Synchronized Measurements from Disparate Sources

How to connect the dots?

Paul Myrda
Sr. Program Manager

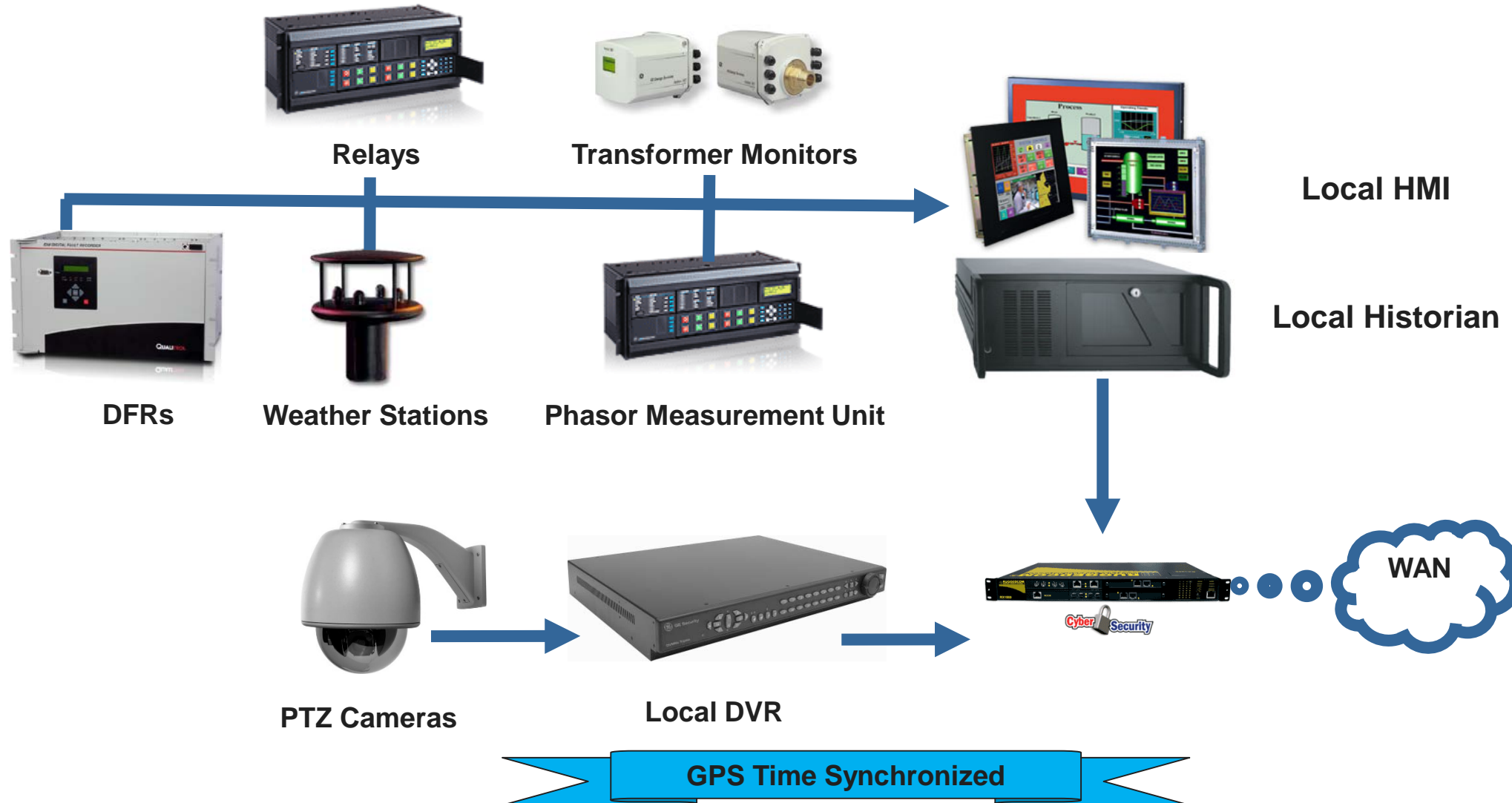**NASPI**
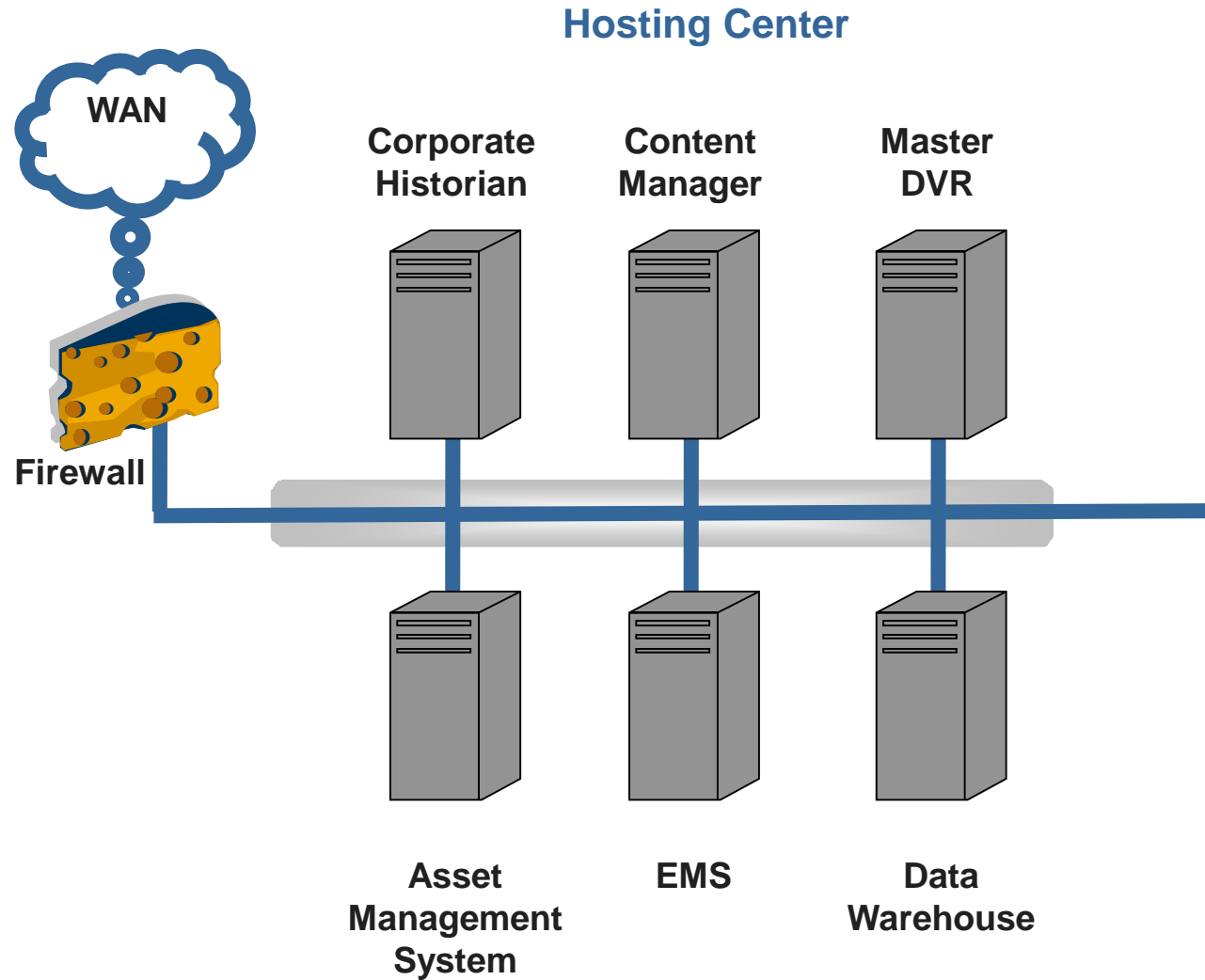**October 2019**

Agenda

- Typical Substation Equipment

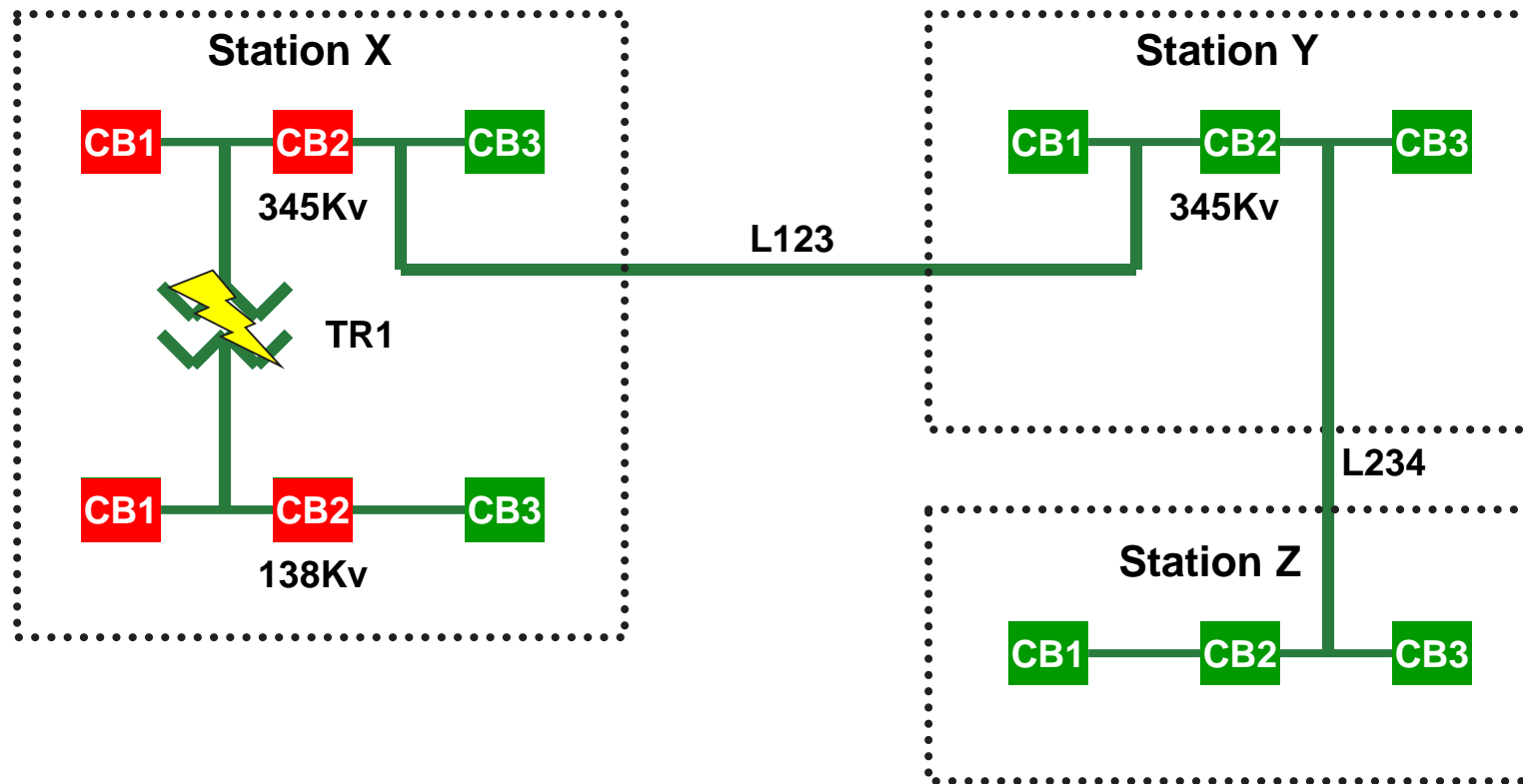- Role of Meta Data

- Connecting the Dots …..

- Key Points

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Typical Substation Equipment

Relays

Transformer Monitors

Local HMI

Local Historian

DFRs

Weather Stations

Phasor Measurement Unit

WAN

PTZ Cameras

Local DVR

Cyber Security

GPS Time Synchronized

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Business Aspect

Hosting Center

WAN

Firewall

Corporate Historian

Content Manager

Master DVR

Asset Management System
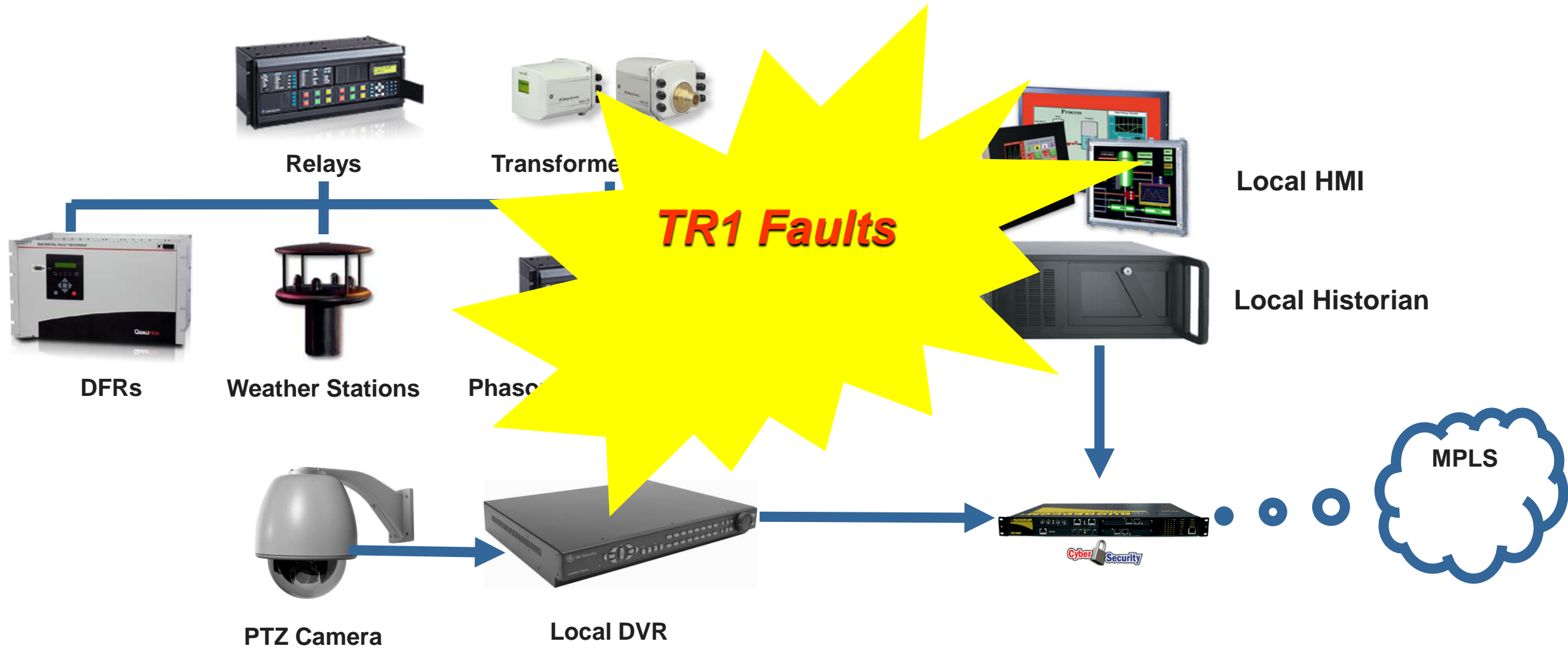
EMS

Data Warehouse

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Mini System Model

Event – TR1 Tripped and Locked Out on March 8, 2006 at 14:30:10

Specific Example Substation X

Relays

Transforme[r]

Local HMI

DFRs

Weather Stations

Phaso[r]

Local Historian

TR1 Faults

PTZ Camera

Local DVR

MPLS

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Business Aspect
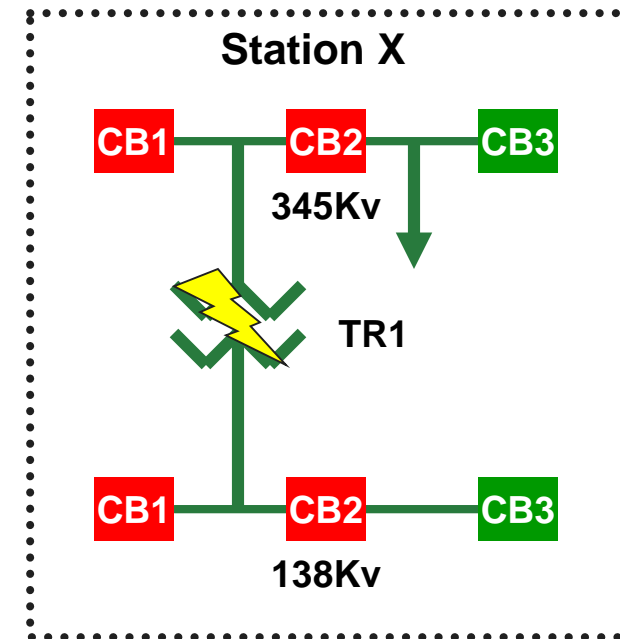
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Information Displays
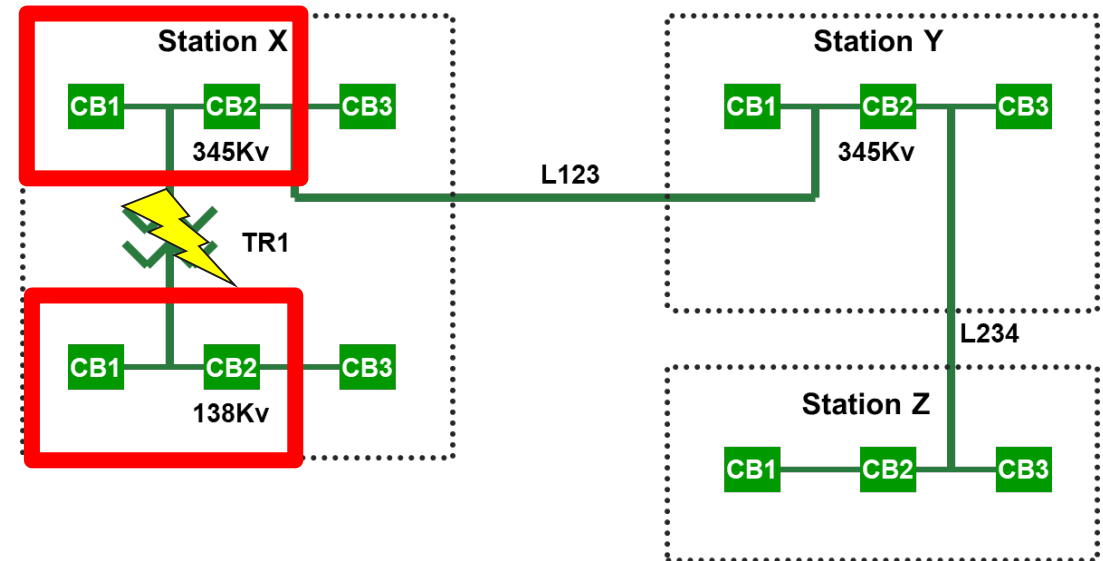
Event Summary

- Event – TR1 Tripped and Locked Out on March 8, 2006 at 14:30:10

  - 345Kv System 1 and 2 relays see fault

  - 138 Kv System 1 and 2 relays see fault

  - Video images of the event

  - One or more fault records

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Meta Data Template

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Example Faults

- TR1 Faults (normal clearing)
  - Station X 345KV, CB1 and CB2 open
  - Station X 138KV, CB1 and CB2 open
  - DFR Records (files) associated with both ends of TR1 need to be migrated to CM.
- Meta Data
  - TR1, 345Kv
  - Station X
  - Devices
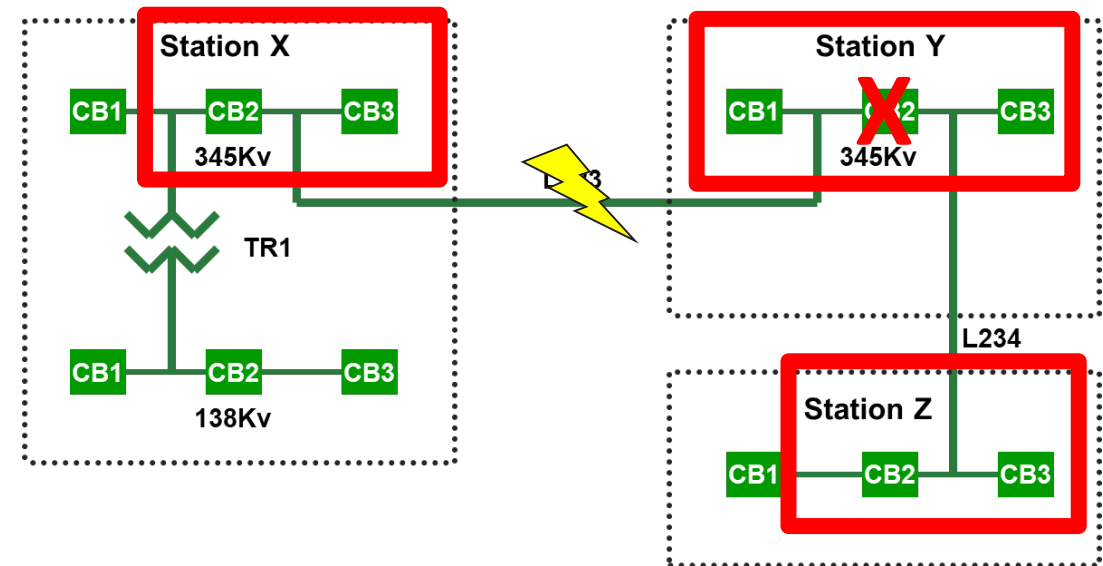   - Station X 345Kv, CB1, CB2
    - Station X 138Kv, CB1, CB2

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Example Faults

- ## Line 123 Faults (normal clearing)
  - Station X CB2 and CB3 open
  - Station Y CB1 and CB2 open
  - DFR Records (files) associated with both ends of Line 123 need to be migrated to Content Manager
- ## Meta Data
  - Line 123, 345Kv
  - Station X, Y
  - Devices
    - Station X CB2, CB3
    - Station Y CB1, CB2

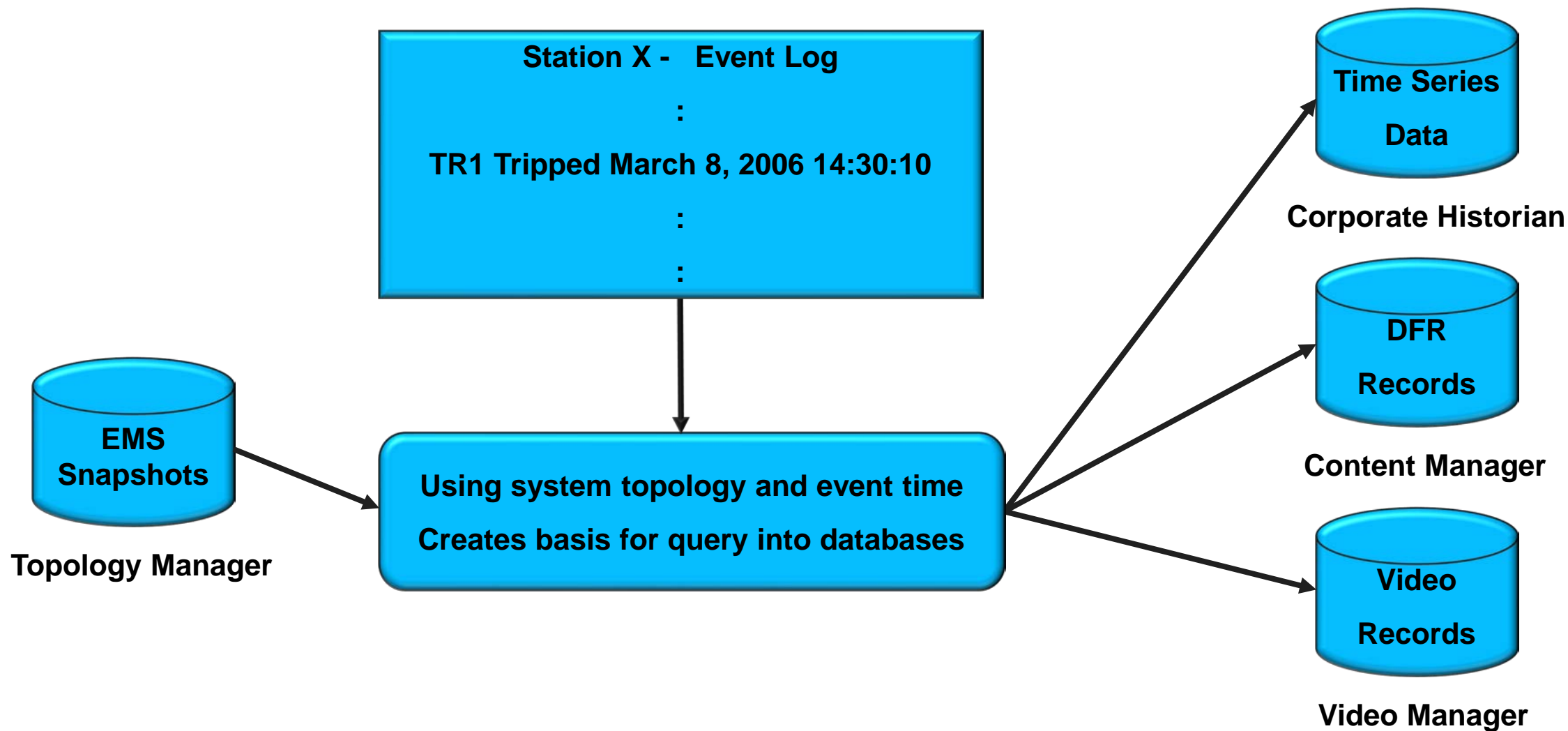EPRI | ELECTRIC POWER RESEARCH INSTITUTE
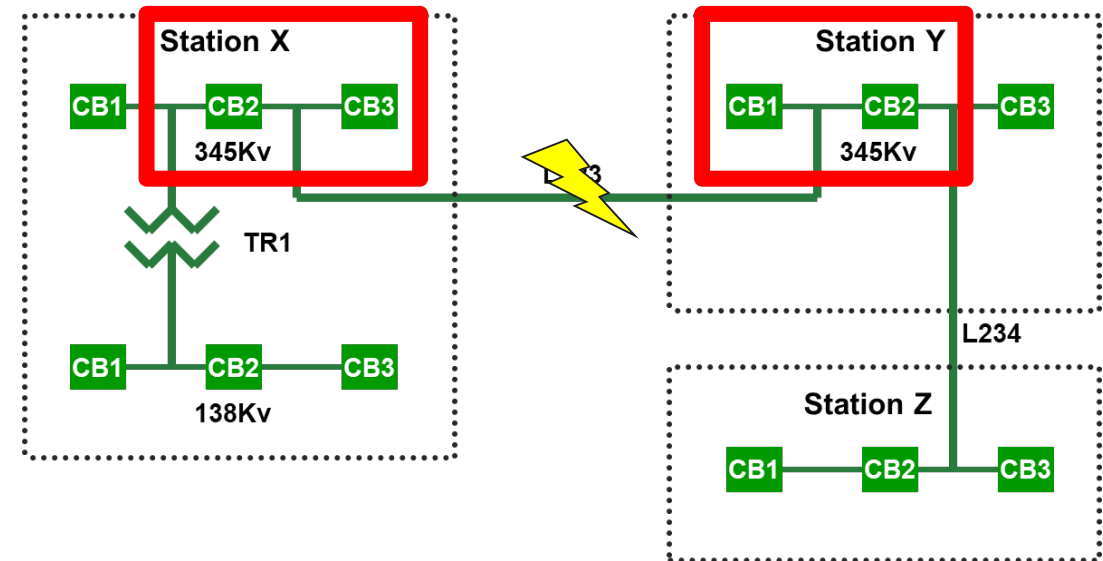
Example Faults

- Line 123 Faults (Breaker CB2 at Station Y Fails)
  - Station X CB2 and CB3 open
  - Station Y CB1 and CB2 and CB3 open
  - Station Z CB2 and CB3 open
  - DFR Records (files) associated with both ends of Line 123 need to be migrated to CM and also Station Z
- Meta Data
  - Line 123, 345Kv
  - Station X, Y, Z
  - Devices
    - Station X CB2, CB3
    - Station Y CB1, CB2, CB3
    - Station Z CB1, CB2

Connecting the Dots ....

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Event Details

Station X - Event Log

:

TR1 Tripped March 8, 2006 14:30:10

:

:

EMS Snapshots

Topology Manager

Using system topology and event time
Creates basis for query into databases

Time Series Data

Corporate Historian

DFR Records

Content Manager

Video Records

Video Manager

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Key Points

- Meta Data Tags can be auto created for events
- Events need to be defined
  - Relays can differentiate between event types
    - Open vs Close vs Trip
- Pointers (query) to relevant data can be determined using system topology database.
- Date and time stamps can be tricky at times such as around midnight
- Scope of event should initially be something like event node plus 2 nodes out.
- Scope would also be event time (t event) plus and minus a time window (t window)

- May need to provide for a manual trigger of data retrieval from substation to hosting center for recent events.
  - The scenario is one where an event happens right after the last poll to the substation. An event occurs and the data hasn't moved from the substation to hosting center yet.
- Process would allow for rapid retrieval of event info for analysis by utility staff
- Archiving could be based on whether or not the data is tied to an event.
- Need to allow for manual creation of Meta Data Tags of Meta Data Tags.
  - For example, Aug 14th Blackout Event would be a collection of smaller events that would be define by utility staff.

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