

Using Web Technologies to Connect and Enrich Data from Heterogeneous Sources

Presented By:

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Introduction

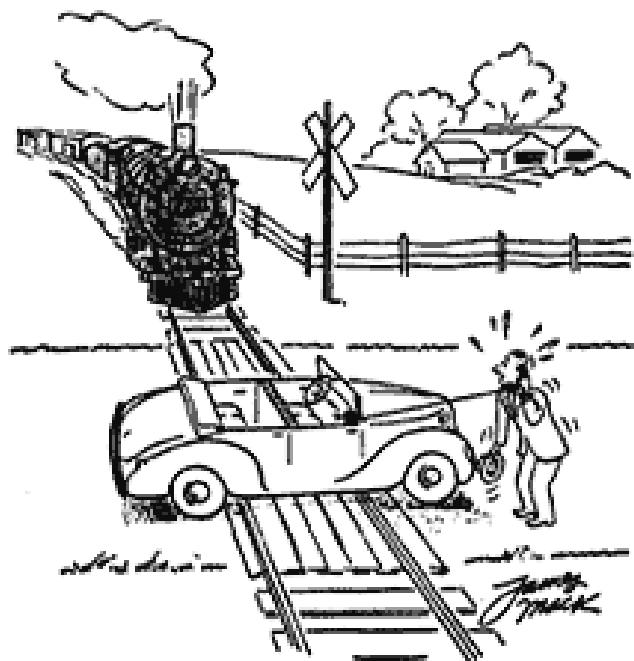
Krishna Kumar, CTO, Space Time Insight

Space Time Insight

- Geospatial Visual Analytics for Real time data
- OSIsoft Partner since 2006
- Several joint customers – CAISO, Sempra, FPL.....
- Venture backed and growing Rapidly !!!



Why do we need Contextual Data?



*"Hello, Mr. Bunting. I've changed my mind—
I'll take that accident policy!"*

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Contextual Situational Intelligence



Where

Is my problem
?



Space

When

Did the
problem start
?



Time

Why

Did it happen ?



Cause

How

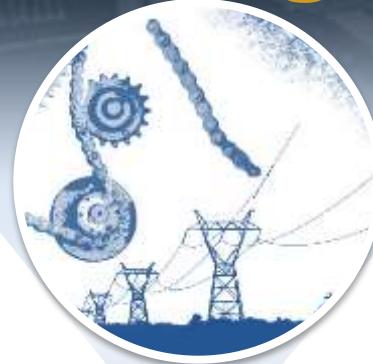
Can I prevent
it ?



Action

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Situational Intelligence with PI



Where

Is my problem?



Geospatial
solution

When

Did the
problem Start?



PI Real-time

Why

Did it happen ?



PI-AF
& Analytics

How

Can I prevent
it ?



PI Notification

Connectivity Options

- PI Web-Parts for Visualization
- PI JDBC / OLEDB - Connection to PI-Db
- PI SDK
- PI Web Services
- Wrapper over PI-SDK
- Streaming Data integration

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PI Web Parts

Home > OSIDemo_New

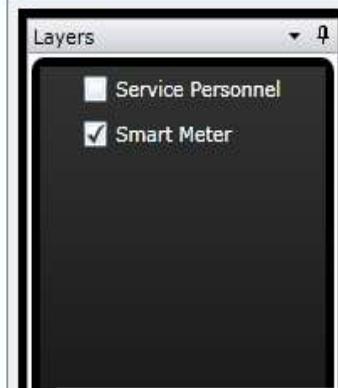
RtTimeRange

Start Time *_2h

End Time *

Apply

BasicSilverLightWebPart Web Part



Time Selection information is passed to webparts and Bing Maps Webpart

A bing Maps Web part is used for visualization of AF-Taxonomy data

RtTreeView

PMUs

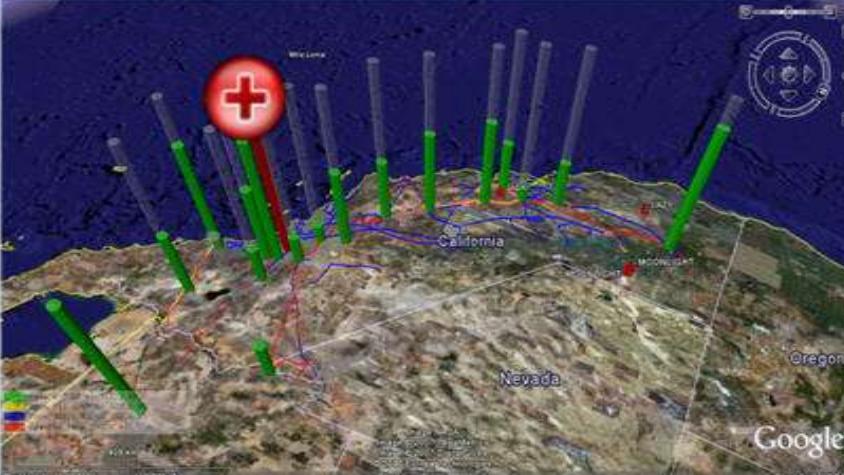
- Smart Meter 1
- Smart Meter 10
- Smart Meter 11
- Smart Meter 12
- Smart Meter 13
- Smart Meter 14
- Smart Meter 15
- Smart Meter 16
- Smart Meter 17
- Smart Meter 18
- Smart Meter 19
- Smart Meter 2
- Smart Meter 20
- Smart Meter 21
- Smart Meter 22
- Smart Meter 3
- Smart Meter 4
- Smart Meter 5
- Smart Meter 6
- Smart Meter 7
- Smart Meter 8
- Smart Meter 9

Web-Parts Example

Substation Groups

- TransDistribuCo
 - Distribution
 - Eastern District
 - Northern District
 - Southern District
 - Western District
 - Transmission
 - Region I
 - Region II
 - Region III
 - Region IV

Overview



Assets Requiring Repair

Substation	Asset	Priority
Bighorn Basin	CB1992	1
Victory Valley	TR9946	1
Wolverine	TR3450	1
Bighorn Basin	TR3045	2

Assets Requiring Attention

Substation	Asset	Priority
Gypsy Junction	CB3994	1
Victory Valley	CB6453	1
Victory Valley	TR0606	1
Victory Valley	TR1171	1
Victory Valley	TR4559	1

Showing 1 to 5 of 17

Recent Work Orders

Date	Substation	Asset	Order No	Task	TaskType	Comments	Assigned To
9/5/2005	Victory Valley	CB9376	2004-1194	N2 TANK ADDED	New Installation		Davis, Ron
9/5/2005	Gypsy Junction	TR4522	2003-1034	TCG TEST - MAIN TANK	New Installation	Please pump water	Krupp, Robert
8/11/2005	Bighorn Basin	TR2003	2004-5629	DGA OIL SAMPLE	Preventive Maintenance		Jones, Sarah
8/11/2005	Bighorn Basin	TR3045	2005-3999	TCG TEST - MAIN TANK	Preventive Maintenance		Jones, Sarah
8/3/2005	Bighorn Basin	TR2003	2003-1034	TCG TEST - MAIN TANK	Other Maintenance		Davis, Ron

Showing 1 to 5 of 71

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Demo with Web Parts and Bing Maps

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Example with Google Earth

The interface consists of three main panels:

- Outage Restoration:** A map view showing red lines indicating power outages or restoration paths over a city area. A legend on the left includes options like "Service Notification", "Dashboards", "Outage", "Service Orders", "Demographics", "Service Personnel", "Drive Radius", and "Traffic".
- Dashboards: RT Graphic:** A sub-panel showing a "Generators" one-line diagram. It displays various electrical components like buses, switches, and generators, each with status indicators (e.g., "No Data", "Normal", "Fault"). A message box at the top right says "Messages [1]".
- Dashboards: RT Tree:** A hierarchical tree view of asset taxonomy. It shows three main groups: Group 1 (Generator 1, Generator 2), Group 2 (Generator 3 through Generator 12), and Group 3 (Generator 13 through Generator 16). Each generator node has a small icon next to its name.

A Live, interactive real time process interface, is geospatially shown here. By clicking the interface below, the frequency effect (shown 'y' axis) can be examined over time.

A Live Process Book (Active View) can be shown geospatially. In this view the substation one-line diagram view can be color coded to identify issues and alert events.

An Asset Taxonomy can be geospatially shown using the AF (Analysis Framework) Interface.

Ensuring Web part communication

```
public override void EnsureInterfaces()
{
    try
    {
        RegisterInterface("MyParametersOutConsumerInterface_WPO_",
            InterfaceTypes.IParametersOutConsumer, //InterfaceName
            WebPart.LimitOneConnection, //InterfaceType
            ConnectionRunAt.ServerAndClient, //MaxConnections
            this, //RunAtOptions
            "paramsOutConsumer_WPO_", //InterfaceObject
            "Consume Parameters From 1", //InterfaceClientReference
            "Consumes parameters from another Web Part."); //MenuItemLabel
        //Description
    }
    catch (SecurityException se)
    {
        _registrationErrorOccurred = true;
    }
}
```



Javascript for Exchanging Communication

```
var paramsOutConsumer_WPQ_ = new objMyParametersOutConsumerInterface_WPQ_();

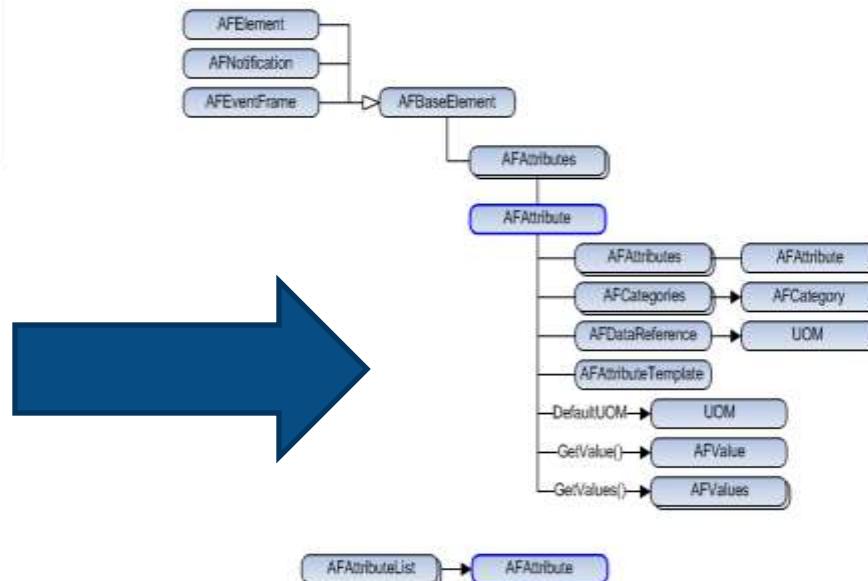
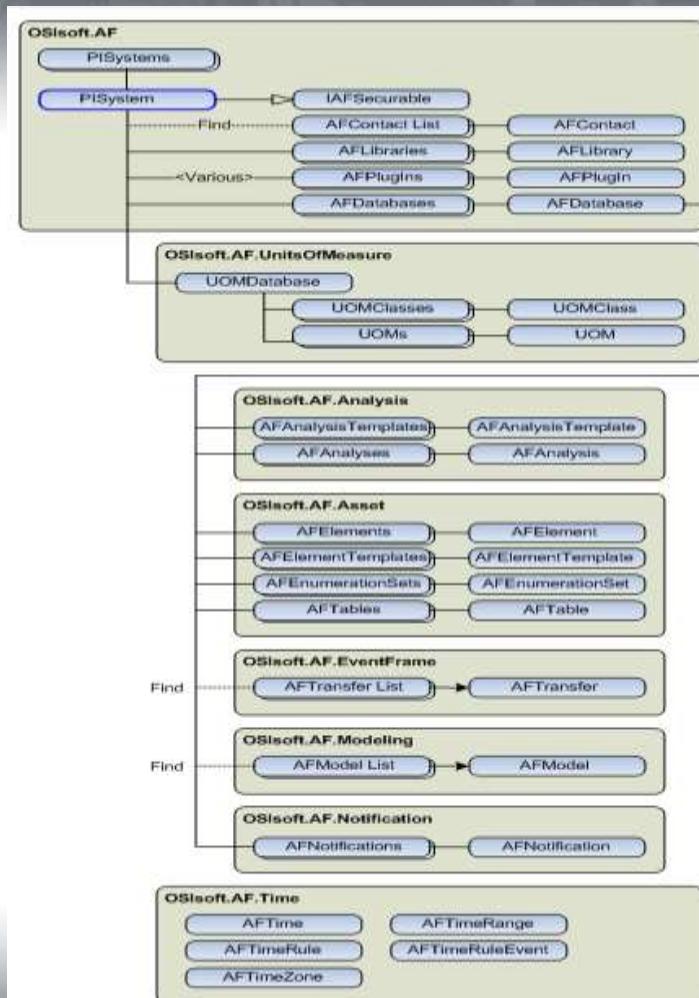
function objMyParametersOutConsumerInterface_WPQ_() {
    this.ParametersOutProviderInit = _parametersOutProviderInit; //method that implements the ParametersOutProviderInit method
    this.ParametersOutReady = _parametersOutReady; //method that implements the ParametersOutReady method
    var _parametersOutProviderInitArgs = null; //Array to store the list of properties names coming from the asset

    //Called when the connection is established and sends the list of properties names that will be sent
    function _parametersOutProviderInit(sender, parametersOutProviderInitArgs) {
        _parametersOutProviderInitArgs = parametersOutProviderInitArgs;
    }

    //Called when the user clicks the asset on the tree view
    function _parametersOutReady(sender, parametersOutReadyArgs) {
        var latitude=null;
        var longitude=null;
        var tmpProps = _parametersOutProviderInitArgs.ParameterOutProperties; //property names
        for(i=0;i<tmpProps.length;i++){
            if(tmpProps[i].ParameterDisplayName=='latitude'){ //for the field named latitude add the value to latitude
                latitude = parametersOutReadyArgs.ParameterValues[i];
                continue;
            }
            if(tmpProps[i].ParameterDisplayName=='longitude'){ //for the field named longitude add the value to longitude
                longitude = parametersOutReadyArgs.ParameterValues[i];
                continue;
            }
        }
        if(latitude!=null && longitude!=" && longitude!=null && longitude!=" )
            showPoint(latitude,longitude,10); //function that calls the map and zooms to the given latitude and longitude
    }
}
```



PI SDK Object Hierarchy



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PI SDK Object Hierarchy

```
1 // This example demonstrates how to create an attribute for an
2 // element and display information about it.
3
4 // Get the Database
5 PISystems myPISystems = new PISystems();
6 PISystem myPISystem = myPISystems.DefaultPISystem;
7 AFDatabase myDB = myPISystem.Databases.DefaultDatabase;
8
9 // Create an Element
10 AFElement myElement = myDB.Elements.Add("MyElement");
11
12 // Create an Attribute
13 AFAtribute myAttribute = myElement.Attributes.Add("MyAttribute");
14 myAttribute.Description = "Attribute for MyElement";
15 myAttribute.DefaultUOM = myPISystem.UOMDatabase.UOMs["kelvin"];
16 myAttribute.DataReferencePlugIn = myPISystem.DataReferencePlugIns["PI Point"];
17 myAttribute.ConfigString = @"\\localhost\sinusoid";
18
19 // Display Attribute Information
20 foreach (AFAtribute CurAttribute in myElement.Attributes)
21 {
22     Console.WriteLine("Name of Attribute = " + CurAttribute.Name);
23     Console.WriteLine("Description = " + CurAttribute.Description);
24     Console.WriteLine("Default UOM = " + CurAttribute.DefaultUOM.Name);
25     Console.WriteLine("DataReference = " + CurAttribute.DataReference.Name);
26     Console.WriteLine("ConfigString = " + CurAttribute.ConfigString);
27 }
28
29 // Remove the Attribute
30 myElement.Attributes.Remove("MyAttribute");
31
32 // Remove the Element
33 myDB.Elements.Remove("MyElement");
```

Fetching Attributes
From an AF Element

Latitude & Longitude are
AF Elements

JDBC / DB example

SPACE • TIME • INSIGHT

Welcome Demo User

Cockpit Smart Cockpit AMI Renewable Service Mgmt WAMS Crisis Mgmt Market Mgmt ISO Situation Room SupplyChain Logout

MISO EAM Dashboards Wind Farm with Meter Where Used List Generation Stations Power Flow Congested Lines Wind Farm Site Simulation Wind Farm with Power Wind Speed Transmission Lines Voltage Congestion Wind Directions Event Simulation Temperature Radar Cloud Cover Wind Calculator

Feb 15, 2007 1pm

Sacramento Fresno California San Francisco San Jose

Active Power 78 mi Reactive Reserve 344.0

over Legend Active Power Reactive Reserve Forecast Reserve

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Google

Dashboards Asset Maintenance Cost Assessment Daily Statistics Legends Power Curve Project Plan RT Graphic RT Gauge RT Tree Transmission Cost Estim... Trend Charts Wind Power Favorites Rubber Banding

Generation Stations: Meter Chart

CurrentCapacity (Sum) AvailableCapacity (Sum) CurrentLoad (Sum)

EAM Dashboards: DailyStatistics

Output (in Kwh) 20 - 25 m/h

Time Period	Output (in Kwh)
4am - 10am	~65
10am-4pm	~80
4pm-10pm	~75
10pm-4am	~70

Power Sale (in thousands)

0 - 5 m/h 5 - 10 m/h 10 - 15 m/h 15 - 20 m/h 20 - 25 m/h 25 - 30 m/h > 30 m/h

\$75.00

Internet 100%

Done

Web Services Example

Dashboard A: Circuit Status

- Dashboards
- Smart Meters
- Demographics
- Smart Warehouse
- Circuit
- Smart Building
- AMI Deploys
- Outage
- Circuit Highlight
- Poles
- Meters
- Demand Potential
- Demand Response
- ISO Alerts
- Voltage Congestion
- Customers

Dashboard B: Volt Var Control

Circuit: Summary Dashboard

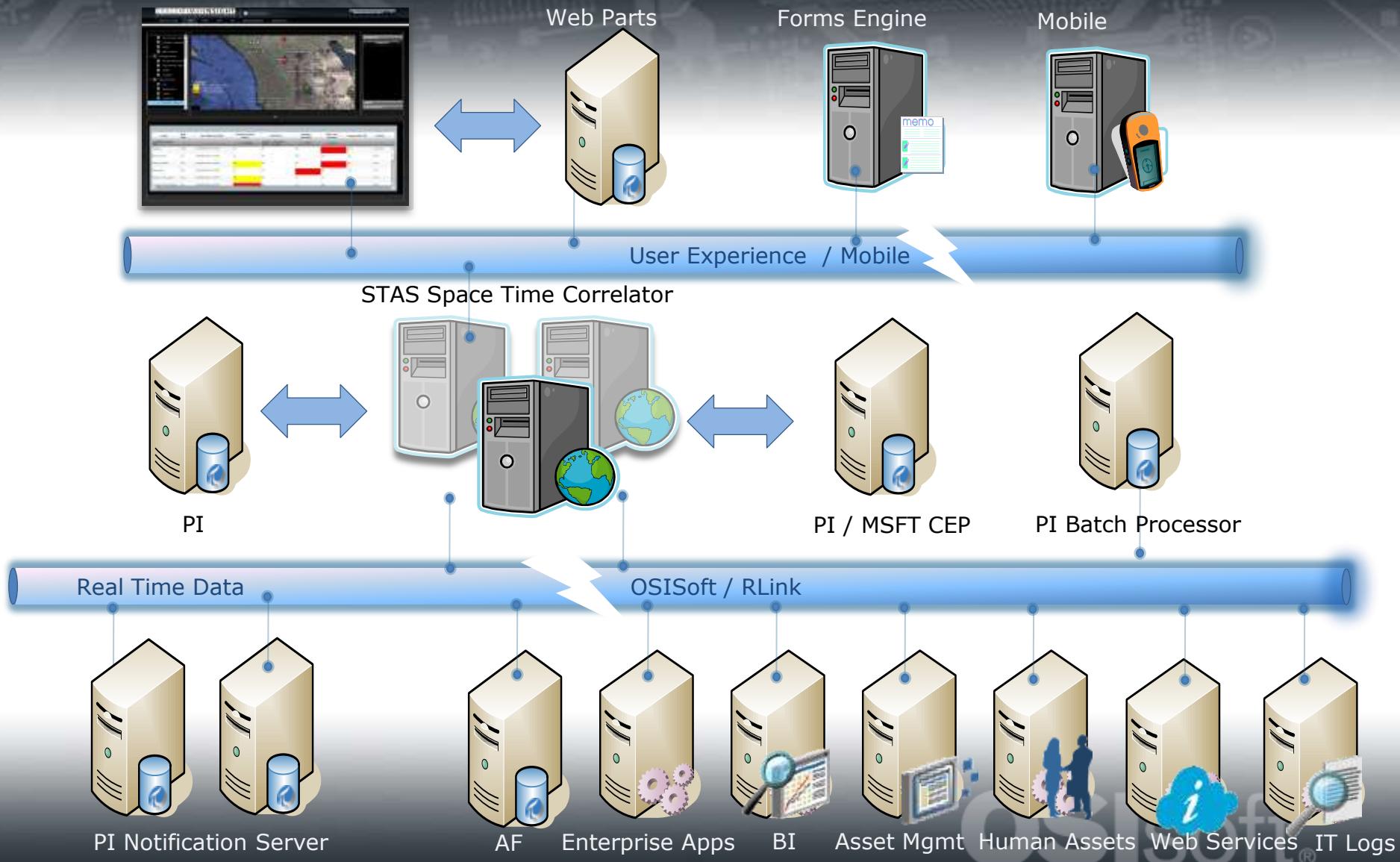
Circuit	District	OH/UG	Voltage	Structu...	Structu...	Load
137	1	UG	12.0	D2120072030	PAD	load
137	1	UG	12.0	H2119372048	PRIMARY HAN	load
137	1	UG	12.0	H109303	PRIMARY HAN	load
137	1	UG	12.0	D117447	PAD	load
137	1	UG	12.0	M103013	MANHOLE	load
137	1	UG	12.0	D117449	PAD	load
137	1	UG	12.0	D117448	PAD	load
137	1	UG	12.0	H2115872055	PRIMARY HAN	load
137	1	UG	12.0	H2115872055	PRIMARY HAN	load
137	1	UG	12.0	P2116372066	POLE	load
137	1	UG	12.0	D2120472054	PAD	load
137	1	UG	12.0	H2115872055	PRIMARY HAN	load
137	1	OH	12.0	P2116372077	POLE	load
137	1	OH	12.0	P2116372092	POLE	load
HC4	1	OH	4.0	P2117772076	POLE	load
HC4	1	OH	4.0	P2114872077	POLE	load
HC4	1	OH	4.0	P2116372092	POLE	load
HC4	1	OH	4.0	P2119472076	POLE	load

Dashboard C: Volt Var Control

Demo with PI-AF

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Reference Architecture





Thank You!

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