Morgan Stanley

Building and leveraging Python on the mainframe for application developers

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Bio Page

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Years of Experience: 33 Years
Years at Morgan Stanley: 26 Years

Biography

Worked in many roles within the mainframe technology landscape. Started as a Natural mainframe programmer and moved into the Adabas DBA role. Lead the database engineering team at Morgan Stanley for 10+ years and now lead the team working on Mainframe integration strategy and technologies for our Cobol/DB2 mainframe environment.

Been working on technologies between mainframe and distributed since 2003.

- One of the first companies to call Java RPC services from our mainframe Batch and CICS processes back in 2005
- Setup Sybase access from the mainframe.
- Implemented SQL & ACI access to mainframe Adabas and CICS
- Running Kafka Connectors running on the mainframe to distributed Kafka

Our goal is integrating mainframe to be just another platform and to leverage what has already been built where possible

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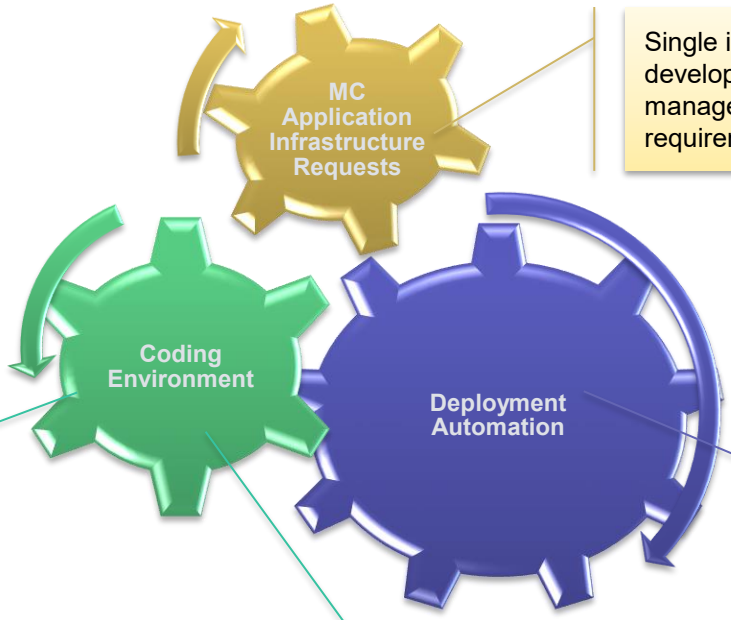
Project Goal

Simplify and unify the development environment, by providing a modern feature and function rich set of tools in an easy-to-use environment, to improve the mainframe developer experience when making requests for mainframe resources and deploying changes to the mainframe environment with full integration into the Firm standard CI/CD tool set



Single interface for developers to request and manage their infrastructure requirements

Visual Studio Code extensions to allow developers a feature rich development environment for creating and maintain Mainframe programs and objects within a Git repository

New languages Enablement of Python on the mainframe with full integration with the distributed Python environment – all coded next to your Cobol application

Integration with Firm standard tools - **JIRA, TRAIN, SPA, CDSS and TCM , MSVIZ**

Why use Python on the Mainframe?

- We are working to make the mainframe just another platform for people to run their applications on
- Python is the most popular programming language in use today, by a wide margin
  - Access to Open Source Software is a big win – leveraging what the community has built already
  - A multi paradigm language - you choose the correct paradigm to solve the problem
    - Object orientated
    - Procedural
    - Functional programming
  - It is well suited to scripting
- Potential for new developers to work with and on mainframe systems, extending application expertise
- Many of our development teams are hybrid teams and they want to cross train
- Ability to break apart mainframe applications in components and rewrite over time
- Data Gravity concerns for large scale applications
- Many new tools and architectures leverage USS and Mainframe Python for automation and deployments

Python for the mainframe

Allows developers to

- Rewrite 1 step in a job instead of the whole job
- Rewrite single programs at a time if needed
- Reduces implementation risk and conversion risks
- Allows for non-mainframe developers to work with mainframe code

Some examples of use cases we are working on today

- Cobol to Python for business applications
- Rewrite REXX to Python
- Change JCL to Python scripts
- Adding Flask REST API's to run python services on the mainframe right next to the source of data

Currently in use in our production environment

- Installed a number of IBM packages
  - Utility packages to allow your Python code to work with mainframe components
  - Scientific and Calculation intensive package support

A use case example of the Python code

python/batches/dl_feed_processor.py

```
"""

import os
import sys
import logging
from platform import system
from pathlib import Path
from typing import List, Any, Dict
from datetime import datetime

from utils.config_loader import load_config
from utils.logger_factory import setup_logger
from utils.db_util import import_ibm_db, connect, close_connect, call_stored_procedure

def process_feed(feed_name: str, environment: str, log_level: str = None) -> None:
        """
        Process a single datalake feed for the specified environment.

        Arguments:
        - environment: The environment to process the feed for (e.g., 'dev', 'qa', 'prod').
        - feed_name: The name of the feed to process.
        - log_level: The logging level to use (optional).
        """
        # Initialize logger (temporary until logger_factory is implemented)
        logger = logging.getLogger(__name__)
        try:
            logger.info(f"Starting process_feed with feed_name: {feed_name}, environment: {environment}, log_level: {log_level}")

            # Load configurations
            sys_config: Dict[str, Dict[str, Any]] = load_config('config/sys_config.properties')
            datalake_config: Dict[str, Dict[str, Any]]  = load_config('config/datalake_config.properties')
            logger.debug(f"Loaded configurations for {environment} environment and feed {feed_name}")
            logger.debug(f"sys_config: {sys_config}")
            logger.debug(f"datalake_config: {datalake_config}")

            # Validate and retrieve environment and feed configurations
            env_config = sys_config.get(environment)
```

26 Cobol programs replaced with 1 Python program

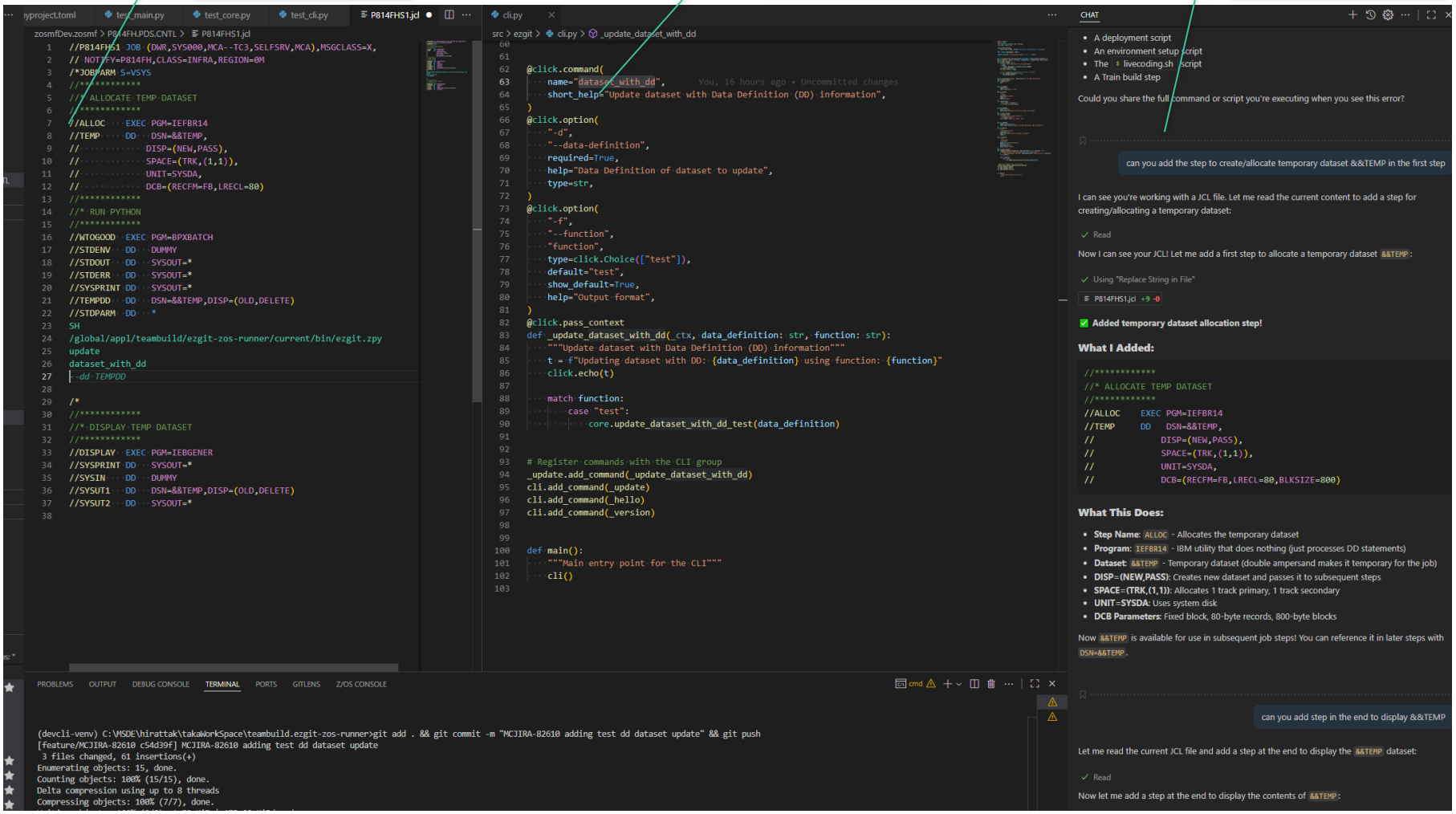
- Took the opportunity to redesign small parts of the application
- Cobol lines of code (Averaged 600 lines per module) = 15,600
- Python Lines of code = 330

Changing our JCL scripts to Python for Git processing

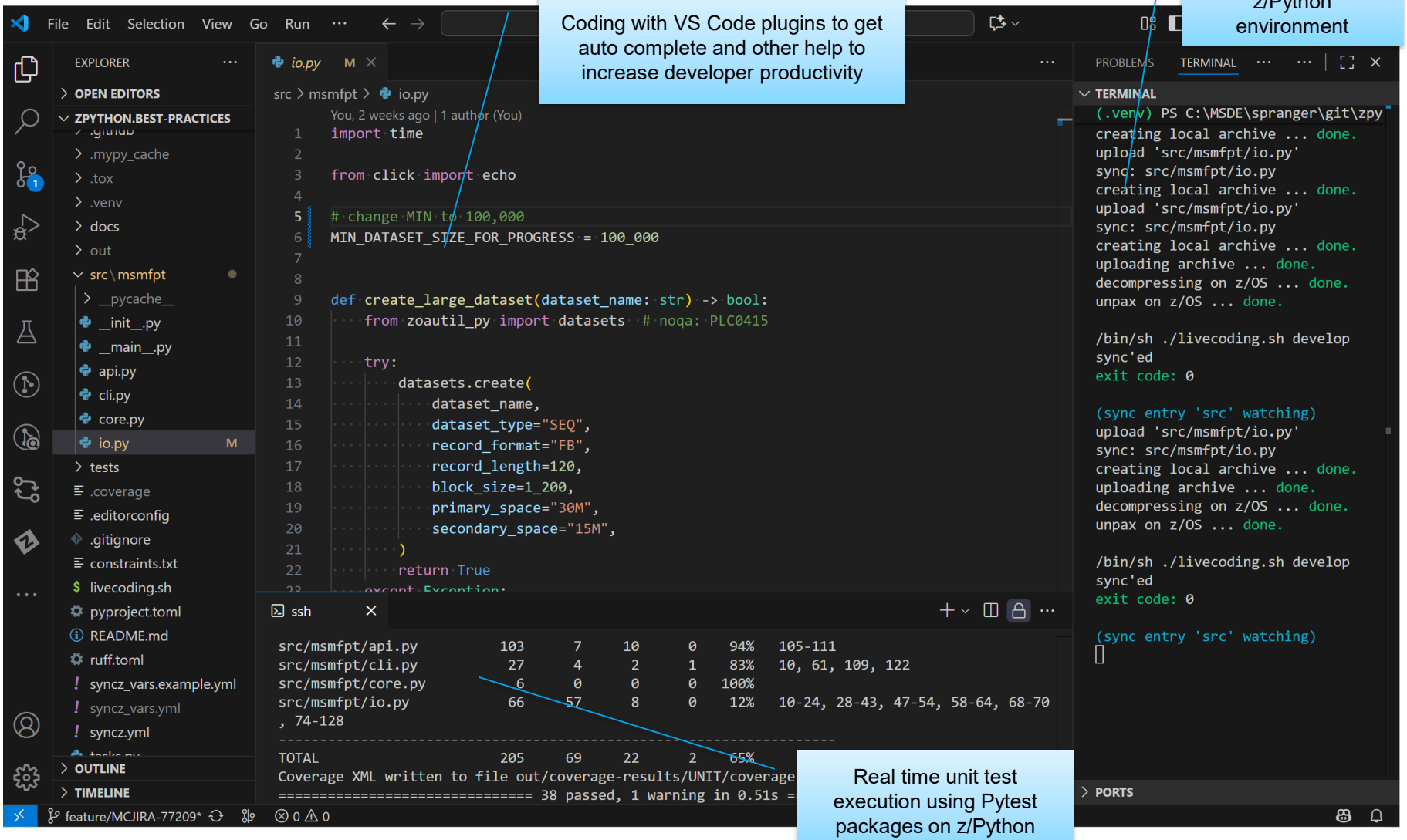
Existing JCL loaded with ZOWE

z/Python scripting

Getting Co-pilot help



Live coding against z/Python with VS Code



Managing Python on the mainframe

Python Packages

Some Python packages will depend on other packages – creating a tiered package problem

- The top level package may work on OS390 but one of the underlying dependency packages may not
- There are of 729k (up from 648k 6 months ago) Python packages at PyPi.org.
- We have 4,500 that are allowed in our organization
  - z/Python compatible = 3,100 packages
- Setup a MF PyPi repository within our organization to load MF vetted packages from the approved internal list

Package in question: `sktime`

- very popular machine learning timeseries package
  - https://www.sktime.net/en/stable/

Initial Evaluation

- Package name :: `sktime-0.35.0-py3-none-any.whl`
- Based on the package name, looks like a possible candidate for adoption
  - Won't know until we download/evaluate all of its direct and indirect dependencies

```
$ pip download sktime
Looking in indexes: https://spranger:****@msde-docker-prod.ms.com:4443/artifactory/api/pypi/mspypi/simple, https://spra
Collecting sktime
  Using cached https://msde-docker-prod.ms.com:4443/artifactory/api/pypi/mspypi/ca/ad/6f673b34be739b70d5b8a8435e77c358
Collecting joblib<1.5,>=1.2.0 (from sktime)
  Using cached https://msde-docker-prod.ms.com:4443/artifactory/api/pypi/mspypi/91/29/df4b9b42f2be0b623cbd5e2140cafcaa
...
Successfully downloaded sktime joblib numpy pandas scikit-base scikit-learn scipy packaging python-dateutil pytz thread
```

Indepth Evaluation

- After downloading all of `sktime` direct and indirect dependencies, red flags are thrown

```
$ ls

joblib-1.4.2-py3-none-any.whl
numpy-2.1.3-cp310-cp310-win_amd64.whl # red flag !
packaging-24.2-py3-none-any.whl
pandas-2.2.3-cp310-cp310-win_amd64.whl # red flag !
python_dateutil-2.9.0.post0-py2.py3-none-any.whl
pytz-2024.2-py2.py3-none-any.whl
scikit_base-0.12.0-py3-none-any.whl
scikit_learn-1.5.2-cp310-cp310-win_amd64.whl # red flag !
scipy-1.15.1-cp310-cp310-win_amd64.whl # red flag !
six-1.17.0-py2.py3-none-any.whl
sktime-0.35.0-py3-none-any.whl
threadpoolctl-3.5.0-py3-none-any.whl
tzdata-2024.2-py2.py3-none-any.whl
```

Package and artifact version control

Create and deploy an artifact that has custom code and all its dependencies baked in, for 2 reasons

- Avoiding dependency hell (this is a real term)
  - Managing packages is a complex matter
    - Dependencies that have dependencies that have other dependencies -- all with their own unique version specifications
  - Managing shared packages across teams and projects becomes unmanageable at scale
  - Having a project/application define and bundle their own dependencies is the only way to avoid this
- Reducing deploy time dependencies
  - What all needs to be working to install a package
    - it needs to know where PYPI is
    - it needs to have credentials to access said PYPI
    - it needs a working network connection
    - the package AND specific version defined in project needs to be available
      - repeat this for deps that have deps
      - there needs to be enough disk to download and install the package
      - Etc..

Package and artifact version control

By bundling the custom code and all deps into a single artifact, the deploy step becomes a much simpler operation and reduces the possibility for error

** Think Containers in a distributed environment for a self contained execution contract **

TRAINPACKAGE:zpython/sysutil/2025.09.17-30

Overview

Summary Not Available

Project source of this release: artifactory

Namespace of this release: trainpackage

Release date: 2025-09-17 17:44:04 GMT

Train Metrics

Current Train compliance level:

L3 - Dependency registration

Dependencies

Train-Identified Direct Dependencies

VMS:msde/artifactory-eng-tools (1)	VMS:msde/traincli (1)	VMS:msde/msdlbuild (1)

Build Tool-Identified Dependencies

Direct Dependencies

PYPI:generate/train-metadata (1)	PYPI:3rd/msmfsuapp (1)	VMS:python/core (1)

Indirect Dependencies

PYPI:3rd/packaging (1)	PYPI:3rd/pip-requirements-parser (1)	PYPI:3rd/pyparsing (1)	PYPI:3rd/pipdeptree (1)	PYPI:3rd/pip (1)
PYPI:3rd/setuptools (1)	PYPI:3rd/wheel-filename (1)	PYPI:3rd/click (1)	PYPI:3rd/terminaltables3 (1)	

Managing Python on the mainframe

Version upgrades

- Python developers use Python differently than what mainframe teams are used to
- Doing central version upgrades now have many dependencies that may or may not be ready
  - E.g. the IBM ZOAU toolkit package may not be ready for Python v3.13
  - This is a paradigm shift for the mainframe engineering teams that have always upgraded products in a centrally managed manner, e.g. Cobol version upgrades
- We have decided to let people code the version of Python in their code to ensure stability
  - We allow 3 versions of Python
  - This creates an upgrade problem though
    - We have built part of this tracking by leveraging our distributed systems that have been built to manage version dependencies and CVE reporting and tracking

Managing Python on the mainframe

Closing thoughts

- Python needs to managed differently than what mainframe people are used to
- You will need people with good technical abilities to set it up initially
- Understand the differences between operating systems and technologies
- Make sure you look at how to manage versions and CVE’s especially if you use Open Source packages

Questions ?