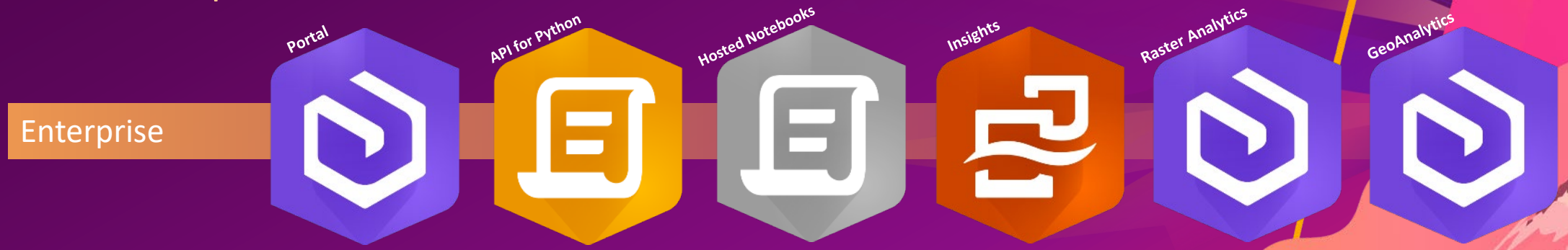

Demo – Introduction to ArcGIS API for Python

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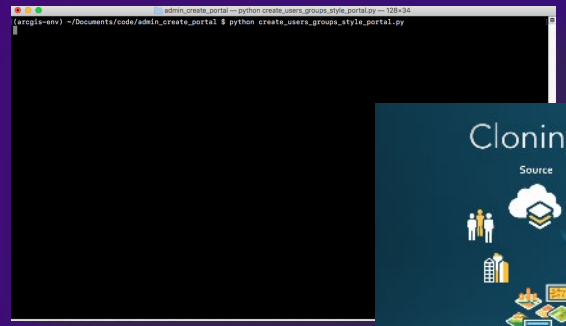
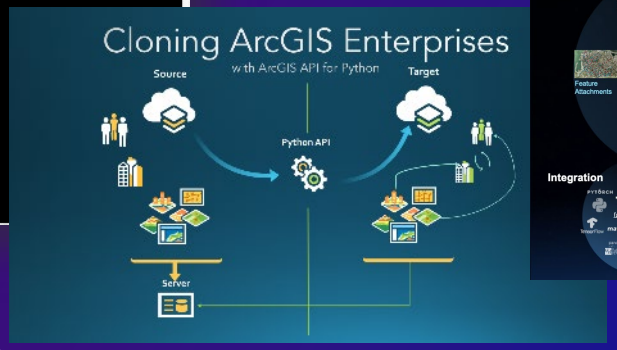
Python as a remote client – Spatial analysis and Enterprise management

Enterprise API for Python

ArcGIS API for Python architecture





Automate WebGIS management

- Populate portal with users, groups
- Clone portals
- Reassign user content
- Perform comprehensive content search
- Determine item relationship
- Create reports of users, their items

Automate content creation

- Automate content publishing during off peak hours
- Update tiles and features from a known database
- Replicate development environment content to production
- Inspect and update items with broken service links

Reproducible research

- Access big data tools programmatically
- Utilize rich 3rd party Python packages for data analysis
- Create rich charts, graphs, embed 2D and 3D maps in Jupyter Notebook environment
- Share your research with data and notes with peers

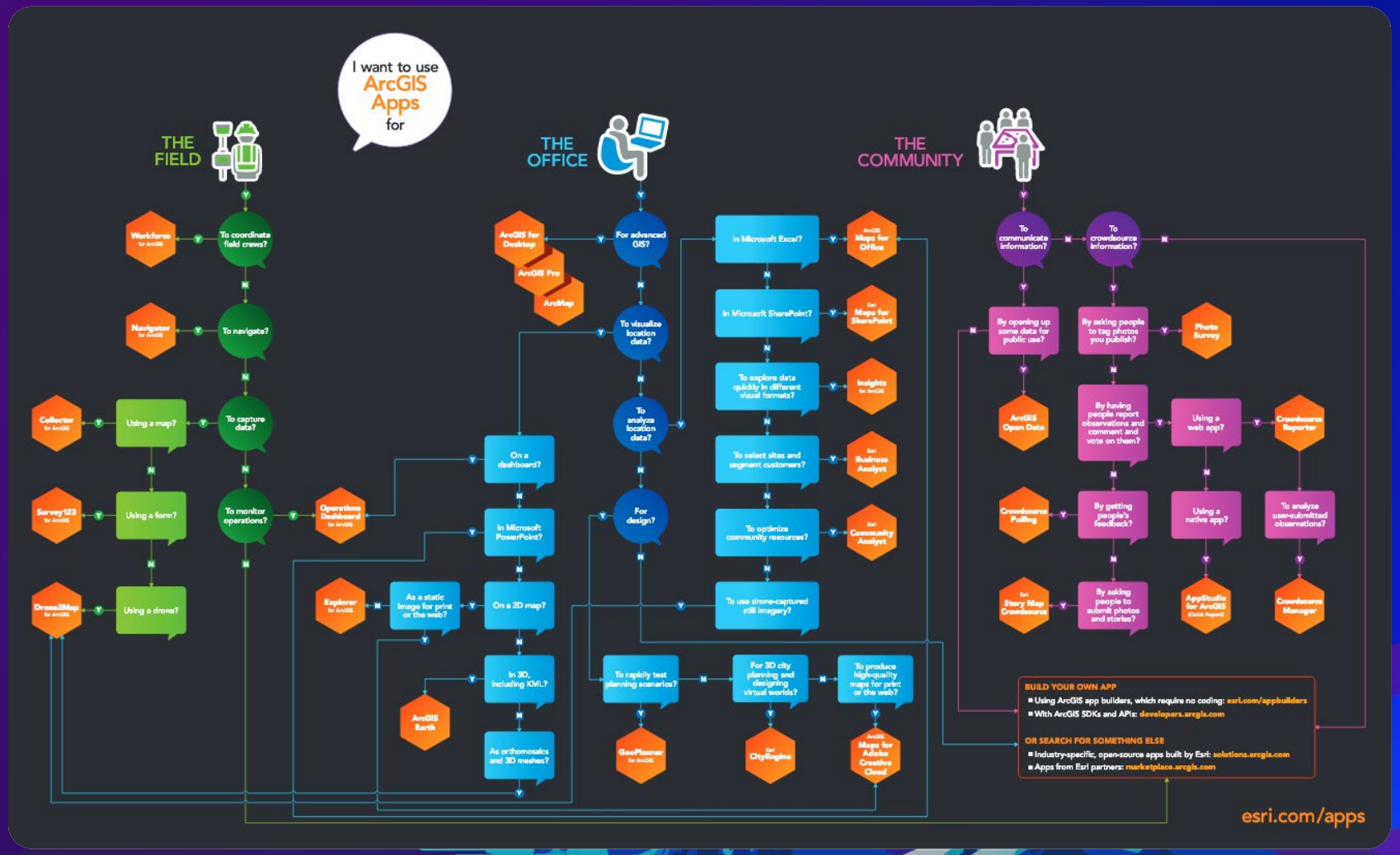
Spatial analysis & Enterprise management

Python as a remote client – automation of Platform apps

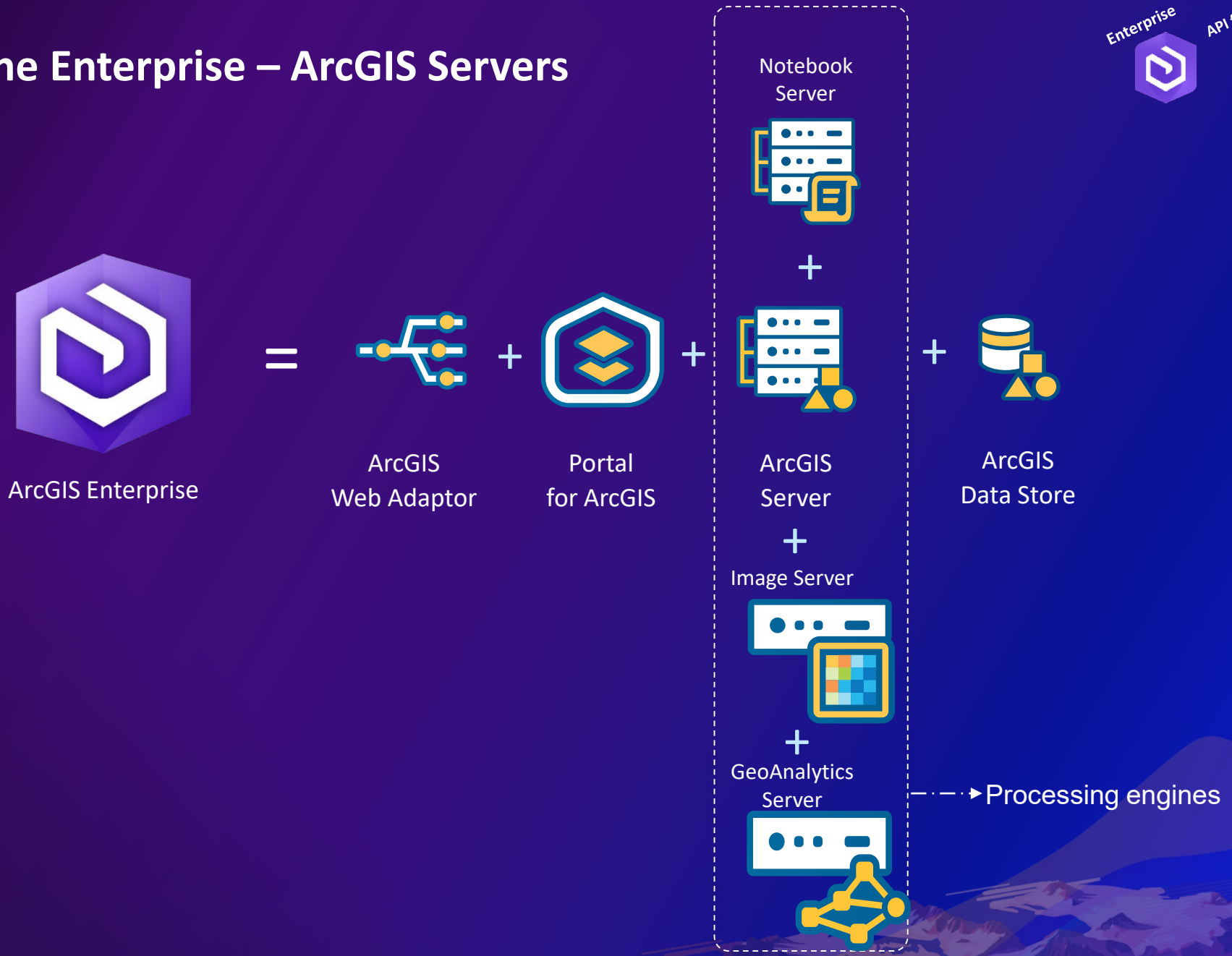
Enterprise

API for Python

- StoryMaps
  - Customize Journal story map
- Workforce
  - Manage Projects, assignments, dispatch
  - Work with attachments, tracks, workers
- Survey123
  - Manage survey and responses
- Hub
  - work with initiatives, events
- Tracker
  - manage tracks, mobile users



Python within the Enterprise – ArcGIS Servers



Python within the Enterprise stack – ArcGIS Servers

Enterprise API for Python ArcPy

ArcGIS Server

- Contains ArcMap and Pro runtimes
- Publish models as GP services / web tools

Image Server

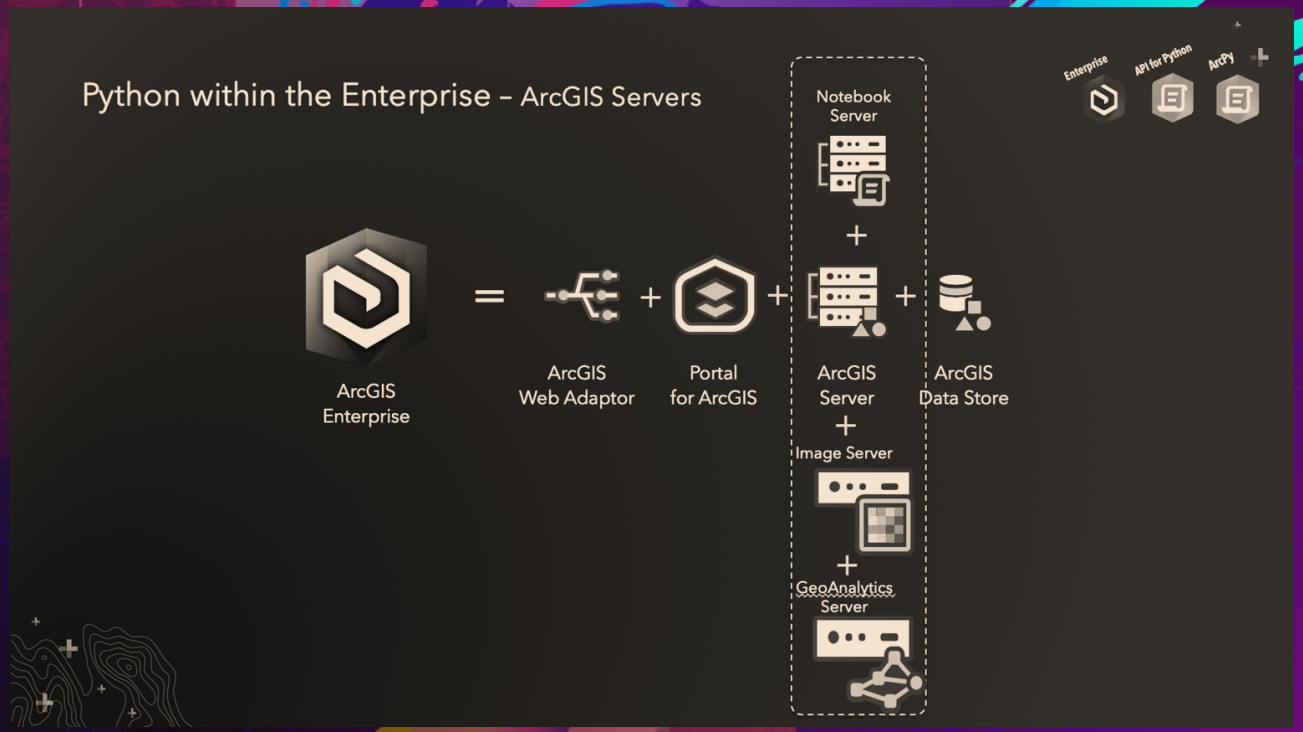
- Author tools as Python Raster Functions. Run in distributed manner

GeoAnalytics Server

- ‘Run Python Script Tool’ allows you to execute custom code on GAX server
- PySpark integration

Notebook Server

- Run ArcGIS API for Python and ArcPy (Linux)



Demo – Analysis with ArcGIS API for Python

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Python in the Runtime stack

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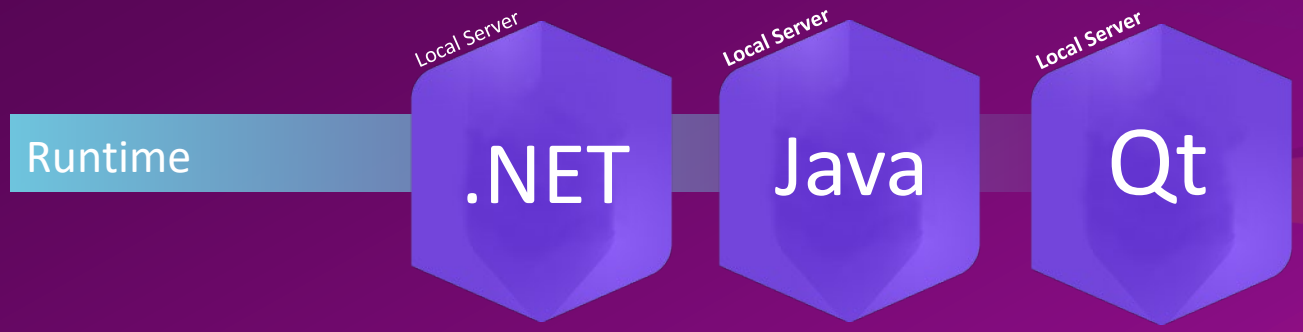

Python In ArcGIS Runtime: Runtime Local Server

- Runtime Local Server is used to provide deeper access to Geoprocessing Tools
- List of Geoprocessing Tools Supported in Runtime Local Server

Python in PaaS

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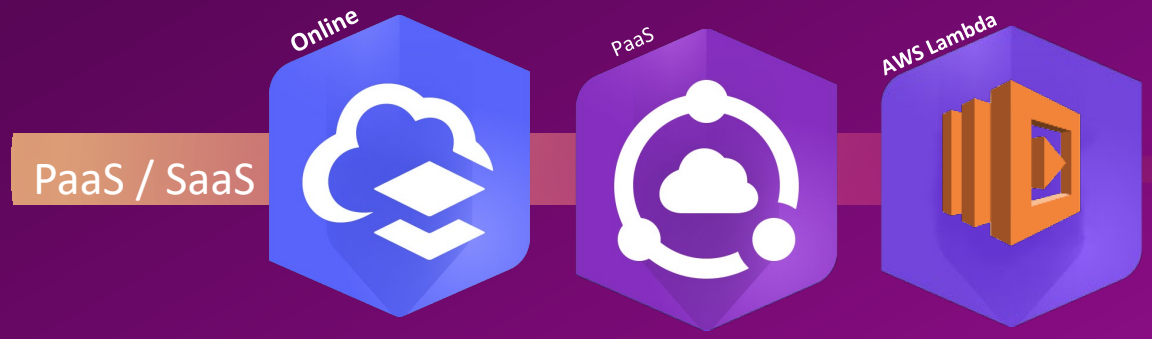
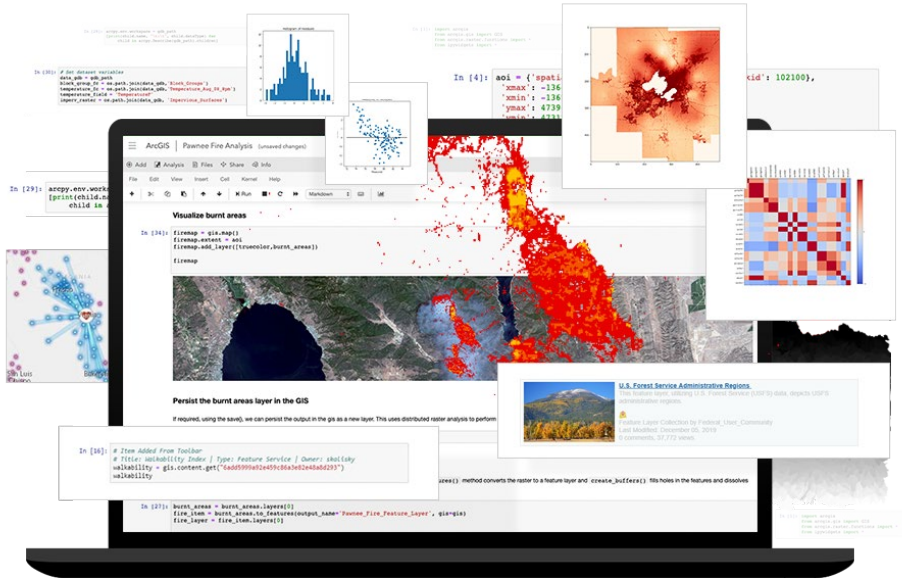


Python in ArcGIS Online

- ArcGIS Notebooks – notebooks as items in your account
- Benefits of SaaS – unlimited scaling, 24 x 7 availability, maintenance free
- ArcPy & ArcGIS API for Python
- Ready to use environment - Over 300+ libraries
- On-demand GPU runtimes for training deep learning models
- Share and collaborate



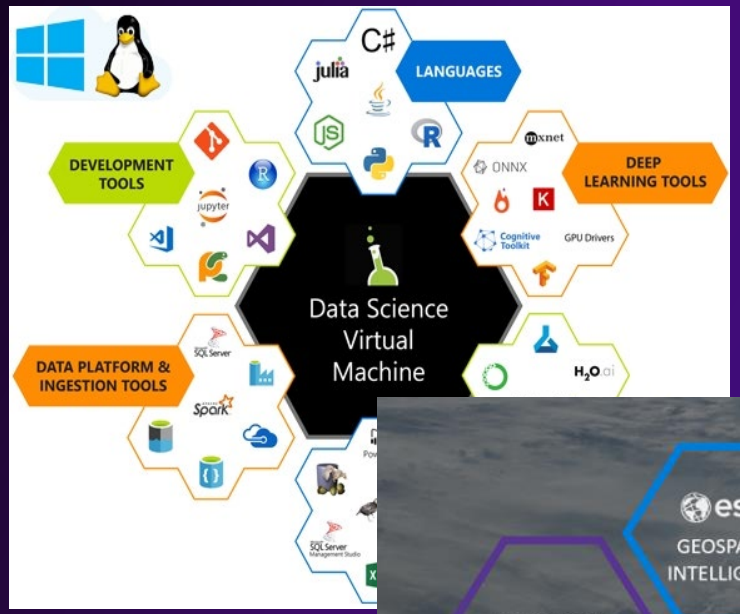
Notebooks in ArcGIS Online

Python and Platform as a Service (PaaS)

- Provides location services
- Integrate location into your apps and business systems
- Build mapping libraries of your choice
- Use Esri’s full range of mapping libraries and no-code options

Reduce time to market and promote creative design

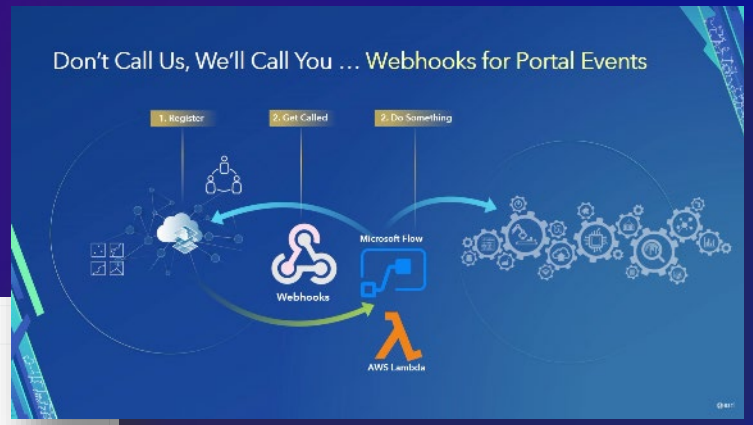
Azure cloud

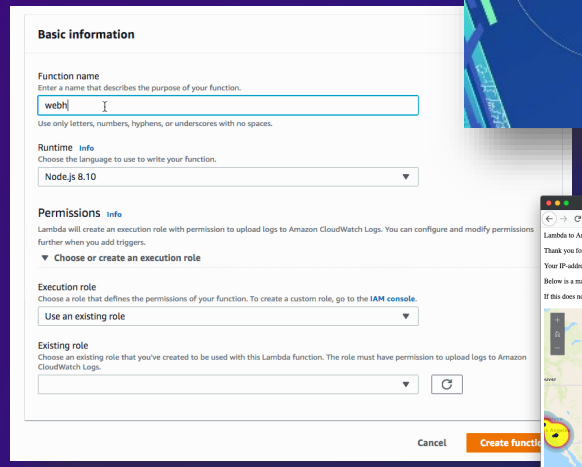


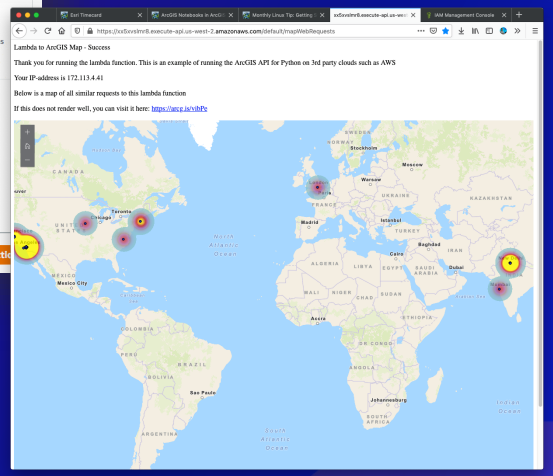
Azure DSVM

Azure GeoAI DSVM

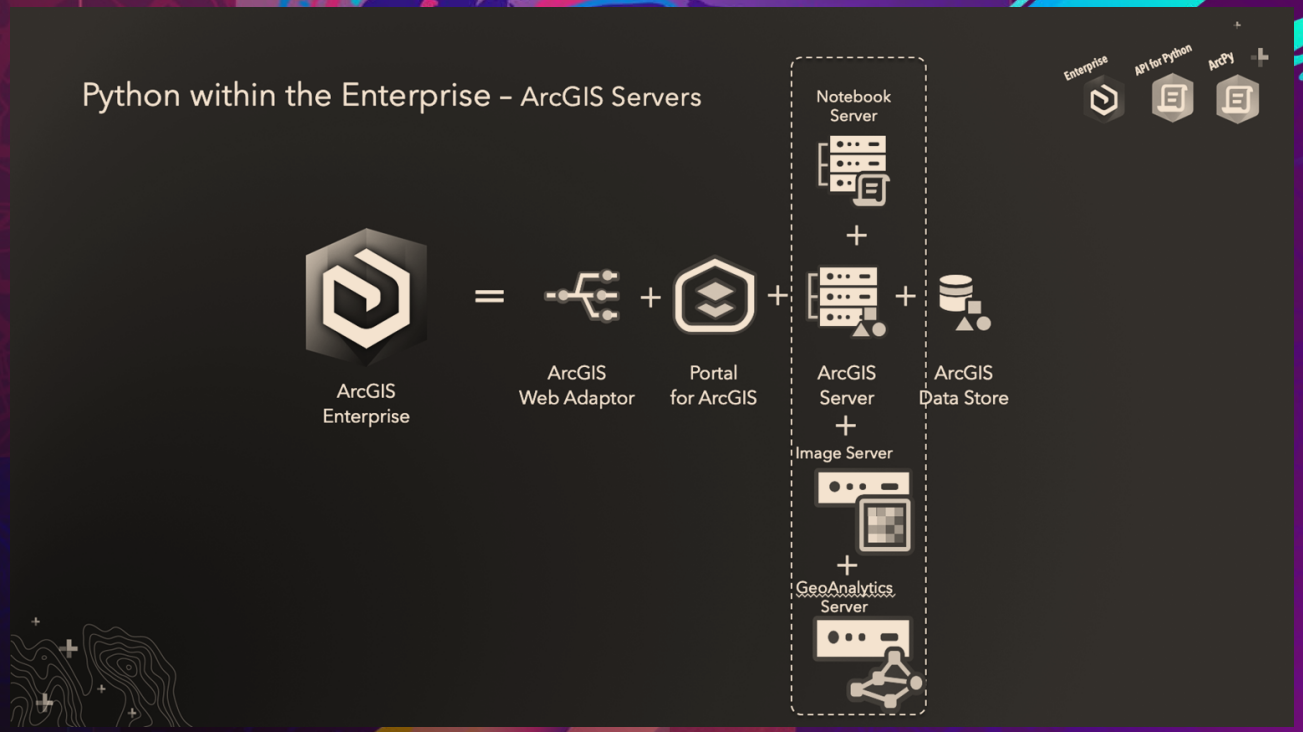
AWS cloud







https://www.esri.com/arcgis-blog/products/arcgis-enterprise/administration/webhooks-dev-summit-2019/



Demo – Administration with `arcgis`

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Python: Road Ahead

Python: Desktop Road Ahead

- Notebooks In Pro
  - Access Local & hosted notebooks, interact with the map
  - Notebooks are a first-class citizen in Pro
  - Drag and Drop from Notebooks
- Improve environment operations performance
- Arrow and PyArrow included with Pro
- GeoAnalytics access through PySpark
- Upgrade Python environments across Pro versions

Python: Enterprise Road Ahead

- Hosted Notebooks
  - Scheduling Notebooks
  - Parity with desktop (*wherever feasible*)
  - Notebook Server Manager
  - Light weight web tools
  - Dask Support
  - Parquet Support

ArcGIS Python Libraries Road Ahead

- ArcGIS API for Python
  - Support for distributed server deployments
  - Enhanced support for authentication systems
  - Improved SSL support
  - arcgis.learn: improve model metrics, image detection workflows
- ArcPy
  - Rich representations for results, rasters, charts
  - ArcPy in external conda environments
  - Rich representations in Notebooks for all objects
- Joint:
  - Better interoperability between ArcPy and the ArcGIS API for Python
  - Spatial dataframes as first-class objects

Conclusion

- Python integrates across the platform
- The ArcGIS Python libraries are becoming available in more places and easier to access
- The integration of the full Python ecosystem into your applications provides you the best of the open source world and the best of what Esri builds

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