



Supply Chain and Asset Traceability for the Electric Grid (SCATE)

EPRI-IEEE Industry Connections Program

IEEE Transformer Committee (Oct 24, 2023)

The problem we are solving . . .

- Products are labelled with analogue markings that require interpretation and manual transcription (or manufacturer specific barcodes that may or may not contain useful information for the customer)
- Manufacturers deliver product data in a various non-structured formats that is difficult to access when needed (PDF, excel, paper)
- Data is manually copied and transferred from one system to another



How we propose to solve it . . .

A **Digital Thread** provides traceability data that seamlessly transfers from one phase of an asset's life to the next from design to decommissioning

Unique IDs that encode attribute data and enable traceability along the entire supply chain

Smart Tags that link the physical asset to its Unique ID and Digital Thread data

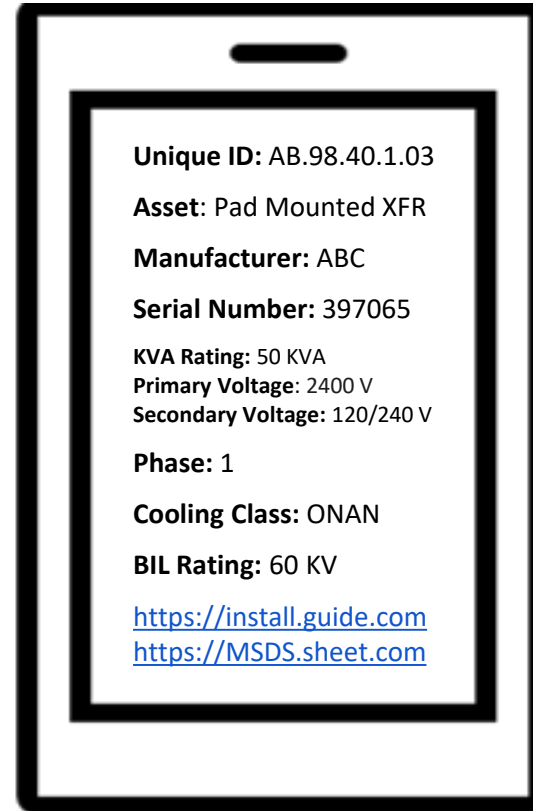
Linked Data is a supporting dataset linked to an asset through its Unique ID

Supply Chain and Asset Traceability for the Electric Grid (SCATE)

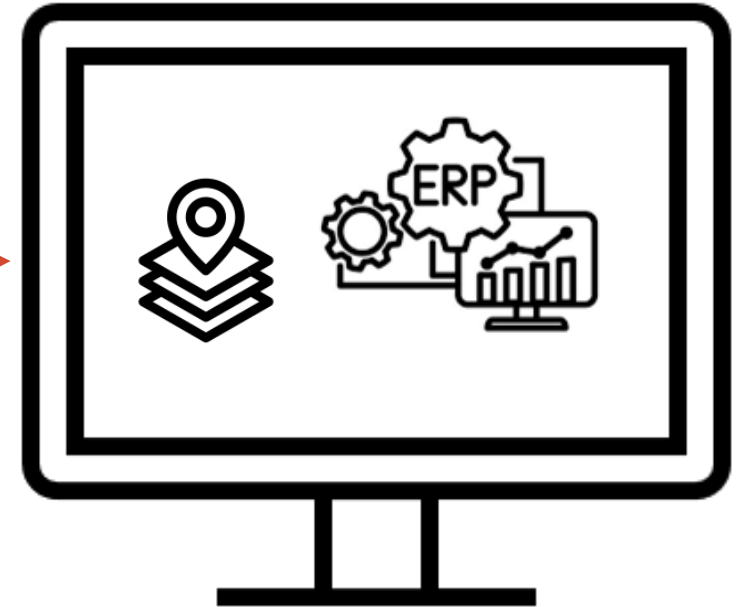
#1 - Manufacturer applies smart tag based on IEEE industry standard data model



#3 - Application decodes barcode into attributes for verification and digital as-building



#4 - Asset data automatically delivered to the utility's system of record to support asset management and analytics



#2 - Utility workers scan barcode in the warehouse or in the field with a mobile application



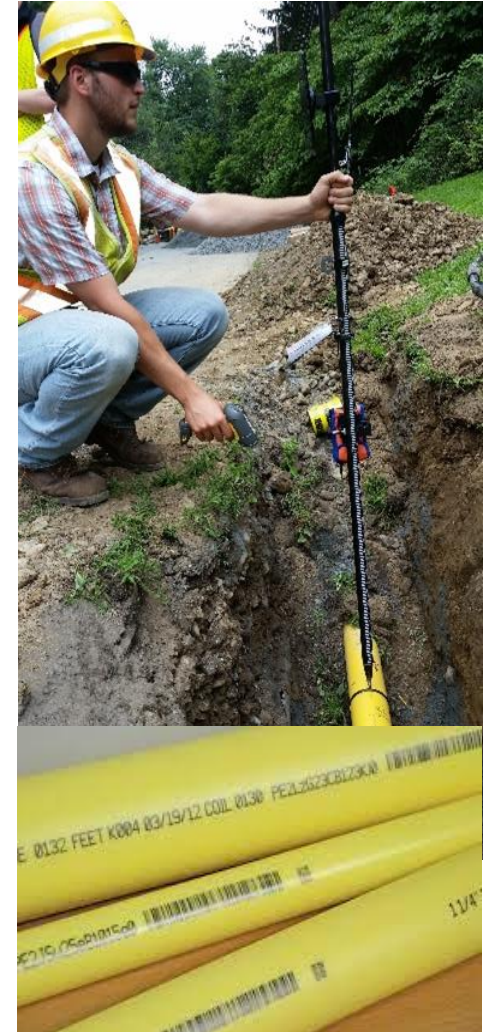
#5 - Field crews access the data for future O&M, recalls, and repairs

SCATE: EPRI-IEEE Industry Connections

- 30+ utilities and manufacturers
- Define use cases
- Prioritize asset types
- Asset-specific work groups to develop data models
- Implementation tests

Success Stories from Natural Gas

- ASTM F2897 provides a traceability code for asset type, manufacturer, date, size, material, and lot code
- Use cases include:
 - Regulatory compliance
 - Digital as-builting
 - Material verification
 - Automated project close-out
 - Automated GIS updating
- Full industry adoption in five years



High Priority Use Cases

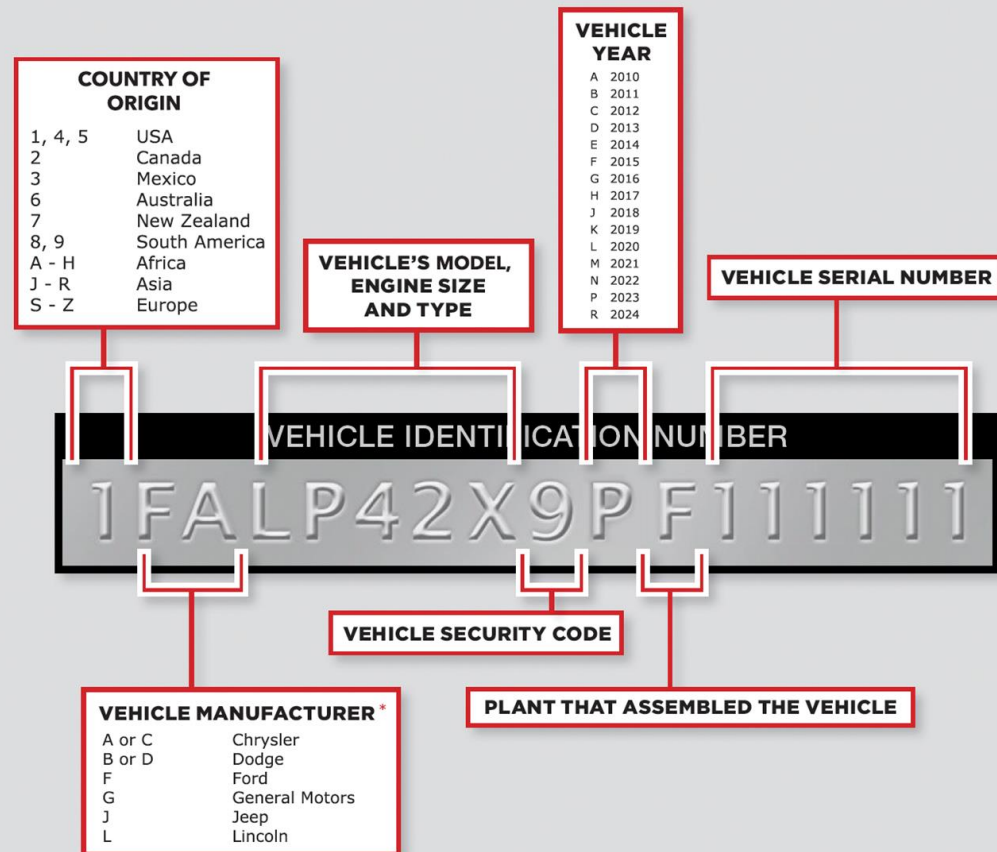
- Tendering and Ordering
- Intake Verification
- Mutual Aid
- Storm Restoration
- Digital As-Building
- Populating Systems of Record (GIS/ERP)
- Asset Management
- Manufacturer Recalls
- Performance Analytics
- End-of-Life: Disposal, Refurbishment, Recycling



Unique IDs

VINs for the Electric Grid

What's in a VIN?



* The 2nd character denotes vehicle manufacturer.
The 3rd character varies by manufacturer and can represent vehicle type or division.

SCATE Unique ID Structure

Unique ID = ABCD12345678AB012345679

↑
Designator ID

↓
Universal
Catalog ID

↑
Manufacturer ID

↓
Traceability ID

SCATE Universal Catalog ID

Universal Catalog ID defines an *asset type* at the catalog item level

- Minimum number of attributes required to define the *type of asset*
- But sufficient level of detail to enable the desired use cases
 - Asset exchange with other utilities
 - Standardized communication and ordering with suppliers
 - Asset verification (supply chain intake, construction)
 - Digital as-building (planned and emergencies)

Underground Cable Example

Universal Catalog ID =

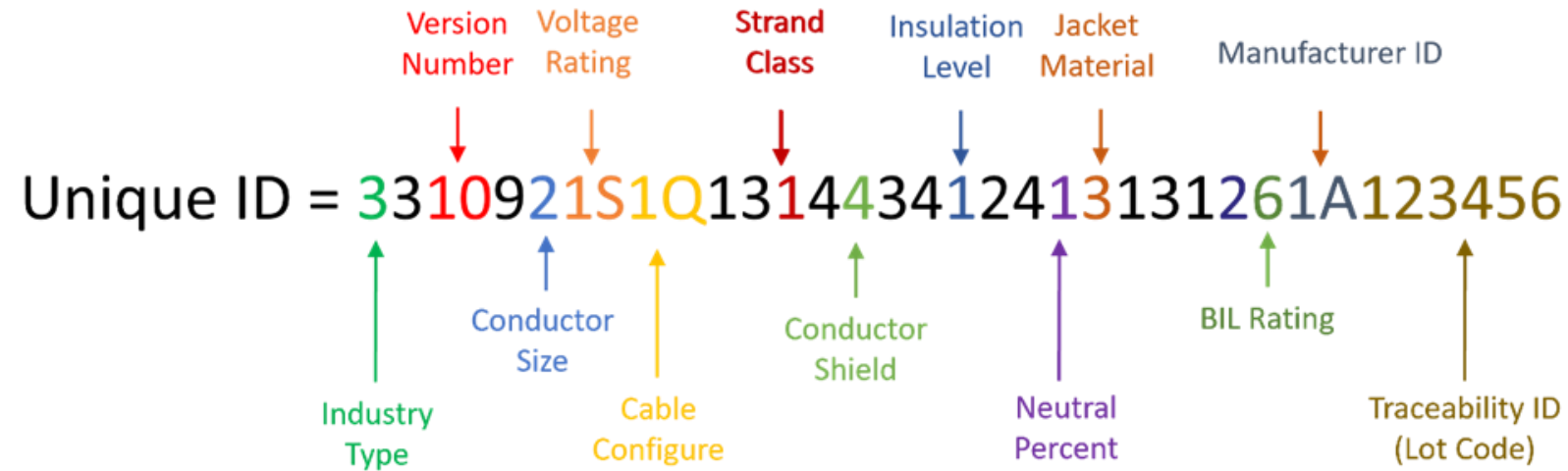
3310921S1Q13144341241313126

Unique ID =

3310921S1Q13144341241313126.1A.123456

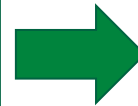
	Attribute	Value	Encoding
Designator	Industry	Electric	3
	Industry Sub-type	Distribution	3
	Version	1	10
	Asset Type	Cable/Wire	9
	Asset Sub-type	Underground - Medium Voltage	2
Universal Catalog ID	Conductor Size	500 kcmil	1S
	Voltage Rating	15 kV	1Q
	Cable Configuration	Single	1
	Phase Conductor Material	Copper - Uncoated	3
	Conductor Stranding - Class	Class B	1
	Conductor Stranding - Type	Reverse-lay Stranded Compressed	4
	Conductor Shield	Semi-conducting PE	4
	Insulation Material	ERP Class II	3
	Insulation Shield	Semi-conducting PE	4
	Insulation Level	100%	1
	Neutral Material	Bare Copper	2
	Neutral Configuration	LACT	4
	Neutral Percent	Full	1
	Jacket Material	LLDPE	3
	Moisture Blocked	Yes	1
	Installation Type	Direct Bury or Conduit	3
	Submersable	Yes	1
	Maximum Temperature	91-105 C	2
	BIL Rating	110 kV	6
Manufacturer ID	Manufacturer	ACME	1A
Traceability ID	Lot Code	123456	123456

Underground Cable Example



Smart Tag

Unique ID: 3310921S1Q13144341241313126.1A.123456
Asset: Medium Voltage Underground Distribution Cable
Conductor Size: 500 kcmil
Rating: 15 kV
Neutral: LACT
Manufacturer: ACME
Batch Code: 123456
CatID - Manufacturer: 72-1014
CatID - Customer: 1297564
Customer PO Number: 77-87345



Core Attributes

Conductor Size: 500 kcmil
Rating: 15 kV
Configuration: Single
Conductor Material: CU
Conductor Stranding - Class B
Conductor Type - Stranded Comp
Conductor Shield: Semi-cond PE
Insulation Level: 100%
Neutral: LACT
Insulation: EPR
Jacket Material: LLDPE
Manufacturer: ACME
Batch Code: 12345

Additional Attributes

CatID - Manufacturer: 72-1014
CatID - Customer: 1297564
Customer PO Number: 77-87345
Date of Manufacture: 1/1/2002
Country of Origin: USA
Reel ID: 12335
Diameter: 1387 mils
Conductor Strand Count: 19

Linked Data

<https://installation.guide>
<https://MSDS>
<https://disposal.guide>

Implementation

- Submission to IEEE for incorporation into an industry standard
- Applied by the manufacturers via barcode

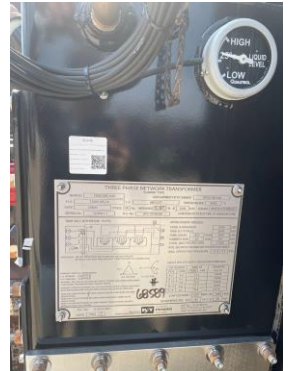
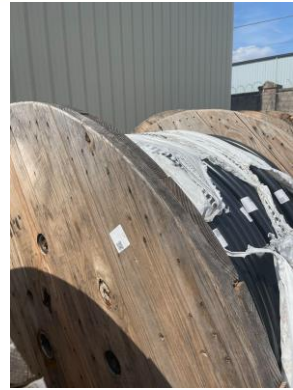
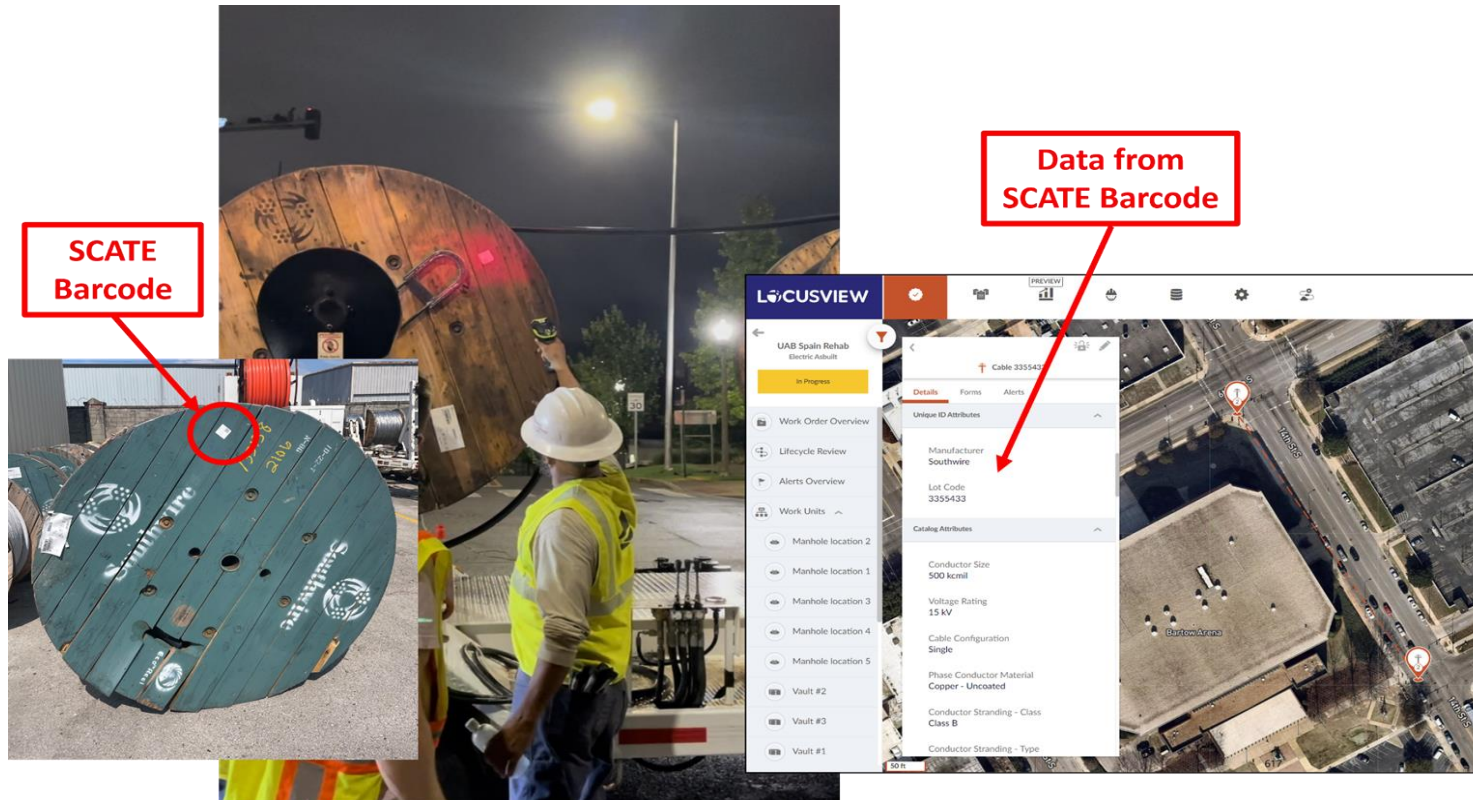
Unique ID = 3C1021151136133543120012345678

Version 1.0 (points to '1' in '1021')
 Single Phase (points to '1' in '1021')
 Secondary Voltage = 120 V (points to '1' in '1021')
 One Bushing (points to '1' in '1200')
 Serial Number (points to '0012345678')
 Transformer (points to '1021')
 Electric Grid Industry (points to '3C')
 60 kV BIL Rating (points to '1136')
 ONAN Cooling Class (points to '3354')
 ACME (points to '12')



Southern Pilot Project

- Network Underground System
- Network Transformer, Cable, TBODY Elbows, HBODY Splices



National Grid Pilot Project

- Pole Mount Transformers
- Pole Assembly Barcode
- Retired Transformers



End of Year Deliverables

- SCATE Specification for Unique IDs and Smart Tags for the following asset types:
 - Distribution transformers
 - Reclosers
 - Pad/vault switchgear
 - Poles
 - Cable and wire
 - Splices

Related Standards

- IEEE Std C57.12.35-2013 - IEEE Standard Bar Coding for Distribution Transformers and Step-Voltage Regulators
 - This standard provides a methodology to standardize the structure and content of the data in the barcodes. No attribute data is included in the barcode but instead uses a utility's catalog ID. The new proposed standard would eliminate the need to utilize a utility's catalog ID and would instead use an industry standard catalog ID with embedded attributes.
- IEC TC17- High voltage switchgear and controlgear data and properties for information exchange - Part 1: Catalogue data
 - This standard provides a standard data model for all switchgear catalog attribute data. This standard does not define the limited set of attributes required to define the object and it also does not include a methodology for creating a unique ID.
- IEC 61406-1 - Identification Link
 - This standard provides a methodology for applying a smart tag with a web-enabled unique ID. This standard does not provide a method to embed attributes into the unique ID and does not define any data model for attribute data.
- IEC 63365 - Industrial process measurement, control and automation – Digital nameplate
 - This standard provides a methodology for applying a smart tag that includes common nameplate data. This standard does not define the actual required nameplate attributes and allows manufacturers to provide any data in an unstructured format.

Proposed IEEE Standards

- T&D Committee - General Unique ID Framework
- Sub-Committees - Asset-specific Unique ID Models
 - Transformers, switchgear, insulated conductors . .

Next Steps

- Continue developing asset-specific unique ID data models
- Continue implementation testing with utilities and manufacturers
- Submit to IEEE for incorporation into an industry standard
- In parallel to standards development, start implementation based on IEEE-EPRI specification (transformers first?)
- Start discussions with utilities to incorporate requirements into purchasing specifications

Thanks!

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