AVEVA PI WORLD

Enterprise Wide PI System

Presented By: Andre Muller, Alister Geary

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Agenda

1. Company Presentation: Andre Muller (3 min)
2. Golden Image: Alister Geary (6 min)
3. Global Architecture: Andre Muller (6 min)
4. Integration workflows with other line of business systems Andre Muller (6 min)
5. Q&A

Company Presentation

We touch the lives of millions of people worldwide

155 countries

where Novartis products are sold

769m patients

reached in total

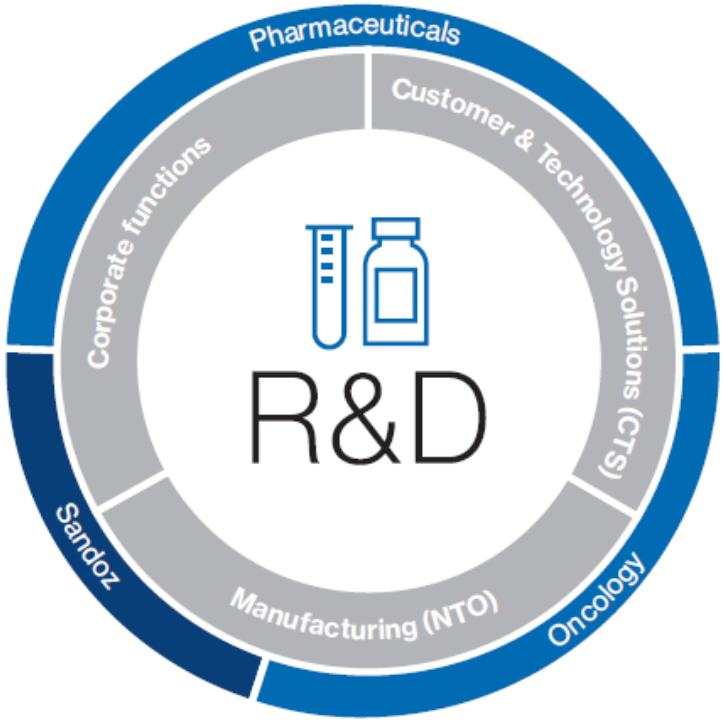
66m patients

reached through access activities

All numbers are for continuing operations

We are a focused medicines company

Our company



USD 48.7bn

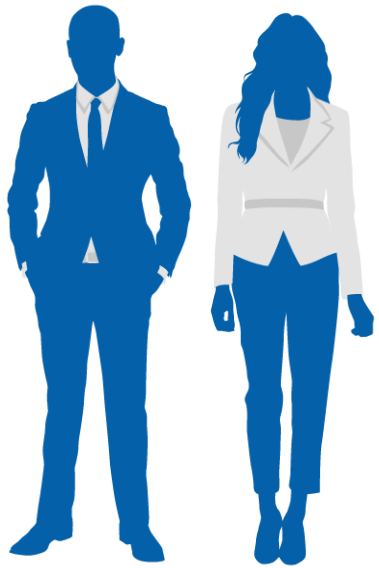
Net sales

USD 8.1bn

Net income

All numbers are for continuing operations

Our strength is the diversity, energy and creativity of our people



110 738

Headcount

142

Nationalities

45.7

Annual training hours per employee

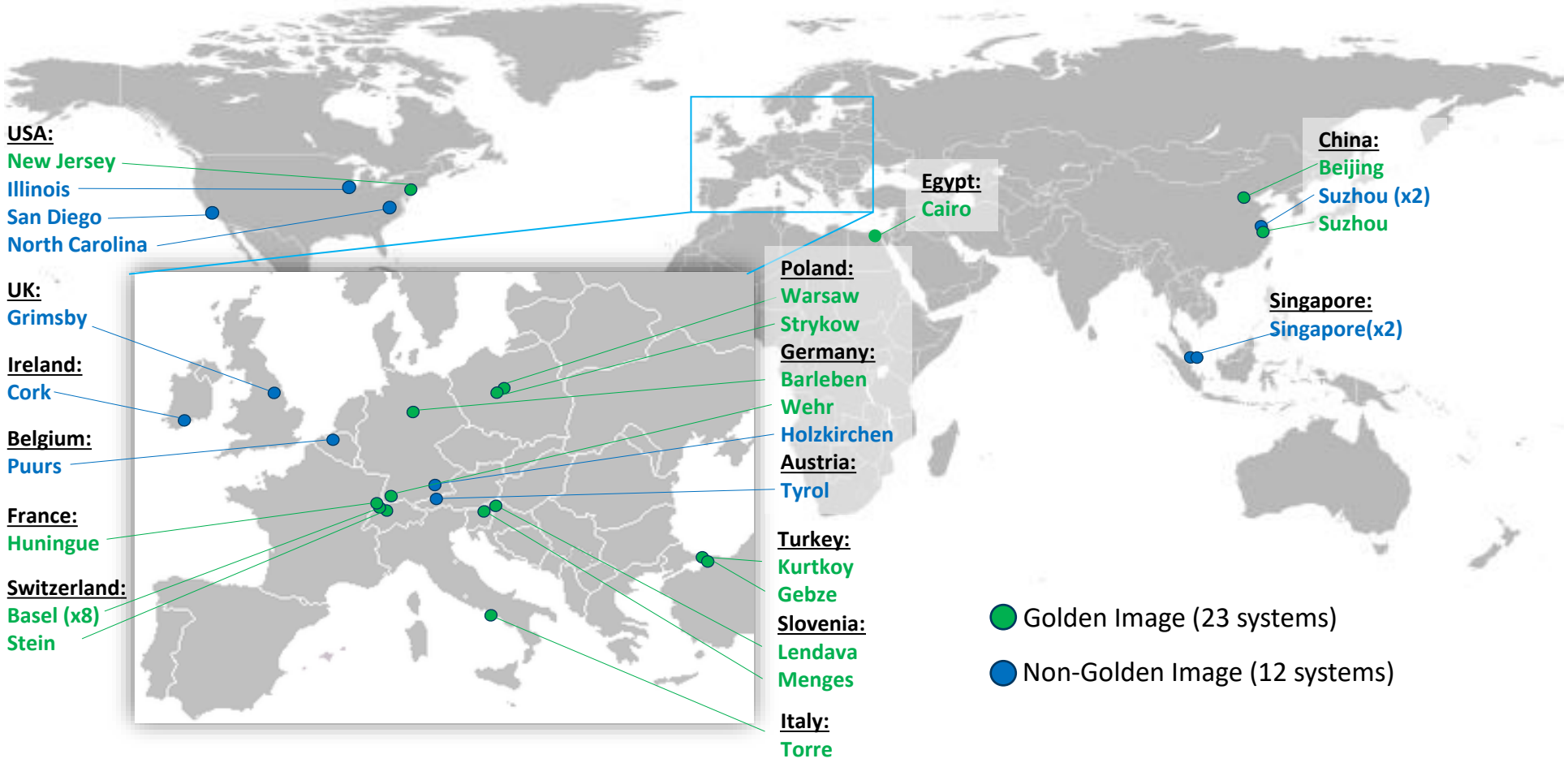
45%

Women in management

All numbers are for continuing operations

Golden Image

PI System current footprint



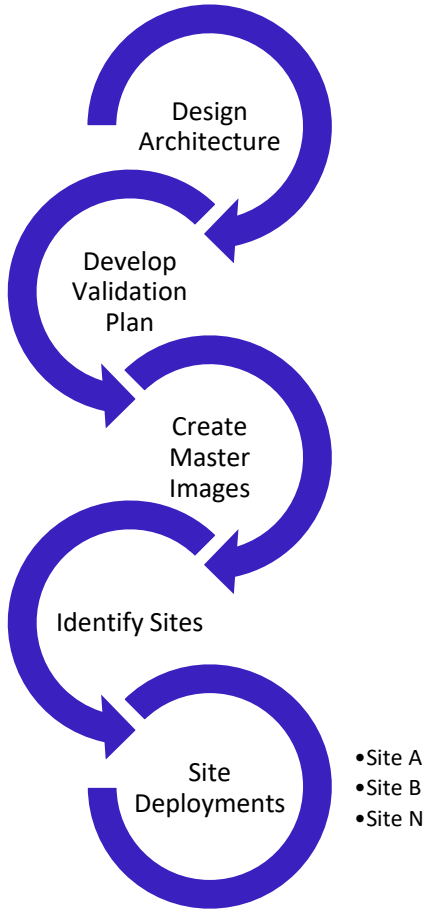
Deployment Challenges

- Novartis has 30+ manufacturing and research sites around the world.
- Deploying PI on a site by site basis raises challenges:
  - Differing PI System Architectures and Windows Versions
  - Different validation approaches for each site
  - Local technical resource availability
  - Missing IT pre-requisites often delayed implementation

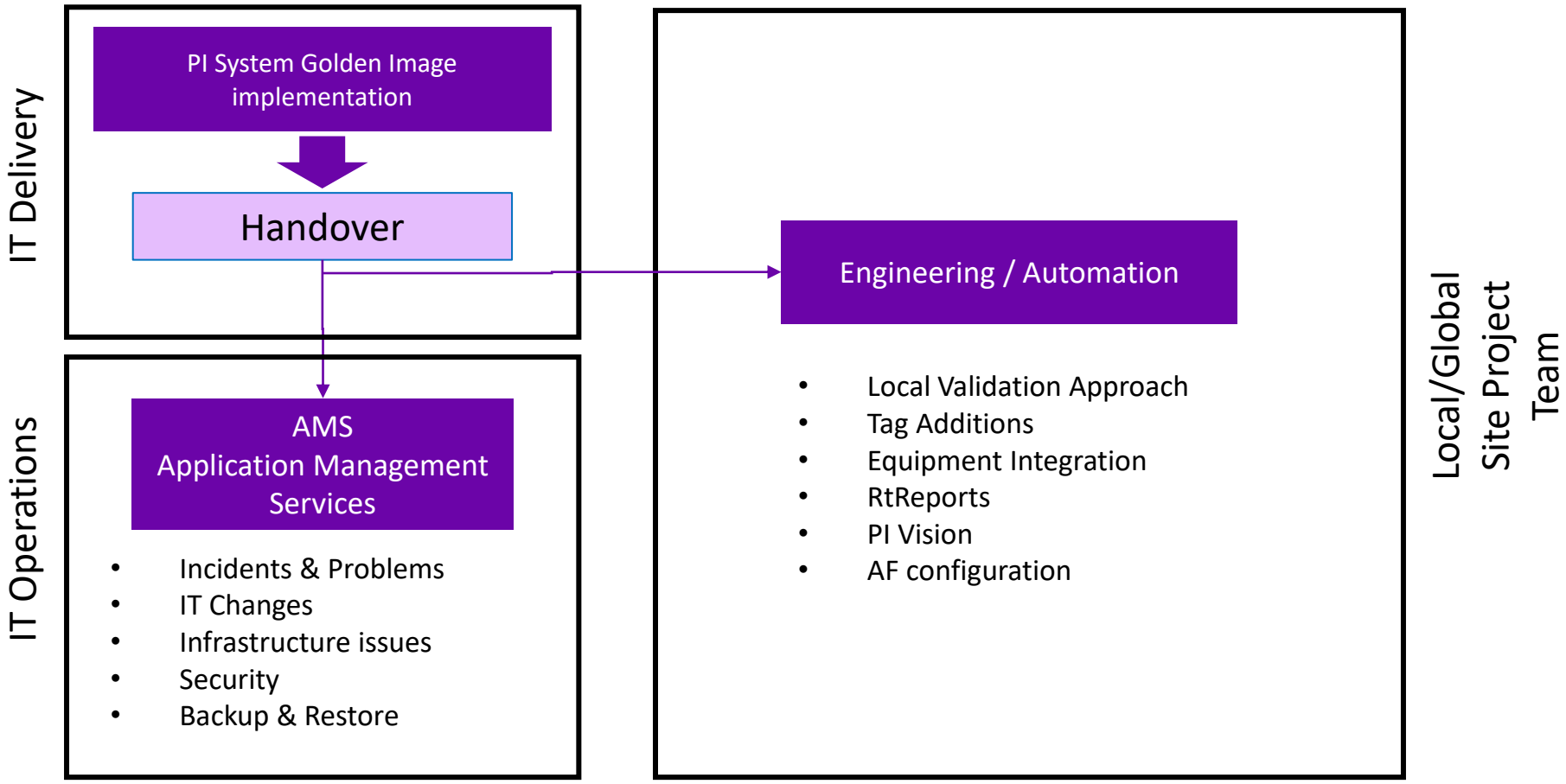
PI System Deployment via Golden Image Process

Objective of Historian Golden image process was to create and qualify global master images that could be deployed to site while inheriting all of the qualified configuration and validated functionality of the master image.

PI System Architecture	• Architecture, Software and OS Version aligned with IT , Automation and OSIsoft as part of Enterprise Agreement Center of Excellence.
Validation	• Create GMP validation plan to cover the Golden Image Process, for both master images and site deployments.
Master Image	• Master images are built and validated against the architecture and validation plan in the global data center.
Demand Planning	•The demand for new PI system deployments and upgrades is constantly reviewed and follows IT Project Management standards.
Deployment and Localization	• A project team with IT and Automation members is formed for each deployment.

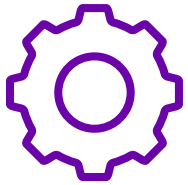


Implementation Process Overview



World-class upstream operations

NOVARTIS | Reimagining Medicine



Challenge

- Manage 30+ PI System deployments on sites located around the world in a consistent and efficient way.

Solution

- Collaborate to create a standardized Golden Image process that can be used for a PI System on any site.

Benefits

- Reduction in PI System deployment cost by 60% and time by over 50%.
- Standardize Architecture, Version and Validation across 30+ Sites.
- Automation Reduces Errors
- Allow for creation of additional Global Services across sites.

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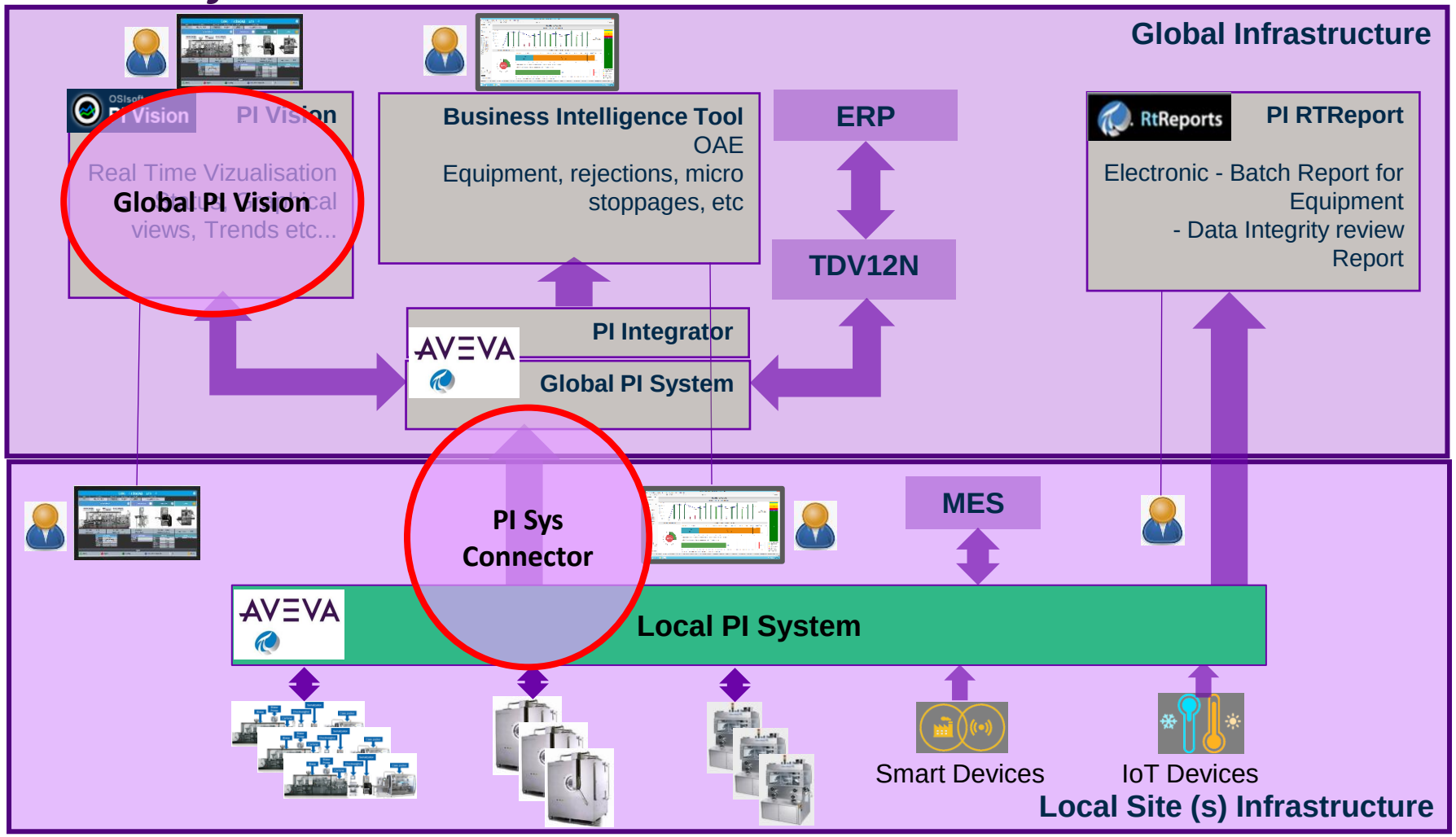
Global PI System infrastructure

Challenges
Local infrastructure

PI Vision:

- Multiple servers requested across 30 + sites
- Site Network segregation according cyber security rules
- Different PI Vision version in the sites
- Standardization
- Developing from the scratch different views for same requirement
- How to bring the data from local to global PI system ?

Business Functional Design
Local and Global infrastructure



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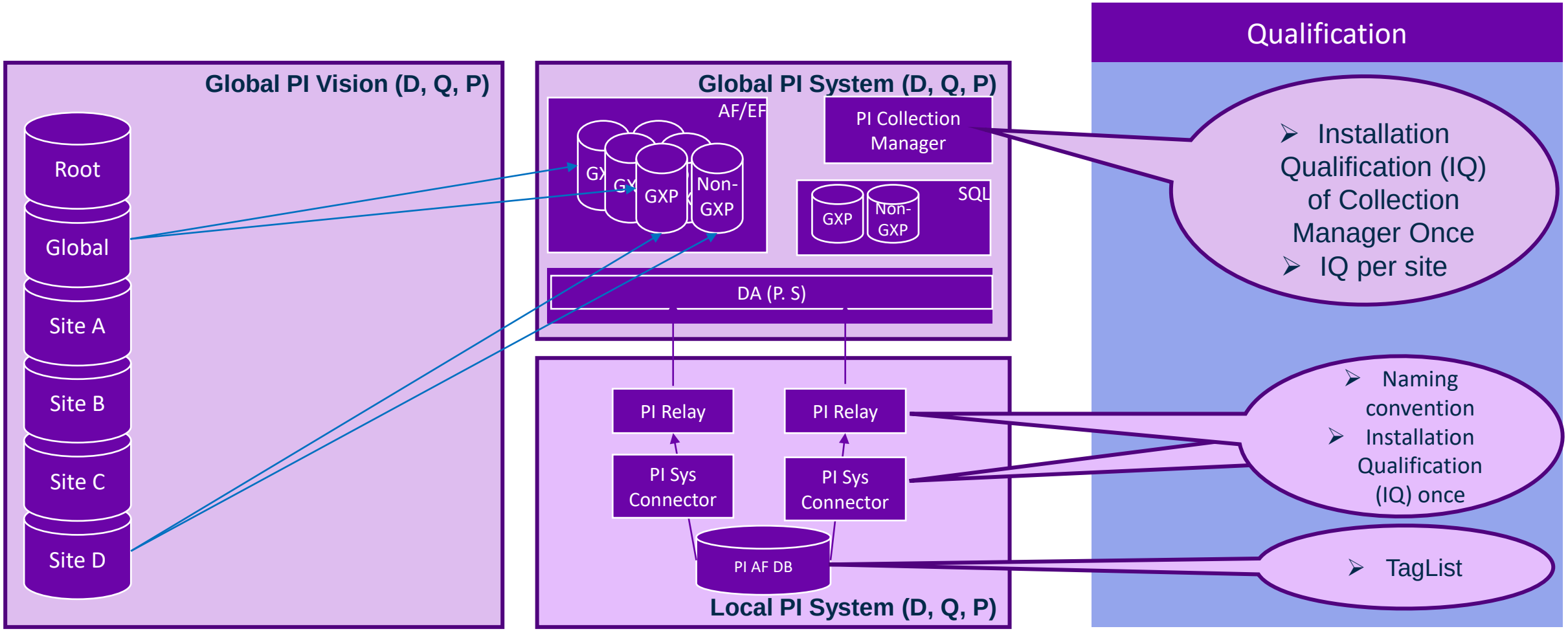
Global PI Vision
Instantiation with PI Sys Connector



Global PI System infrastructure

Challenge

- Multiple servers requested across 30 + sites
- Site Network segregation according cyber security rules
- Different PI Vision version in the sites
- Standardization
- Developing from the scratch different views for same requirement
- How to bring the data from local to global PI system ?

Solution

- Enable a Global PI System architecture for the sites
- Implementation of PI Sys Connector

Benefits

- Reduces the number of local servers
- Efficient replication capability with the global PI Vision
- Increased standardization same views for the same work center across sites
- Apply same qualification strategy
- Reduces the qualification steps (automatic tag update with PI sys connector) No Tag list anymore on global level

Integration workflows with other line of business systems

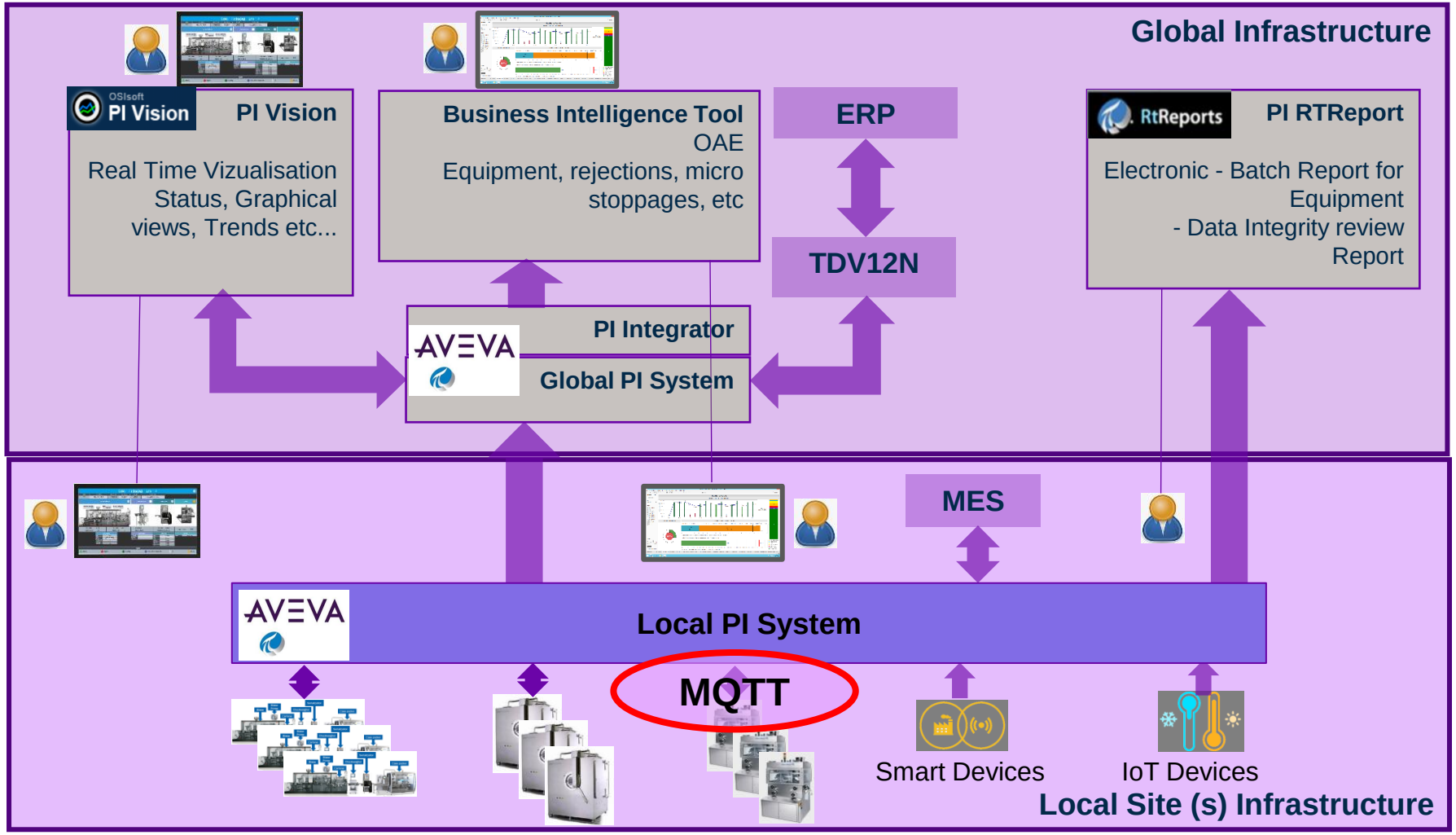
Challenges

Integration workflows with other line of business systems

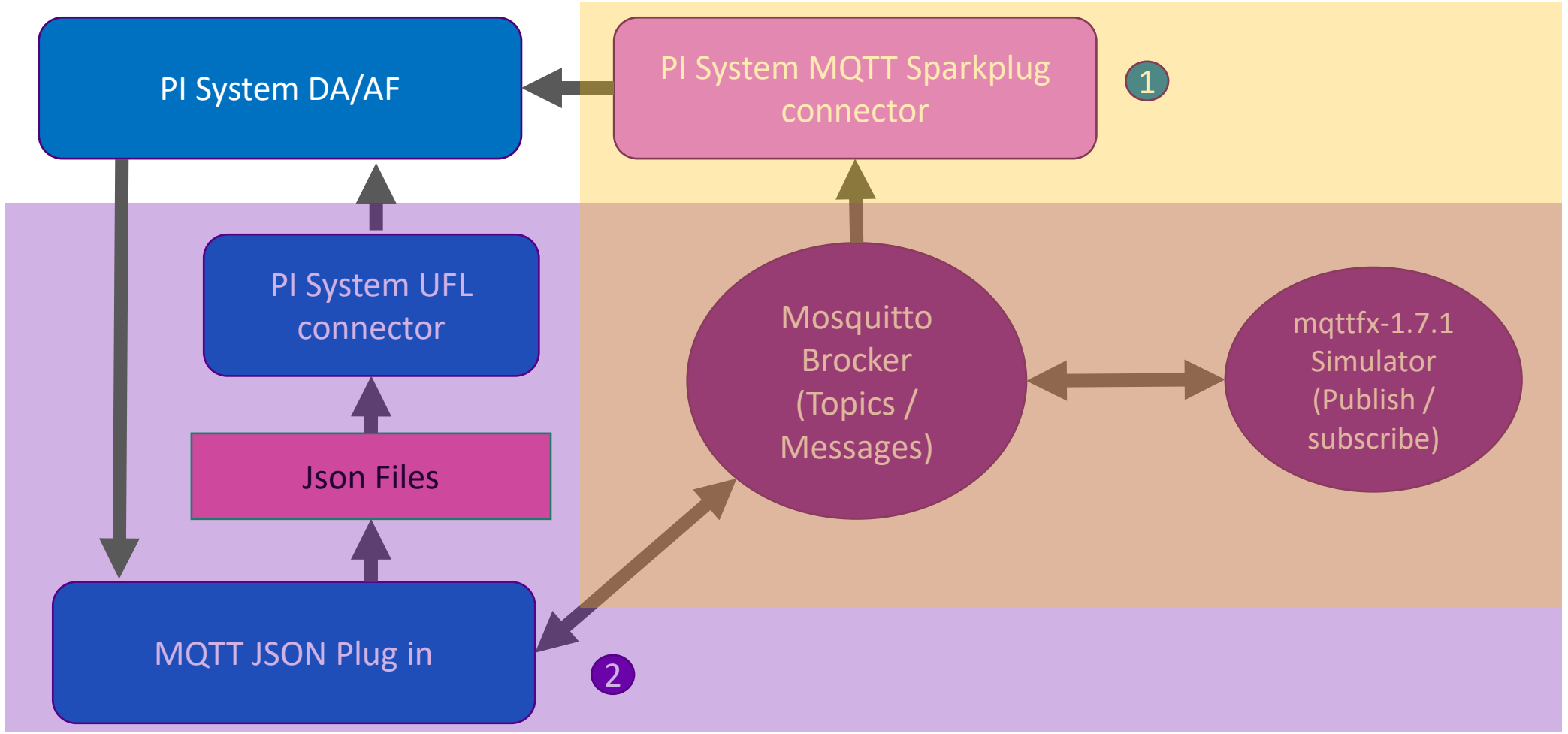
Transfer data from equipment specific for Cell and Gene, to PI historian

- Only MQTT Technology as Interface available from equipment vendor side
- Interface required between an Application on Linux and Aveva PI system on Windows

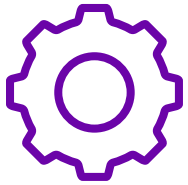
Business Functional Design
Local and Global infrastructure



MQTT Overview
Software design



Integration workflows with other line of business systems



Challenge

- Interface available from equipment vendor side
- Linux and Windows compatible

Solution

- JSON Plugin used till new version of PI MQTT connector released
- PI MQTT connector with read/write capability and Json format as well, not only Sparkplug

Benefits

- Stay with vendor solution no customization required and keep the adaption within Novartis
- Easy to implement JSON, Sparkplug
- Standard messaging protocol
- Enables it on a global level for future use cases

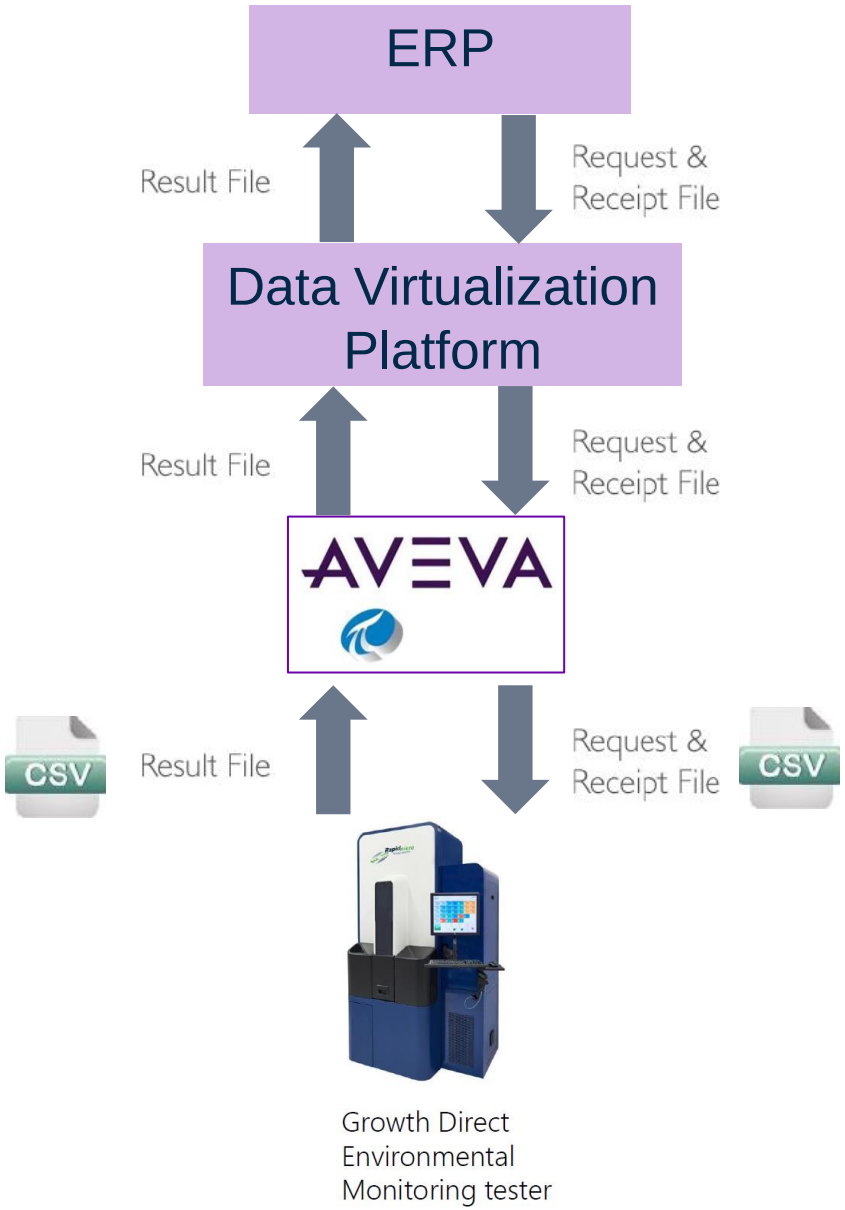
Challenges

Integration workflows with other line of business systems

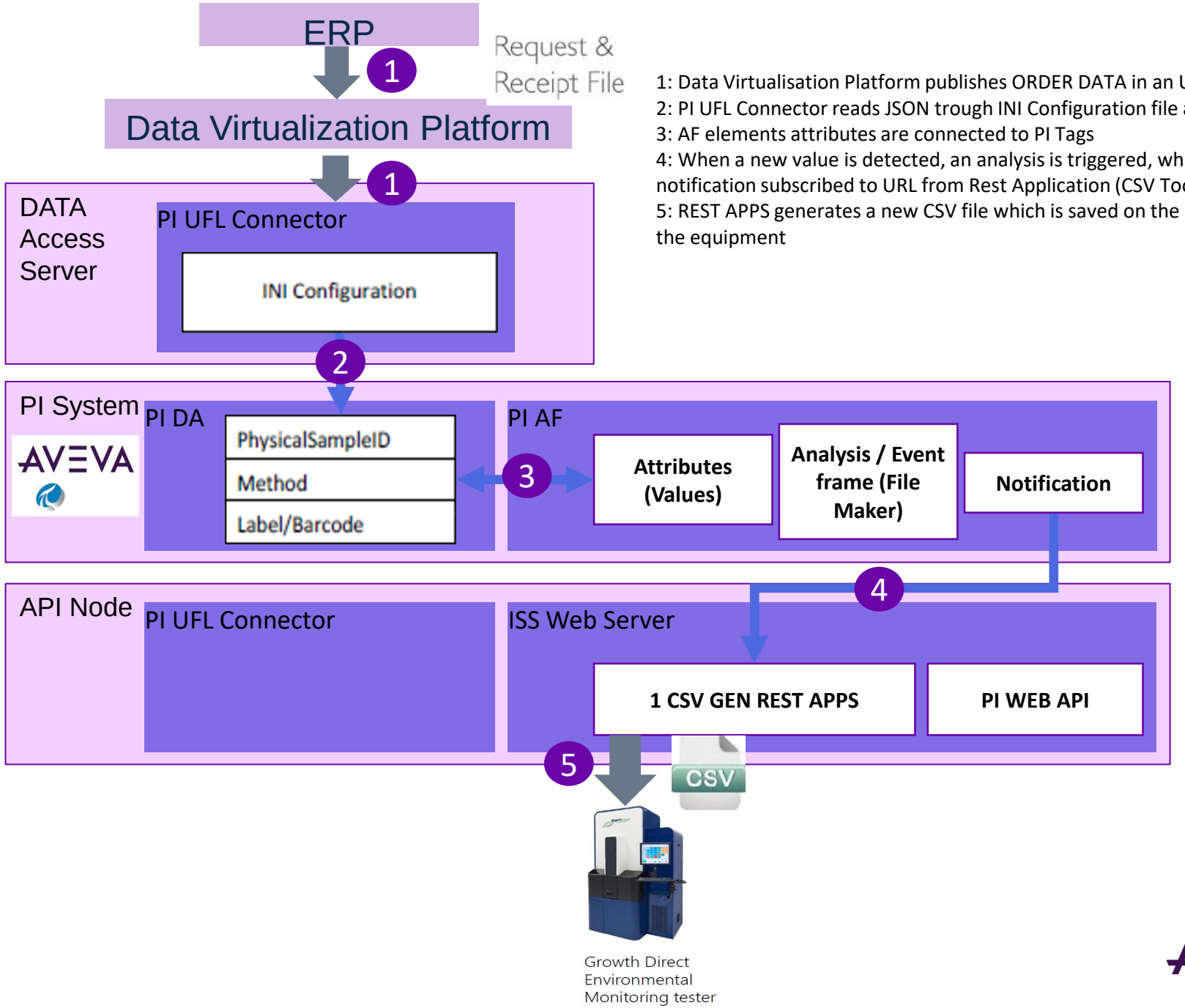
- Replace manual data entries for test results from equipment to ERP system with an automated functionality
- Automated functionality for Cross domain file transfer
- Bi Directional communication

Growth Direct Environmental Monitoring tester

CSV Tool
Systems Overview



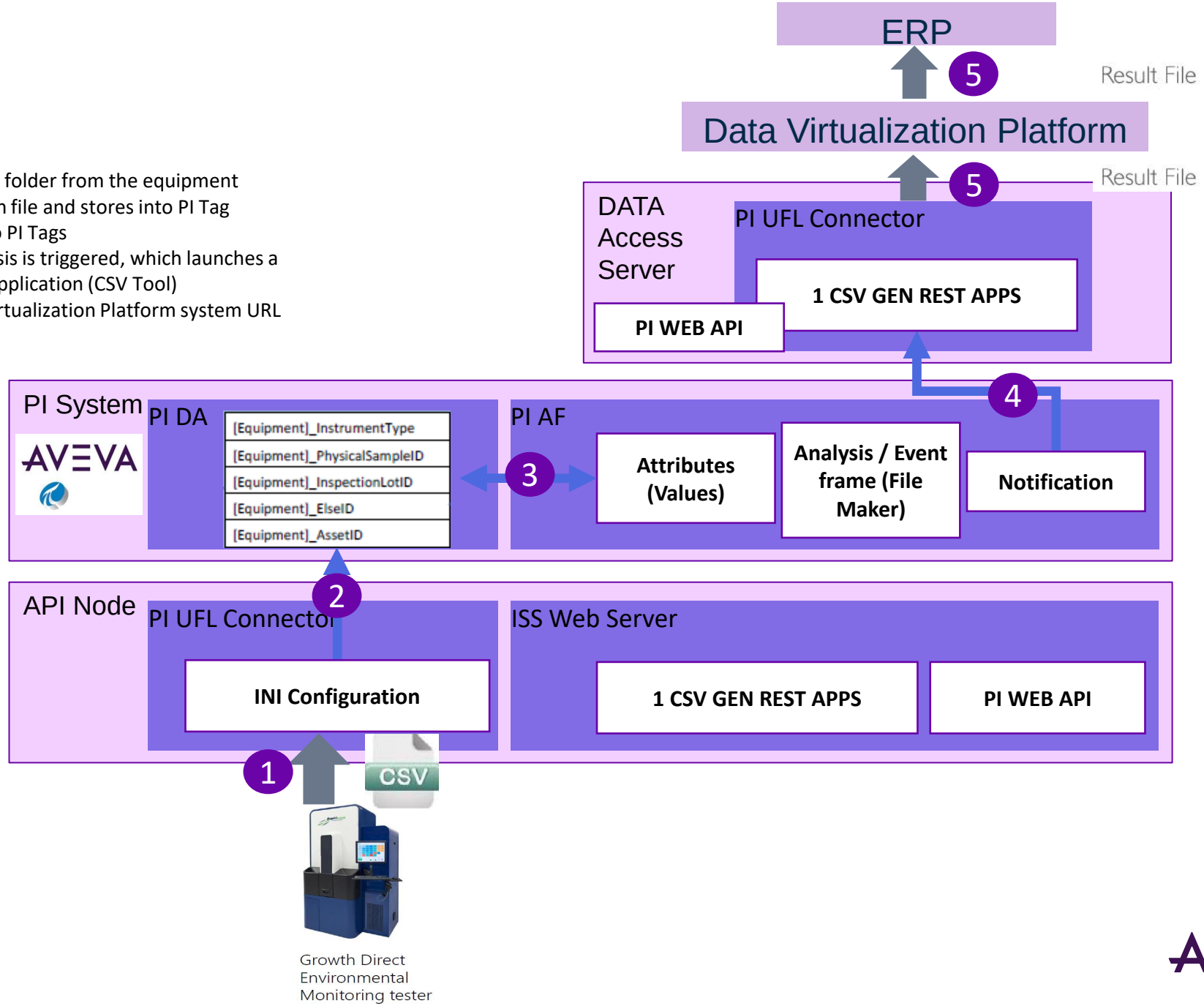
CSV Tool
Data Flow



1: Data Virtualisation Platform publishes ORDER DATA in an URL
2: PI UFL Connector reads JSON trough INI Configuration file and stores into PI Tag
3: AF elements attributes are connected to PI Tags
4: When a new value is detected, an analysis is triggered, which launches a notification subscribed to URL from Rest Application (CSV Tool)
5: REST APPS generates a new CSV file which is saved on the shared folder from the equipment

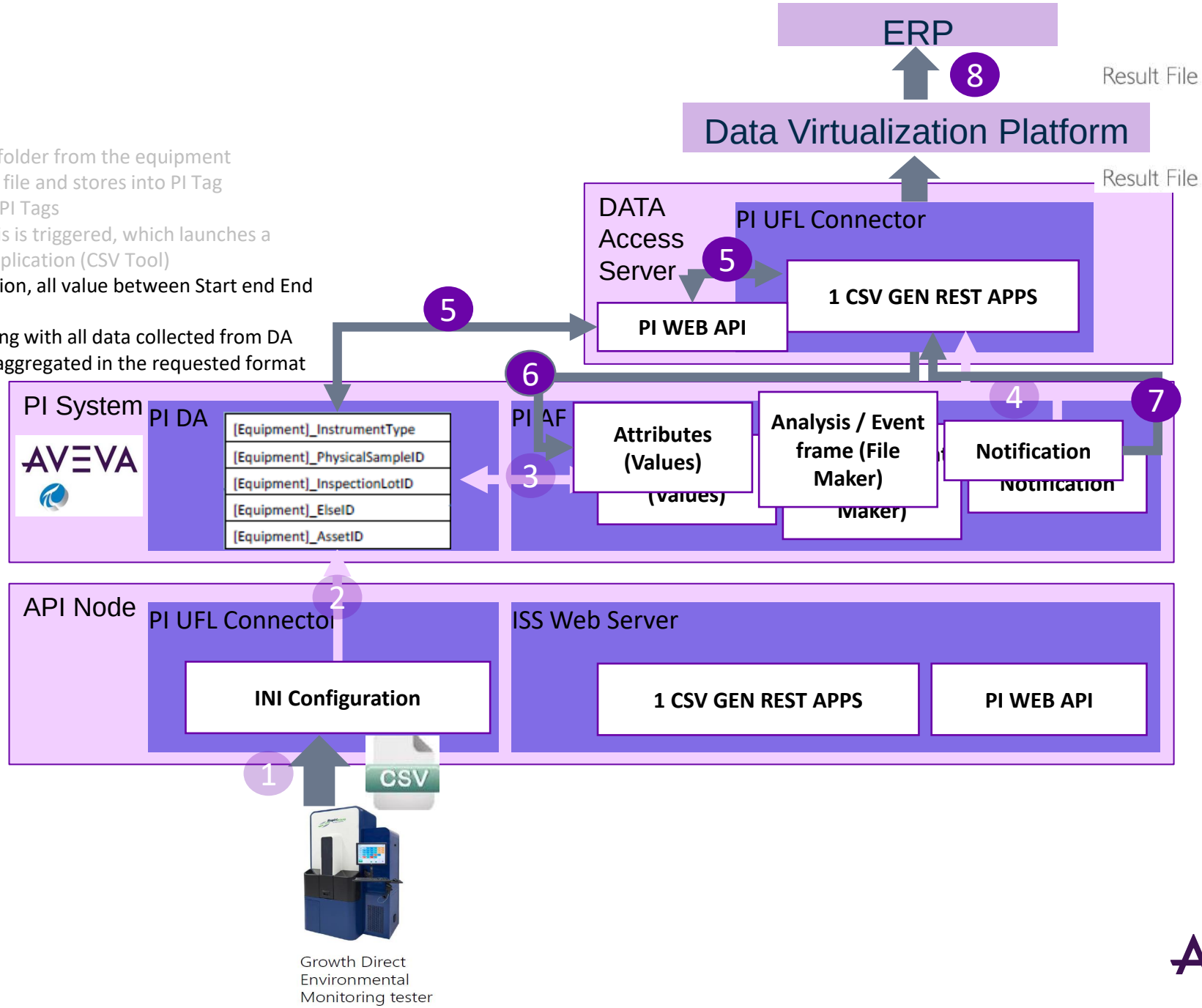
CSV Tool
Data Flow

1: New Result File is created on the shared folder from the equipment
2: PI UFL Connector reads INI Configuration file and stores into PI Tag
3: AF elements attributes are connected to PI Tags
4: When a new value is detected, an analysis is triggered, which launches a notification subscribed to URL from Rest Application (CSV Tool)
5: REST APPS sends string result to Data Virtualization Platform system URL



CSV Tool
Data Flow

1: New Result File is created on the shared folder from the equipment
2: PI UFL Connector reads INI Configuration file and stores into PI Tag
3: AF elements attributes are connected to PI Tags
4: When a new value is detected, an analysis is triggered, which launches a notification subscribed to URL from Rest Application (CSV Tool)
5:REST APPS query trough PI Web API function, all value between Start end End Time, date are send to DA
6: REST APPS writes into AF attributes a string with all data collected from DA associated with Start and End Date a, time aggregated in the requested format
7: Notification is subscribed to the REST APPS URL
8: REST APPS sends string result to Data Virtualization Platform system URL



Integration workflows with other line of business systems

Challenge

- Replace manual data entries for test results from equipment to ERP system with an automated functionality
- Automated Cross domain file transfer
- Bi Directional communication required

Solution

- Notification used
- Web API connector
- CSV GEN REST APPS

Benefits

- Easy replication capability
- Limited qualification effort in case of adding values in the message
- Enabler for future use case e.g. “Counter Based Maintenance”

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