Writing High Performance Applications with the PI AF SDK

Presented by: Shrey Satpathy and Jason King

A little bit about us...

- Shrey Satpathy
  - Product Support Engineer, Developer Technologies
- Jason King
  - Sr. Software Developer, AF/ AF SDK

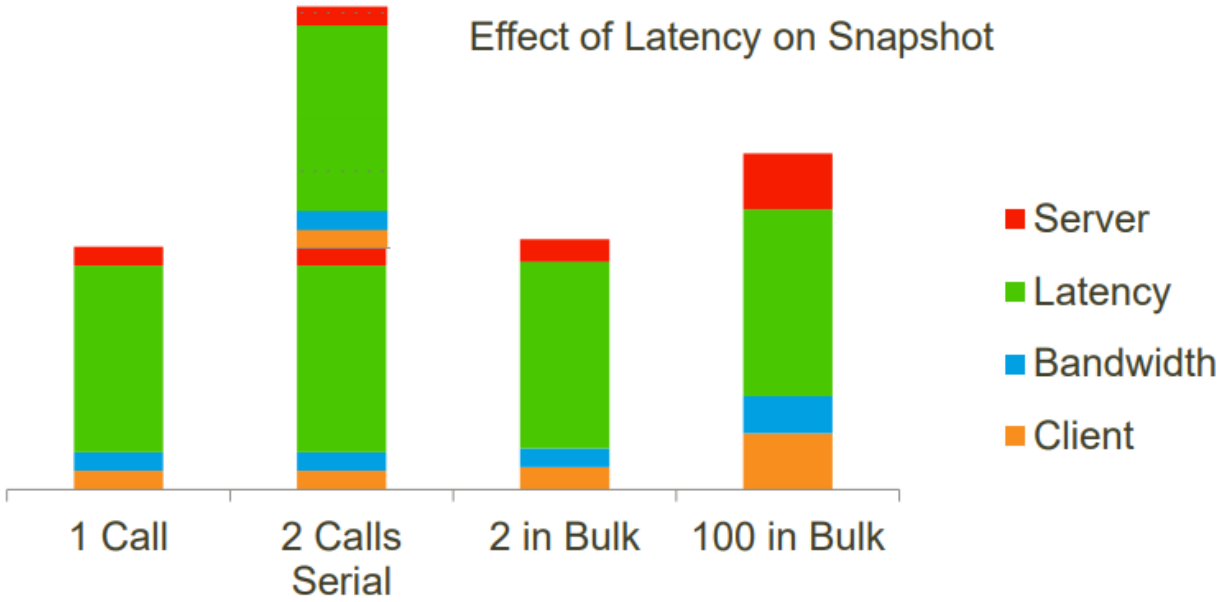
A little bit about you...

- Familiar with .NET development
- Familiar with the AF SDK
- Wish to learn best practices when developing against the AF SDK
- Desire to build scalable, highly performant applications against the PI System.

Topics We Will Cover

- Data Retrieval (Serial/Parallel/Bulk/Async)
- Search (FindElement/AFElementSearch)
- Event Frame (CaptureValues)
- DataPipe(IObserver Pattern)
- AFDataCache

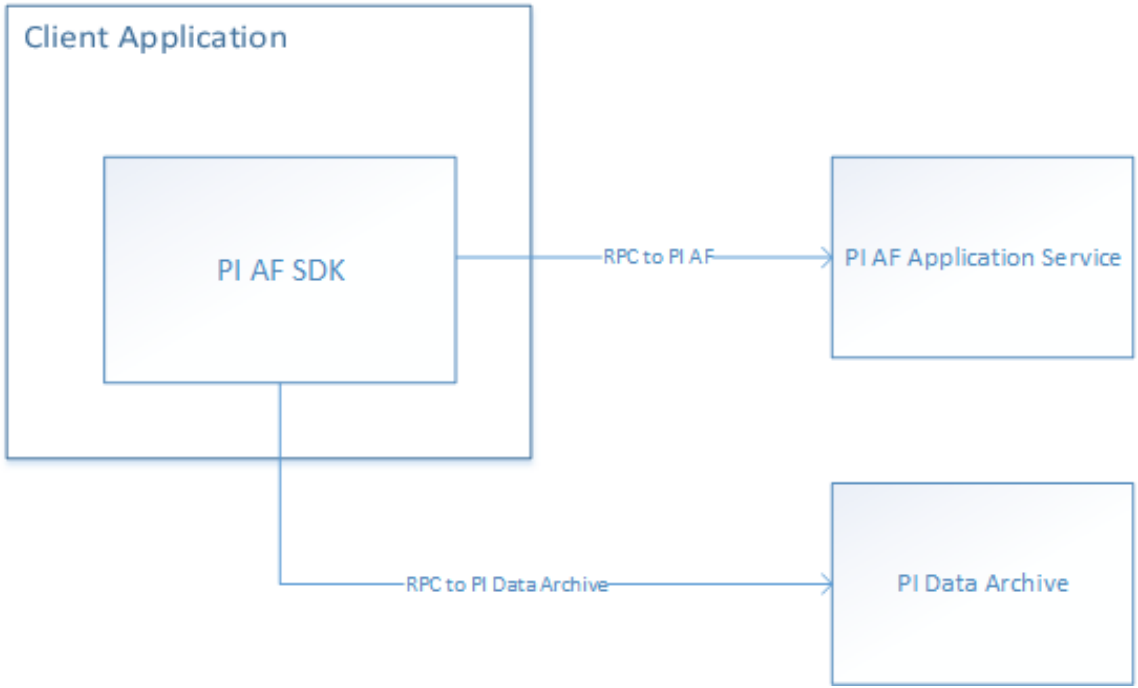
Performance 101



Performance 101

- Minimize calls and bytes to/from server
- Make calls in parallel to utilize idle client cores
- Utilize paging of results
- Minimize memory footprint

Data Retrieval Basics



Reading Data From the PI Data Archive

- Serial
- Parallel
- Bulk
- Bulk + Parallel
- Asynchronous

What is performance without metrics

- OSIsoft.AF.Diagnostics
- PIServer.GetClientRpcMetrics, introduced in PI AF SDK 2.9
- Easy to implement

Serial Query

- Easy to implement
- Also the slowest for large queries

Parallel Query

- using System.Threading.Tasks
- Utilize idle client cores
- Faster than Serial Query
- Still make several calls to the server

Bulk Query

- Introduced in PI AF SDK 2.6 (2014)
- RPC on PI Server introduced in 2012
- Allows queries for multiple PI Points to be batched into 1 query
- Client has some control on how results are paged back to the client.
- Uses dedicated threadpool on PI Data Archive

Bulk Query in Parallel

- Use those idle client cores
- Use thread-safe collections
- Caution: maximum concurrent bulk queries limit on PI Data Archive

Asynchronous Query

- Introduced in PI AF SDK 2.8
- Based on .NET Task-based Async pattern
- Effect of latency is mitigated by executing concurrently
- Reduce number of threads used to service a call by returning waiting threads to thread-pool
- Provide the illusion of performance for responsive UI

Summary for Data Retrieval

Query Type	Server RPC Used (RecordedValues)	Dev effort	Pros	Cons
Serial	Getarcevents	low	Easy to implement	Slowest for large queries
Parallel	Getarcevents	med	Utilize client resources	Several calls to the server
Bulk	Arcbulkquery + Arcbulkquerychunkfetch	low	Minimize calls to server while using a dedicated thread pool	Need the same request for all points
Bulk + Parallel	Arcbulkquery + Arcbulkquerychunkfetch	med	Get the best of bulk queries while utilizing client resources	Need the same request for all points
Asynchronous	Getarcevents	high	Effect of latency is mitigated because remote calls can be executed concurrently while maximizing client resources	Still making several requests to the server which can cause a performance hit

Search (FindElements/AFElementSearch)

- FindElements has been obsoleted
- Use fullLoad set to true unless you just need names or count of elements
- Allows for paging of results
- Demo

Event Frame (CaptureValues)

- CaptureValues
  - Stores values on the AF server
  - Can only be called on a closed event frame
  - Expensive calls made at time of capture and not at search
  - Makes server-side filtering possible on non-static attributes
  - Demo

DataPipe(IObserver Pattern)

- 100k attributes and 50k event/s per pipe
- Use IObserver pattern
  - GetUpdateEvents is a wrapper around an observer
  - Smaller memory footprint to minimize .NET garbage collections
  - Make sure to keep OnNext as lean as possible
- Use Async polling for even faster results
- Demo

AFDataCache

- No automatic data cache with data retrieval
- Only enabled on AFData object returned by AFDataCache.Add
- Makes fewer calls to source server
- Returns more up-to-date data in case of I/O attributes
- Demo

Speakers

- Jason King
- Sr. Software Developer
- OSIsoft
- Jking@osisoft.com

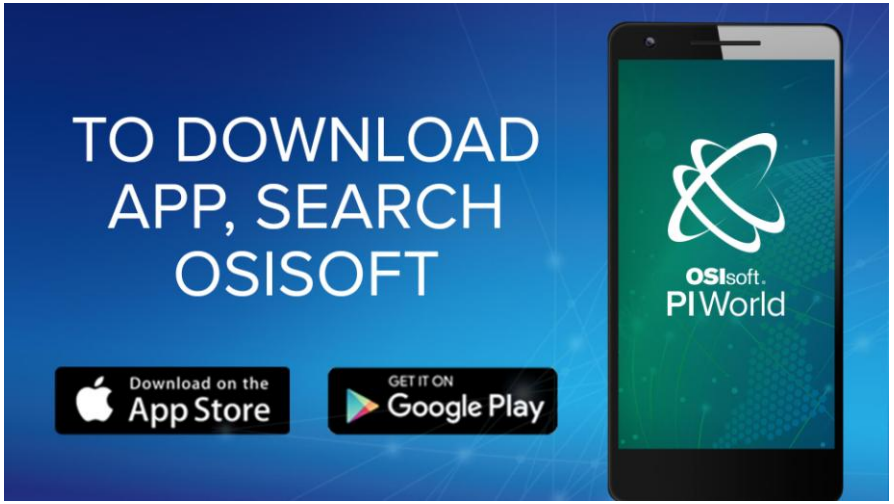
- Shrey Satpathy
- Product Support Engineer
- OSIsoft
- Ssatpathy@osisoft.com

Questions?

Please wait for the **microphone**

State your **name & company**

Please remember



ARE YOU READY FOR DAY 3 !

HILTON

- Opening Session & Product Track
- Best Practices Track
- Partner Marketplace Showcase

PARC 55

- Developer Track & Tech Talks
- PI Security Workshop – Not just for Security Gurus!

IT'S THROWBACK THURSDAY AT GEEK NIGHT TONIGHT!

Hilton – Grand Ballroom 7:00 – 10:00 PM

Power Generation User Group Meeting

Parc 55 – Cyril Magnin III
10:30 am – 12:30 pm

Refer to mobile app for exact location and timing

PARTNER & PRODUCT EXPO

Today’s Expo Hours

10:00 am – 3:00 pm

Golden Gate and Yosemite

LUNCH IN TWO LOCATIONS TODAY

General Attendee Lunch – Hilton

Developer Lunch – Parc 55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PI World
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FINAL TRAINING LABS START TOMORROW AT 9:00 AM

All labs require pre-registration

Check the back of your badge for room locations and visit the registration desk with any questions!