

Introducing Capital[®] HarnessXC[™]

The Newest Member of the CHS Family

Embargoed Until October 16, 2006

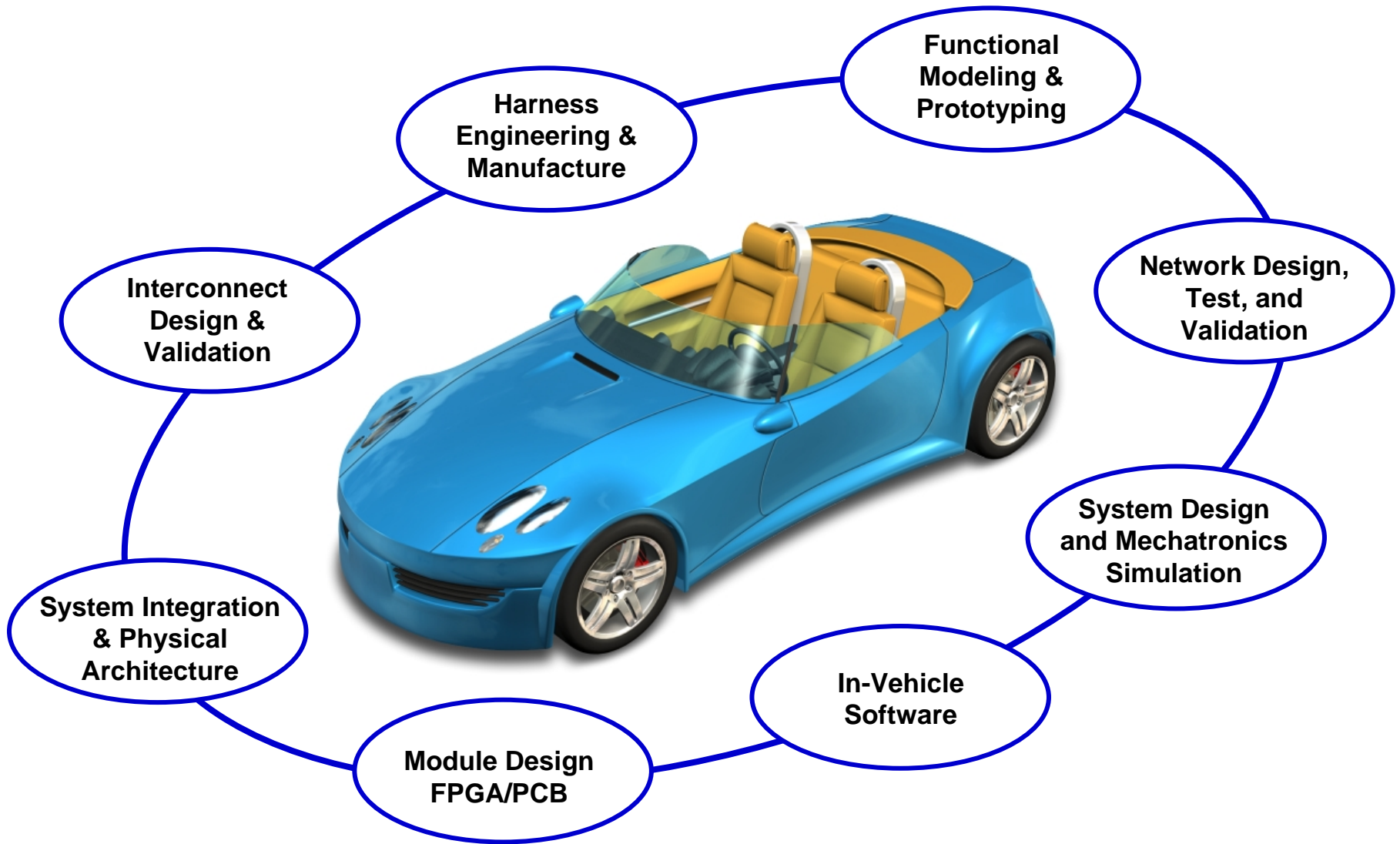
Mentor Graphics
Integrated Electrical Systems Division

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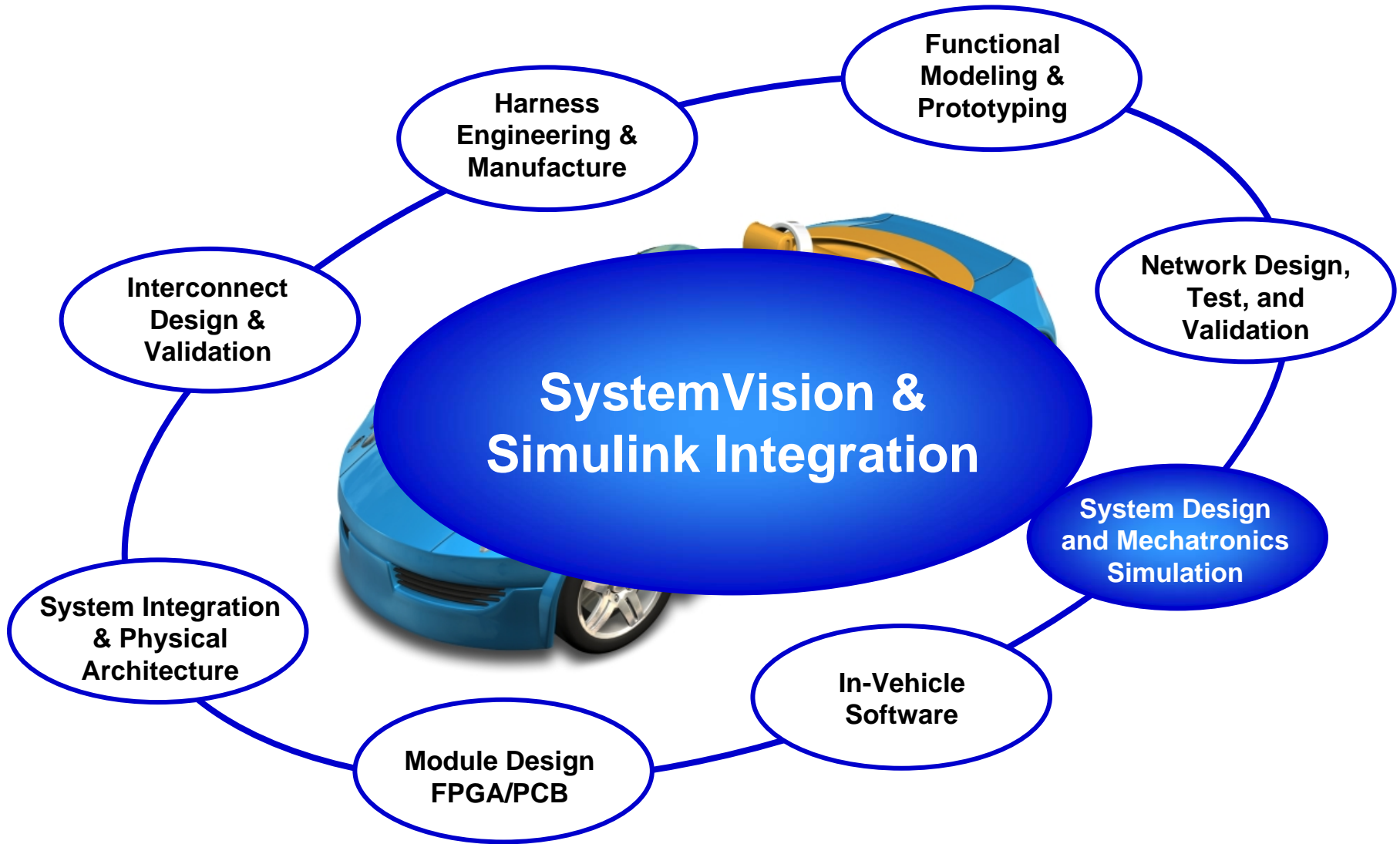
Agenda

- **Mentor Graphics automotive strategy update**
- **CHS overview**
- **Wire harness design process**
- **New product: Capital HarnessXC**

Mentor is Uniquely Positioned



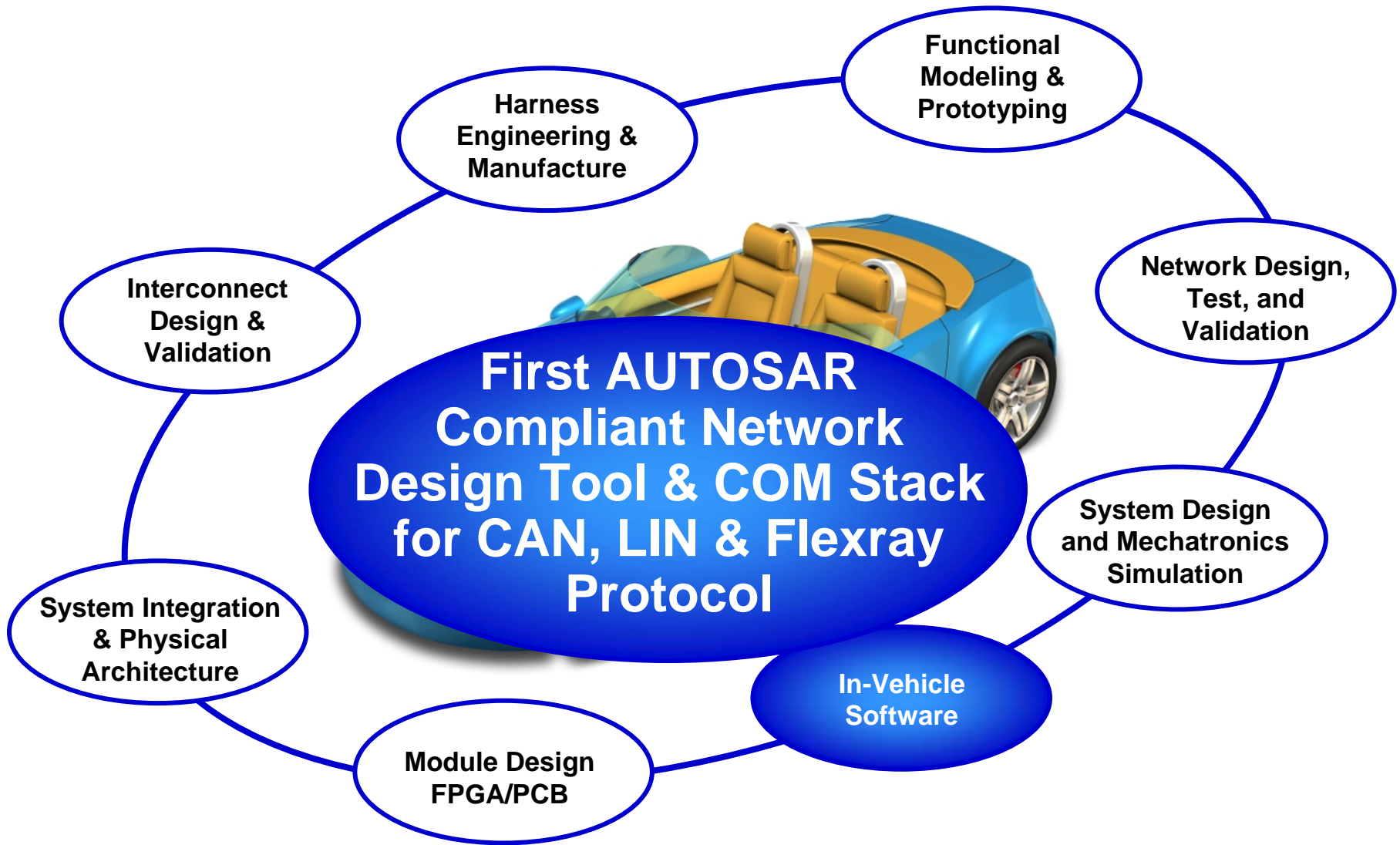
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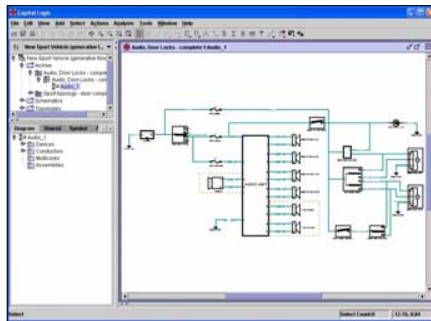


CHS Overview

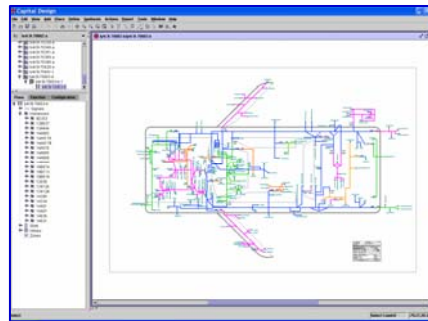
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Capital Harness Systems (CHS)

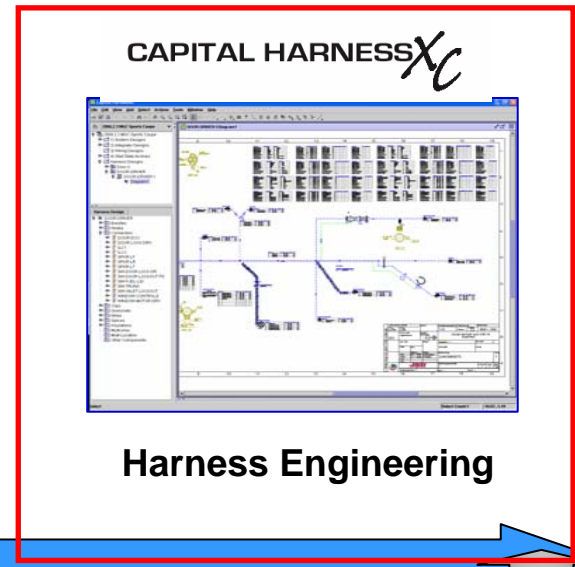
- **What:** integrated software suite for electrical system design
 - Transportation platforms: automotive, aerospace, rail
- **Purpose:** reduce design, manufacturing and warranty costs associated with vehicle electrical systems
- **Covers extended flow**



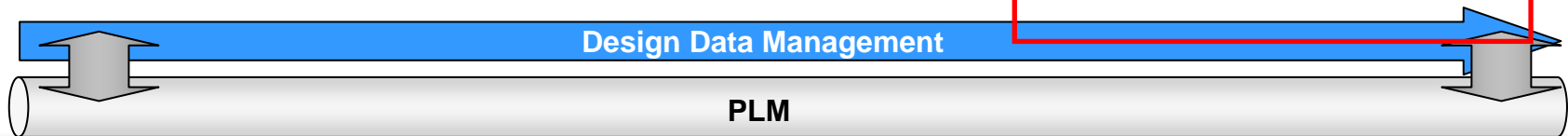
System Design



System Integration



Harness Engineering



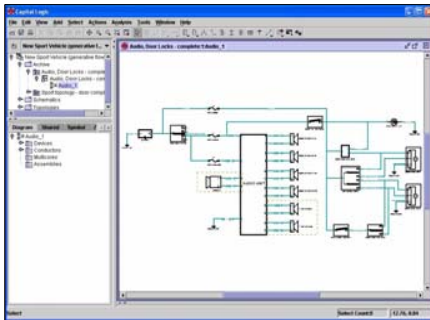
CHS seeks to mend a largely broken flow

Very little automation support for the physical design process

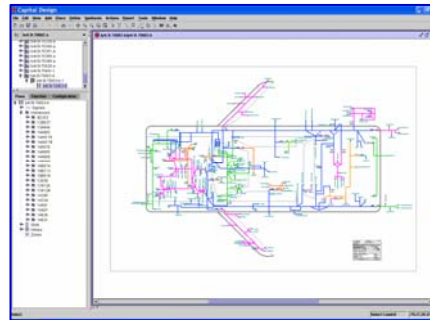
- Integration of logical systems into the vehicle & the creation of the electrical design system (EDS) is a largely manual task with little design automation, simulation or verification
- Work is drawing focused with significant waste of engineering talent

System tools are disparate

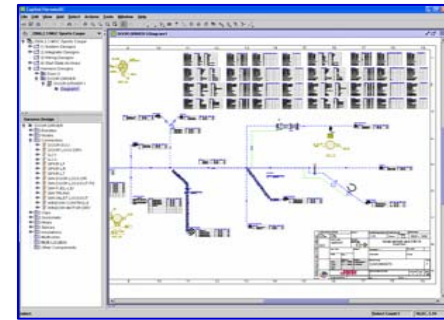
- Systems are created using many disconnected tools & vendors: consolidation and efficient re-use is hard



System design



System integration



Harness engineering

Design data management

Electrical design data is not managed as a flow

- Various stages in the flow use disparate tools from multiple providers: severe disconnects appear at many key design interfaces
- Data enrichment is captured and change managed in an ad-hoc way

Service groups are underserved

- Today's technology feeds service groups poorly
- New capabilities are needed to integrate views and diagnostics support

CHS Products

Share Common Data Repository

**Enterprise Access to
Designs and Design Data**

Custom Reports and Diagram Synthesis

Enterprise Integration

Data Integration with Other Systems

Harness Manufacturing

Factory Utilization of Design Data

Logical Systems Design

Connectivity of all Involved
Systems



Harness Engineering
Design Completion,
MBOM Creation and Costing

Physical Implementation
Electrical Distribution System
(Wiring)

Embedded Simulation and Analysis

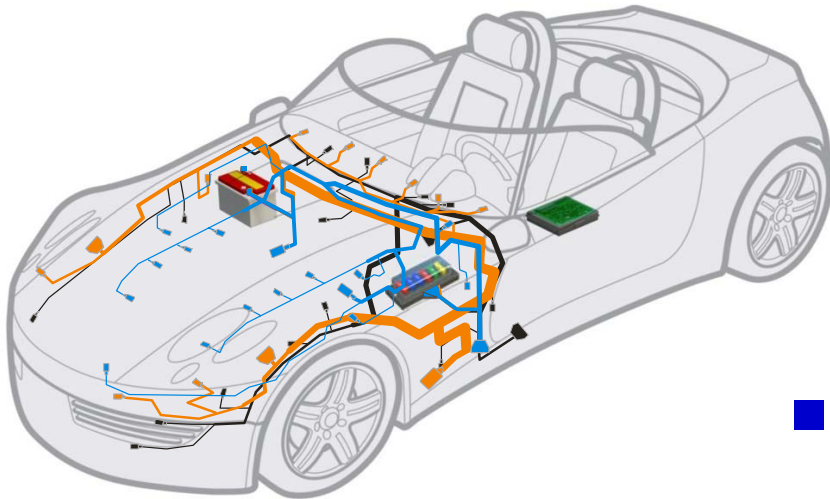
Decision Support, Design Validation
and Certification

Capital[®] HarnessXC[™]

Wire Harness Design Process

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Wire Harness Engineering Process

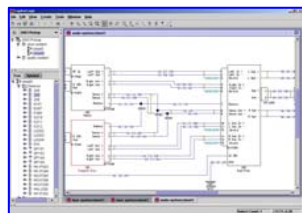


- **Target: manufacturable wire harness design**
 - Meets design requirements
 - Fully specified (100% MBOM)
 - Optimized and validated for manufacture
 - Documented

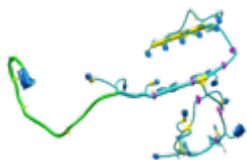
- **Wire harness = complex assembly of components**
 - May be thousands of components
 - May be hundreds of configurations for each harness (“derivatives”)

Wire Harness Engineering Process

Inputs



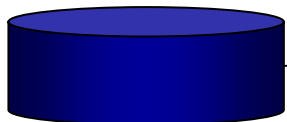
① Wiring Data



② Mechanical Data

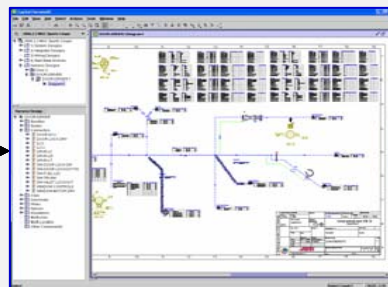


③ Configuration Data



④ Component Data

Engineering

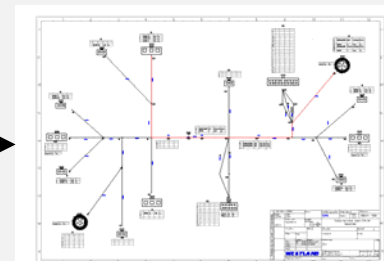


- Design embellishment
- Automated engineering

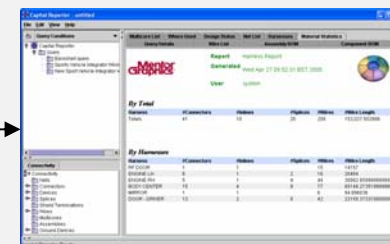
Value-add

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Outputs



① Engineering Drawings

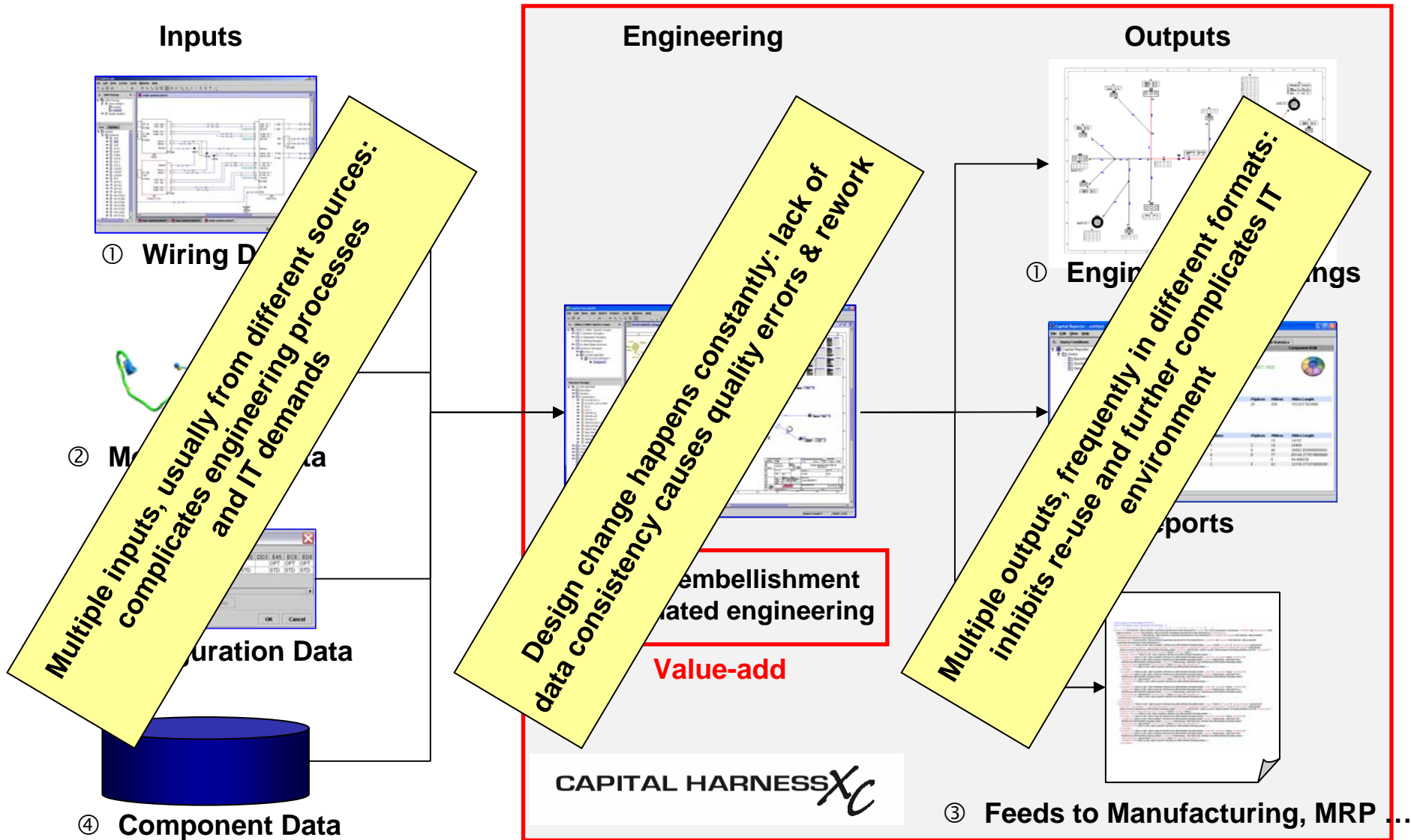


② Reports



③ Feeds to Manufacturing, MRP ...

Sources of Harness Design Cost



Productivity Issues

- **20% of engineering time is spent originating designs**
80% of engineering time is spent changing designs

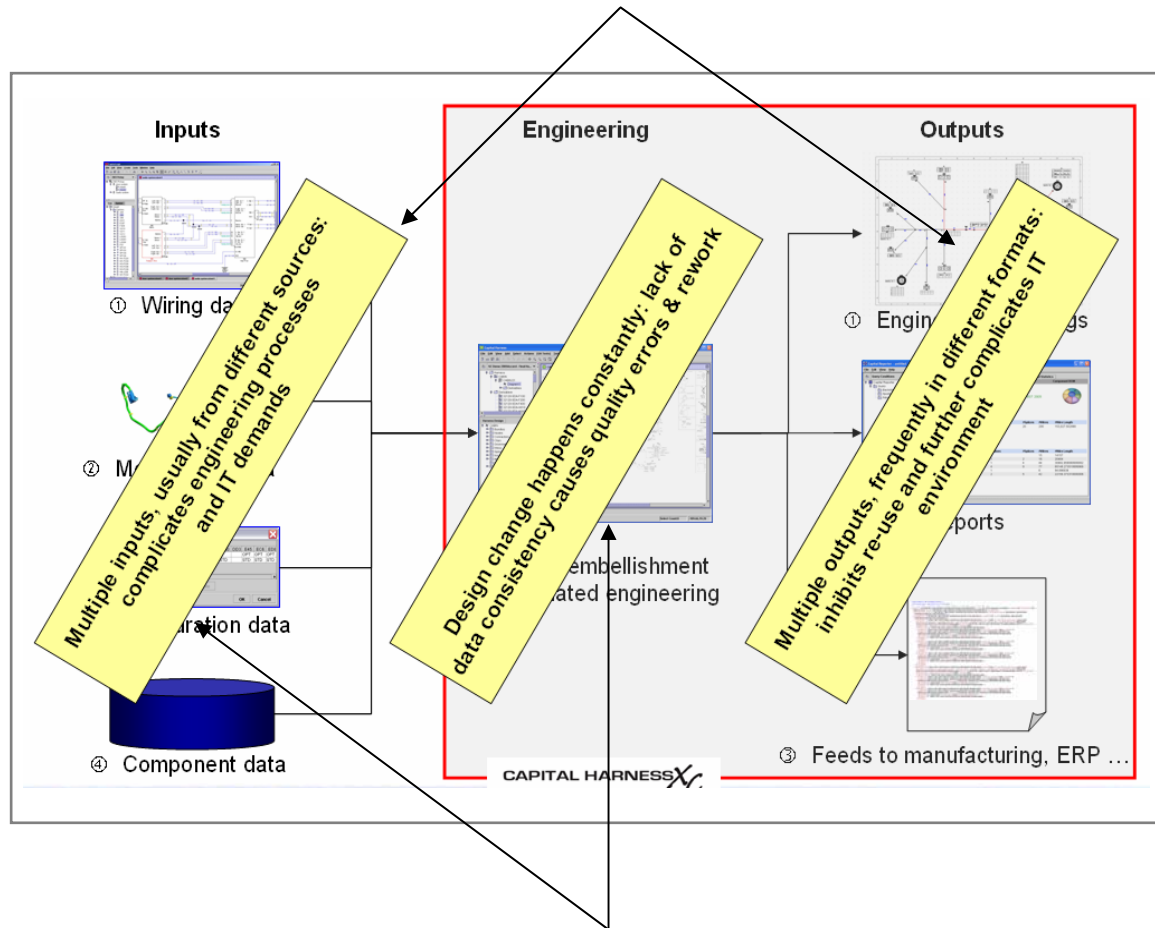
- **30% of engineering time is spent re-drawing diagrams**
 - Re-drawing in response to design change
 - Re-drawing to different graphical format

“90% of our engineers’ time is spent doing validation, not creative design work...”

*Head of E / E design,
Automotive OEM*

Addressing Sources of Harness Design Cost

Support for common tools & processes



Support for multi-source design change

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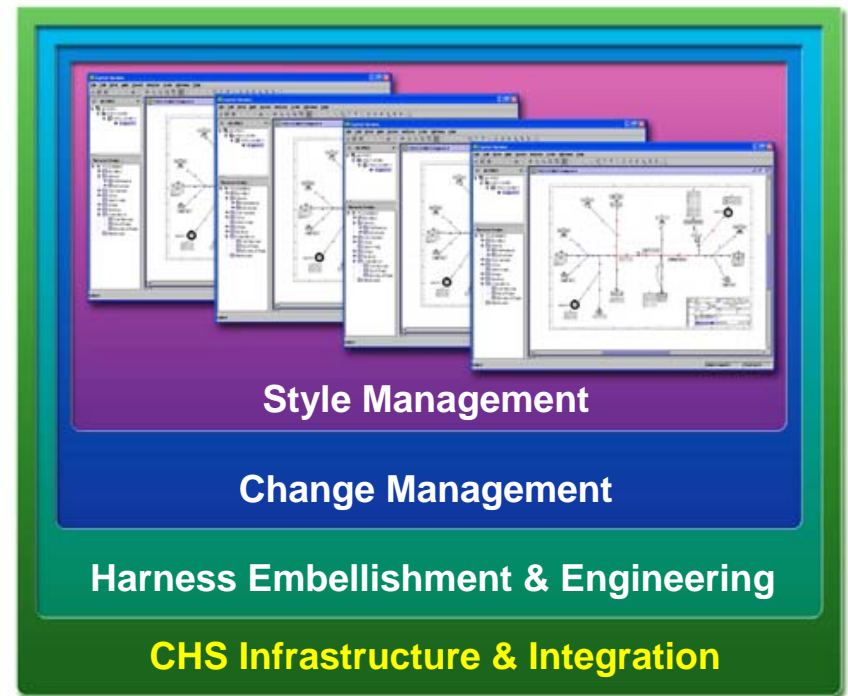
Introduction

Key Technologies Addressing Design Cost

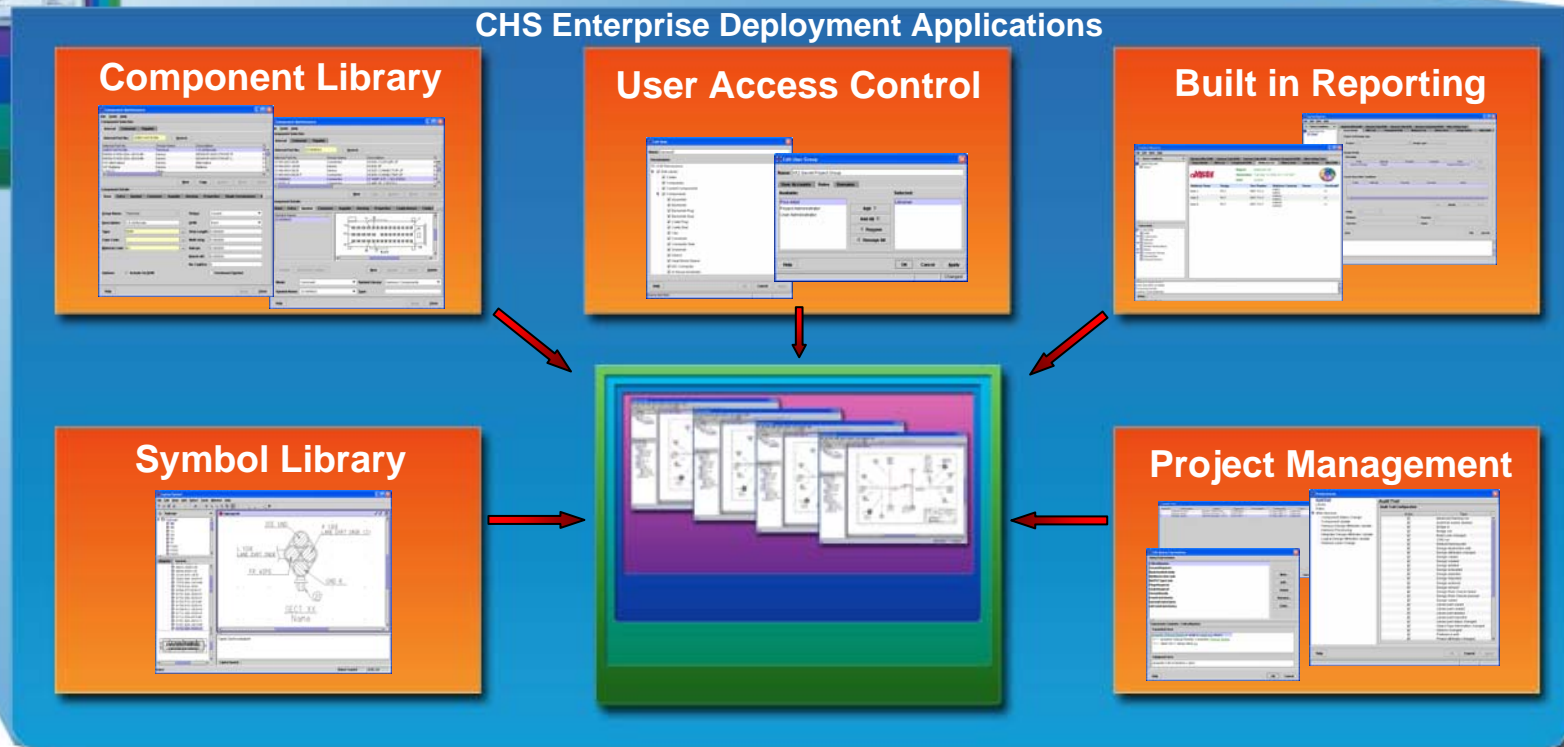
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Capital HarnessXC

- **Capital HarnessXC: a new harness design tool that addresses key industry issues**
 - Inefficient resource deployment & high IT costs caused by disparate tools & processes
 - Wasted time and design errors caused by poor management of design change
- **Key new technologies**
 - Data-driven graphical styling
 - Configurable design change rules
- **Rich design embellishment & automated engineering**
- **Core CHS product**
 - Seamless integration with other CHS design tools
 - Powerful data management & integration infrastructure



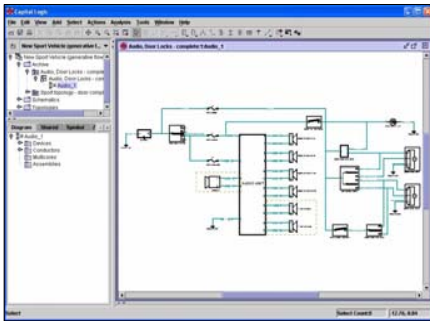
Leveraging the Power of CHS



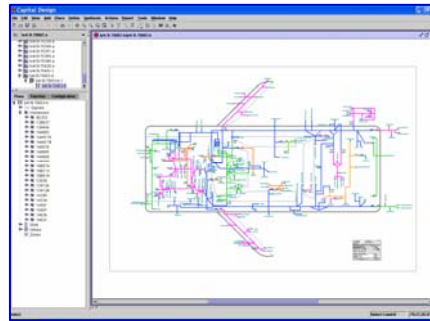
- **Capital HarnessXC ships with the applications needed for enterprise deployment**

Leveraging the Power of CHS – Multiple Inputs

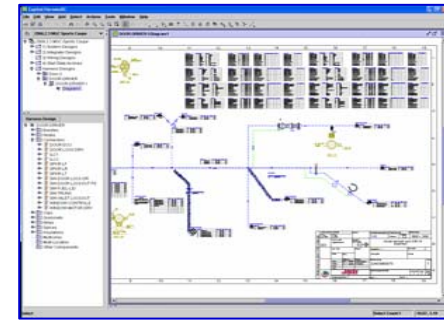
- **Capital Logic / Capital Integrator: seamless integration**
 - Common object model and project management infrastructure



Capital Logic



Capital Integrator



Capital HarnessXC

Design data management

- **Neutral data input format examples:**
 - **Harness XML and Project XML: native CHS formats**
 - **Entry points for component library data, configuration logic ...**
 - **DSI: widely used, from previous Mentor Graphics product ***
 - **KBL: emerging German harness design data standard ***

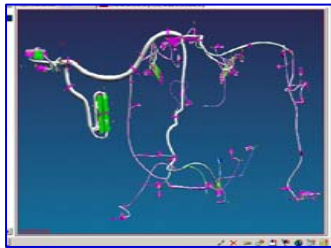


** Available May 2007*

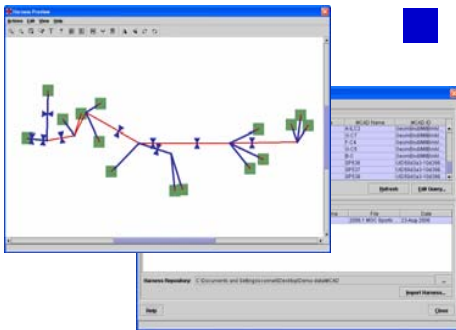
Leveraging the Power of CHS – MCAD Input

- Uses CHS plug-and-socket integration architecture

—Flexible: easy to add new MCAD integrations

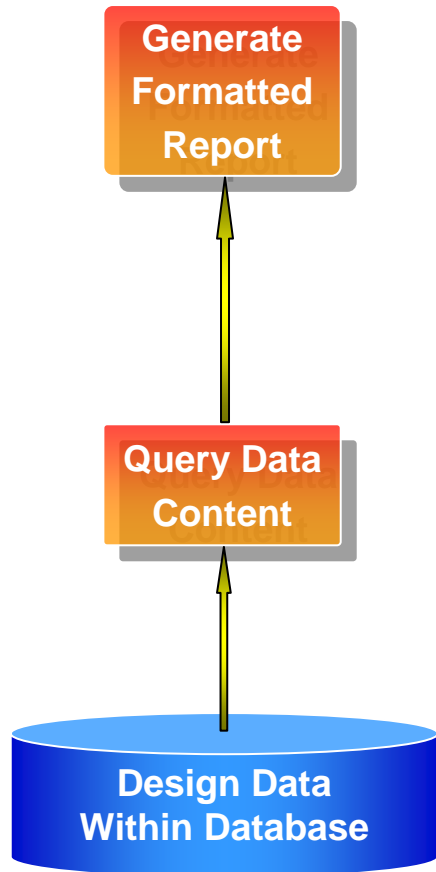


- Standard integrations with CATIA V5, CATIA V4, UGS NX and I-deas



- 3D → 2D and change reconciliation technologies

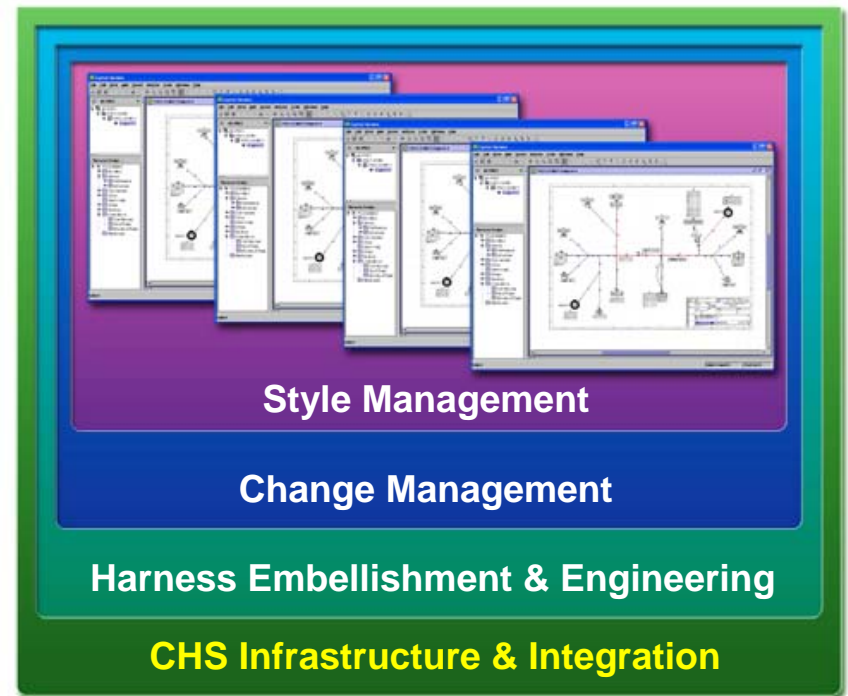
Leveraging the Power of CHS – Data Reporting



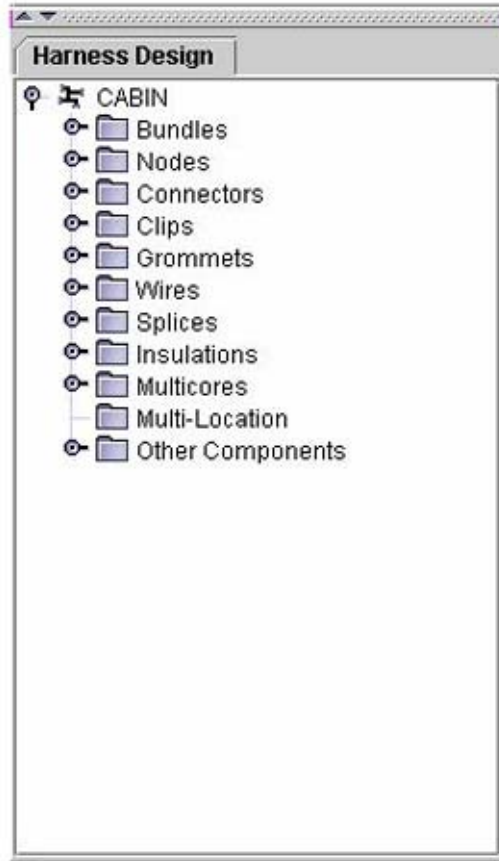
- **CHS is data-centric**
 - All design data is stored in a relational database
- **Capital HarnessXC includes CHS flexible data mining application**
 - Queries can be configured and stored
 - Output formats can be styled
- **CHS reporting is exposed to other enterprise applications as a web service**
 - Or published as HTML, XML ...

Capital HarnessXC

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Design Embellishment

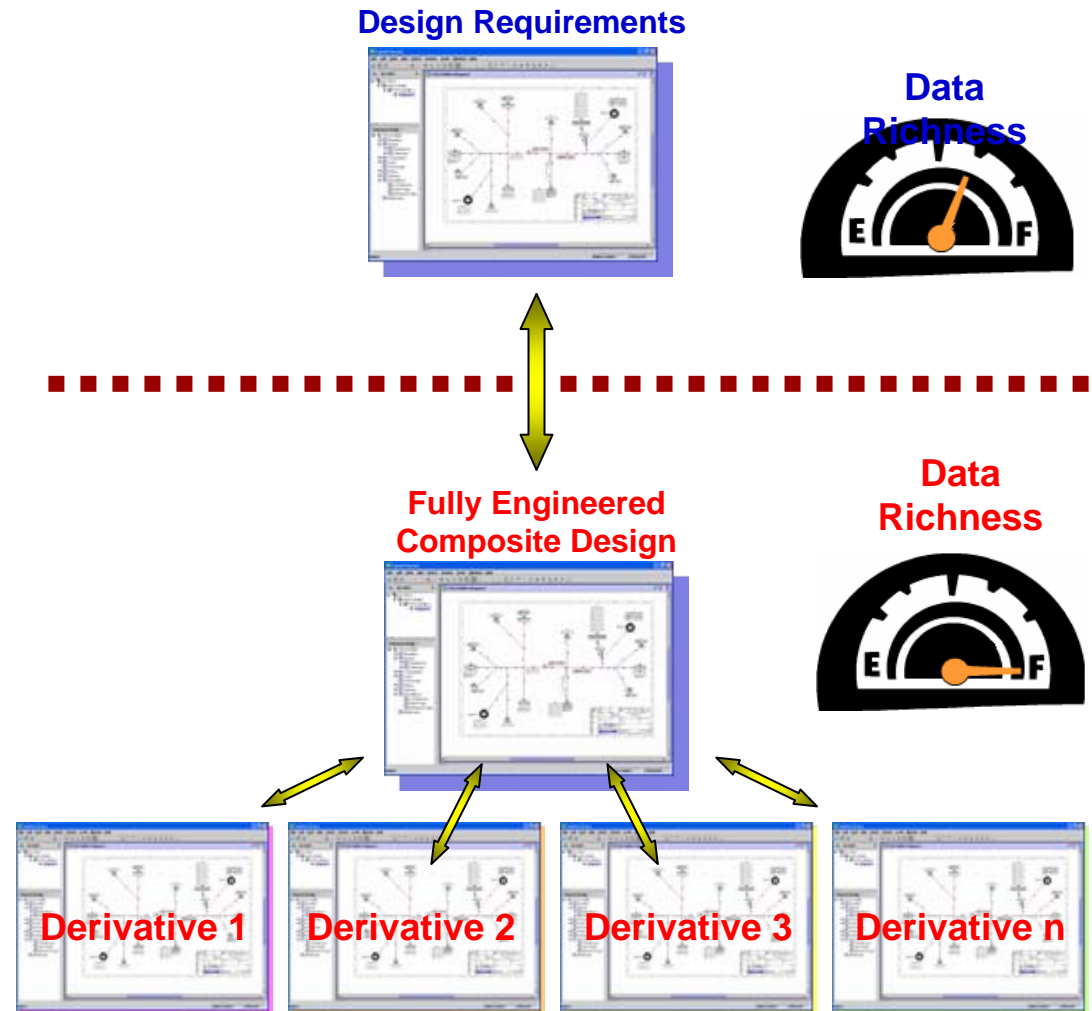


- **Embellishment:** addition of design details not defined elsewhere
 - Examples: shield termination design; spot tape placement
 - Capital HarnessXC is a dedicated tool, managing all common harness objects

- **Target:** all design requirements defined
 - End product requirements defined, not every part number
 - Can act as part of contract OEM ↔ harness supplier

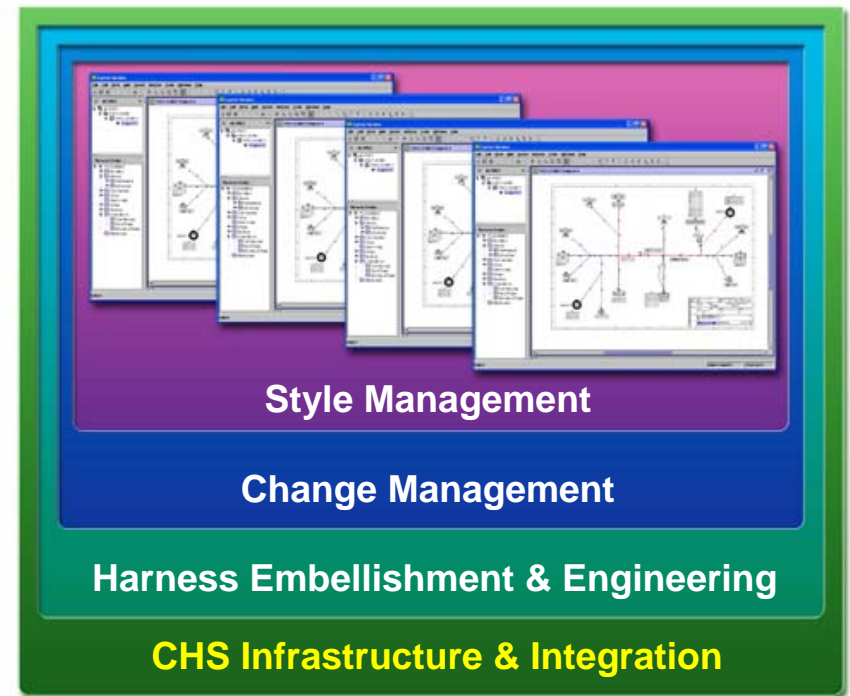
Automated Engineering

- **Engineering: automated design completion & validation**
 - Examples: terminal, plug & seal selection; wire length calculation; design rule checks
- **Capital HarnessXC re-uses industry-leading engineering algorithms from previous product**
 - Calculations are fully composite (all harness configuration derivatives automatically managed from parent)
 - Data accessible by other value-add CHS applications (example: Capital Costing)



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Drawing (Diagram) Style Management

- Drawings are key artefacts

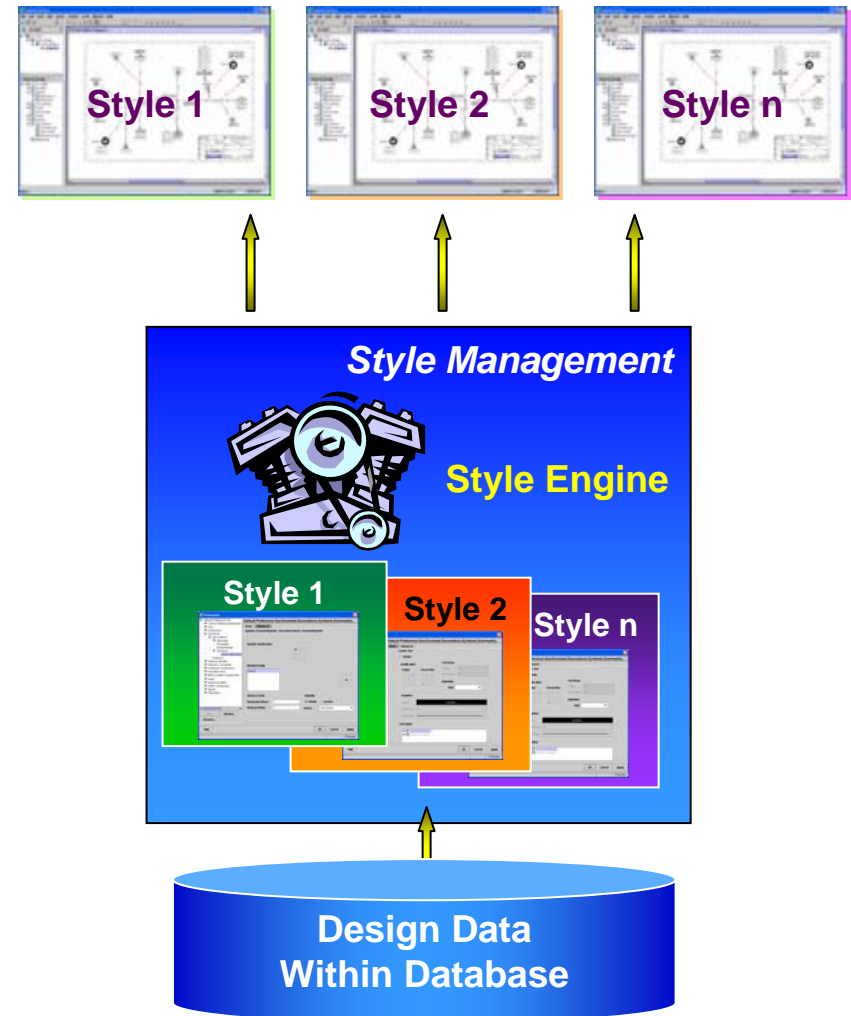
- Convey information via coded symbols, linestyles ...
- Many different drawing styles used

- Drawings rendered via **style engine** that intelligently configures graphics

- Static styles (examples: font, text position, title block)
 - Content reflects design data
- Dynamic styles that *depend* on design data
 - IF x THEN y
- Styles may be stored and re-applied

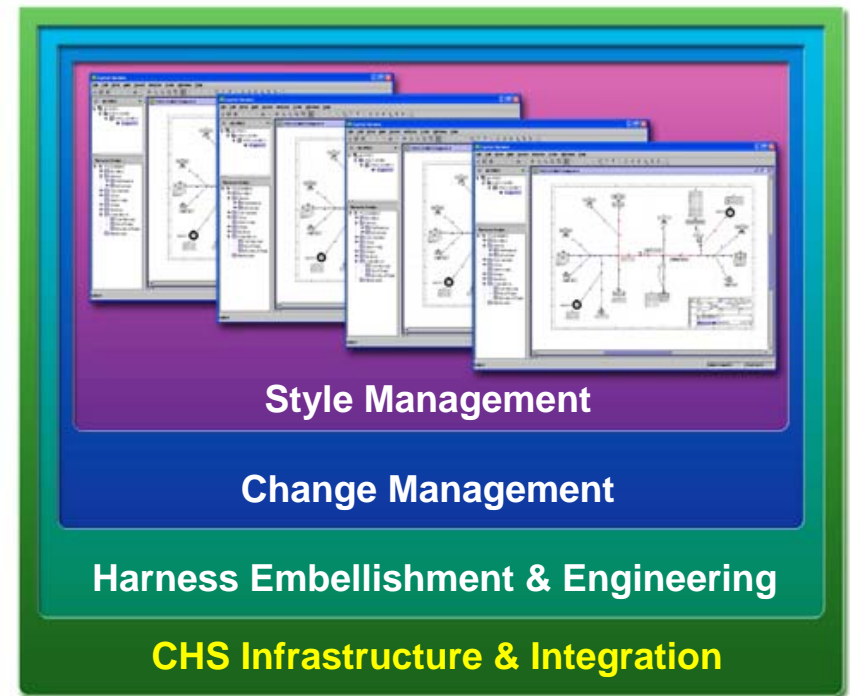
- Many graphical formats supported from standard tool

- Design data is re-usable across multiple projects

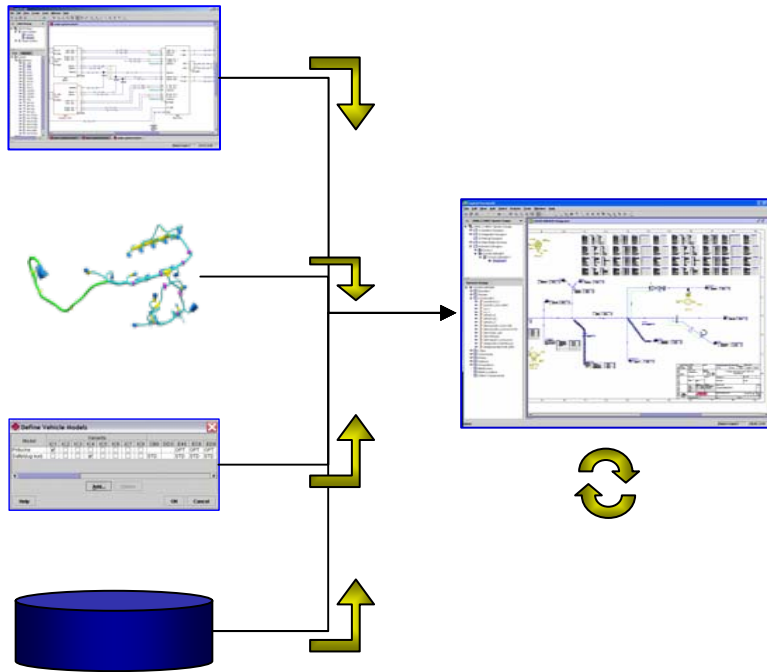


Capital HarnessXC

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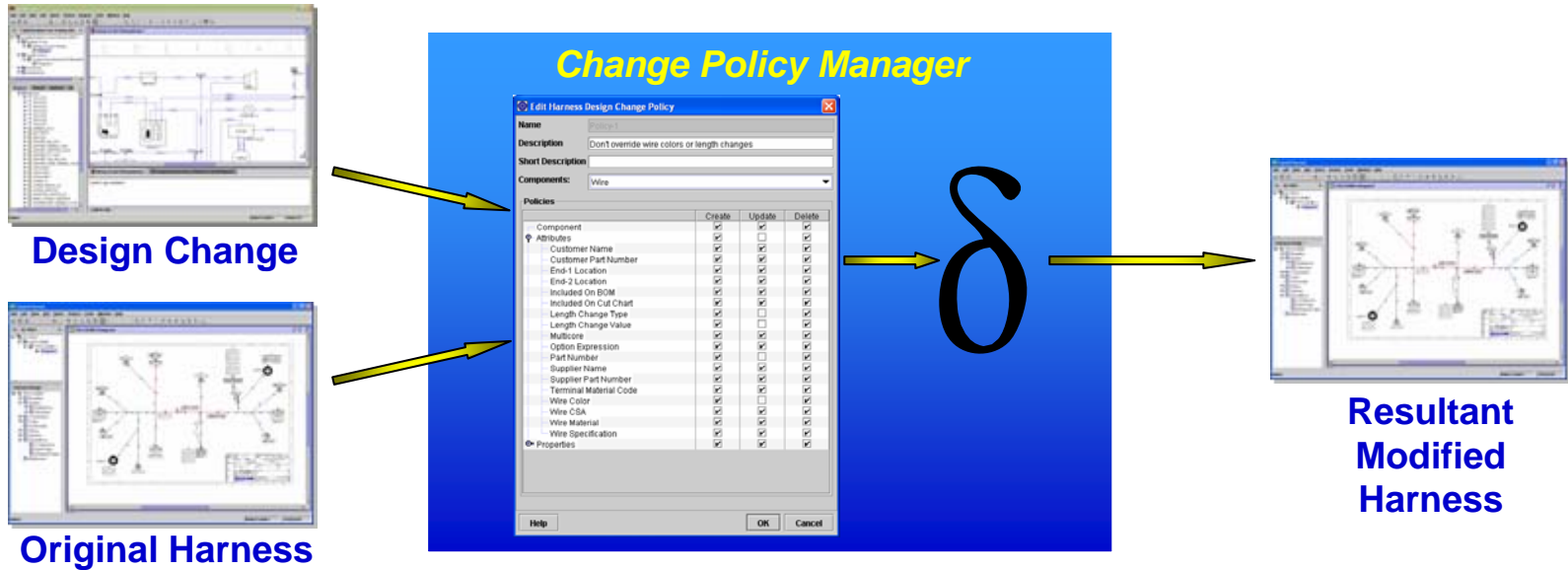


Design Cost – Change Management



- Design change is a daily event
- Changes originate from any of the design inputs, or from embellishment
- How to detect & control design change while preserving previous value-add ?

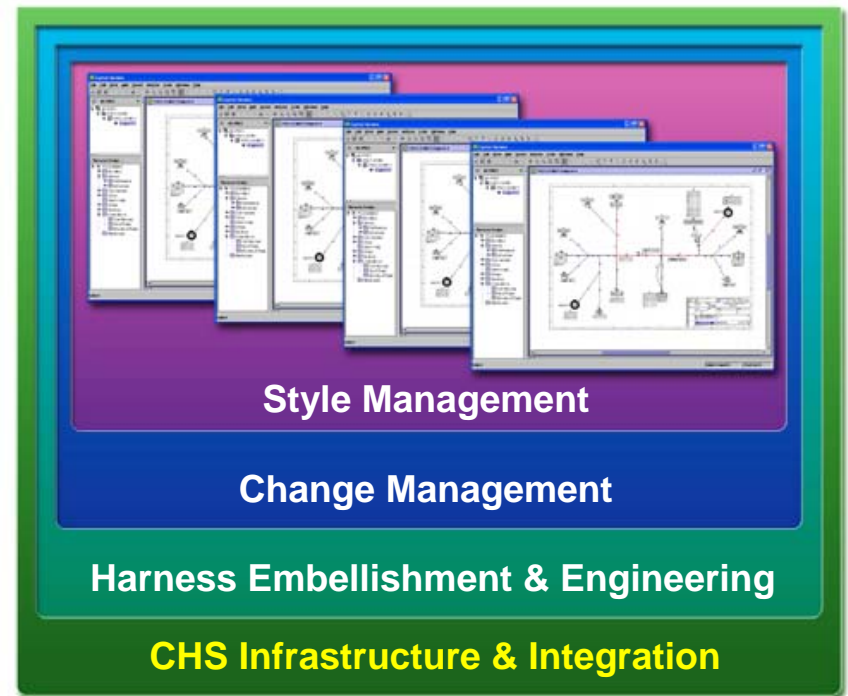
Change Policy Management



- Defines how application responds to design changes
- Multiple change policies can be defined to support different flows
- Can be controlled at object (wire, connector, bundle ...) or attribute (connector name, wire color ...)
 - Changes classified as Create / Update / Delete

Summary

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