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THE POWER OF PI**

**MONTEREY CALIFORNIA**



**OSIsoft™**

# PI System Management

OSIsoft Field Service – Best Practices

# PI on VMS – Cookie of the Day

- Bye's First Law of Model Railroading:

“Anytime you wish to demonstrate something, the number of faults encountered is proportional to the number of viewers.”

source: `pisrc$disk:[chuck]cookies.txt`



# PI System Management Targets

- Actionable Information at all Times
  - 100% Reliability
  - 100% Availability
- Continuous Improvement
  - “Evergreen” Database Content
  - User Support and Skill Development
- Capacity Planning
  - Application and Upgrade Deployment Strategy
  - System Performance and Technology Review

# Reliability & Availability Incident Scope

Level 1 – Single Point or Client

Level 2 – Multiple Points or Clients

Level 3 – Single Server or All Clients

Level 4 – Multiple Servers and Clients

## Incident Tracking Matrix:

- Scope, Severity, Duration, Frequency
  - Importance of specific tags or users is not a constant.
  - Investigate for an assignable root cause.
  - Note: problems can cascade from level to level.

# PI System Fault Detection

## Data Reliability

1. Instrument to Tag
2. Scan Class
3. Interface / Vendor API
4. API/SDK or Platform
5. API Buffer
6. Network
7. PI Real Time Services
8. Server Platform

## Information Availability

1. Tag to User
2. Display/Report/Pager
3. Client Application
4. API/SDK or Platform
5. Network
6. Data Archive
7. PI Real Time Services
8. Server Platform



# System Fault Record – Message Logs

- Log File Messages
  - Interface and/or Client Applications
    - PIPC.LOG (ICU Watchlog – live updates)
  - PI UDS Services
    - PI Healthcheck (Pigetmsg -f )
  - Windows
    - Event Viewer (Eventvwr)
- Code Translation Utilities
  - PIDiag -e “-10401” (No Write Access – Secure Object)
  - APISnap \1 (Shows snapshot by point ID, 1 = “sinusoid”)

# PI System Integrity Instrumentation

- Data Collection
  - UNIINT Monitoring Tags
    - IORates and Scan Performance Points
  - PI Status Interface (Detects “Flatline” Condition)
    - Watchdog Tag
- Network and Platform
  - “Basic” Interfaces
    - PIPerfmon, Ping, SNMP
  - System Utilities (Run in periodic script)
    - Netstat, Plartool, Pllistupd, Pinetmgrstats (PIConfig)

# Best Practices – Hardware Specs

- Processor
  - CPU is bottleneck resource on most PI UDS systems
    - Don't sacrifice clock speed for more than 2 CPUs
- Network Infrastructure
  - Isolated collision domain for PI UDS (Switched)
  - NIC requirement is proportional to number of clients
- Memory
  - PI memory footprint is modest at steady state
- Disk
  - Read Caching Controller(s)
  - Dedicated Partition and Physical Drive(s) for PI UDS



# Reliability – Component Solutions

- Storage Arrays
  - RAID 1, RAID5 or combination.
  - Fibre-Channel Based Storage Area Network (SAN)
- Power Supply
  - Dual Supply, Dual Feed, UPS or combinations.
- Multiple NICS
  - Use “Teaming” for fault tolerance and/or load balancing
  - Dedicated NICs for data collection network and client access

# Reliability – Time to Repair Solutions

- Hours (Default Solution)
  - Rebuild then restore system from backup
- Minutes
  - Hot backup with manual intervention to activate
- Seconds
  - Automatic fail over but cache and connection lost
- Zero
  - Cluster technology with bumpless fail over
  - Independent dual systems and/or infrastructure

# Best Practices – System Architecture

- When In Doubt – Distribute
  - Data Collection Nodes (API/SDK)
  - Universal Data Servers (PI-UDS)
- Especially to:
  - Optimize LAN/WAN Efficiency
  - Increase Scalability and Performance
  - Isolate Scan Classes from Upsets
  - Implement Advanced Control Schema
  - Organize Administration and Manage Risk



# Best Practices – Interface Strategy

- Ethernet Connectivity
  - Convert Serial Links to Ethernet (ie. Modbus)
- Standards Based / Multipurpose Interfaces
  - **OPC is Preferred Solution** (avoid DCOM).
  - ODBC Versatile but has performance limitations
  - BATCH FILE All purpose import tool
  - PltoPI across WAN and tiered data collection
- COM Connectors
  - Ideal for high level systems integration

# Best Practices – Database Plan

- Tag Database
  - Naming Convention **optimize for Tag Search**
  - Point Source Codes and Standard Update Rate
  - PI Security Scenarios
  - Calculations and Common Aggregates
- Module Database Design
  - Equipment Hierarchy
  - Application Oriented Aliases and Views
  - Batch Tracking

# Best Practices – PI Deployment Plan

- Network
  - Domain member server or standalone.
  - Assign DNS Alias Name(s) for PI Server
- Time Synchronization
  - Verify the master time keeper
- Client Administration
  - Control of PI registry settings and “.INI” files
  - Group policy settings, publish client applications.
- Remote Access
  - GUI Control of data collectors and servers
  - Access to client, server and data collector log files



# Best Practices – Platform Readiness

- Windows System Setup
  - W2K or better, dedicate a partition for Windows
  - Current drivers and service release
    - Access to Internet & OSISOFT is a plus
- Common Extras
  - IE, IIS (FTP), SNMP, Terminal Server, Tools
  - Office, Resource Kit, SQL Server, Visual Basic
  - 3<sup>rd</sup> Party Anti-Virus and Backup Clients
- Reboot Test

# Best Practices – Home Node PI Setup

- Dedicated Partition for PI (NTFS)
  - Archive Path and Size
    - Change default from DAT to ARC
    - 10 to 20 MB per 1000 Points
  - SDK and PI Client Path...set by first PI client
    - Change default from Program Files to \PIPC
    - Do NOT install client to server root \PI
    - Do NOT install buffering (interface node only)
- Edit “PIBASE.DIF” (optional)
  - SHUTDOWN=0
  - EXCDEV=0, COMPDEV=0.1, COMPMAX=900000

# Best Practices – Post Installation

- System Management Tools
  - SMT (V2.0 just released)
  - ICU (Interface Configuration Utility)
    - Saves startup settings in PI Module Database
    - Add “Basic” Interfaces and Performance Equations
- Configuration Settings and Site Specific Files
  - PICONFIG Scripts (Security Plan, Timeouts)
  - SITE and INI files (\PI\ADM , \PI\DAT)
- Windows Changes
  - Enable PI Shutdown Script (GPEDIT.MSC)
  - PATH environment variable (Append \PI\ADM)
  - Hardware Profile “PI Disabled”
  - Repair Disk



# Best Practices – Data Collector Node

- Install 3<sup>rd</sup> Party Driver
  - Verify connectivity to Data Source and PI Server
    - Use static IP and host table aliases to bypass DNS
- PI Interface Configuration Utility (ICU)
  - SDK/API Installation
    - API Buffer (Install but disable until interface is working)
- Verify PINET Protocol Layer to Server:
  - APISNAP and ABOUTPISDK Utilities
  - Check the time settings (PIDIAG –TZ)
  - Add PITRUST and/or HOST records on PI-UDS
- Install PI Interface Software
  - Check for version updates and ICU add-ins

# Best Practices – Interface Startup

- Interface Basic Commissioning

- DO

- Read the interface manual and release notes
    - Select a few “known good” instrument tags for polling
    - Use “WatchLog” to monitor PIPC.LOG
    - Shakedown BAT file from a DOS console window
    - Implement UNIINT scan performance points if supported

- DON'T

- Don't ignore error messages, address all reported errors
    - Don't overload the scan schedule, use second instance

# Data Collector – Acceptance Test

- Reboot Test
  - Verify Shutdown Script Runs and all PI Services Stopped
  - Automatic Restart
    - Log File has no unexplained errors, save “golden” startup log.
- Buffer Test
  - Verify Buffer setup with ICU “BUFUTIL”
  - Short Buffer Test (Minutes)
    - Automatic Reconnect – No out of order events
  - Long Buffer Test (Hours)
    - Recovery time is 10 times faster than test period
- Record Performance Metrics
  - Resource consumption, Scan Time, IO Rate



# Home Node – Acceptance Test

- Reboot Test
  - Verify Shutdown Script Runs (all PI programs stopped)
  - Unattended Startup, no unexplained errors
    - NT Event Viewer
    - PIPC.LOG and PI Healthcheck – save “golden” startup logs.
  - Out of Order Event Count (SHUTDOWN.DAT file)
- PI Backup
  - Review Log File(s) for unexpected messages
    - Backup Log, PIPC.Log, Server Log, Data Collector Log
- Benchmark Performance
  - Typical baseline resource <10% utilization – no clients.

# Best Practices – PI Backup

- Scheduled Backup Configuration
  - Add PIBackupAT.BAT to Scheduled Tasks
    - Parameters for Source, Destination, and Archive Count
  - Appropriate scheduling is essential
    - Real time services are not interrupted
    - Archive, PointDB, & Batch are flushed, locked out during copy
- Full DAT Backups (including snapshot)
  - Manually execute after stopping PI or reboot
- Auxiliary Backups
  - SMT worksheets / Site configuration scripts (ModuleDB)
  - PICONFIG backup of snapshot in PISITEBACKUP script

# Best Practices – Archive Shift Strategy

- New and Current Archives (Shift Enabled)
  - Create about 10-20 Fixed Archives
    - High Performance Redundant Disk
- Permanent Archives (Shift Disabled)
  - Periodically back the oldest shift archives
    - Plartool –bs # , Copy to permanent disk, Plartool –be
    - Assign new name (ie. YYYYMMDD.PI3 )
    - Set read only attribute, Copy/Burn to second media
    - Unregister original, Register Permanent
    - Delete original, Create and register new shift archive



# Best Practices – Documentation

- System Topology
  - Data Flow Diagram (Start from Network Diagram)
- Software Inventory
  - Licenses and Versions
  - User Information
  - Custom Applications
- Data Integrity Checks
  - “CurVal” Report (Sort on snapshot timestamp)
  - “Hog” Report (Sort on archive event count)

# Best Management Practices Summary

- Data Reliability is the Priority
  - Incidents may affect all downstream services and users
  - If data is 100%, usually application or user issue
  - Key element: “Administrative Procedures”
- Planning is Integral to Continuous Improvement
  - System architecture and technology review
  - Acceptance testing after improvement projects
  - Key element: “Performance Monitoring”
- Please visit
  - <ftp://ftp.osisoft.com/pub/service/install-standards>