How to build a PI System in 3.14 minutes.

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Satellite PI Systems and PI Collectives
Complexity of big numbers

- Current PI System deployment of around 125 PI systems
- Per PI System 4 – 12 servers are involved
- Additional deployment of >250 PI systems is expected
Case for change

• New PI System deployments will be combined with additional tools for optimization
• Current deployment effort for combined system is ~ 7 days
• Deployment of >250 PI Systems → 1750 days of effort
Satellite PI Systems and PI Collectives

• “Natural satellite, an object naturally occurring in orbit.” – Wikipedia

• “Satellite campus, which is physically detached from the main campus” - Wikipedia

• A satellite PI System is a detached collection of OSIsoft products that perform a specific function and “orbit” a PI Collective sending data to it.
Satellite PI Systems and PI Collectives

- Global PI Collectives collect data from multiple Satellite PI Systems.
- The default is that all Satellite PI Systems send their data to a single global PI Collective, unless there are specific issues such as data export compliance.
- Where required there will be additional PI Collectives for collecting data but the same principle applies.
PI Collective

- 2 members of the PI Collective
- High availability
- 1 place to see all satellite PI System data
Satellite PI System

Treasure Map

X marks the spot
Satellite PI System – Buried Treasure

• At the centre of any good X on a treasure map is the buried treasure.
• At the centre of our X is the PI Server treasure chest.
Satellite PI System – Buried Treasure

• You can’t take a PI Server anywhere these days without his buddy the PI AF Server.
• Turns out his buddy has some skills that we will need later on…
Satellite PI System – Buried Treasure

• You won’t have much fun with the PI Server without feeding it some data.
• We dug up the PI Interfaces for OPC DA to help us out.
Satellite PI System – Buried Treasure

• We continued to dig… needing to perform some calculations on the data at source we decided to use Microsoft StreamInsight, and the PI for StreamInsight Adapters*.

*Redeveloping to use AF SDK + Reactive Extension strategy.
Satellite PI System – Buried Treasure

- Finally, and fatigued from all the digging, we needed a method for replicating the data to the PI Collective.
- The PI to PI TCP/IP Interface was the perfect way to achieve this.
Satellite PI System

- Data replication to PI Collective
- Multiple OPC data sources
- PI to PI data flow
- StreamInsight “event” data flow
- Custom web application
- Custom StreamInsight application
Satellite PI System Complications
Satellite PI System – complications

- Each satellite PI System will use a combination of different OPC data sources.
- Data rates will be either 250ms for approx. 1,000 tags, or 1000ms for approx. 700 tags.
- Need to be able to monitor all Satellite PI Systems.
- How to make sure all PI Systems are created the same when installing 300 times; eliminating the human factor.
- Time required to install each PI System.
Satellite PI System – OPC

• Pre-create all PI Interfaces for OPC DA instances.
• Disable each interface instance.
• Only switch on (enable) each interface instance that is required for a PI System deployment.
Satellite PI System – Data rates

• Only ever replicate minimum 1000ms data events to the PI Collective.
• Controlled from the receiving PI Collective (Exception Minimum).
• 250ms data rate required by Satellite PI System users; PI Collective users only require 1000ms data rate.
Satellite PI System – Monitoring

- PI Performance Monitor interface used on each machine.
- Satellite PI Systems stores all performance data locally, and then the performance data is replicated to the PI Collective.
- A single view on the PI Collective enables each Satellite PI System to be monitored from one place. (Providing it maintains it’s network connection.)
Satellite PI System – Monitoring

• PI Notifications used to alert on specific components of a satellite PI System.
• PI ProcessBook used as primary monitoring tool based on template displays.
• PI CoreSight used as secondary monitoring tool for drill down investigation of Satellite PI System issues.
• Working with OSIsoft to bring these specific monitoring requirements to OSIsoft Managed PI.
Automating builds
Satellite PI System – Automating builds

• Most installs are repetitive on each of the different machines involved in the PI System. For example, PI Prerequisites Kit.
• Most installs would then be repeated across all deployments of the PI System.
• Main differences really came from changes to the environment where the PI System runs, e.g. the server names & IP addresses.
Satellite PI System – Automating builds

- Original starting point (and fall back option) is to have manual installation “cookbooks” that detail each step of a PI System installation.
- Over 200 pages and counting just for PI components, with a few assumptions and references to other “cookbooks” of the overall build.
- Unavoidable that when the same cookbook is given to two different people that two identical base systems are not built given the complexity and extent of each PI System installation.
Satellite PI System – Automating builds

• Current manual build time of between 5 and 8 days, dependent on the experience of the PI System within the build team across the globe.

• Target is to complete the PI System installations in a matter of minutes. 3.14 minutes to be precise.

• How?
Satellite PI System – Automating builds

The how includes some parts that some PI System Administrators may find disturbing!
Satellite PI System – Automating builds

• Use VMware imaging to create base set of images with the PI Components installed.
• Use PowerShell to create scripts to localise the base images when used in a deployment.
• Tinker with some parts of the PI System that are normally hidden from users.
Satellite PI System – Automating builds

- Reconfigure PI Interface for Performance Monitor command file (new PI Server name)
- Reconfigure each PI to PI Interface command file; default PI Collective? (Includes reconfiguring PI Buffer Subsystem.)
- Modify the PI SDK registry
- …

- Reconfigure PI Interface for Performance Monitor command file (new PI Server name)
- Reconfigure each PI Interface for OPC DA command file
- Modify the PI SDK registry
- …

- Generate a new AF Server Id
- Reconfigure PI Interface for Performance Monitor command file (new PI Server name)
- Modify the PI SDK registry
- …

- Reconfigure PI Interface for Performance Monitor command file (new PI Server name)
- Modify the PI Module Database to change interface server names of configured interfaces.
- Modify PI Security
- …

Remote PowerShell sessions

Main PowerShell session

Remote PowerShell sessions

Remote PowerShell sessions
Satellite PI System – Automating builds

- Installations are now consistent.
- Installation time is dramatically reduced, leading to faster deployments of PI Systems.
- Support of deployed PI Systems should be relatively consistent for troubleshooting issues.
- Validation and periodic monitoring scripts can be built to ensure on-going alignment with the installation script; no unauthorised deviations.
Satellite PI System – Automating builds

- PowerShell Tools for the PI System used to test the theory for the automated builds. Currently only a CTP on OSIsoft vCampus, waiting eagerly for its full release.
- Will be put to the test and refined as we approach mass deployments of PI Systems.
- On-going support, patching and management of VM Images is a separate activity from this presentation but an important one to consider for automating builds.
What next?
What next?

- Produce extensive validation scripts with deviations reports in PowerShell, and replicate to the receiving PI Collective via normal data replication (clue: BLOB).
- Develop PowerShell script standards to rapidly deploy private cloud based PI Systems for all of the Shell businesses.
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