TVA Implementation of openXDA

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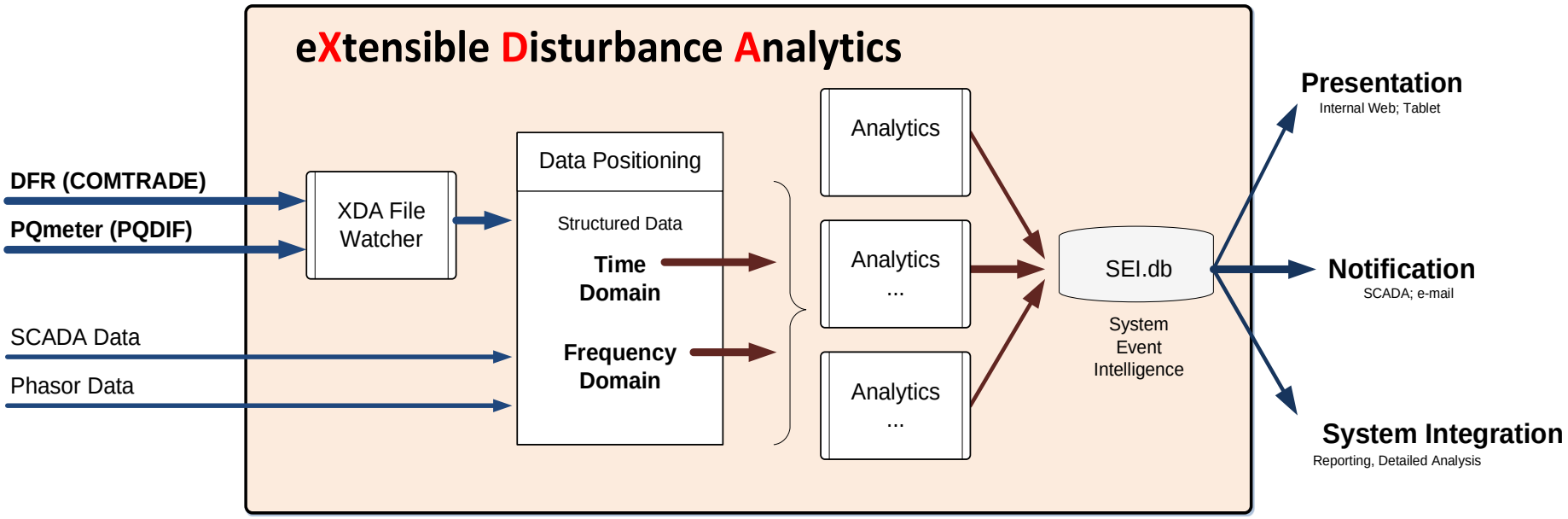
GPA Users Forum

Background

- **TVA has a large population of disturbance meters**
  - 400 DFRs from 3 vendors
  - 400 PQ meters (200 ION Revenue meters by EOY)
  - 200 Relays that could potentially be used
- **TVA worked with EPRI and GPA in 2012 to develop and bench test automated fault location** [openFLE]
- **This work was extended to a pre-production pilot by TVA in 2013 with the business objectives to:**
  - Improve intelligence available to Transmission Operators
    - For line reclosing
    - For dispatch of line crews
  - Improve quality and reduce cost of disturbance analysis
- **GPA generalized openFLE and renamed it openXDA**

openXDA Overview



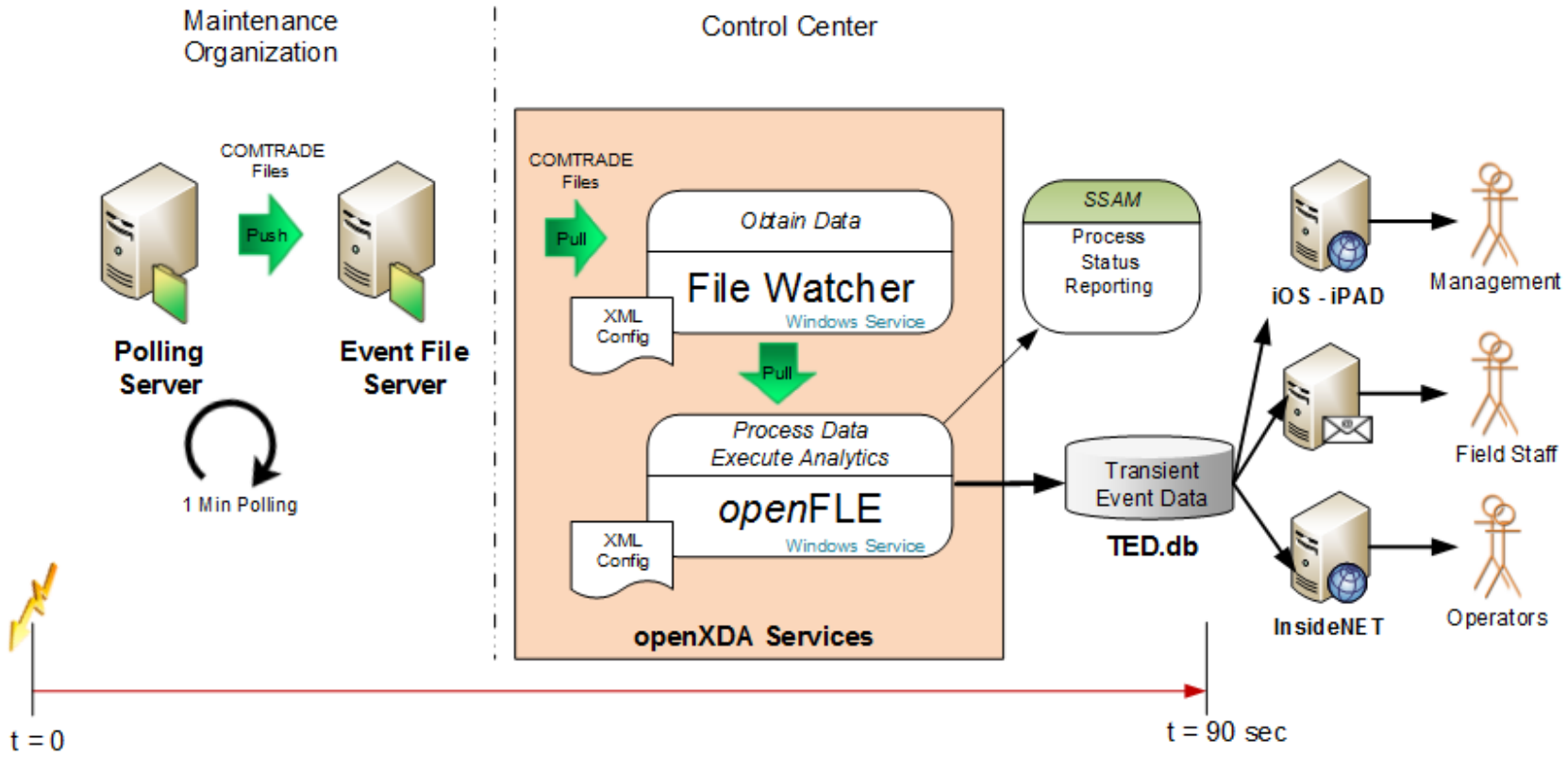
1. Obtain Data → 2. Process Waveform → 3. Execute Analytics → 4. Save Results → 5. Present Results

The Pilot – 10 Subs; 30 lines

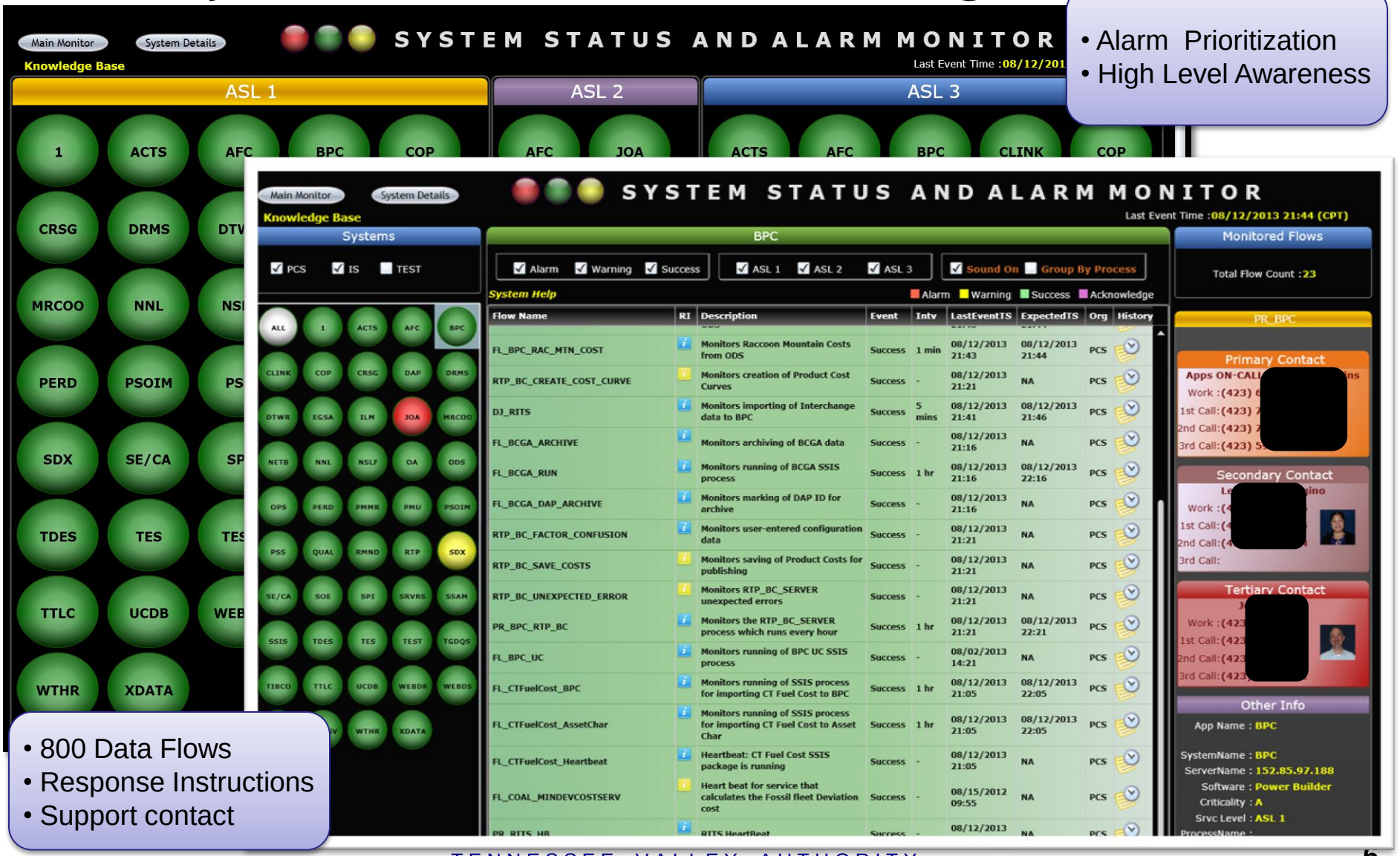
- **Colbert #1**
- **Colbert #2**
- **Douglas**
- **Pickwick**
- **Charleston**
- **Franklin #2**
- **Fort Loudoun**
- **Oakwood**
- **Springfield**
- **Bull Run #1**

Approach: *Simple low-cost implementation without full integration with other TVA systems to allow benefits to be showcased to key users – Transmission Operators and Power System Engineers*

Pilot System Architecture



System Health Monitoring



- Alarm Prioritization
- High Level Awareness

- 800 Data Flows
- Response Instructions
- Support contact

File Watcher XML

- Server/Root Path
- Folder(s)
- Meter attributes
  (to allow use in file renaming)
- Include subfolders(Y/N)
- File types to watch
- Action – copy or move

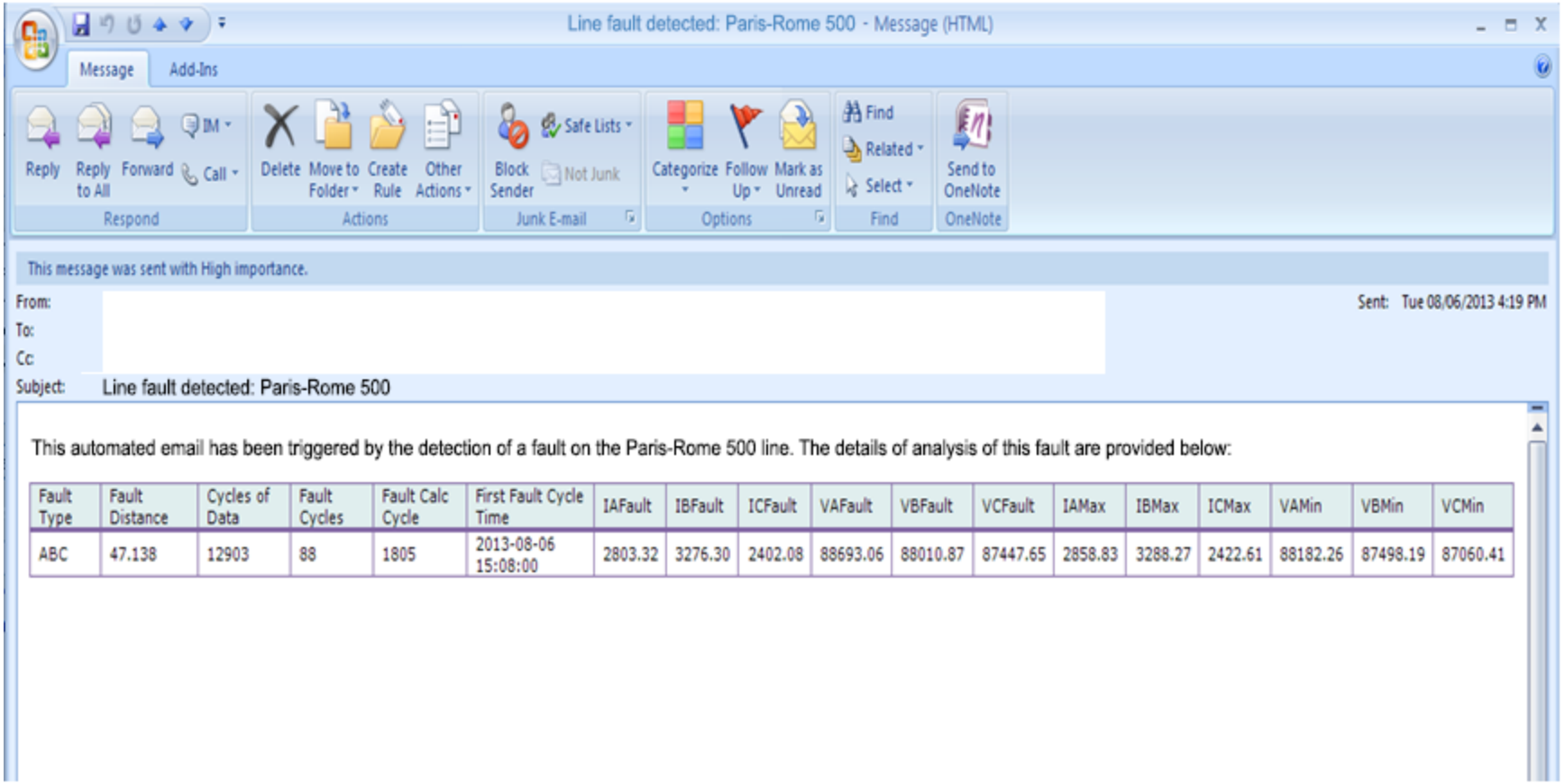
```
<sourceRootPath>..\openFLE\Watch</sourceRootPath>

<watchActions>
    <folder name=".">
        <meterName>  </meterName>
        <meterSN>  </meterSN>
        <meterAssetID>  </meterAssetID>
        <meterAlias>  </meterAlias>
        <meterSubstationName>  </meterSubstationName>
        <meterVendor>  </meterVendor>
        <meterModel>  </meterModel>
        <meterSubstationID>  </meterSubstationID>
        <produceResultsXML>Yes</produceResultsXML>
        <includeSubFolders>Yes</includeSubFolders>
        <fileFilter>*.dat, *.cfg</fileFilter>
        <watchCreated action="copy"
                      destinationFolder ="..\openFLE\Drop"
                      destinationFileName = "{existingFilename}" >
            Yes
        </watchCreated>
        <description>  </description>
    </folder>
</watchActions>
```

Fault Location XML

- Line Name
- Nominal Voltage
- Rated Current
- Length
- Trigger Method
- End Station
- Impedances
- Channel Mapping

```
<line ID="xx2">
    <name>   </name>
    <voltage>  </voltage>
    <rating50F>  </rating50F>
    <length>    </length>
    <faultTrigger method="xx">  </faultTrigger>
    <endStationID>   </endStationID>
    <endStationName>  </endStationName>
    <impedances>
      <R1>3.1805</R1>
      <X1>16.67497</X1>
      <R0>15.21303</R0>
      <X0>52.45370</X0>
      <Rs>7.19134</Rs>
      <Xs>28/60121</Xs>
    </impedances>
    <channels>
      <VA>0</VA>
      <VB>1</VB>
      <VC>2</VC>
      <IA>28</IA>
      <IB>29</IB>
      <IC>30</IC>
      <IR>31</IR>
    </channels>
    ...
</line>
```

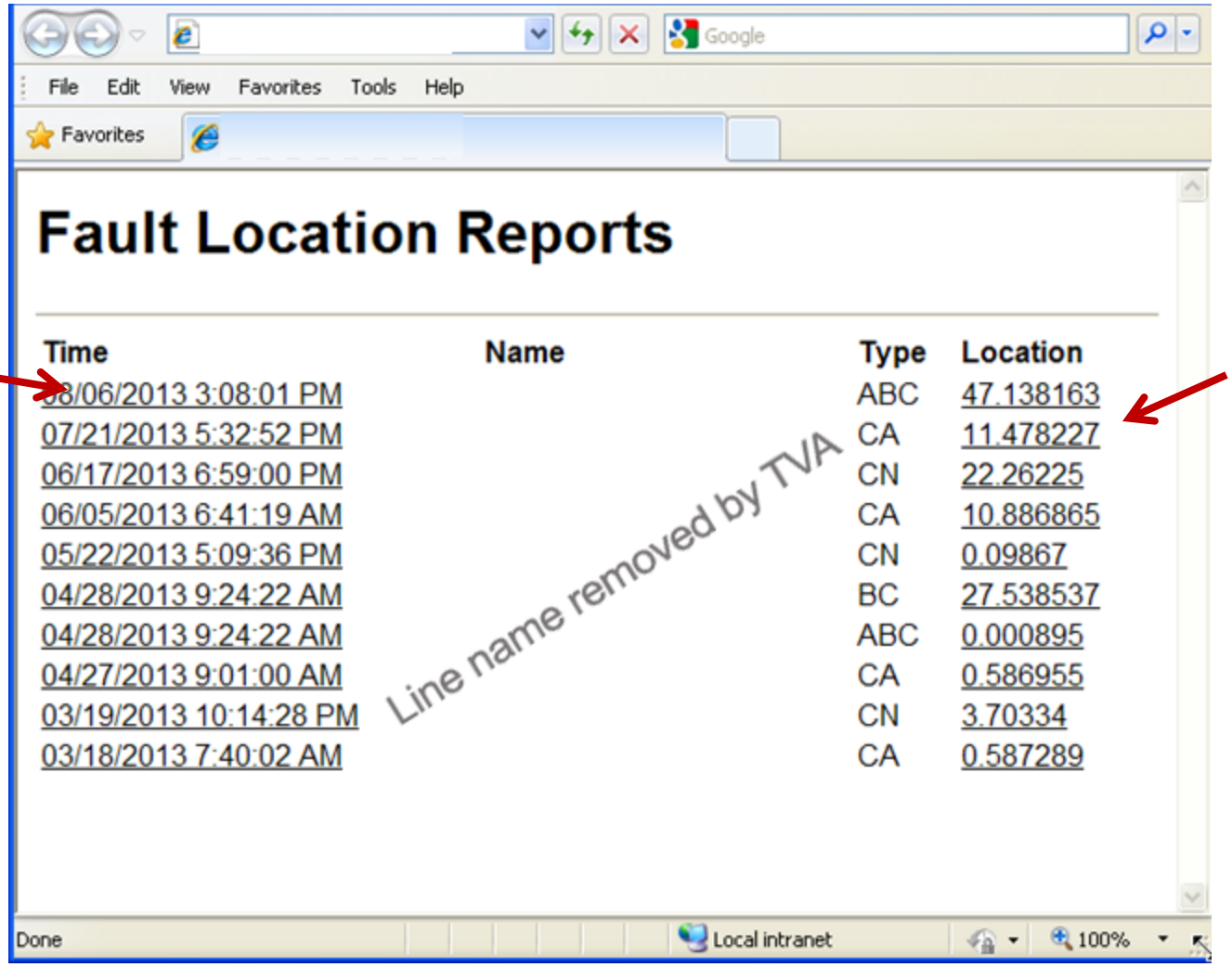
Example – Email Notification



Fault Type	Fault Distance	Cycles of Data	Fault Cycles	Fault Calc Cycle	First Fault Cycle Time	IAFault	IBFault	ICFault	VAFault	VBFault	VCFault	IAMax	IBMax	ICMax	VAMin	VBMin	VCMin
ABC	47.138	12903	88	1805	2013-08-06 15:08:00	2803.32	3276.30	2402.08	88693.06	88010.87	87447.65	2858.83	3288.27	2422.61	88182.26	87498.19	87060.41

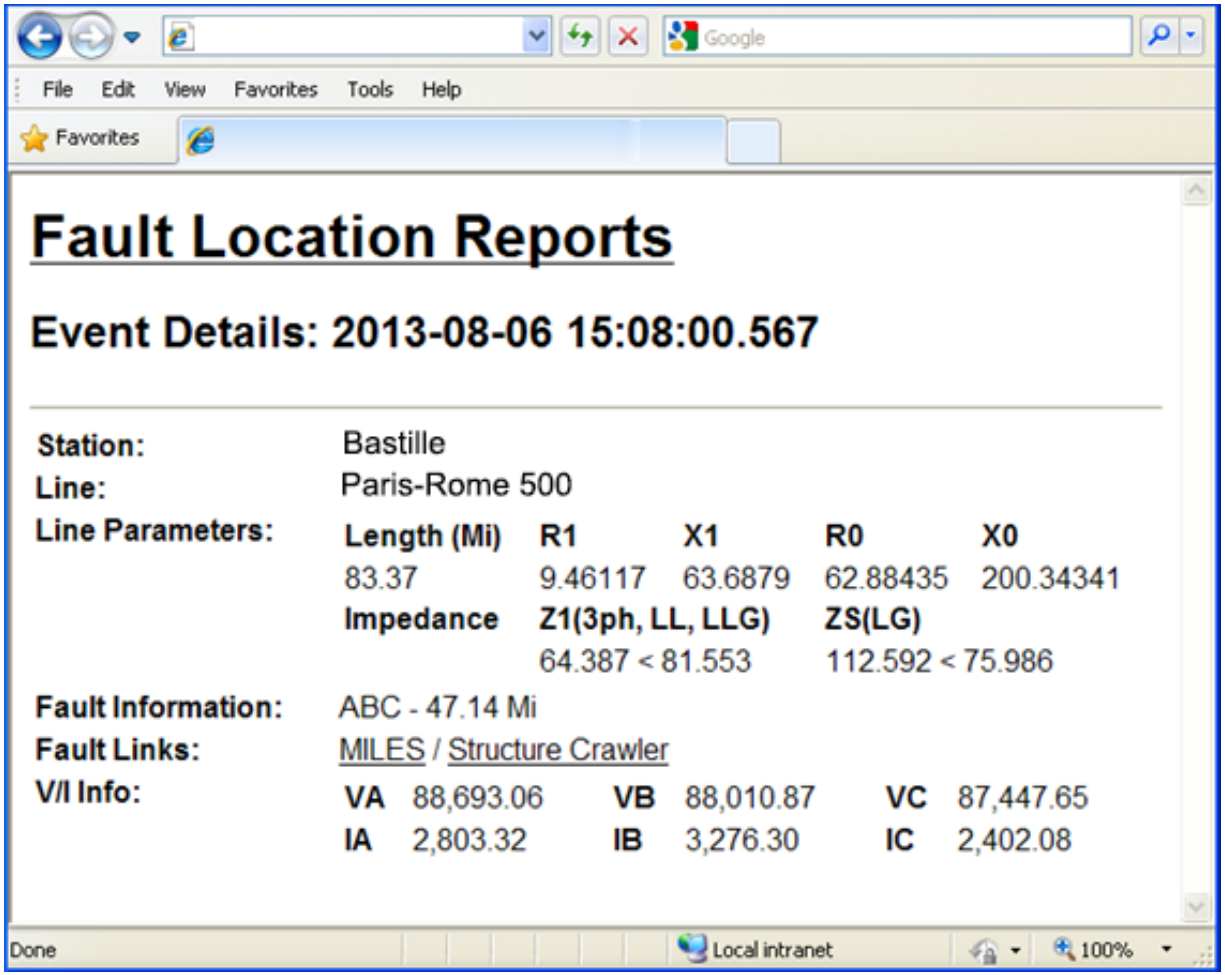
Web Based Reporting

Links to Details Page

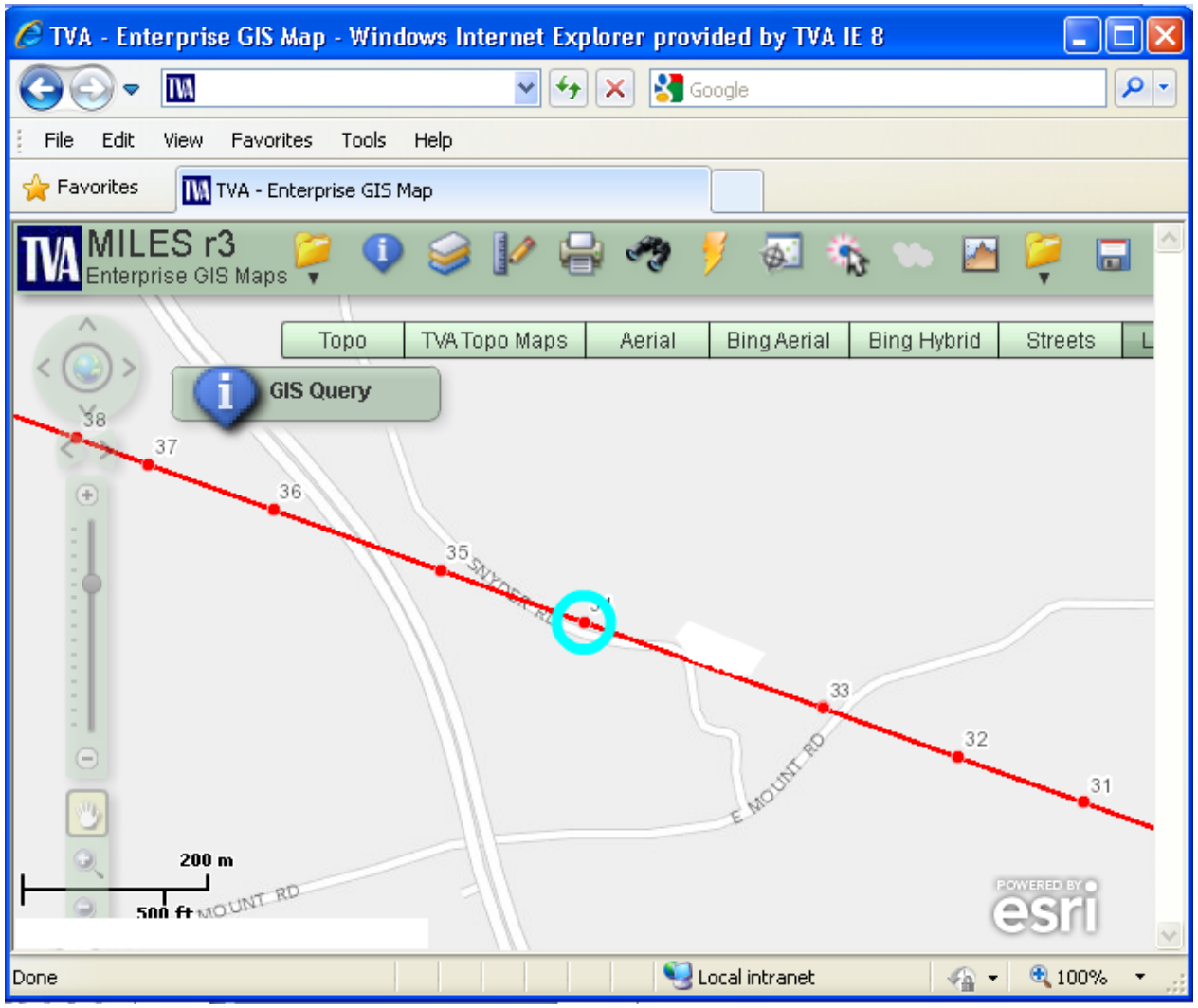


Links to Map of Location

Fault Detail



Map Detail


TVA - Enterprise GIS Map - Windows Internet Explorer provided by TVA IE 8
File Edit View Favorites Tools Help
Favorites
TVA - Enterprise GIS Map
MILES r3
Enterprise GIS Maps
Topo
TVA Topo Maps
Aerial
Bing Aerial
Bing Hybrid
Streets
GIS Query
38
37
36
35
33
32
31
SNYDER RD
E MOUNT RD
MOUNT RD
200 m
500 ft
POWERED BY esri
Done
Local intranet
100%

Plans after the Pilot

- **In FY 2014,**
  - Expansion of the system to include all meters that produce well-formed COMTRADE or PQDIF files and potentially DFR's
  - Simplification / Automation of openXDA configuration
    - Developing processes to improve DFR channel mapping configuration control
    - Acquiring line parameter data directly from primary source
  - Investments in software and hardware to enhance polling process
  - Increase confidence by adding multiple fault location algorithms
  - Look for other problems that could be solved with openXDA (e.g. equipment health)