AGENTIC INDUSTRIAL EQUIPMENT ONBOARDING

Hubert Asamer

Industrial Solutions Architect & Tech Lead - AWS

asamerh@amazon.de

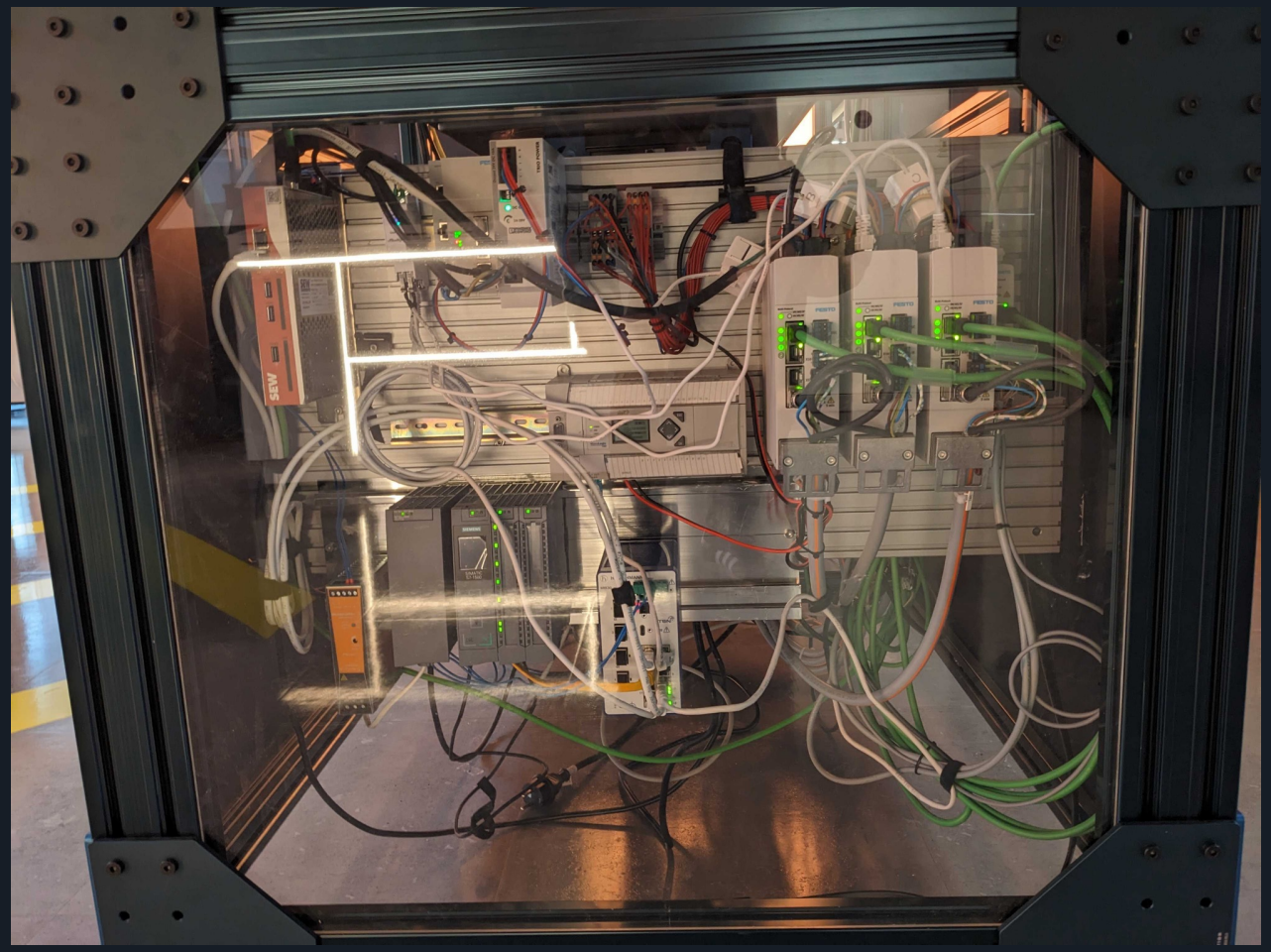
Content

- Problem Statement & Customer Examples
- Moonshot Goal: Onboard new PLC &
  - have data in Iceberg in 5 minutes
- What Agentic AI & SFC bring to the Table (and what not)
  - AWS Agentic AI offering
  - How to start quickly with Strands Agent SDK
  - SFC – what is it?
- Live Demo

The perfect world…

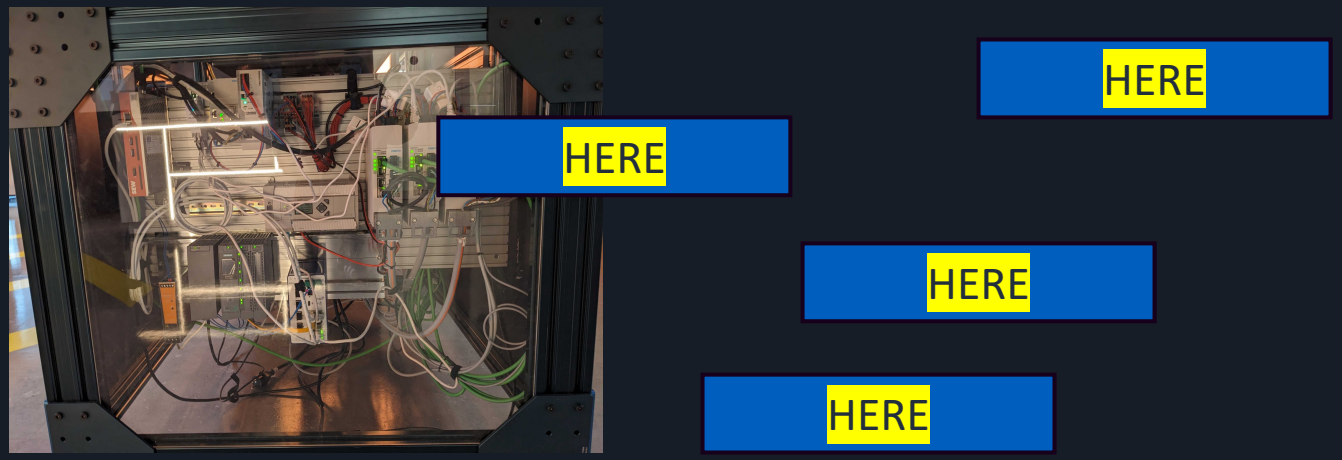
- Standardized equipment
- Telemetry collected
- Context aware Data Ingest
- Democratized Access to all data
- Telemetry Data solves real business problems
- Equipment & Processes optimized using AIML

The Reality…



- Various equipment vendors & generations
- Equipment Data onboarding takes very long
- Data Silos inside proprietary Data Collection regimes
- No Context for Data
- Ingested Data not consumable for ML/AI
- Tbo bro, that whole OT data collection is broken…

Most manufacturers are....



But we want solve Problems with Data!

Moonshot Vision:

- **I want all employees in my company to have access to all equipment telemetry of all sites, all the time, without exceptions.**
  - All Data shall be easily accessible in tabular form – best case with some SQL (Iceberg?)
  - Realtime (actual) data shall be consumable using nats or mqtt at site-level or multi-site level
- **I want my equipment (e.g. Machines, PLC) onboarded within at max. 5 minutes and telemetry data shall be flowing from the shopfloor to Iceberg instantly.**
- **All Site-Level Data needs to be exposed as OPC-UA server**

Challenges & Solutions

- OT Data Collection Challenge
  - → SFC
- Domain Knowledge Challenge
  - → wont fix, to some extent LLMs & Domain Docs may help
- OT/IT configuration & coding challenge
  - → LLM, specialized MCPs & Knowledge bases
- Internal/External Data Sharing challenge
  - → AWS Platform has all built in

What is SFC?

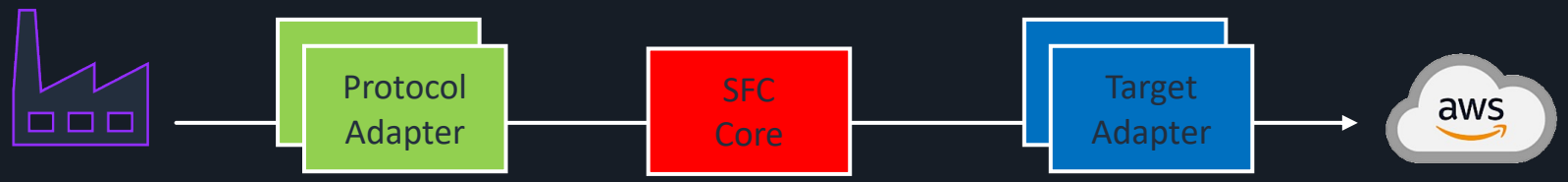
- Industrial edge connector/target framework
- By design, avoiding dependencies and dealing with customer production cases regarding hardware, execution environments, networking, configuration, and deployment methods
- Flexibility and extensibility
- Comprehensive customization achieved solely through configuration
- Bridging the OT/IT gap

https://github.com/awslabs/industrial-shopfloor-connect

SFC Architecture

SFC Components

- SFC Core
- Protocol Adapters
- Target adapters



SFC Concepts

An SFC instance runs one or more configured Schedules

Schedule:

- Reading interval
- Sources to read from
- Targets to send the data to

Source :

- Protocol Adapter
- Values to read

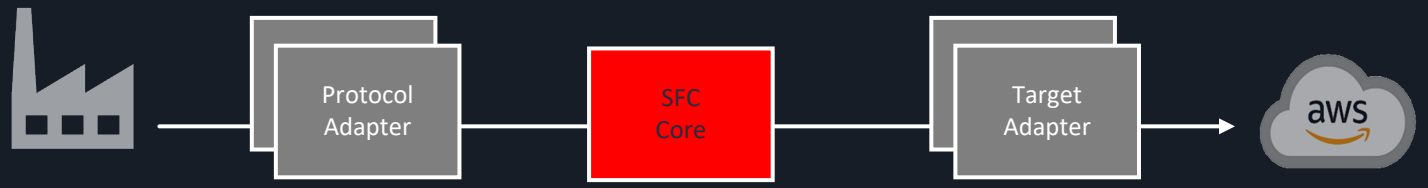
Target:

- Target adapter
- Destination of the collected data

```
"Schedules": [
  {
    "Name": "Schedule1",
    "Interval": 1000,
    "Description": "4 configured AWS targets",
    "Sources": {
      "OPCUA-SOURCE" : [ "*" ]
    },
    "Targets": [
      "S3Target",
      "KinesisTarget",
      "LambdaTarget",
      "IoTCoreTarget"
    ]
  }
]
```

Core process

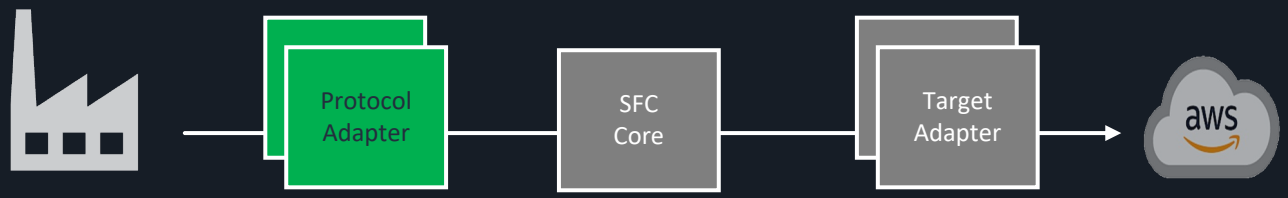
- Orchestrates reading of data from adapters and writing to targets through configured schedules
- Can read from multiple connectors and write to multiple targets for different destinations
- Supports edge processing and data filtering
- Maintains full type fidelity, fully abstracted from actual protocol adapter
- Handles configuration, metrics collection, and logging
- Adopts a configuration-centric approach



Protocol adapters

- Single task, reading data from industrial equipment
- Loosely coupled with SFC-Core
- New adapters can be built on top of SFC infrastructure, no changes to SFC core needed

```
"Sources": [
  "OPCUA-SOURCE": {
    "ProtocolAdapter": "OPCUA",
    "SourceReadingMode": "Subscription",
    "Channels": {
        "ServerStatus": {
            "Name": "ServerStatus",
            "NodeId": "ns=0;i=2256"
        },
        "ServerTime": {
          "Name": "ServerTime",
          "NodeId": "ns=0;i=2256",
          "Selector": "@.currentTime"
        },
        "State": {
          "Name": "State",
          "NodeId": "ns=0;i=2259"
        }
    }
]
```

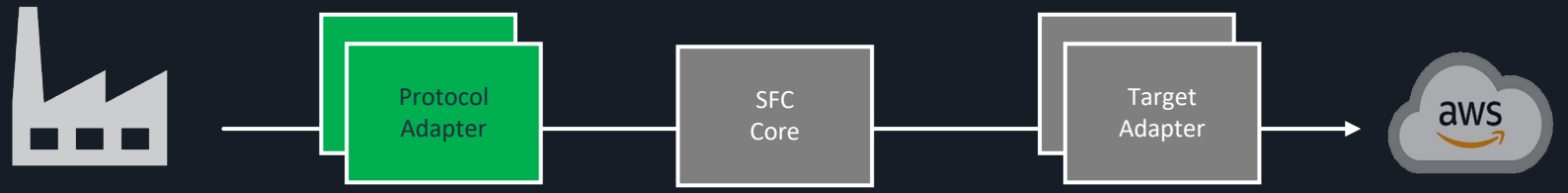


Available Protocol adapters

- Modbus-TCP
- OPCUA
- Siemens S7
- Rockwell/AB EthernetIP PCCC
- MQTT
- SQL (JDBC)

- Beckhoff ADS
- SNMP
- Mitsubishi SLMP
- IO Link (soon)
- REST
- CAN Bus (J1939)

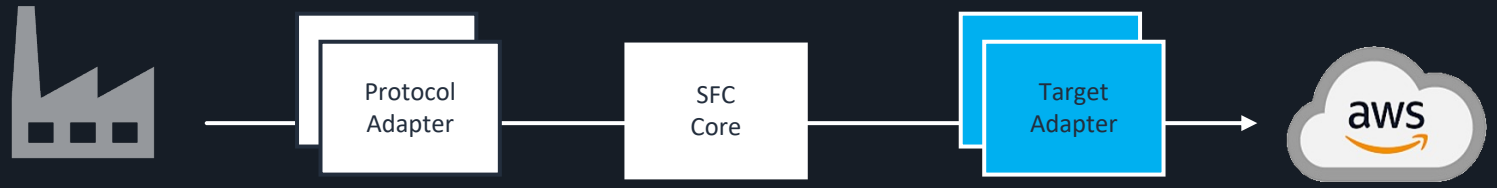
https://github.com/awslabs/industrial-shopfloor-connect/blob/main/docs/adapters/README.md



Target adapters

- Singe task, writing data provided by SFC-Core to their target specific data store or cloud service
- Loosely coupled with SFC-Core
- Buffering, template transformations and compression

```
"Targets": [
  "IoTCoreTarget": {
    "TargetType": "AWS-IOT-HTTP",
    "TopicName": "sfc-topic",
    "Region": "eu-west-1"
  },
  "S3Target": {
    "TargetType": "AWS-S3",
    "Region": "eu-west-1",
    "BucketName": "sfc-bucket",
    "Interval": 60,
    "BufferSize": 10,
    "Template" : "DataToCSV.vm"
  }
]
```



Available Target adapters

AWS

- AWS IoT Analytics
- AWS IoT Core
- Amazon Kinesis Data Streams
- Amazon Data Firehose
- AWS Lambda
- Amazon Managed Streaming for Apache Kafka (MSK)
- Amazon Simple Storage Service
- AWS IoT SiteWise
- Amazon Timestream
- Amazon Simple Notification Service
- Amazon Simple Queue Service
- S3 Tables (Iceberg)

Local / Edge

- AWS IoT SiteWise Edge
- Terminal output
- Local file system
- MQTT
- NATS.IO
- OPCUA
- OPCUA-WRITER

https://github.com/awslabs/industrial-shopfloor-connect/blob/main/docs/targets/README.md

SFC is Config Driven

- SFC has a very rigid & strict JSON config schema
  - https://github.com/awslabs/industrial-shopfloor-connect/blob/main/docs/core/sfc-configuration.md

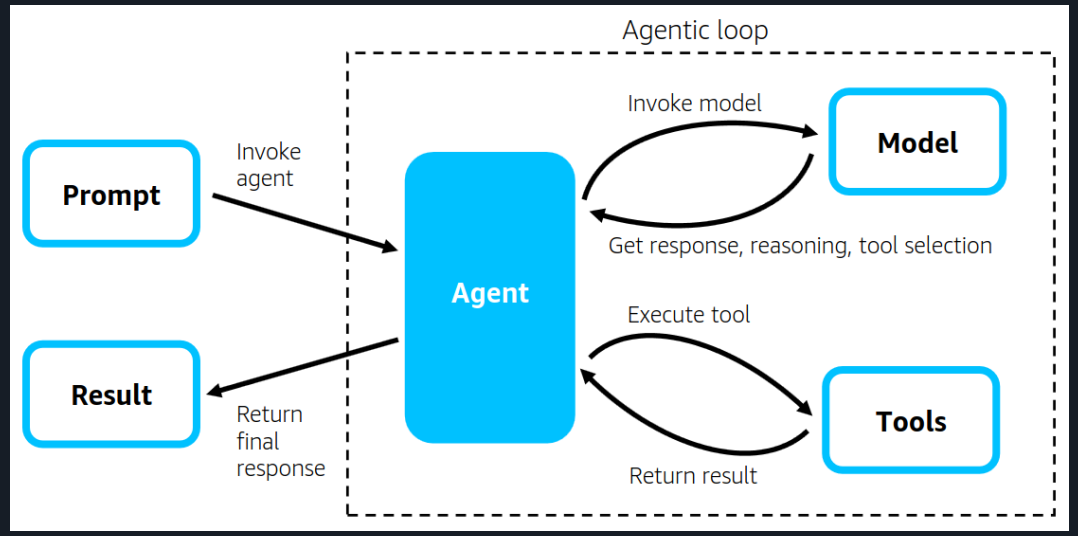
- That is a solid base for a LLM to produce SFC configs

- But: **LLMs & Agents** need some help from **specialized tools**, that explain how the Config must look like.

Wait, Agents?

- Yes, Agents are dedicated applications, that can properly communicate in a loop with LLMs.
- Agentic programs use tools & MCP servers and their exposed capabilities
- AWS released Strands Agents SDK earlier this year...
- With Strands it’s very easy to create agentic AI applications

https://strandsagents.com/latest/



SFC Agentic App Example

AI-powered assistant for AWS provided Shop Floor Connectivity (SFC) configuration management and testing. Using python Strands Agents SDK and FastMCP.

Demo

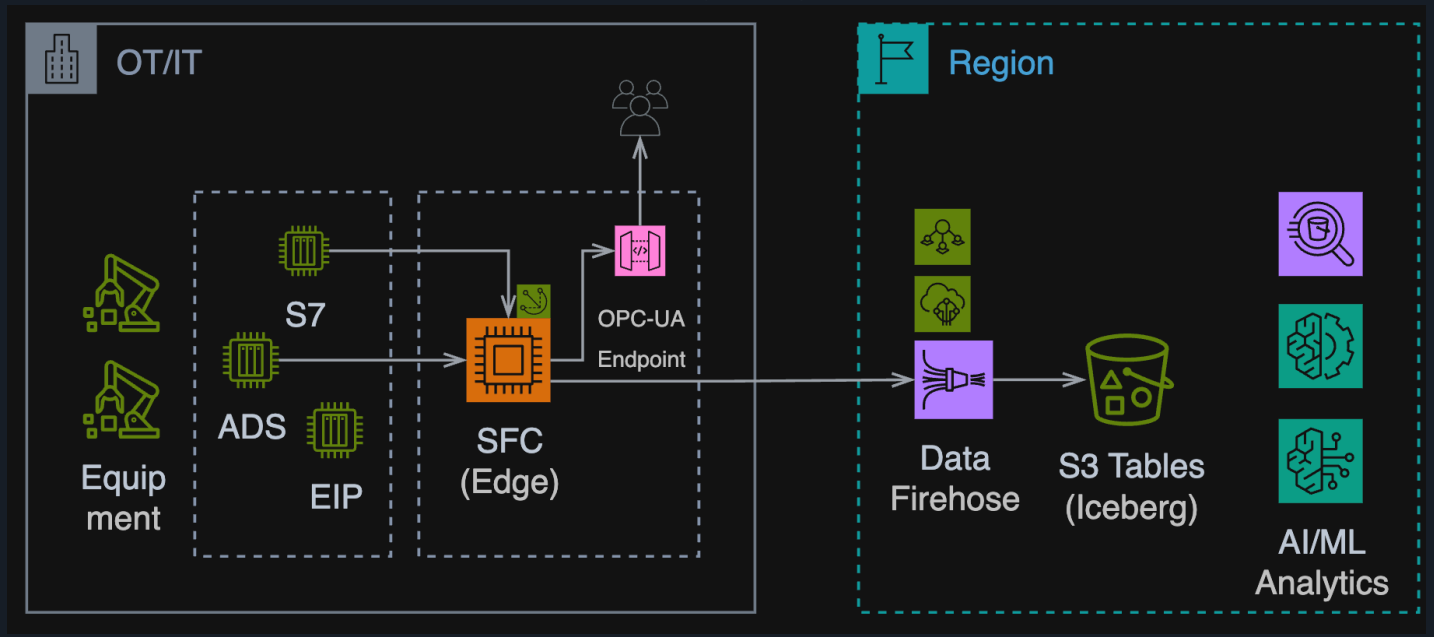
- S7 PLC
- Beckhoff PLC

→ Onboard S7 PLC based on some CSV (using Agent)

→ Expose all PLC tags as OPC-UA server

→ Send selected PLC tags to Firehose & S3-Tables (using Agent)

→ Query PLC Data using Athena



Thank you!