UC2006 **OSISOFT USER CONFERENCE**

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Putting OPC to Work: OSIsoft's OPC Architecture

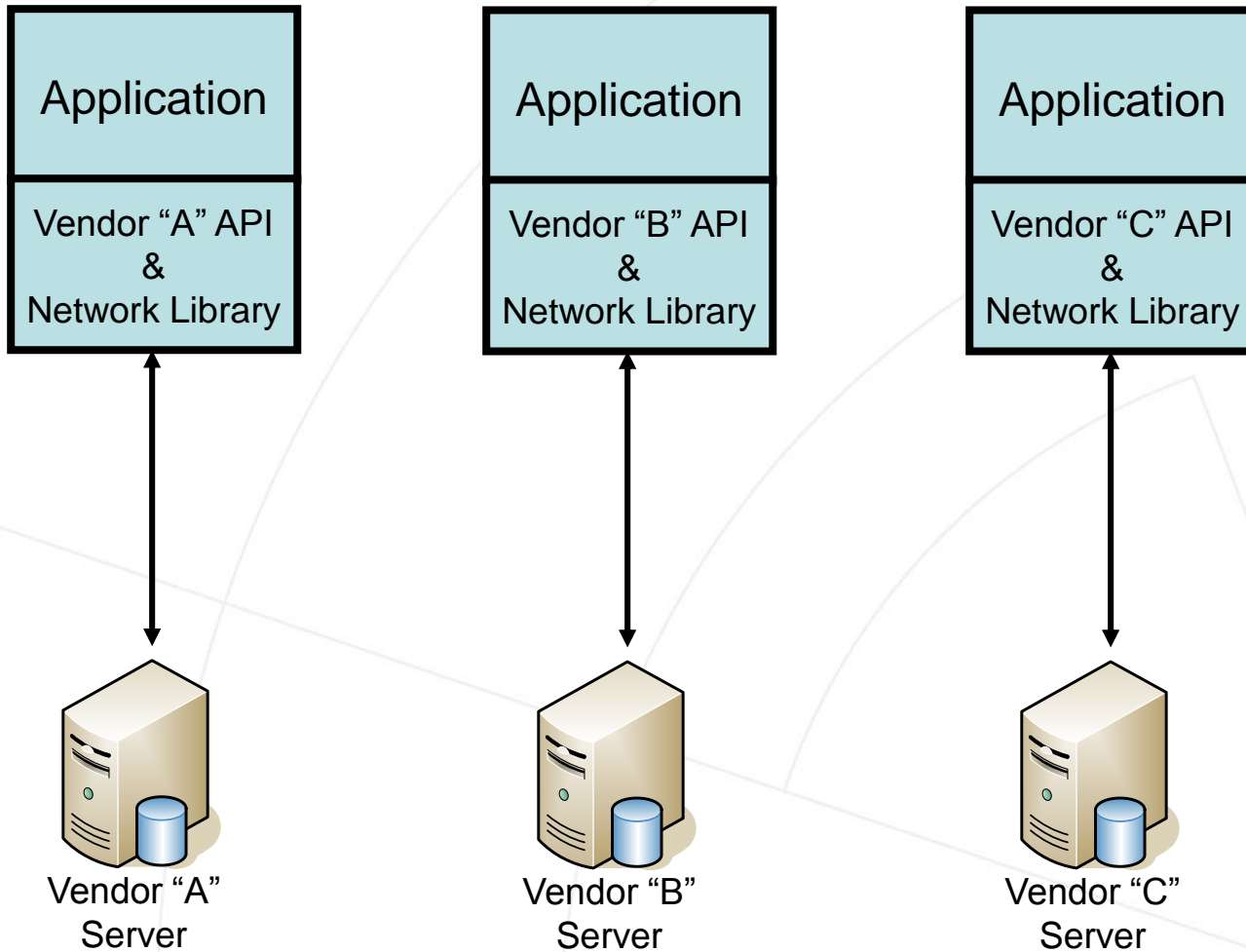## Ray Verhoeff
VP Research

Agenda

- The Interfacing Problem

- What is OPC?

- OSIsoft's OPC architecture

- Current products

- What will OPC do next?

- How will OSIsoft respond?

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The Interfacing Problem

Application

Vendor "A" API
&
Network Library

Application

Vendor "B" API
&
Network Library

Application

Vendor "C" API
&
Network Library

Vendor "A"
Server

Vendor "B"
Server

Vendor "C"
Server

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Windows DLLs

- Simple: code library with named subroutines

- Vendors shipped their Windows libraries as DLLs

  - version independence
  - Allowed update of application without relinking
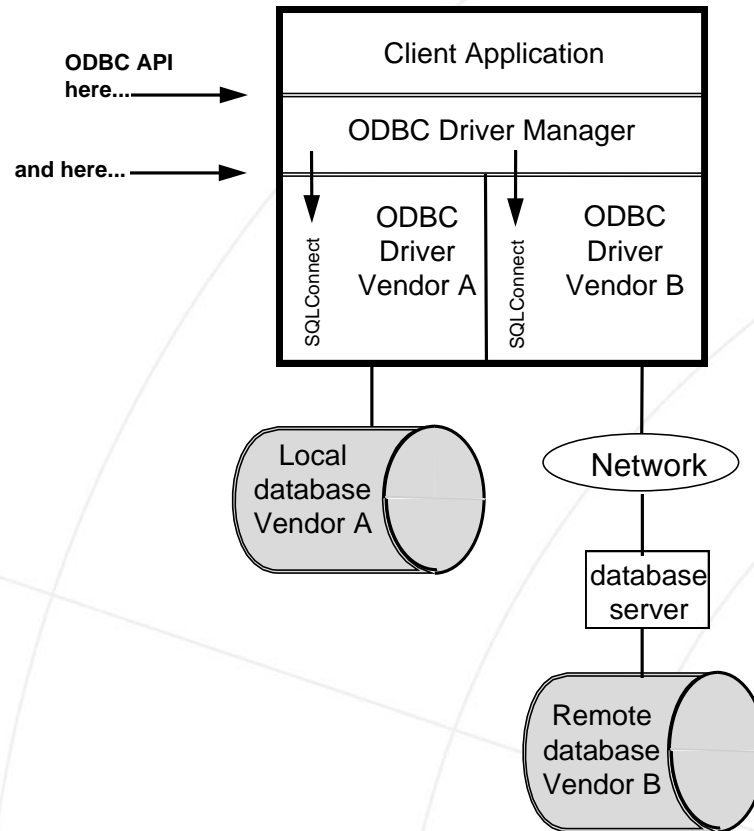
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Windows DLLs

- DLL subroutine names and semantics remained proprietary

- No one suggested developing an industry-standard set of subroutines for accessing industrial data
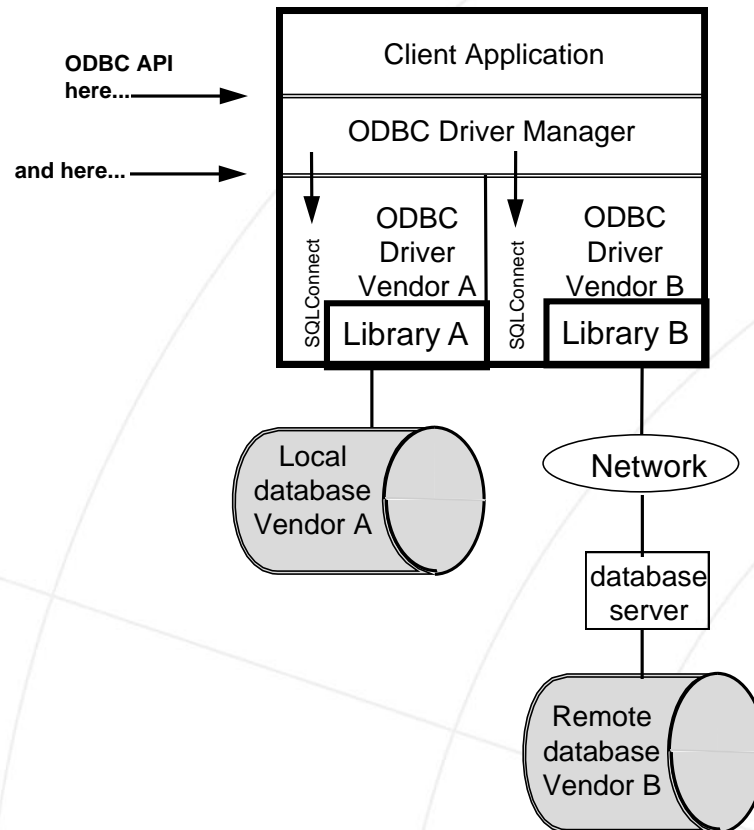
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Open Database Connectivity (ODBC)

ODBC API here... →

Client Application

ODBC Driver Manager

and here... →

SQLConnect | ODBC Driver Vendor A | SQLConnect | ODBC Driver Vendor B

Local database Vendor A

Network

database server

Remote database Vendor B

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Open Database Connectivity (ODBC)

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Open Database Connectivity (ODBC)

"ODBC == Ray Verhoeff"

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ODBC Successes

- Abstracted access to relational databases

- Allowed database vendors to leverage their existing programming & network APIs

- Enable client application vendors to broaden the databases they support

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ODBC Failures

- Subtle differences in SQL implementations
- "Spaghetti" connections
  - All clients connect directly to all servers
- Vendor's API libraries still need to be deployed on all workstations
  - Difficult upgrades
  - Troubleshooting often means visiting the workstation

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History of COM

- OLE first released by Microsoft in 1991

- Organized routines into groups called Interfaces and gave them unique identifiers

  – If a object "exposed" an interface, it was required to support all routines in it

- Facilities for browsing available Interfaces

- Intuitive support for COM in Visual Basic

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History of OPC

- Industry realized it could continue to create proprietary interfaces OR work together

- OPC Foundation created in 1996

- First standard, OPC DA, released in August 1996
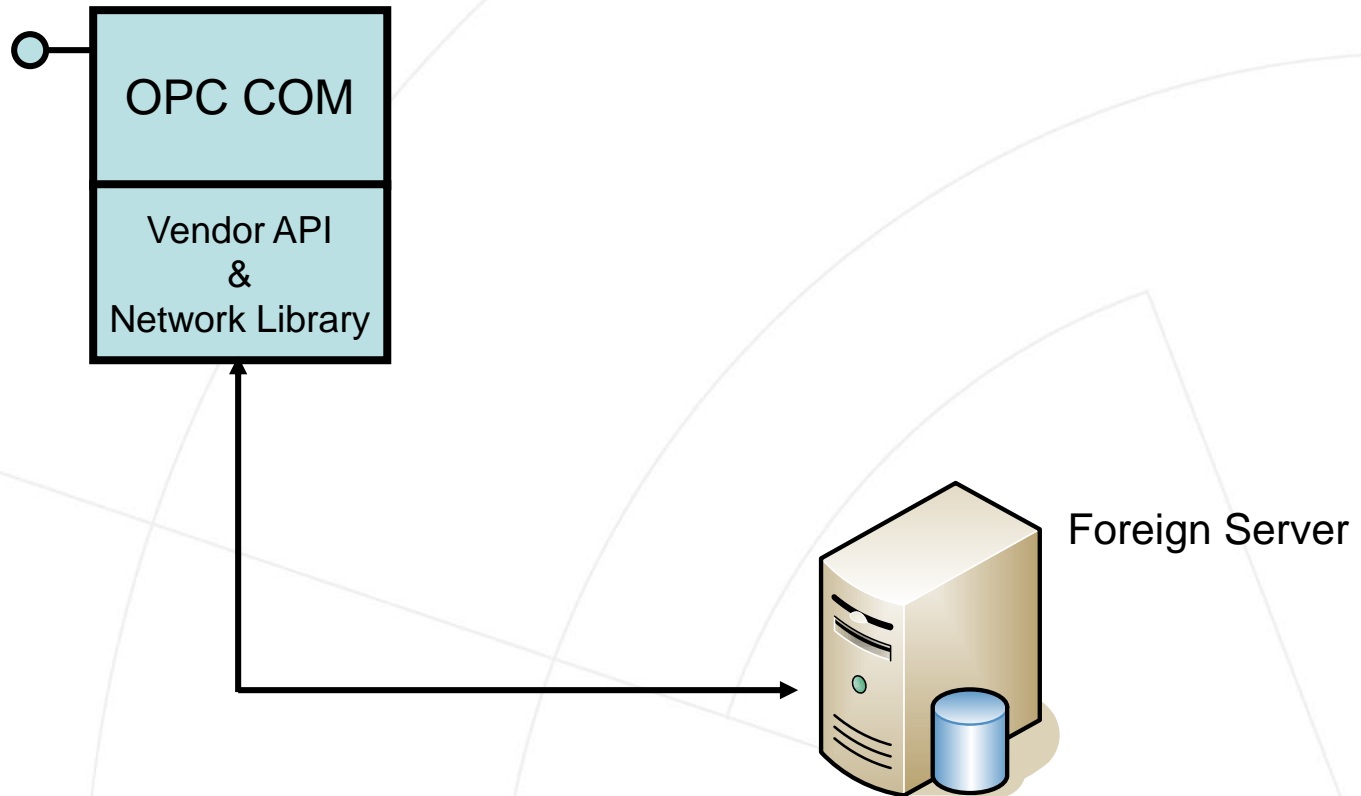
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OPC Interfaces

- DA
  - Data Access
- HDA
  - Historical Data Access
- A&E
  - Alarms and Events
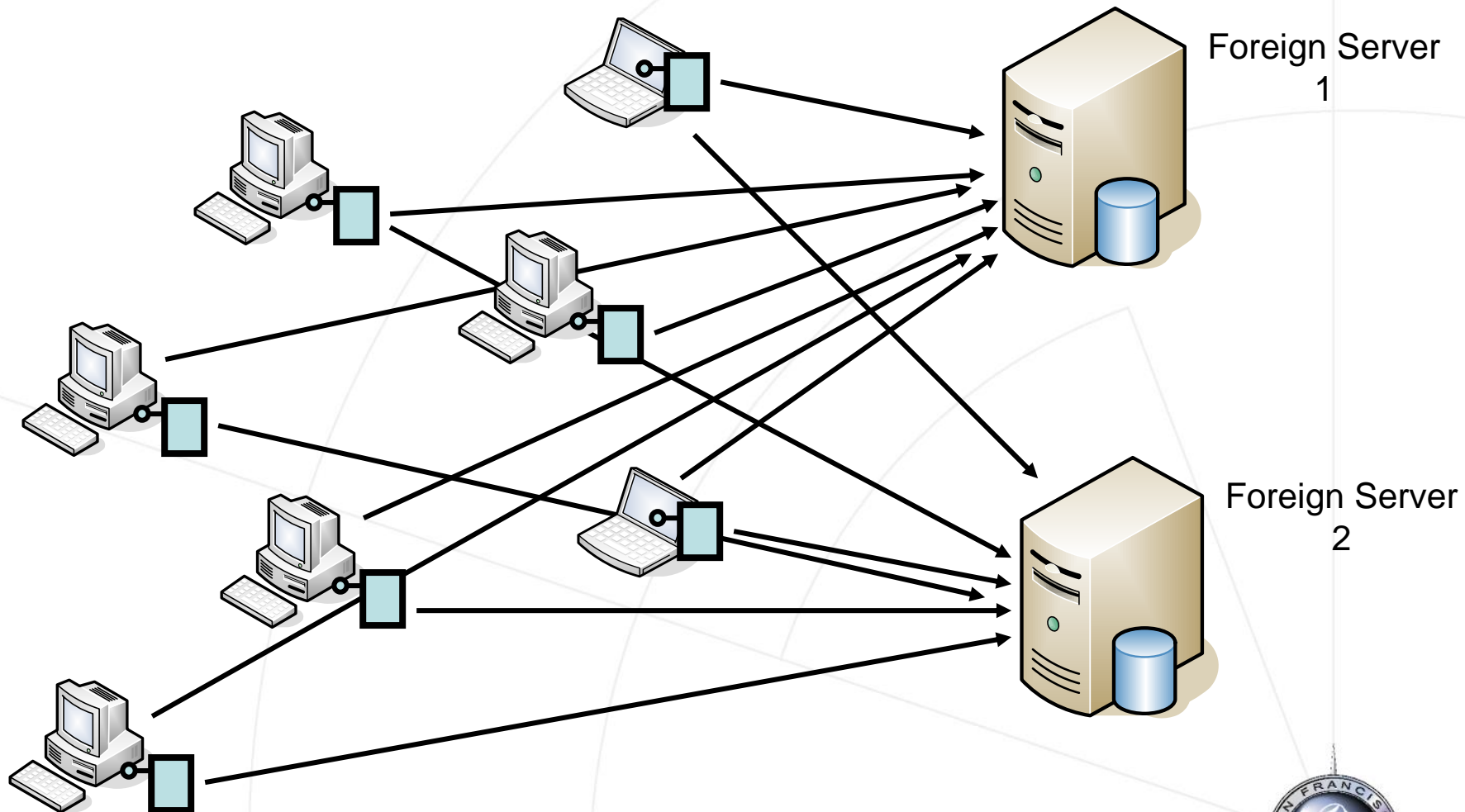- Command Execution
- Batch

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OPC Interface Model

OPC COM

Vendor API
&
Network Library

Foreign Server

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OPC Deployment

Foreign Server 1

Foreign Server 2

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OPC Access in OSIsoft Clients

- This is not our architecture

- We want to help you avoid the workstation management problem

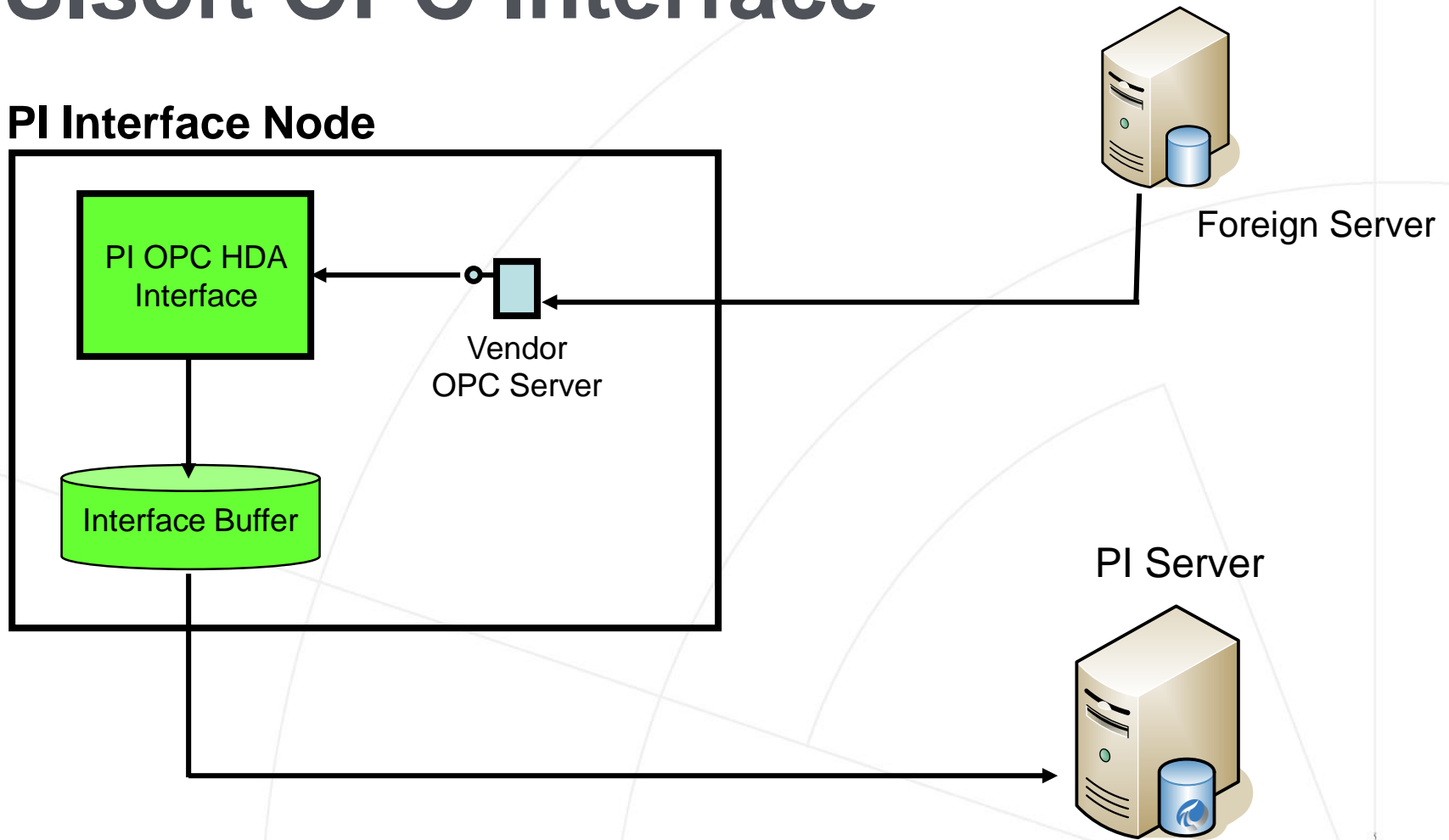**VALUE NOW, VALUE OVER TIME**

OSIsoft architecture

- Centralize!

- Install OPC Server and vendor libraries on PI Interface node or PI Server

- Keeps deployment, management and troubleshooting in one place

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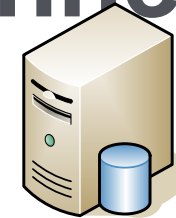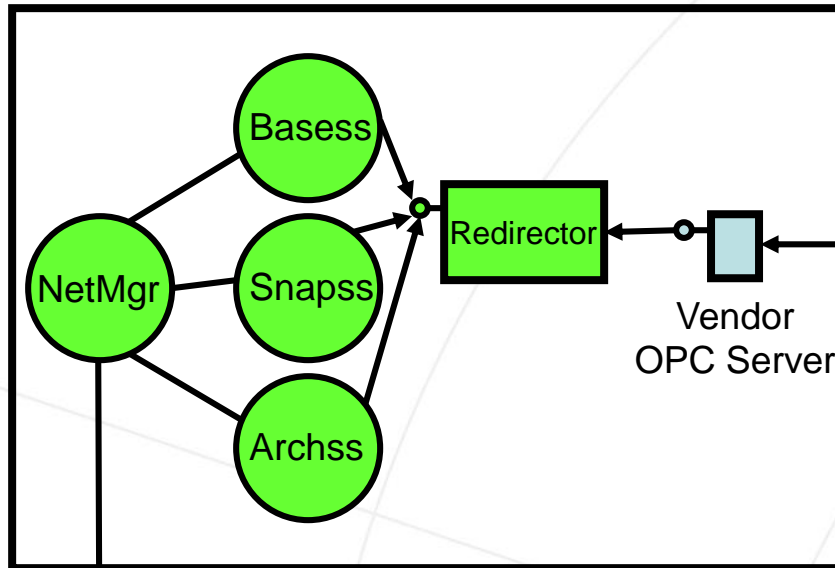
OSIsoft OPC Interface

PI Interface Node

PI OPC HDA Interface

Vendor
OPC Server

Interface Buffer

Foreign Server

PI Server

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OSIsoft OPC HDA COM Connector

PI Server

Foreign Server

Basess

NetMgr

Snapss

Archss

Redirector

Vendor
OPC Server

PI Clients
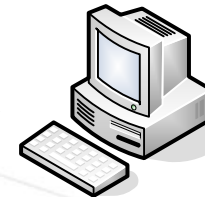
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OPC Interface in the High-Availability Environment

PI Interface Node

Failover Coordination

PI Interface Node

PI Server

Shared Configuration

PI Server
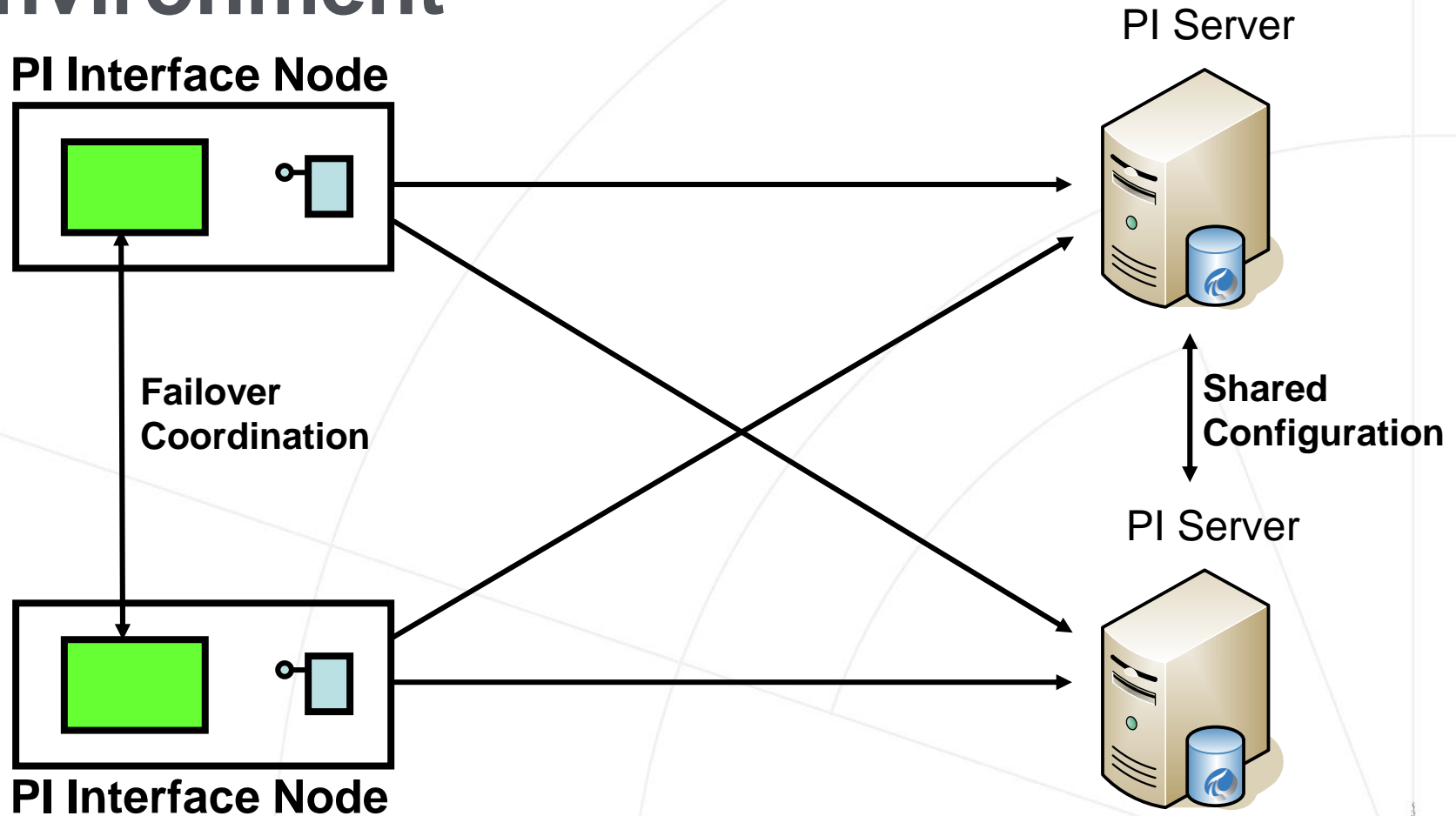
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OPC COM Connector in the High-Availability Environment

PI Server

PI Clients

PI SDK

Shared Configuration

Foreign Server

PI Server
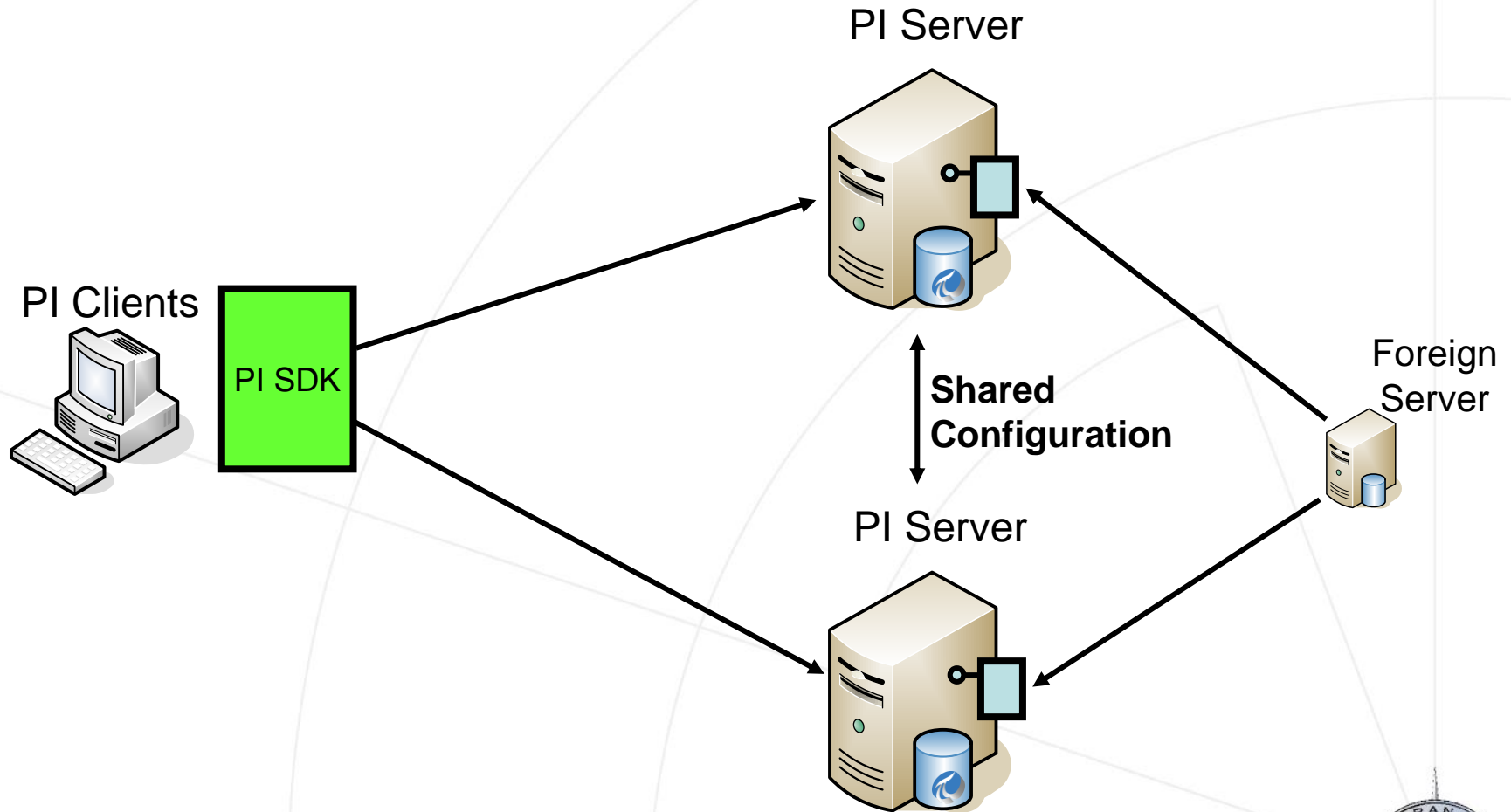
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OPC Point Configuration Simplified

- Auto-Point Sync

  - Builds correctly configured points in PI if the "foreign system" exposes its configuration

  - Available for OPC if "Browse" interface exposed

- APS Connector for the OPC Interface

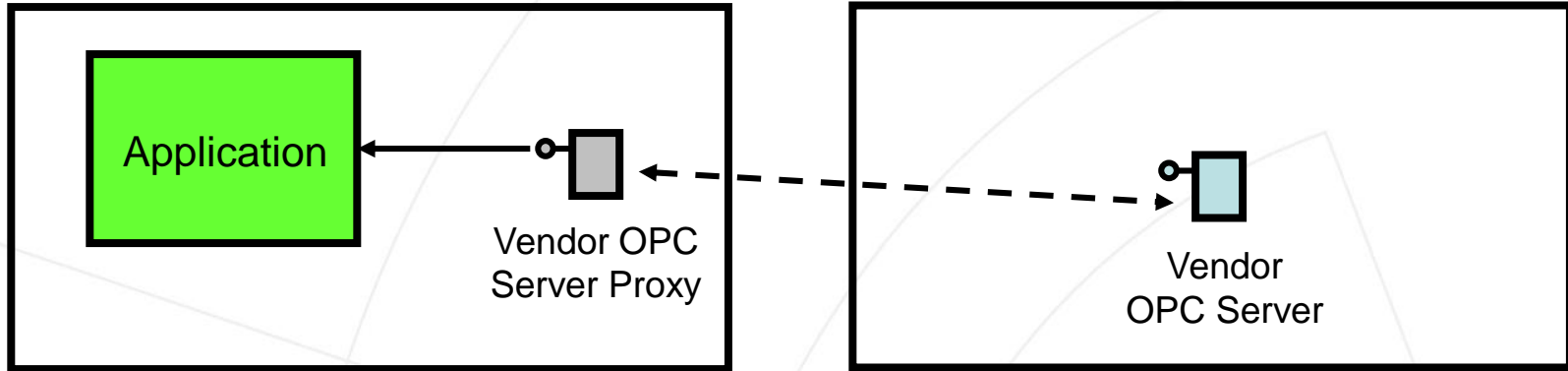- APS Connector for the OPC HDA COM Connector

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OPC Security

- No formal security model

  - Implementations use Windows security or proprietary implementation

- DCOM

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DCOM

Application

Vendor OPC
Server Proxy

Vendor
OPC Server

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DCOM

- Based on Windows RPC

- Did not perform particularly well

  – Replaced vendor networking with Microsoft's

- Difficult to configure

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DCOM

- Deliberately disabled in Windows XP SP2, not removed

  - Microsoft KB 87560 article on how to restore it: "How to Troubleshoot WMI-related issues in Windows XP SP2"

- Probably safe within a LAN

- Some sites use "Tunnels" for DCOM over TCP/IP

  - But "stateful" firewalls cannot track traffic

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OSIsoft OPC Servers

- OSIsoft OPC DA Server

- OSIsoft OPC HDA Server

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What OPC is doing next

- OPC UA
  - Universal Architecture
- Embraces Microsoft .NET, Indigo
- Exploits Web Services
  - Non-Microsoft Server implementations possible
- Final spec due in August
- OPC Foundation hopes for commercial products in 2007

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OPC UA Topics

- Address Space

- Relationships

- Service Sets

- Profiles

- Transport

- Security

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OPC UA Address Space

- "Set of objects and relationships exposed by an OPC UA Server"

- Nodes:
  - Have Attributes, which have values
  - Minimum:
    - Node name
    - Node type
    - Node id

- All objects are nodes, not all nodes are objects

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OPC UA Relationships

- All Nodes exist at least in a hierarchy

- Nodes may have references to each other
  - Allows rendering of network relationships

- Server may show subsets called Views
  - Views are also hierarchies
  - Client can browse available Views
  - Default View is entire hierarchy

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OPC UA Service Sets

- Available services are grouped:
  - Server
    - CreateSession, CloseSession, GetSecurityPolicies
  - Node
    - AddNode, AddReference, DeleteNode, DeleteReference
  - Attribute
    - Read, HistoryRead, Write, HistoryUpdate

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OPC UA Profiles

- Client can obtain from Server exact features supported

- Profiles define:

  – Security model

  – Support for levels of DA, HDA, A&E

  – Transport

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OPC UA Transport

- Actual transport not specified by OPC

- Transport Profiles:
    - SOAP or TCP/IP

- Payload Profiles:
    - XML or Binary

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OPC UA Security

- Client and Server hold X.509 v3 Certificates

- How they are obtained is not defined by UA

- GetSecurityPolicies to exchange certificates

- RequestSecurityToken to create secure session

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OPC UA Security

- Requirements
  - authentication
  - integrity
  - confidentiality
  - authorization
  - non-repudiation
  - availability

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OPC UA Security Threat Types

- Message flooding

- Eavesdropping

- Message spoofing

- Message alteration

- Message replay

- Malformed messages

- Server profiling

- Session hijacking

- Rogue Client or Server

- Compromising user credentials

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OSIsoft and OPC UA

- Use OPC Foundation "wrapper" to support COM-based OPC Interface against third-party OPC UA Servers in 2006

- Native OPC UA Interface committed

- OSIsoft OPC UA Server in 2007
  - Will expose Foundation data model

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OSIsoft HA Platform Release

- OPC Interface failover

- N-way interface buffering

  – Supports Phase 1 PI Server Replication

- OPC HDA COM Connector configurations will replicate in Phase 1

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OSIsoft Futures

- Standards-based access techniques will become first-class connection methods
  - PI OPC UA Server
  - PI OLE DB

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OSIsoft Futures

- RtPM client connectivity will migrate to Platform Release 3 Data Access

  - "Foundation" Data Access

- RtBaseline Services will evolve to support data access by clients

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Summary

- OPC abstracts Servers allowing for common clients, still leveraging vendor networking

  – Vendor libraries need to be installed on clients

- OSIsoft has centralized OPC usage:

  – PI Interface node

  – PI Server

- Architecture scales on the OSIsoft High-Availability platform

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Summary

- OSIsoft active in OPC UA

- We will keep deployments centralized, but Highly-Available

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