What it Takes to Model a Wiring Solution

Technical Track – Technical Perspective for How S1000D Applies to Supply Chain/Component Suppliers

Mike Cook

S1000D User Forum 2012
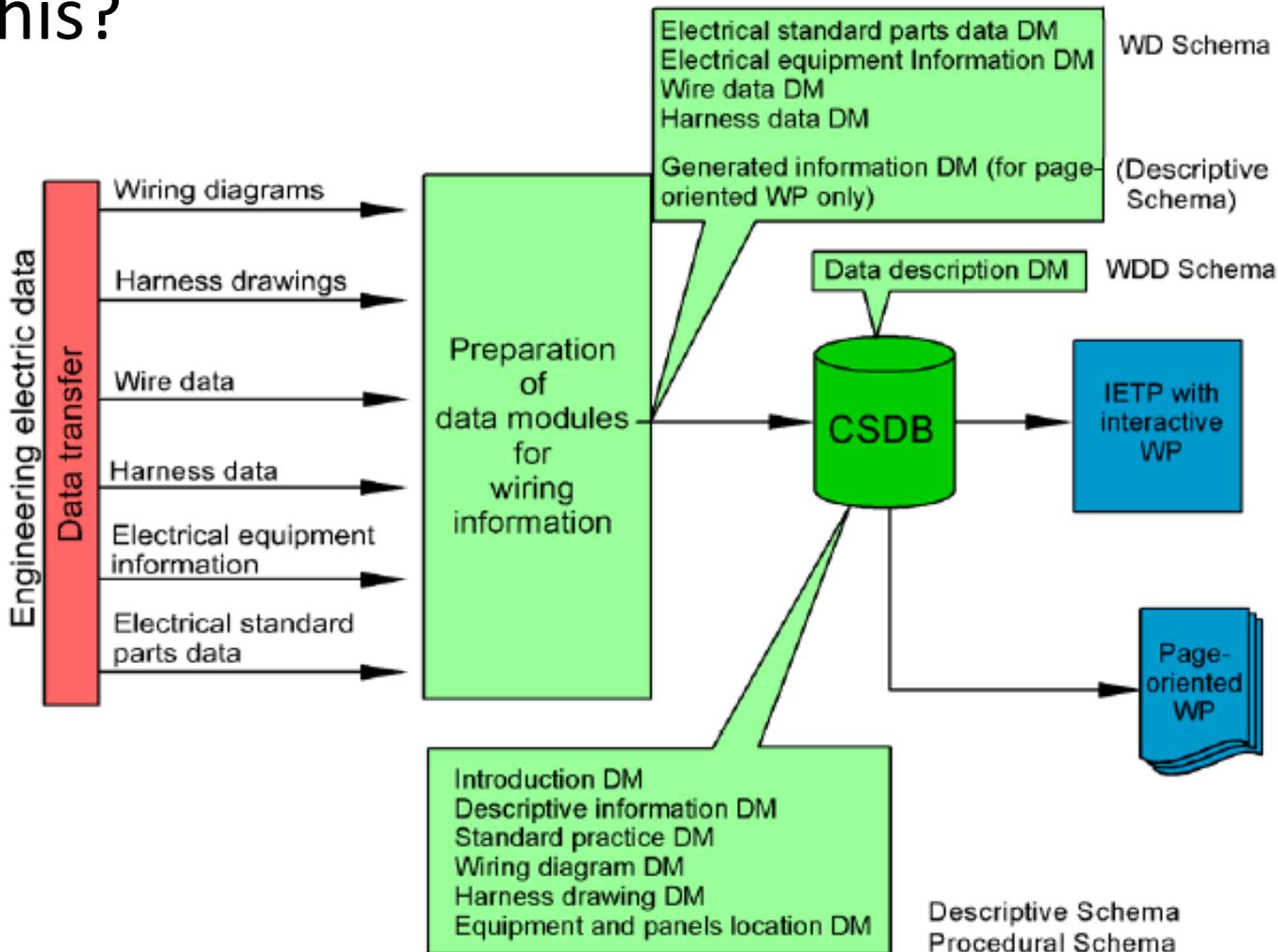*June 18-21, 2012*

Remember this?

This is close to what you're going to need. And this comes straight out of the specification.

The problem with it is, they don't tell you how all of this is meant to work.

Notice the Red block?

In the vernacular of old map makers:

Here there be Monsters!

Engineering electric data — Data transfer
- Wiring diagrams
- Harness drawings
- Wire data
- Harness data
- Electrical equipment information
- Electrical standard parts data

Preparation of data modules for wiring information

Electrical standard parts data DM
Electrical equipment Information DM
Wire data DM
Harness data DM — WD Schema

Generated information DM (for page-oriented WP only) — (Descriptive Schema)

Data description DM — WDD Schema

CSDB

IETP with interactive WP

Page-oriented WP

Introduction DM
Descriptive information DM
Standard practice DM
Wiring diagram DM
Harness drawing DM
Equipment and panels location DM — Descriptive Schema / Procedural Schema

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Almost All Wiring Solutions are Custom, and this is Why

- Most businesses have custom internal methods or custom software solutions for documenting the wiring for their products
- Wiring information is usually entered or managed by engineers not technical writers
- Wiring information is generally in a continuous state of flux
- Wiring data may be unique for specific customers
- What you need to track or manage may not be what your customers need
- Creating consumable schematics for paper is commonly a chore (difficult to fit onto a single page)
- Electronic solutions tend to not be in charted waters (realm of monsters)
- Usable electronic solutions tend to be top heavy or non-portable (may not fit into an IETP)

Wiring and Part Data – What are the Differences?

- One of the common issues first time navigators of the specification encounter is, wiring data starts to look a lot like part data
- Wiring data *IS* part data, examples:
  - Harnesses/Bundles – have part numbers
  - Connectors have part numbers
  - Clips to connect harnesses/wires/connectors to mounting/routing points are parts
- Wiring tends to *span* ZONES of a product (This is really important! – You don't want to be eaten by the dreaded zone monster.)
- Wiring harnesses generally have spare wires (are you carrying a spare fuselage with you all the time?)
- Wiring in some products can be very difficult to replace or are an integral part of a larger assembly – requiring both the wiring and the assembly to be replaced as a single unit
- Wiring can be very difficult to test

Can you Really Author by Hand?

- If you're documenting a very small product – it's possible

- If you're documenting something with more than 50 wires in it, you might not be able to manage the complexities of the configuration (50 wires, multiple connectors, multiple attach points, multiple pins in each connector, wire types, wire characteristics, colors, length, shielding, sheaths, etc)

- Authoring by hand implies you have no electronic schematic software or any engineering CAD/CAM systems with data you can exploit

- For the vast majority of products on the market that require the horsepower of S1000D, the answer is – No – you probably can't effectively hand author the wiring data modules that use the wrngdata.xsd schema.

- You are expected to hand author the descriptive data modules. However, it is possible to auto-generate skeleton files for many of the descriptive data modules so some of the information a technical writer will need is present when they go to author content. For example, almost all "diagram" related data modules must have a <figure> and <graphic> reference. You might as well boilerplate those into a wiring data module template for 051, 052, 054, and 055 information codes.

Data Re-use – Potential Export or Import Sources

- If you do have an engineering system with the wiring data stored in it, you can use it as a source for the majority of your wrngdata.xsd based data modules.

- Here there be Monsters! - Many of the schematic creation software programs allow you to export the content of a schematic to another data format. From that, you might be able to create a convertor to export the data into an S1000D wrngdata.xsd format.

- The truth is, if you can't convert the data from your engineering software, you're probably not going to be able to effectively and efficiently create a wiring data manual.

Integration Points Between Wiring and Parts Data

- When you create a wiring data manual solution, you're going to need to think about HOW all the information gets organized and how it's going to be used by an end user

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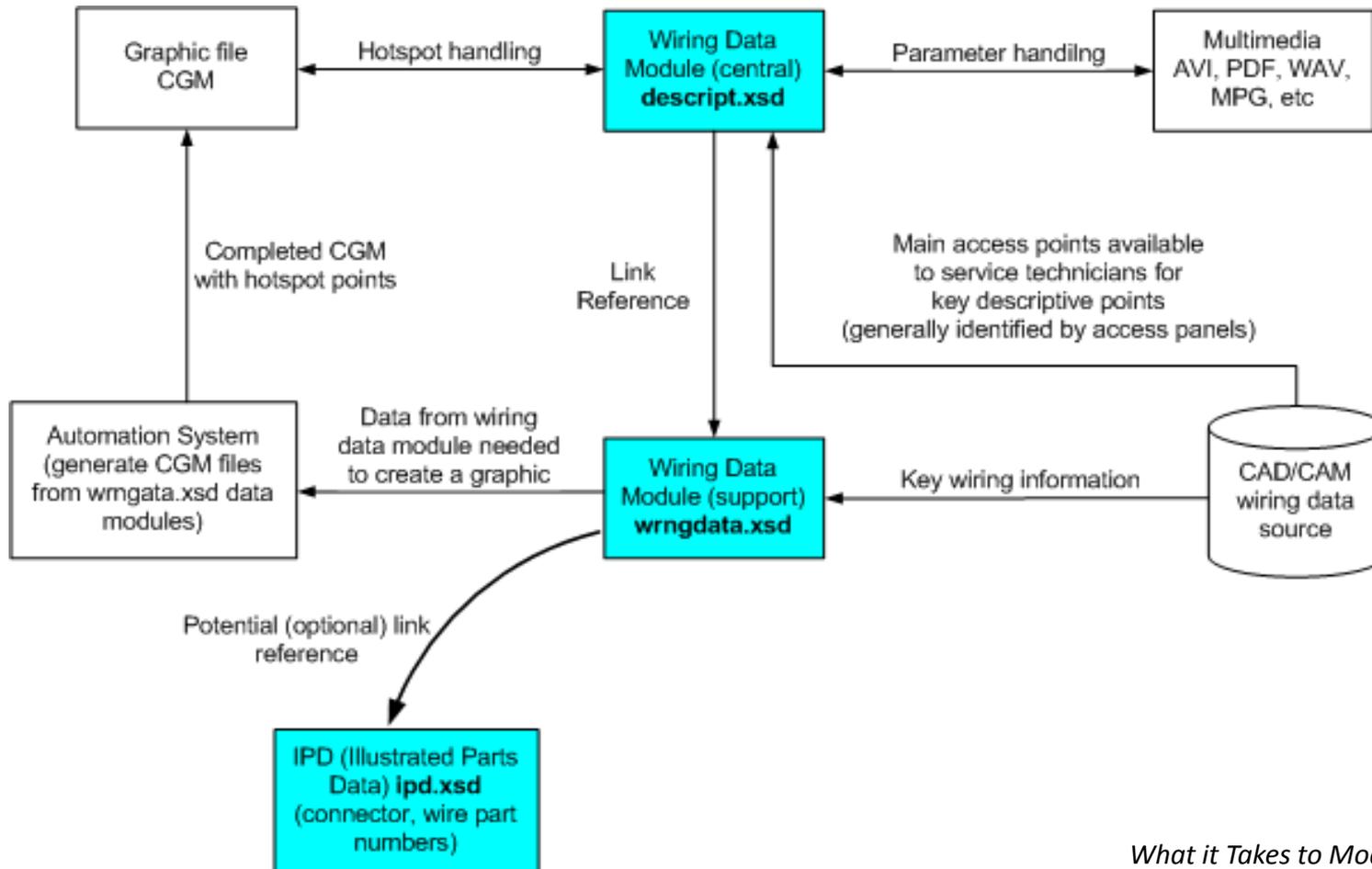
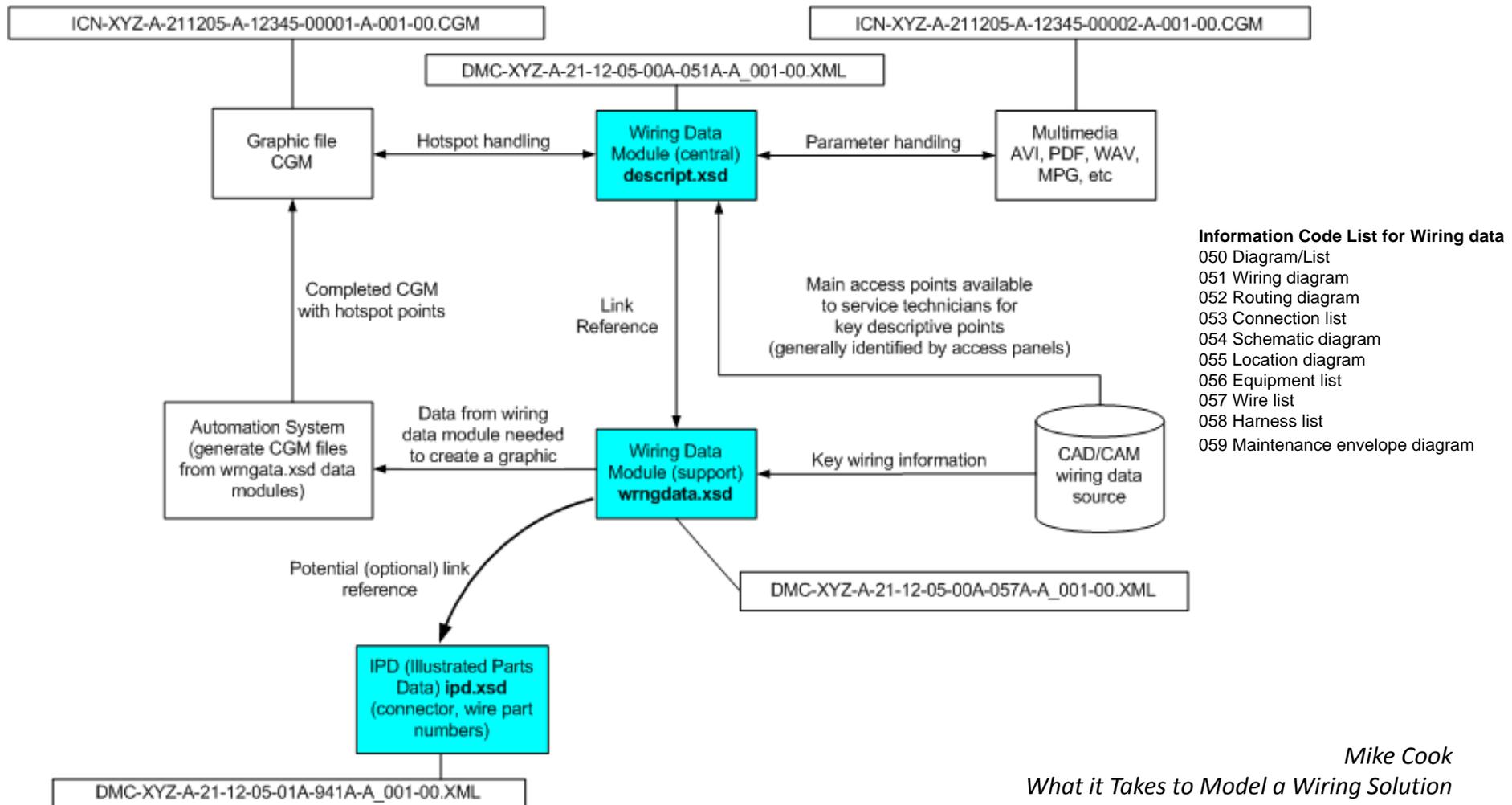# Integration Points Between Wiring and Parts Data (cont'd)

- Generally, it's a good idea to list the wiring data for a schematic when an end user clicks on a wire reference in a graphic (CGM)

- When the wire is selected, the equivalent of a bill of materials (BOM) for that wire – sourced from a wiring data module made from a wrngdata.xsd schema is presented.

- For each part number reference in the wrngdata.xsd based data module, a link into an ipd.xsd based part data module is not a bad idea

- Connectors, clips, and pass through points should also be accessible from a wrngdata.xsd based data module

- It is NOT advised to organize wires or harnesses by zone – since wires and harnesses usually span zones of a product (in other words, don't try to use a zonal SNS with wiring – and practically speaking it's not a good idea to use a zonal SNS for parts either)

Which Schemas Might You Use

- Depending on the type of wiring data manual you want to create, you're most likely going to use:
    - descript.xsd
    - wrngdata.xsd

- Optionally, you may need:
    - proced.xsd

        Note: If you create a Standard Wiring Practices Manual (SWPM) you'll most likely need the proced.xsd. Most servicing related processes are more commonly stored in a maintenance manual.

- Parts data modules based on the ipd.xsd are commonly present in the Illustrated Parts Catalog (IPC)

How to Organize a Potential Integrated Data Set

- For grins, let's add some data module and information control number codes to the previous diagram:

ICN-XYZ-A-211205-A-12345-00001-A-001-00.CGM

ICN-XYZ-A-211205-A-12345-00002-A-001-00.CGM

DMC-XYZ-A-21-12-05-00A-051A-A_001-00.XML

Graphic file CGM	Wiring Data Module (central) **descript.xsd**	Multimedia AVI, PDF, WAV, MPG, etc

Hotspot handling

Parameter handilng

Completed CGM with hotspot points

Link Reference

Main access points available to service technicians for key descriptive points (generally identified by access panels)

Automation System (generate CGM files from wrngata.xsd data modules)

Data from wiring data module needed to create a graphic

Wiring Data Module (support) **wrngdata.xsd**

Key wiring information

CAD/CAM wiring data source

Potential (optional) link reference

DMC-XYZ-A-21-12-05-00A-057A-A_001-00.XML

IPD (Illustrated Parts Data) **ipd.xsd** (connector, wire part numbers)

DMC-XYZ-A-21-12-05-01A-941A-A_001-00.XML

Information Code List for Wiring data
050 Diagram/List
051 Wiring diagram
052 Routing diagram
053 Connection list
054 Schematic diagram
055 Location diagram
056 Equipment list
057 Wire list
058 Harness list
059 Maintenance envelope diagram

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How to Organize a Potential Integrated Data Set (cont'd)

- 21 – Environmental Control
- 21-12 – Environmental Control, Compression
- 21-12-05 – Environmental Control, Compression, Actuator

XYZ-A-**21-12**-05-00A-**051**A-A Environmental Control, Compression, Actuator – Wiring diagram
XYZ-A-**21-12**-05-00A-**052**A-A Environmental Control, Compression, Actuator – Routing diagram
XYZ-A-**21-12**-05-00A-**057**A-A Environmental Control, Compression, Actuator – Wire list
XYZ-A-**21-12**-05-00A-**058**A-A Environmental Control, Compression, Actuator – Harness list
XYZ-A-**21-12**-05-00A-**520**A-A Environmental Control, Compression, Actuator – Remove procedure
XYZ-A-**21-12**-05-00A-**720**A-A Environmental Control, Compression, Actuator – Install procedure
XYZ-A-**21-12**-05-00A-**941**A-A Environmental Control, Compression, Actuator – Illustrated parts data

It is common to provide wiring information at a higher level and not have detail to the unit assembly within the TOC. For example, it is more likely for the content highlighted in pink to be referenced as:

XYZ-A-**21-1**0-00-00A-051A-A Environmental Control, Compression – Wiring diagram
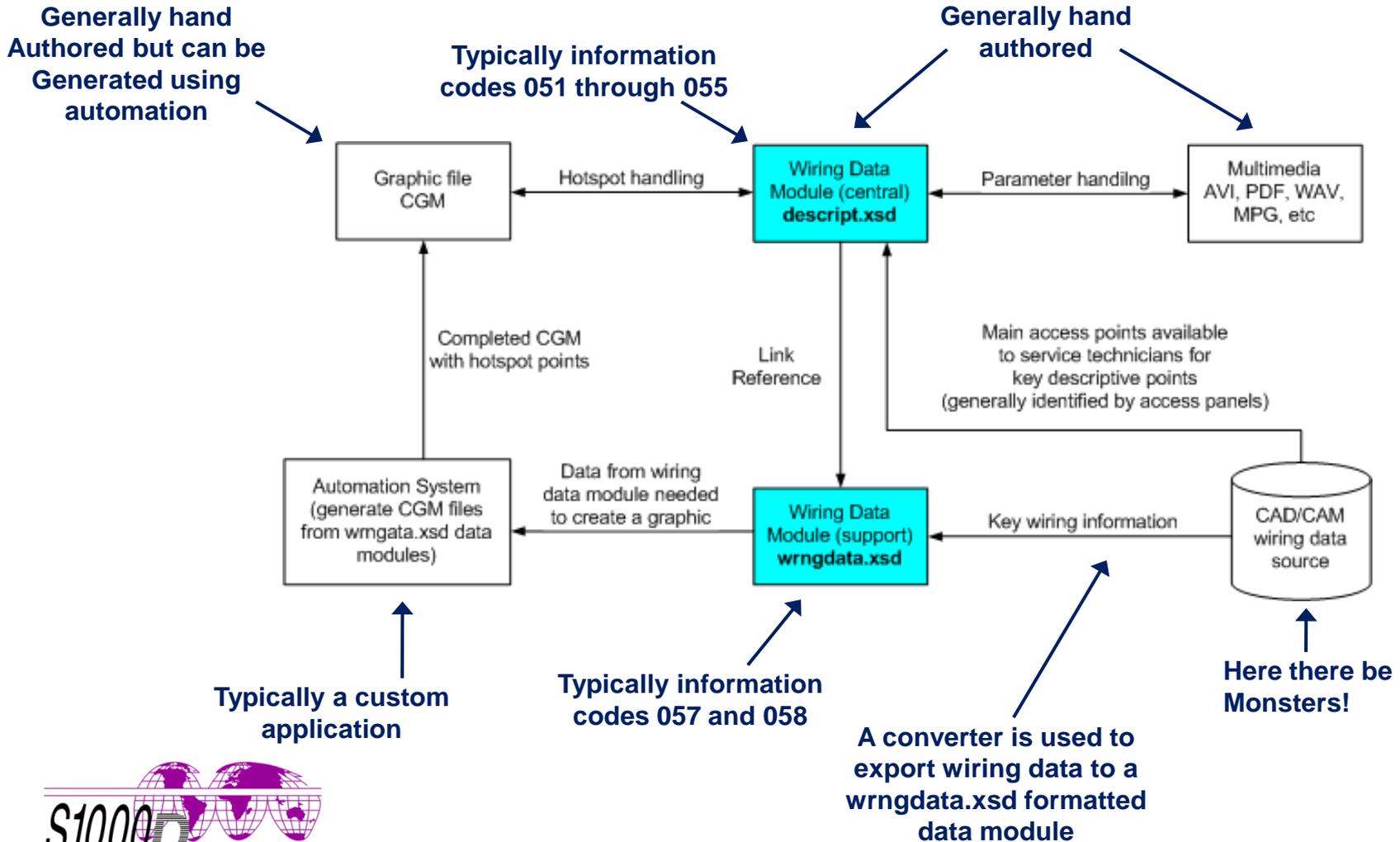XYZ-A-**21-1**0-00-00A-052A-A Environmental Control, Compression – Routing diagram
XYZ-A-**21-1**0-00-00A-057A-A Environmental Control, Compression – Wire list
XYZ-A-**21-1**0-00-00A-058A-A Environmental Control, Compression – Harness list

This is all dependent on what the system being documented is. You may need to provide wiring information to the Unit/Assembly level – especially if you're creating the CMM

How Graphics and Multimedia Integrate into a Wire Data Set

Generally hand Authored but can be Generated using automation

Typically information codes 051 through 055

Generally hand authored

Graphic file CGM

Hotspot handling

Wiring Data Module (central) **descript.xsd**

Parameter handilng

Multimedia AVI, PDF, WAV, MPG, etc

Completed CGM with hotspot points

Link Reference

Main access points available to service technicians for key descriptive points (generally identified by access panels)

Automation System (generate CGM files from wmgata.xsd data modules)

Data from wiring data module needed to create a graphic

Wiring Data Module (support) **wrngdata.xsd**

Key wiring information

CAD/CAM wiring data source

Typically a custom application

Typically information codes 057 and 058

A converter is used to export wiring data to a wrngdata.xsd formatted data module

Here there be Monsters!

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How Graphics and Multimedia Integrate into a Data Set (cont'd)

- A wiring diagram generally documents the wiring configuration for a "system", "sub system", "sub-sub-system" or "unit/assembly" (sound familiar?)

- However, a wiring diagram or schematic generally documents much more than just what's at a specific level in the TOC. It may be necessary to show the overall integration of a larger set of systems – thereby creating a different contextual representation of content than a physical breakdown

- It is up to the wiring gods to determine what level a wiring schematic or wiring diagram might need to be represented as in an IETP solution

- It is not uncommon for wiring data at the unit/assembly level of the TOC to be provided by the manufacturer of the Unit/Assembly (large products tend to be made up of sub systems from various other manufacturers) - in this case, wiring information might only be available from the vendor of that product – service manuals for that product will generally have wiring information and does not need to be replicated in your system unless a specific need for custom integration arises. In this case, you'll need to negotiate with the vendor for access to their wiring data.

Analysis of Your Customer's Needs

- If you're going to create a custom digital wiring solution for your customers, take into account the following issues:
  - Can it fit into an IETP or does it need to be a separate application?
  - If it's a separate application, is it accessible from the IETP?
  - Is the IETP accessible from the custom digital application?
  - Can you link to part data?
  - Does your customer have custom configurations of your product requiring the use of applicability?
  - Does your solution solve a customer's problem?
  - Does the solution make it easier or faster for your customer to do work?
  - Can your solution survive an audit?
  - Will your solution use non-standard drivers or software requiring licenses (may be a problem for military based solutions)

Where Angels Fear to Tread

- In the overall scheme of solution options, there are areas where life can get complex very quickly. Of all the areas you should be concerned about, the following four are important:
- Zones
  - Use of zonal SNS WILL create havoc (talk about monsters! This can be very hard to recover from if you do not understand the implications a zonal SNS will create for configurations of your project data and subsequent recycling of content)
- LSAR
  - Logistical Support Analysis – a realm of parts meets procedural data modules. Because wiring is also a closely tied type of part, LSAR data may affect the procedural data modules you create. Links from procedural data modules to wiring data modules may need to be closely monitored if an LSAR system is used to update part/wiring data.
- Multimedia
  - Due to the complexity of multimedia solutions, a change in the configuration of a product generally invalidates the data in multimedia solutions. In some cases, generic instances of wiring data when present in multimedia solutions may be necessary since it may be almost impossible for the creators of multimedia data to keep up with changes.
- Dynamic Wiring Solutions
  - If used, generally, this is the most effective way of keeping up with the engineering/configuration changes of a product – when driven from the source CAD/CAM engineering data. However, this tends to be a costly method and can increase overall costs of an automated wiring data solution. Long term though, this may be the best approach since it can be managed through automation.

Pulling it Together to Make a Coherent Solution You Can Publish

- A coherent solution can take many forms – this is just a generic view

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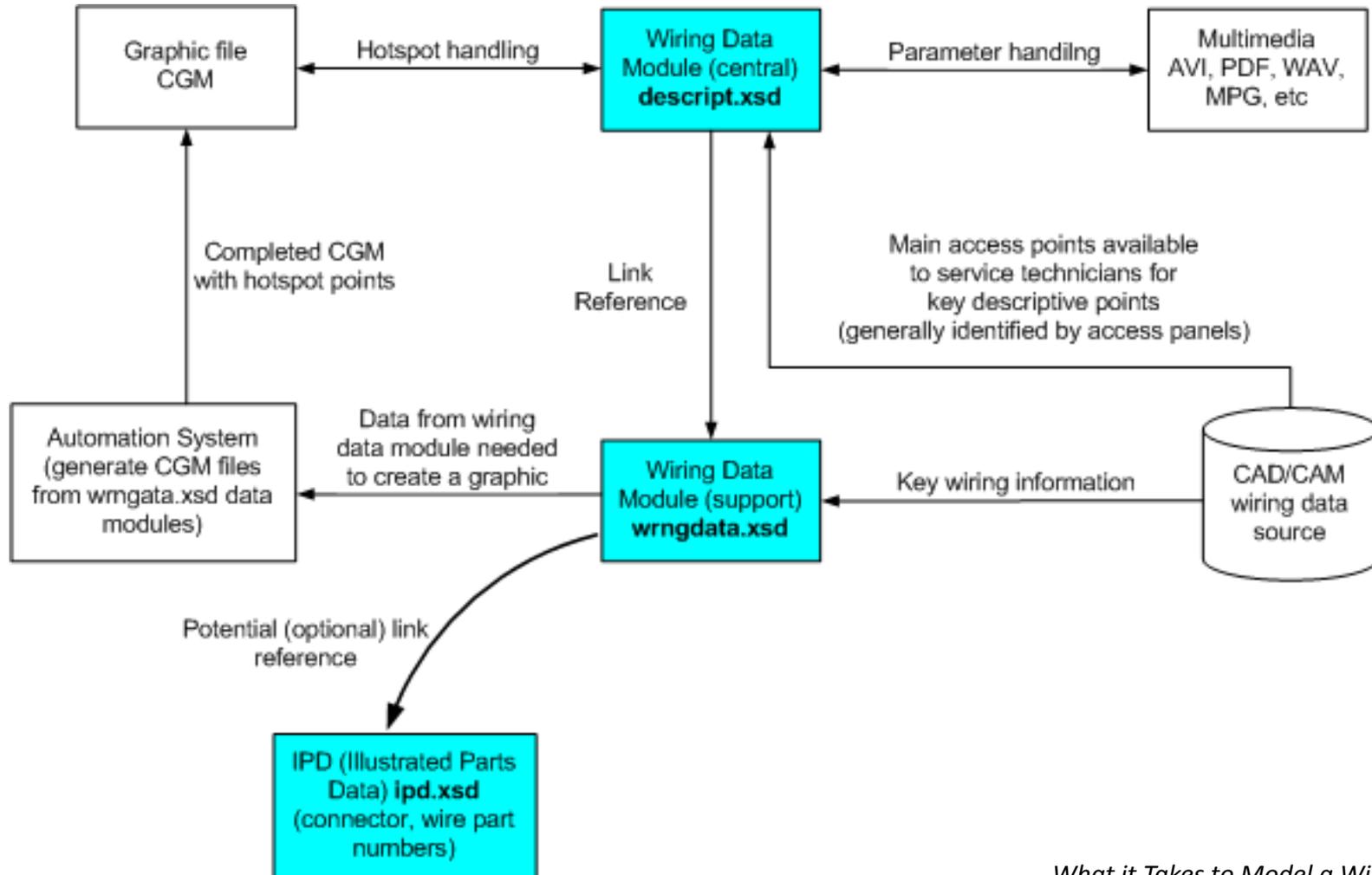
Pulling it Together to Make a Coherent Solution You Can Publish (cont'd)

- You'll need to identify the hierarchy of how the various wiring data modules call into each other. Here's an example. If you want to have the harness list be the master list of all wires (for the equivalent of a work breakdown structure (physical)) you could use something like what is depicted here. This example is just to give you an idea of what is possible.

- In many cases, service techs can only get at the wiring data through a procedural data module simply because it is expected they would have no need to navigate the wiring data in an ad-hoc manner. But that's up to you. There is no rule governing how you should reveal wiring data. Do what makes sense for your project.

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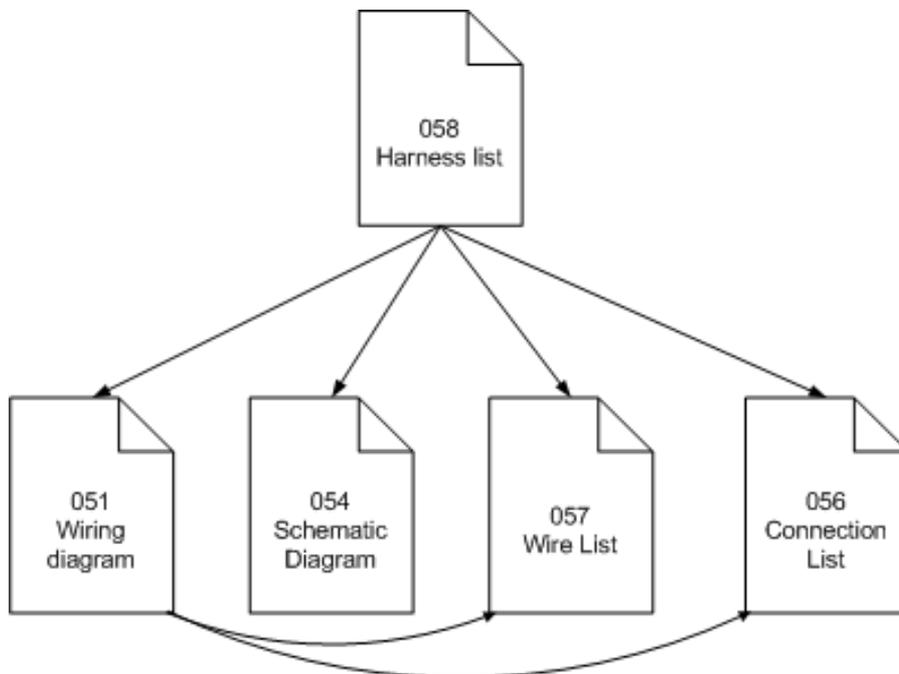
Integrating a Solution into the Supply Chain

- Providing you keep track of where all the wiring information came from, part data, and connectors, you should be able to identify the necessary information for ordering parts.

- If forethought is put into the design effort of your IETP solution, information needed by a technician or engineer can be copied from the source data for use in an ordering system. Therefore, supplier information should be available (when possible) as part of a wrngdata.xsd data module – or if a link is available to an ipd.xsd data module, the supplier information and part information should be available too.

- Depending on the solution, if your customer has specific ordering needs, it might not be a bad idea to provide the equivalent of a generic order form so an end user can print out a part order form, or submit the order form to a procurement agent.