# **OSS Tools**
# for System Management


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# Agenda

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- Current State of System Management on IBM i
- Operational Monitoring with Prometheus
- Data Visualization with Grafana
- Event Monitoring with Manzan
- Manzan + AI

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# Current State of System Management on IBM i

# What tools are you using for monitoring your IBM i systems?

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1. Dynatrace
2. Nagios
3. Instana
4. DataDog
5. Control4i
6. Syslog Reporting Manager (SRM)
7. Created your own
8. Other

# Specialty is a collective disadvantage

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1. Dynatrace
2. Nagios
3. Instana
4. DataDog
5. Control4i
6. Syslog Reporting Manager (SRM)
7. Created your own
8. Other

Each solutions has their own...

- Configuration
- Host installation requirements
- Monitoring capabilities
  - Collect system metrics (active jobs, ASP consumption)
  - View sub system information
  - Identify long-running SQL
  - View job queue

# Do you use Grafana?

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1. Yes, with IBM i
2. Yes, but not with IBM i
3. No, but we want to
4. No, we don’t want to
5. No, don’t know what it is

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# Operational Monitoring with Prometheus

# Prometheus Overview

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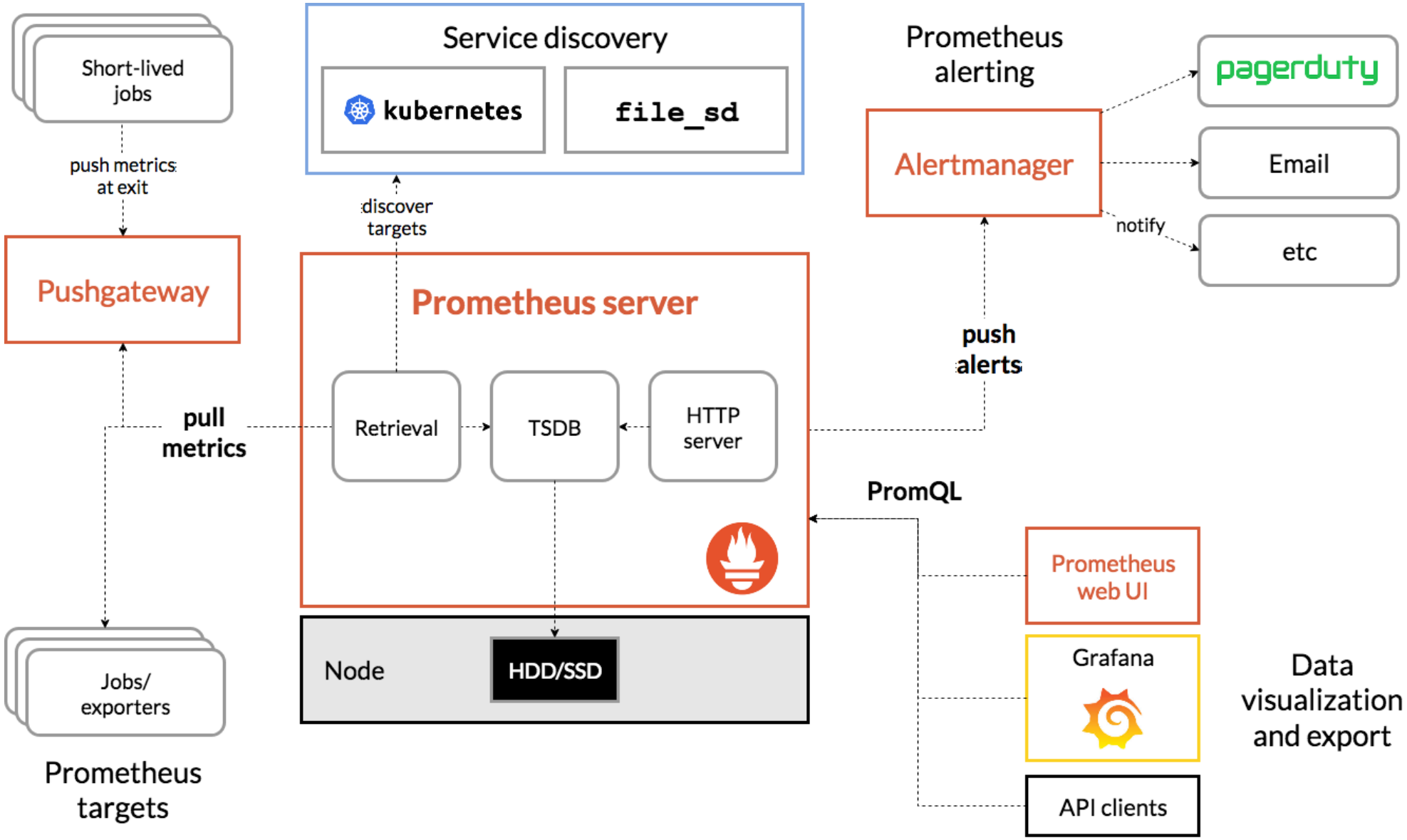
## What is it?

- Leading open-source systems monitoring and alerting toolkit
- Collects and stores metrics as timeseries data

## Features

- Multi-dimensional data model with time series data identified by metric name and labels
- Provides a functional query language called PromQL
- No reliance on distributed storage
- Has an alert manager built-in
- Easily paired with Grafana and other monitoring solutions

# Prometheus Architecture



# Prometheus Data Model

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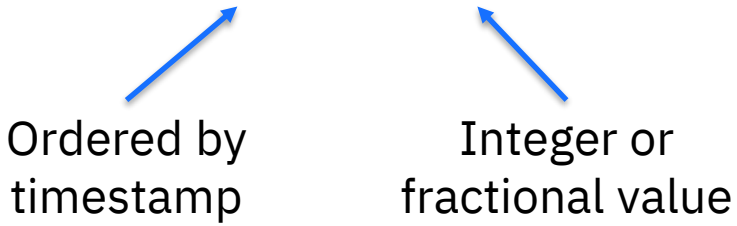
- All data is stored as a time series: `(timestamp, value)`




- Each time series has a name (metric name)
  - General feature of a system that is measured
- Each time series can have key/value pairs (metric labels)
  - Identifies a particular dimension of the metric
- Notation: `<metric name>{<label name>=<label value>, ...}`
  - `api_http_requests_total{method="POST", endpoint="/messages"}`
- Time series is uniquely identified by metric name + metric label
  - `temperature{city="Toronto"}`
  - `temperature{city="Rochester"}`

# PromQL (Prometheus Query Language)

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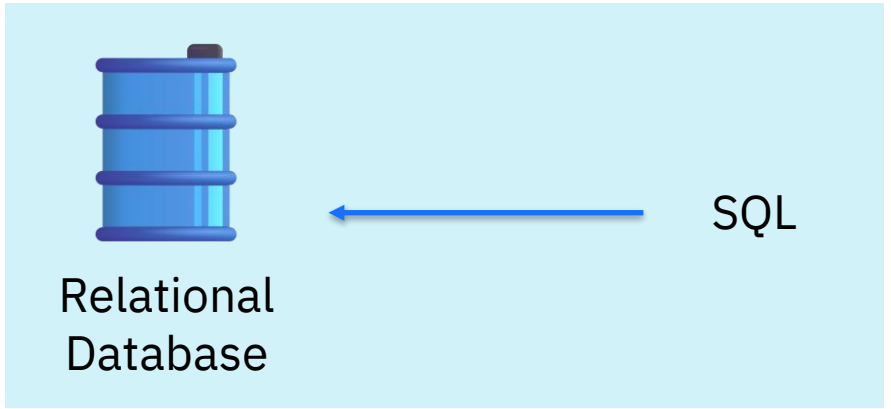
Functional query language that lets the user select and aggregate time series data in real time

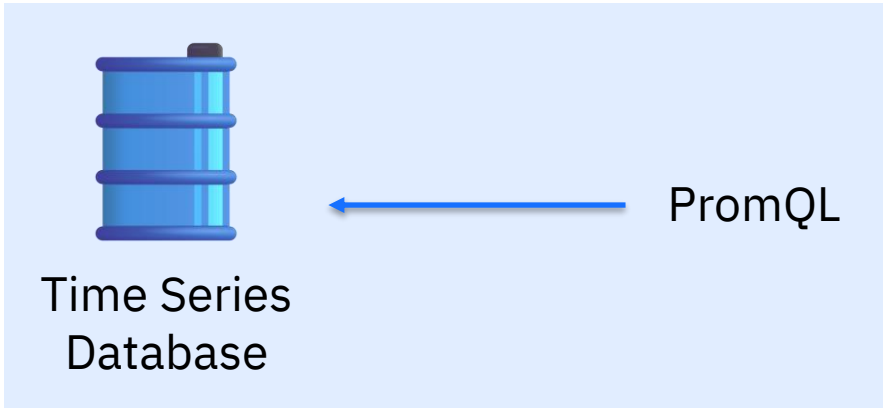
Types:

- Instant query: Evaluated at one point in time
- Range query: Evaluated at equally-spaced steps between a start and an end time

Usage:

- Get/filter metrics we are interested in
- Aggregate metrics
- Build dashboards
- Setup alerts



# PromQL Basics

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| SQL | PromQL |
| --- | --- |
| select * from http_server_request_count | http_server_quest_count |
| select * from http_server_request_count where uri=“/api/people” | http_server_quest_count{uri=“/api/people”} |
| select * from http_server_request_count where uri=“/api/people” and method=“GET” | http_server_quest_count{uri=“/api/people”,method=“GET”} |
| select * from http_server_request_count where status like ‘2%’ or status like ‘3%’ or status like ‘4%’ | http_server_quest_count{status=~“2..\|3..\|4..”} |

# More PromQL Basics

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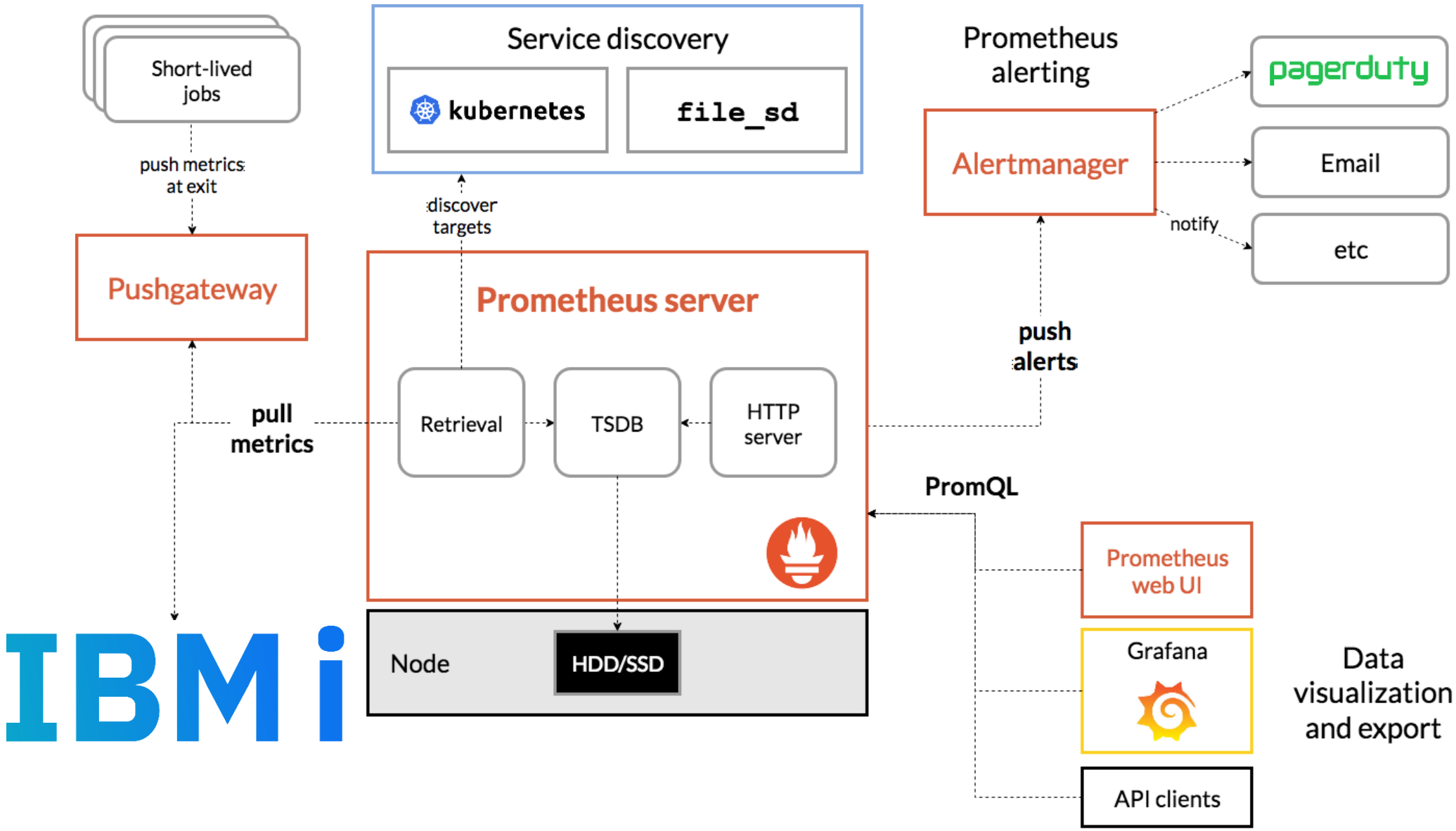
Instant query → Instant vector
Range query → Range vector

# How to use Prometheus with IBM i





# Monitoring IBM i with Prometheus

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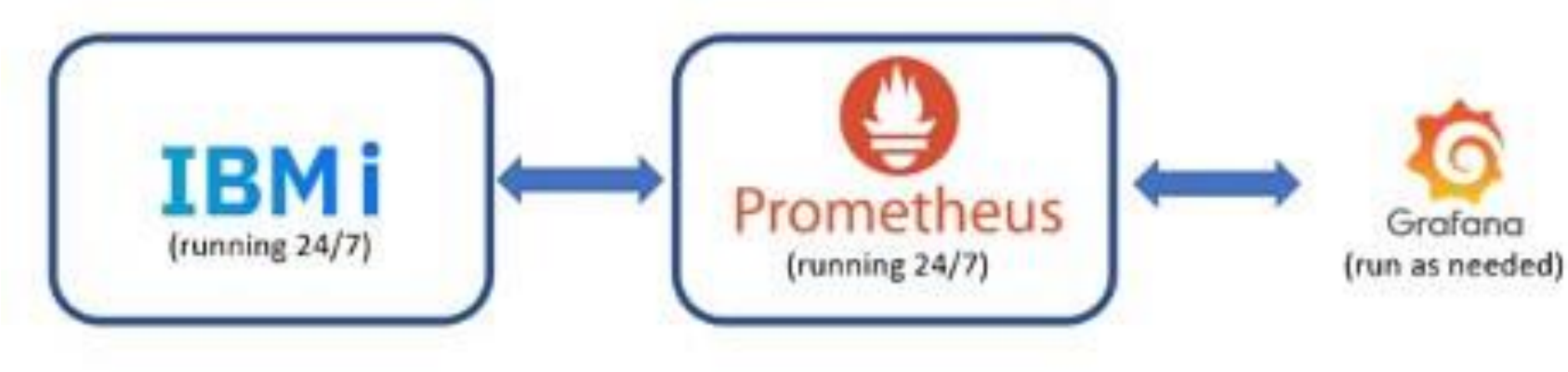
- Blog post by Jesse Gorzinski: "Monitoring IBM i with Prometheus“ https://techchannel.com/Trends/12/2022/ibm-i-prometheus

- Simplified view
  - Passive exporter running on IBM I
  - Prometheus running on some central location, preferably Docker or Podman
  - Grafana running somewhere, preferably Docker or Podman



# Prometheus can be the bridge to other solutions

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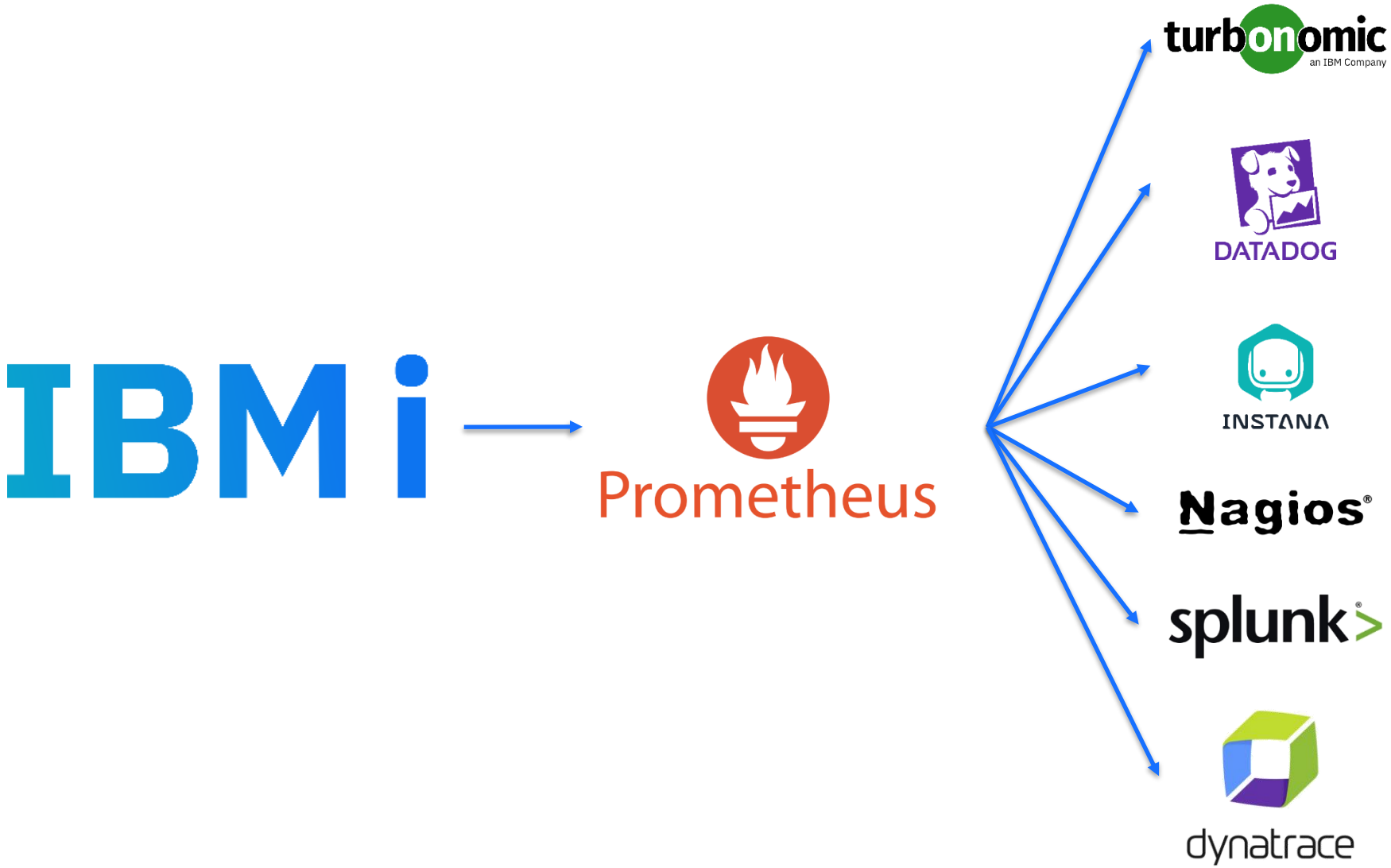

# JDBC Prometheus Exporter

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- https://github.com/ThePrez/prometheus-exporter-jdbc
- An interface for passive metric collection which allows Prometheus to scrape it
- Deploys on IBM I
- Exports over 400 metrics
- Customizable metrics with SQL
- Demo: http://ibm.biz/ibmi-prometheus

```
{
  "port": 9853,

  "queries": [{
      "name": "System Statistics",
      "interval": 60,
      "enabled": true,
      "prefix": "STATS",
      "sql": "SELECT * FROM TABLE(QSYS2.SYSTEM_STATUS(RESET_STATISTICS=>'YES',DETAILED_INFO=>'ALL')) X"
    },
    {
      "name": "System Activity",
      "interval": 20,
      "prefix": "SYSACT",
      "include_hostname": true,
      "enabled": false,
      "sql": "SELECT * FROM TABLE(QSYS2.SYSTEM_ACTIVITY_INFO())"
    },
    {
      "name": "number of remote connections",
      "interval": 60,
      "sql": "select COUNT(REMOTE_ADDRESS) as REMOTE_CONNECTIONS from qsys2.netstat_info where TCP_STATE
    },
    {
      "name": "Memory Pool Info",
      "interval": 100,
      "multi_row": true,
      "prefix": "MEMPOOL",
      "sql": "SELECT POOL_NAME,CURRENT_SIZE,DEFINED_SIZE,MAXIMUM_ACTIVE_THREADS,CURRENT_THREADS,RESERVED
    }
  ]
}
```

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# Data Visualization with Grafana

# Grafana Overview

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# LogQL Query Language

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# Prometheus Visualization with Grafana

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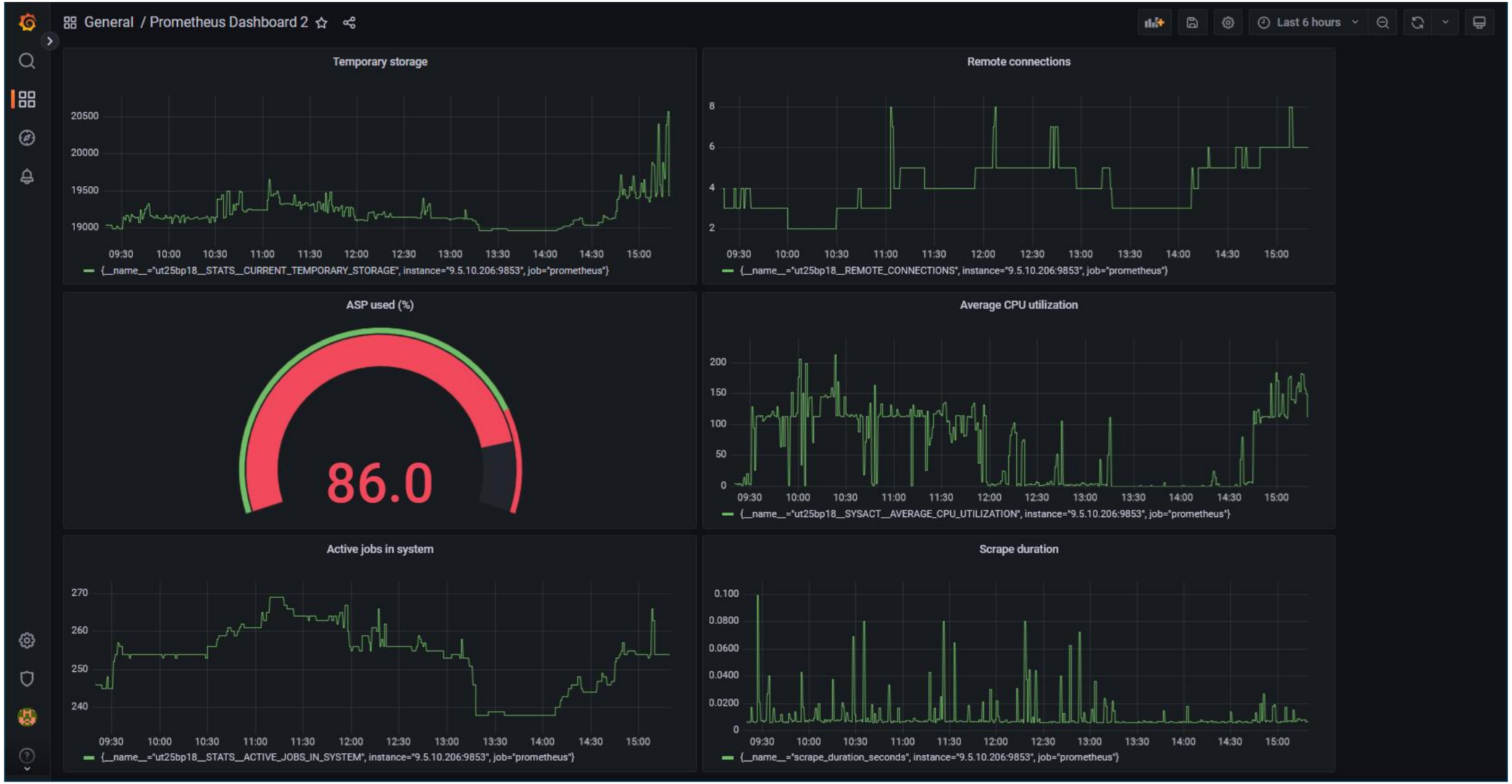

# Grafana Backend (Direct, No Prometheus)

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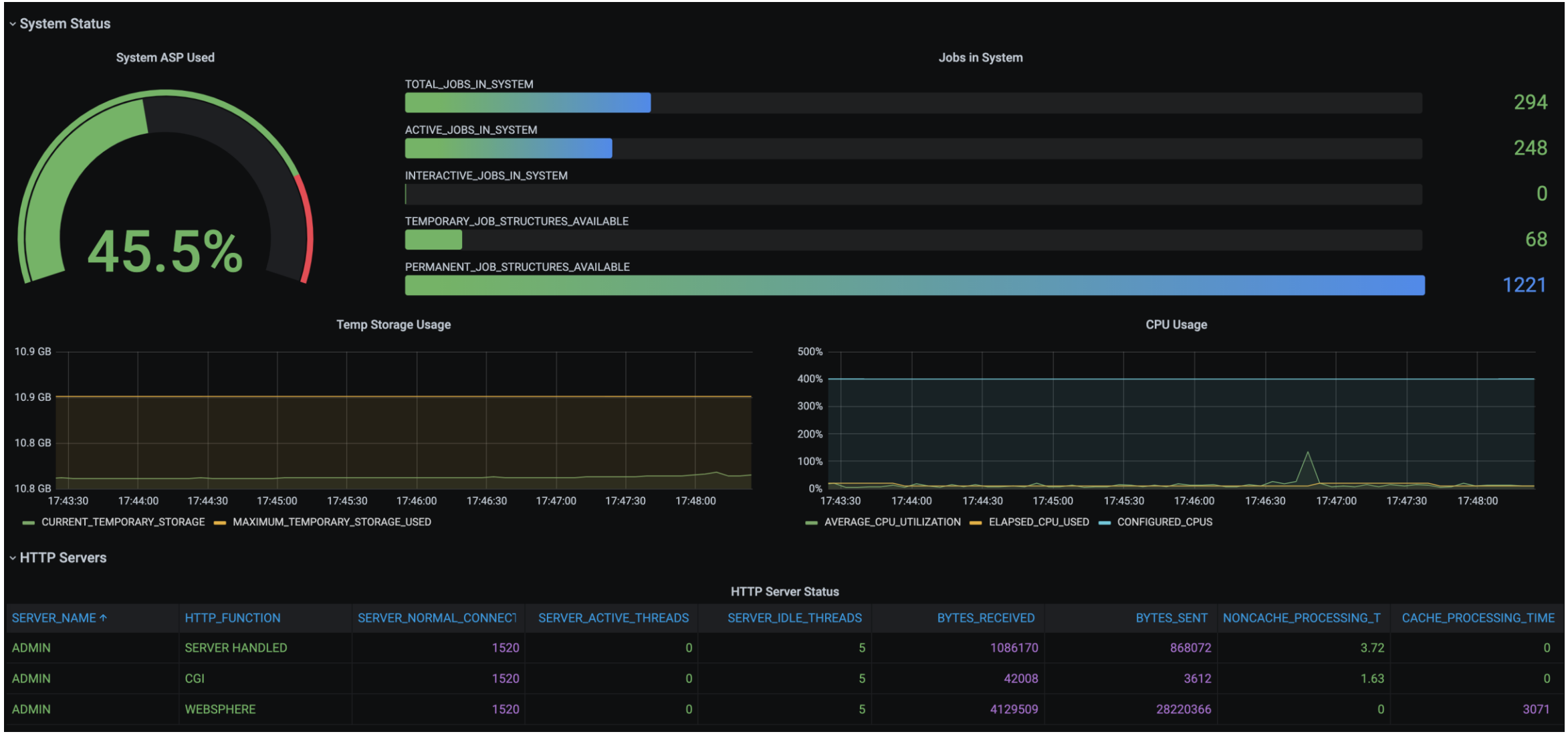

# Grafana with or without Prometheus

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| | Prometheus | Straight to Grafana |
|---|---|---|
| Persistent storage | Prometheus | Grafana |
| Persistent storage of unused metrics | Prometheus | -- |
| Metric type | Numerics | Numerics/strings/other |
| Ecosystem | Extremely Broad | There |
| Scalability | Excellent | Good |
| IBM i requisites | None | Node.js |
| Initial setup | Easier | Easy |

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# Event Monitoring with Manzan

# Manzan Overview

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- Open-source event handling tool designed to simplify handling of system events
- Serves as a gateway for publishing IBM i events to a variety of endpoints:
  - User applications
  - External resources
  - Open-source technologies
- Example use cases:
  - Monitoring system events with a third-party open source or proprietary tool
  - More comprehensive integration with syslog facilities
  - Queryable system events
  - Consolidated auditing/reporting activity.

# Understanding the Architecture: Inputs

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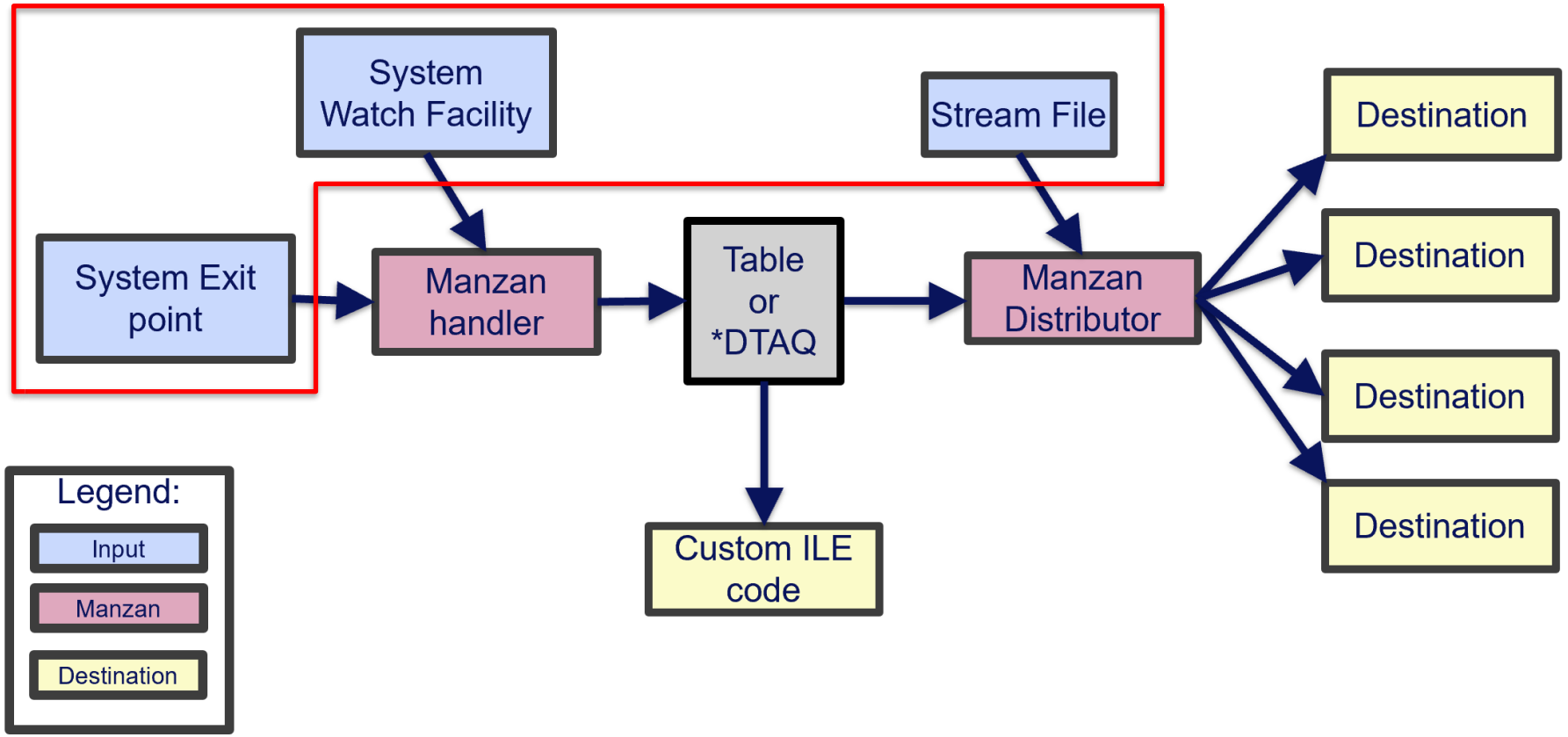
## Inputs: Sources of your data

- Stream file
- System watch facility (STRWCH)
  - MSGQ
  - LIC logs
  - PAL logs
- System exit points
- Audit journals (*coming soon*)



# So what can Manzan monitor...?

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| | | | |
|---|---|---|---|
| Application crashes | Log data | Specific entries in log data | System Limits alerts |
| History Log entries | Problem log entries | *SYSOPR messages | Specific job log messages |
| Audit journal events (future) | PAL entries | VLOGs | Fishy TCP connections (future) |

# Understanding the Architecture: Destinations

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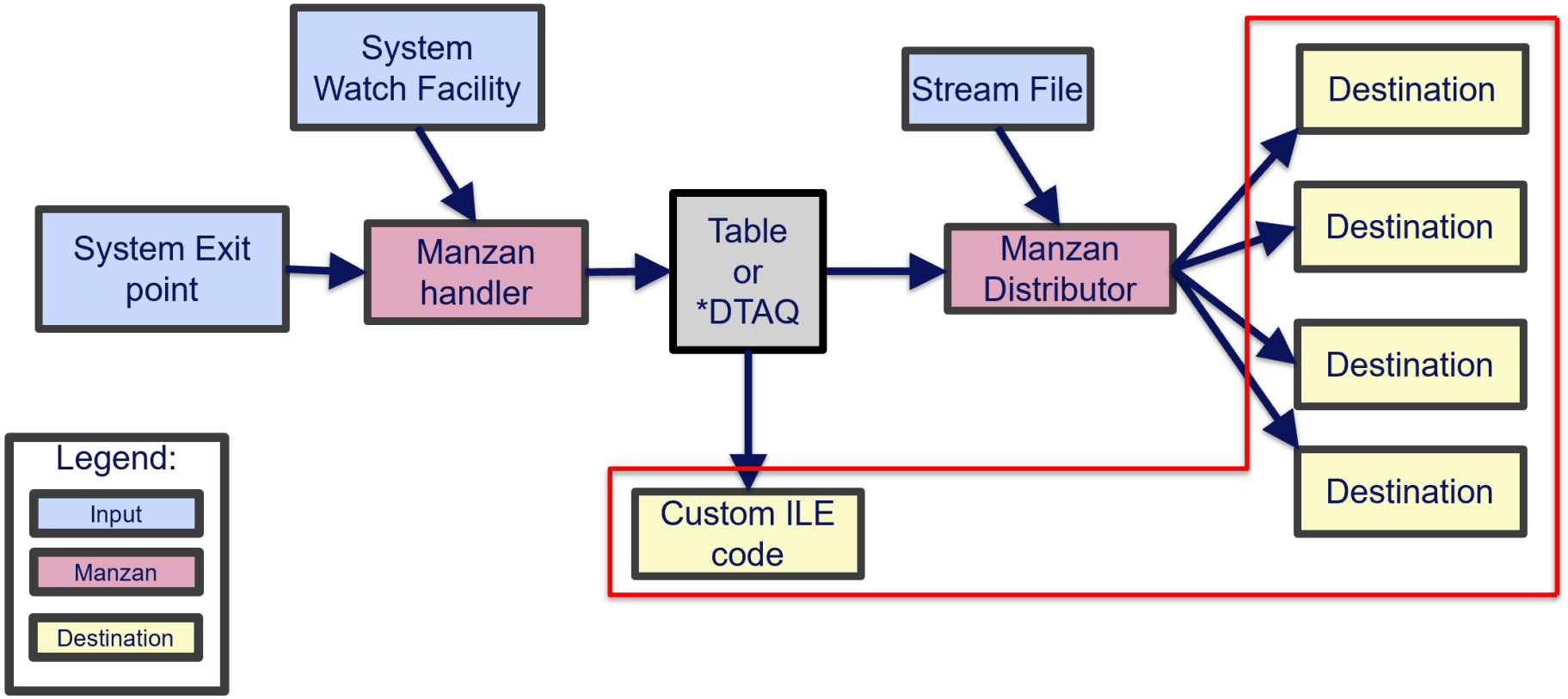
## Destinations: Locations to send data

- Supported destinations:
  - HTTP/HTTPS endpoints (REST, etc)
  - Email (SMTP/SMTPS)
  - SMS (via Twilio)
  - Slack
  - FluentD
  - Kafka
  - Sentry
  - Grafana Loki
  - Google Pub/Sub
  - ActiveMQ
- Custom ILE Code



# So can Manzan send data anywhere...?

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- Many desitnations are already working, but there are more to come
- Desired target not on the list? Please open an issue to the repository and let us know!
- Track supported destinations: https://theprez.github.io/Manzan/#/?id=where-can-i-send-these-events

- ActivateMQ ⏳
- AWS Simple Email Service (SES) ⏳
- AWS Simple Notification System (SNS) ⏳
- ElasticSearch ⏳
- Email (SMTP/SMTPS) ✅
- FluentD ✅
- Google Drive ⏳
- Google Pub/Sub ✅
- Grafana Loki ✅
- HTTP endpoints (REST, etc) ✅
- HTTPS endpoints (REST, etc) ✅
- Internet of Things (mqtt) ⏳
- Kafka ✅
- Mezmo ⏳
- Microsoft Teams ⏳
- PagerDuty ⏳
- Sentry ✅
- Slack ✅
- SMS (via Twilio) ✅
- Splunk ⏳

✅ = implemented 🌓 = partially implemented ⏳ = future

# Understanding the Architecture: Handler and Distributor

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# Configuring Inputs and Destinations

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Configuration files are located in /QOpenSys/etc/manzan

app.ini

data.ini

dests.ini

# Sending Messages to Slack

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# Ingest Logs into Grafana Loki

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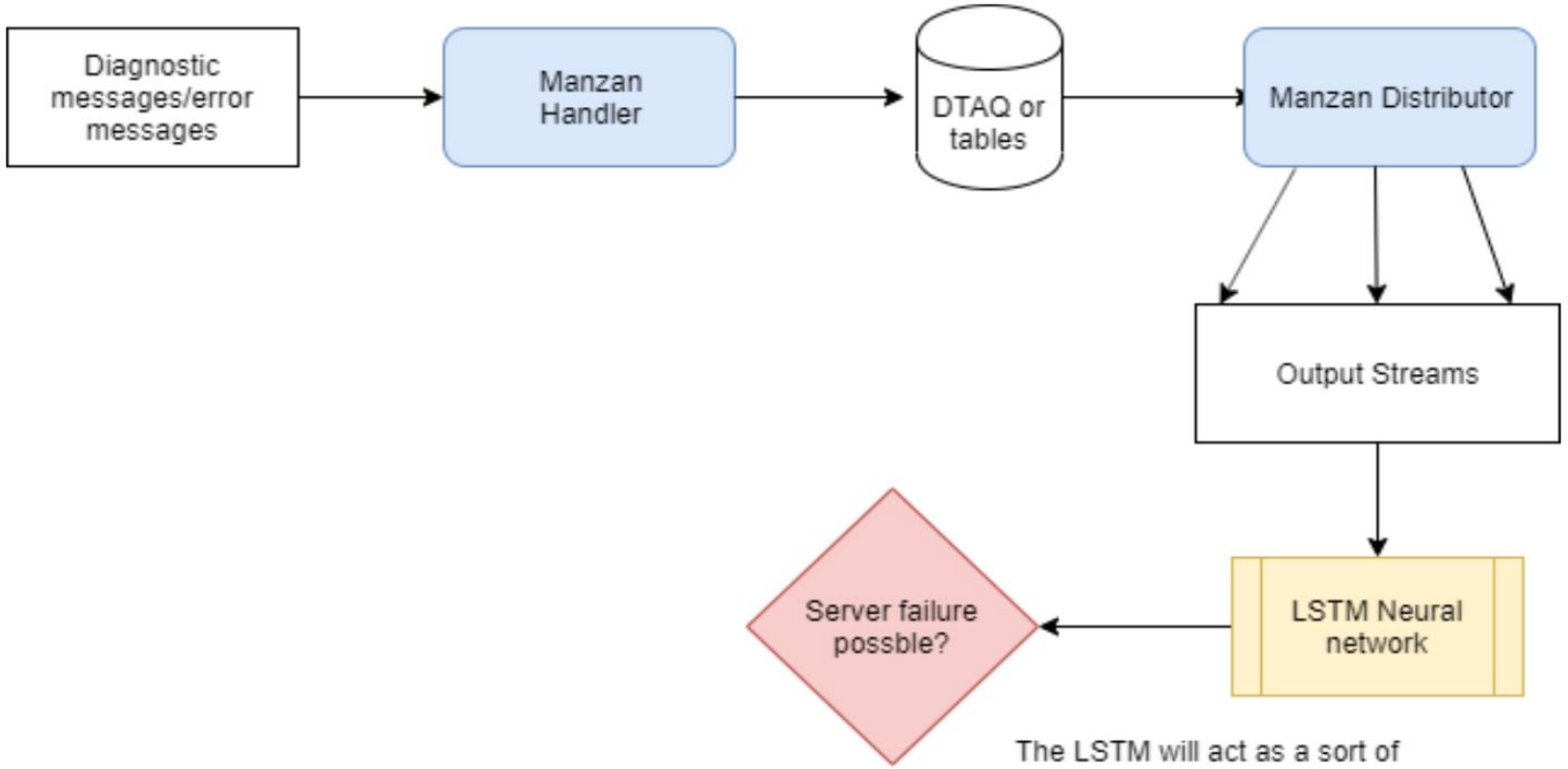
# Manzan + AI

# AI-Based System Monitoring: Failure Prediction System




The LSTM will act as a sort of failure prediction system, based on the diagnostic and error messages that have been recently generated by the server

# AI-Based System Monitoring: Intrusion Detection System

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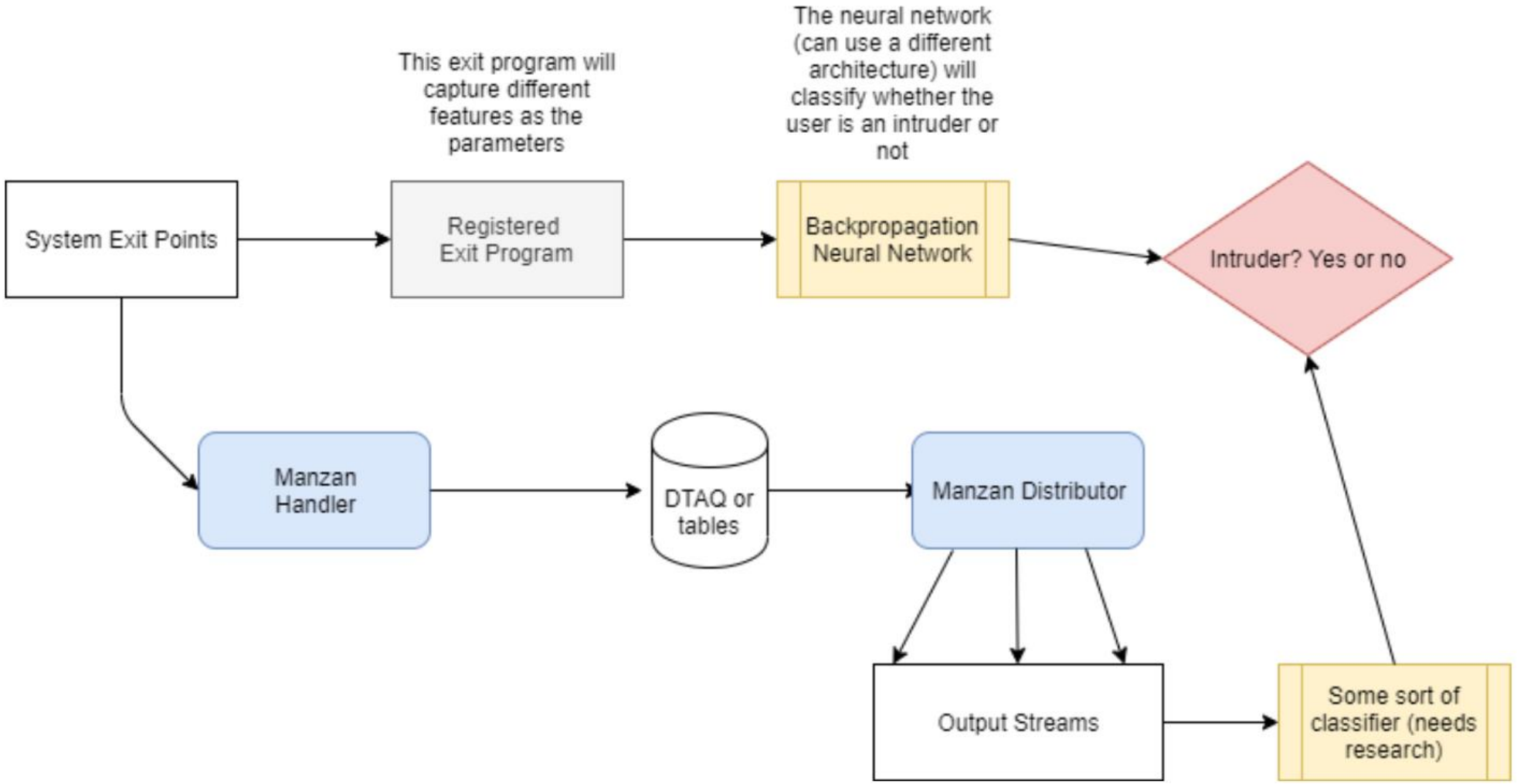

# AI-Based System Monitoring: Health and Performance Assistant

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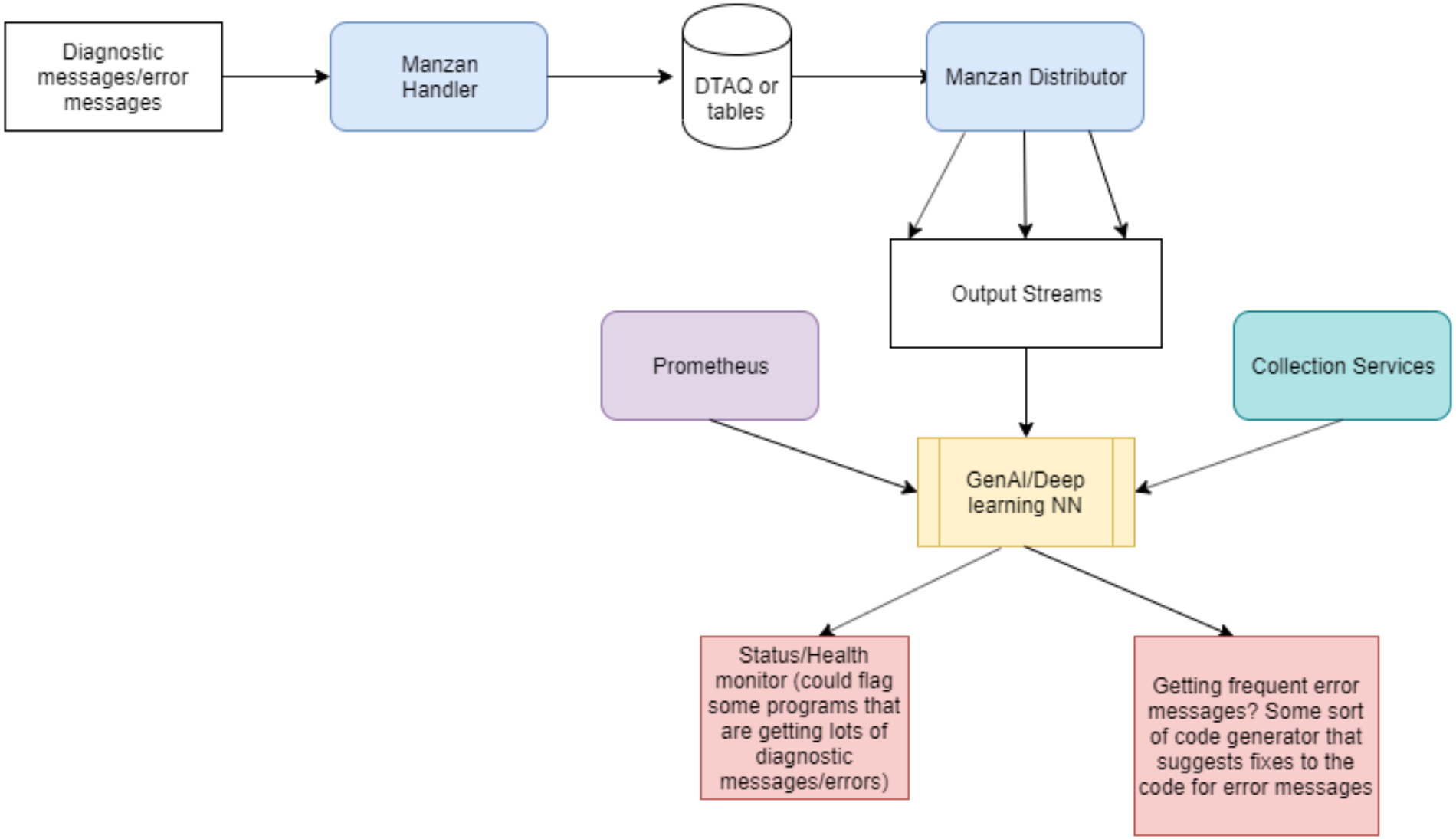

# Takeaways

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# Any Questions?

# Important Links

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## ABC

- WIP WIP

# For More Information

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| Links You Need | Twitter | #Hashtags |
|---|---|---|
| IBM i Home Page: https://www.ibm.com/it-infrastructure/power/os/ibm-i (find link to Forrester Study and updated IBM i Strategy Whitepaper)<br><br>IBM Strategy Whitepaper: https://www.ibm.com/it-infrastructure/us-en/resources/power/i-strategy-roadmap/<br><br>IBM Client Success: https://www.ibm.com/it-infrastructure/us-en/resources/power/ibm-i-customer-stories/<br><br>Support Life Cycle: https://www.ibm.com/support/lifecycle/<br><br>License Topics: https://www-01.ibm.com/support/docview.wss?uid=nas8N1022087<br><br>Fortra IBM i Marketplace Survey https://www.fortra.com/resources/guides/ibm-i-marketplace-survey-results |  <br><br>@IBMSystems<br>@COMMONug<br>@IBMChampions<br>@IBMSystemsISVs<br>@IBMiMag<br>@ITJungleNews<br>@SAPonIBMi<br>@SiDforIBMi | #PowerSystems<br>#IBMi<br>#IBMAIX<br>#POWER9<br>#LinuxonPower<br>#OpenPOWER<br>#HANAonPower<br>#ITinfrastructure<br>#OpenSource<br>#HybridCloud<br>#BigData |