



## Improving Electromechanical Product Development

Pawel Z. Chadzynski

VP, Product Management (remote)

John Peng, Solution Specialist (stand-in)

# Agenda

---

## Mechatronics

Enhanced ECAD-MCAD Collaboration Process

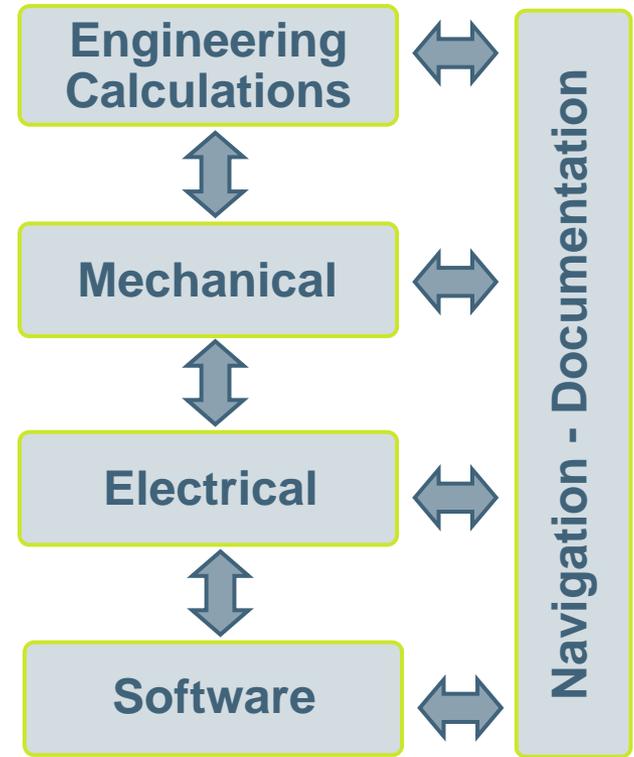
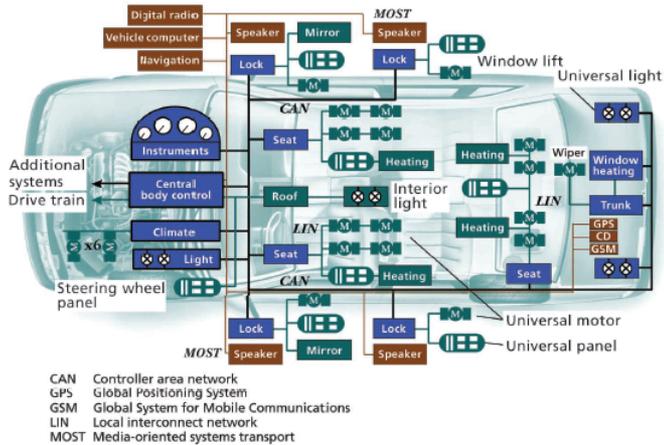
Solution Details

Summary



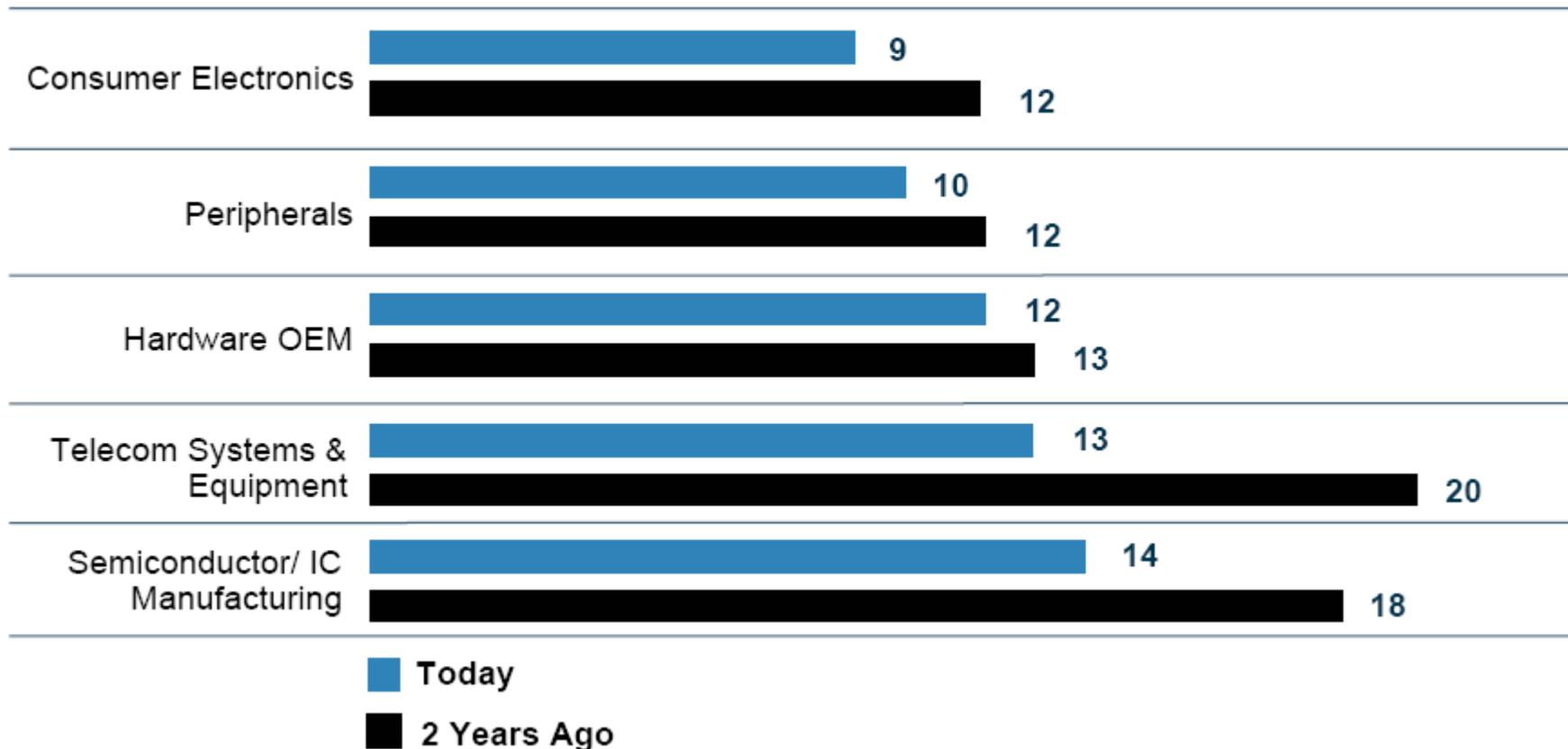
# Product Development is Challenging...

**Complex Products ... defined by ... Complex Information**



## More Complex Technology, More Distributed Development Teams, Less Time ...

Average Product Development Cycle Time (Concept to Release) (in Months)

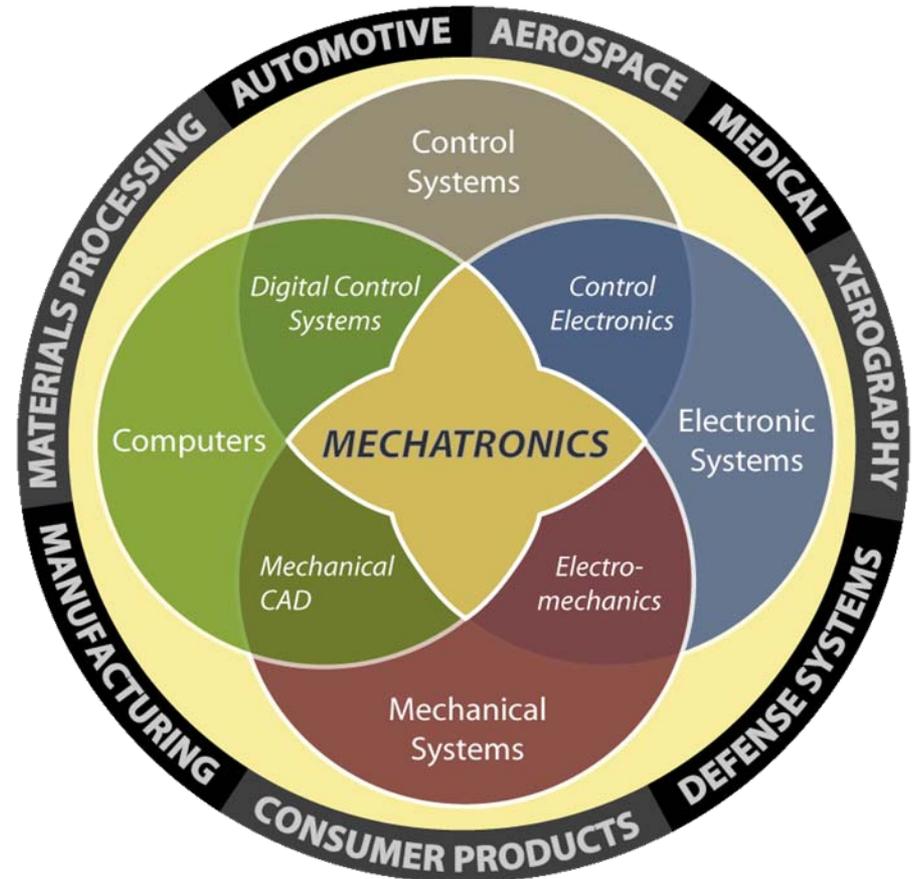


Source: "Best Practices in Product Development, Electronics & High Tech", PTC/IBM/Reed Research 2005

# Mechatronics – The Holy Grail

(ˈmek·əˈträn·iks)

“A branch of engineering that incorporates the ideas of mechanical and electronic engineering into a whole, and, in particular, covers those areas of engineering concerned with the increasing integration of mechanical, electronic, and software engineering into a production process.”



Source: <http://www.answers.com/topic/mechatronics>

## A few supporting statistics....

---

### What have been the impact of poor integration between electrical, mechanical and software disciplines?\*

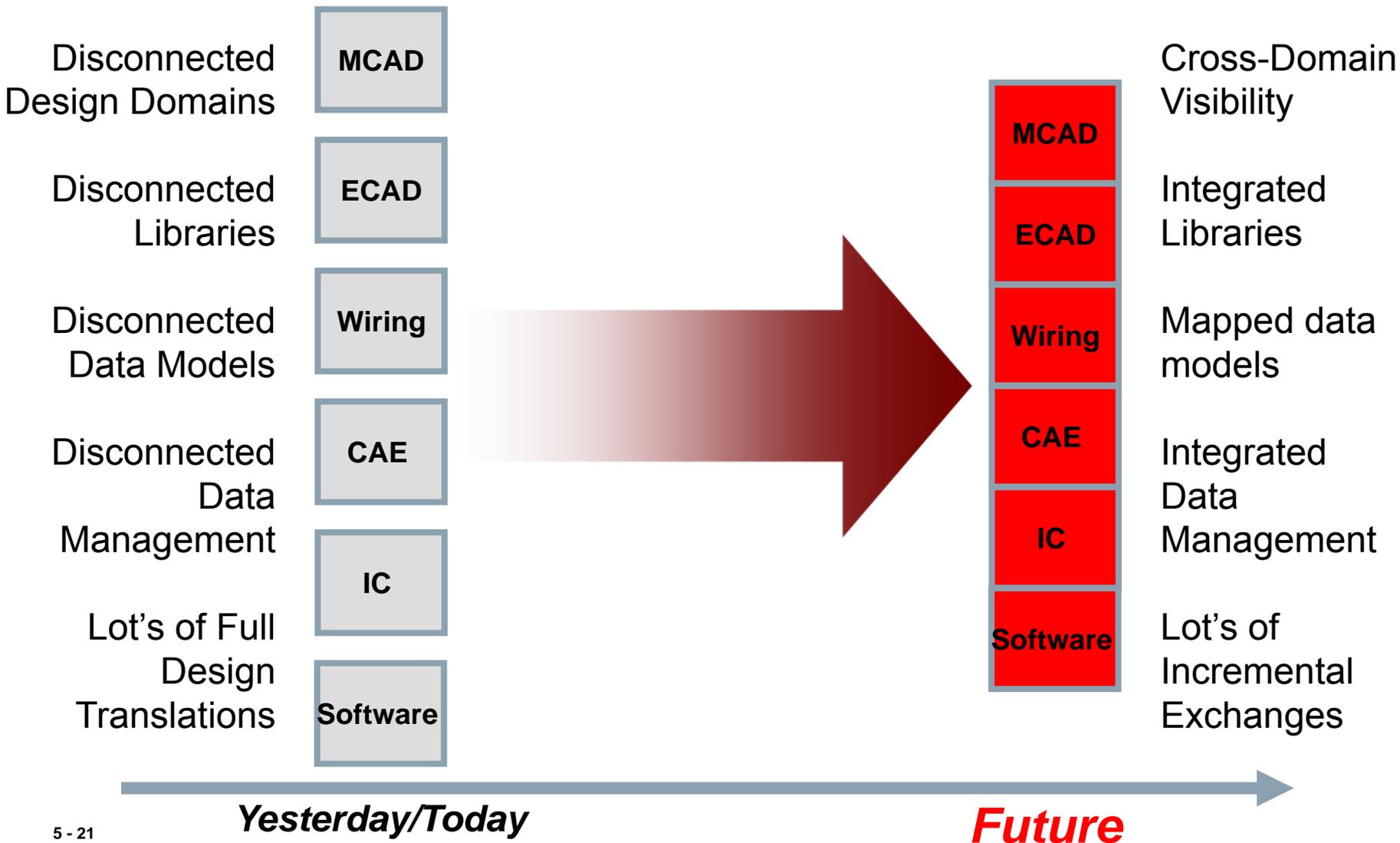
- Over 2/3 missed development and manufacturing milestones
- 88% incurred additional development and manufacturing costs
- 44% missed product launches

### Which approaches would be the most effective to preventing these impacts?\*

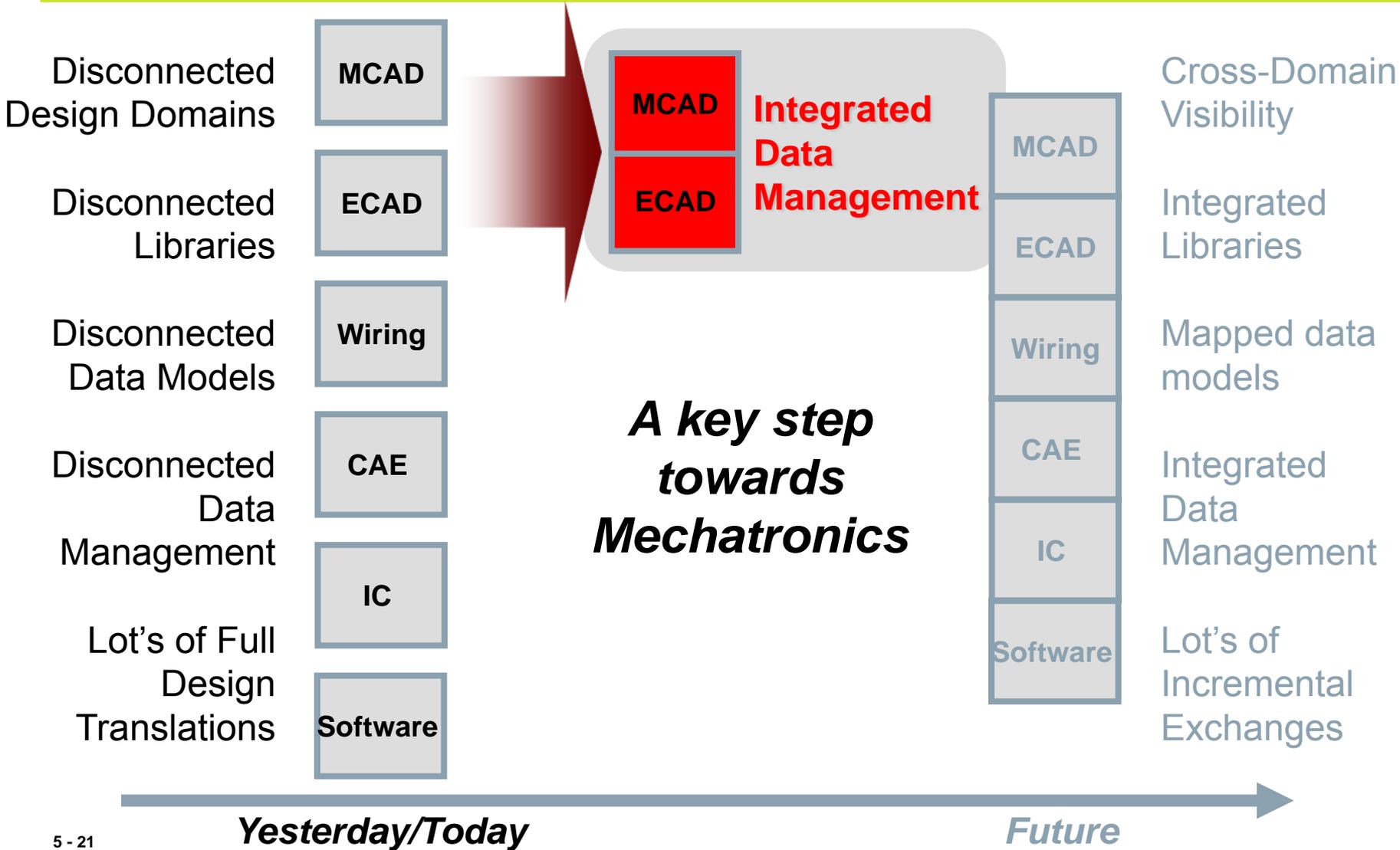
- 82% said the ability to review , assess or verify the other disciplines design changes
- 76% said the ability to review or verify the other disciplines' development progress
- 76% said the ability to track changes

*Source: PTC survey of Electro-Mechanical Collaboration Seminar participants, January 2006*

# Mechatronics – Tools & Processes



# ECAD-MCAD Collaboration



# Agenda

---

Mechatronics

Enhanced ECAD-MCAD Collaboration Process

Solution Details

Summary



# Typical ECAD-MCAD Collaboration

## 1. MCAD Tasks

- Define board outline
- Define cutouts
- Define Keep in/outs
- Define Holes
- Define fixed components

## 2. Full design transfer

Several standard formats

## 3. ECAD Tasks

- Define board structure
- Place all components
- Route all interconnects
- SI analysis
- Timing analysis
- EMI analysis
- Changes to MCAD definitions



## 5. MCAD Tasks

- Component height analysis
- Thermal analysis
- Structural analysis
- EMI analysis
- Spark analysis
- Changes to ECAD definitions

## 4. Full design transfer

Several standard formats

# What is IDF (Intermediate Data Format)

Transfer of complete PCB layout description between MCAD and ECAD

- Board outline with cutouts
- Mechanical holes
- Keep In/Out areas for TOP/BOTTOM (placement and routing)
- Component placement for TOP/BOTTOM
- Penalization

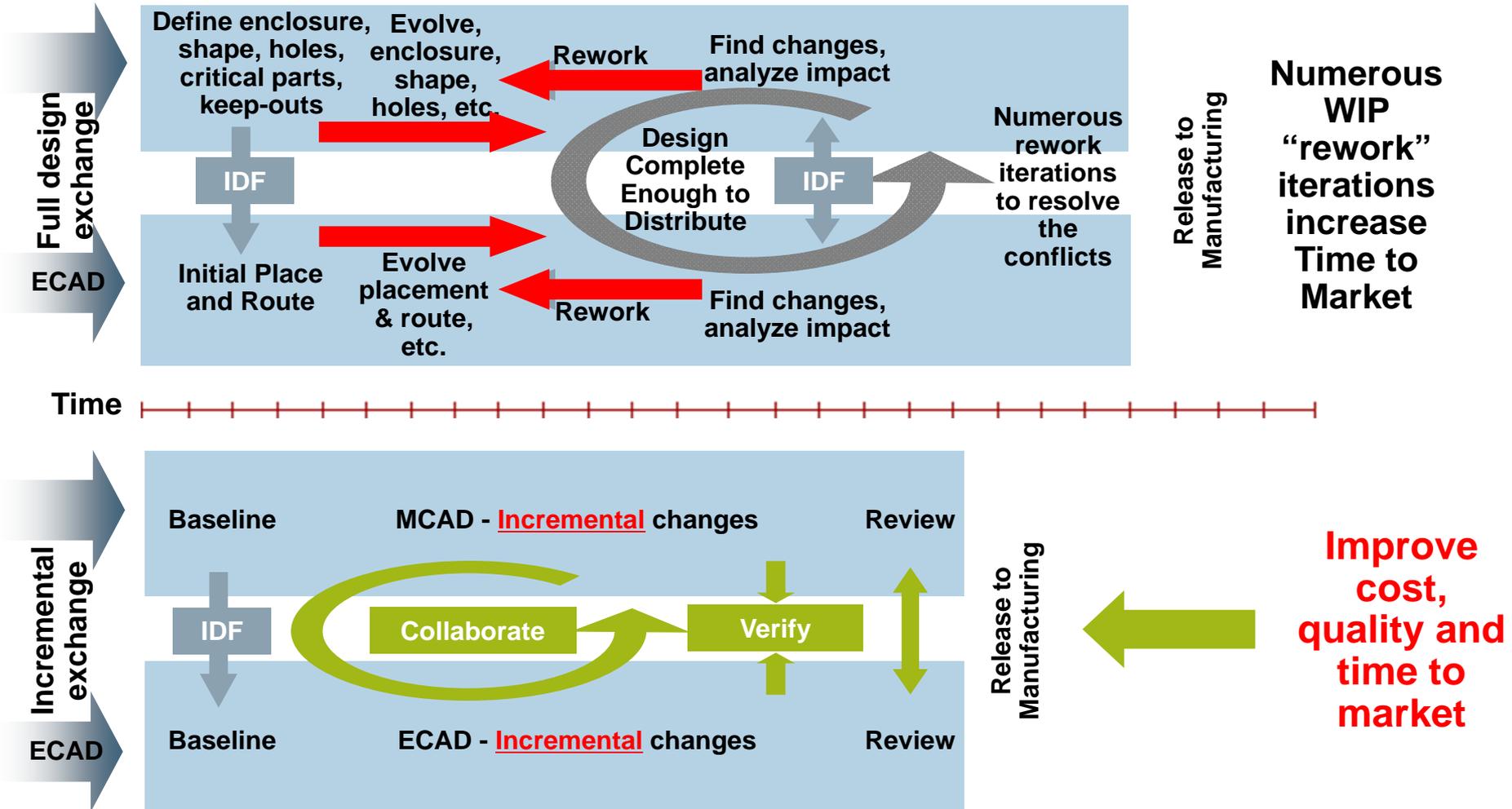
## Versions

- IDF 1.0, released in 1993, limited adaptation
- IDF 2.0, released in 1995, wide adaptation by ECAD and MCAD vendors
- IDF 3.0, released in 1998, never embraced by the industry

## Key limitations

- Not owned by any standard body
- Focus on full design transfer as opposed to incremental changes
- Not extendable

# Enhanced ECAD-MCAD Collaboration



# EDMD XML Schema Standard

## What does it do?

- Provides exchange mechanism for incremental design changes instead of exchange of the entire design
- Allows development of collaborative solutions between the independent MCAD and ECAD authoring tools

## What is it?

- An open industry standard for selective exchange of PCB design changes between MCAD and ECAD tools

## Who owns it?

- The standard was developed under the auspices of the ProSTEP iViP organization and any changes must go through the related committee

## Who uses it?

- PTC (MCAD vendor) and Mentor Graphics (ECAD vendor) have adopted it for the latest tool releases – other vendors are beginning to engage as well



# What controls does EDMD schema contain

---

## What is the design

- Name, URL, etc

## Baseline

- A functional alternative for IDF full design capture

## What object is changed

- Component U15, Board outline, etc

## What is changed about the object

- Location (x, y, rotation, side, etc), properties (names and values)
- Geometry (but not for component because that is a library change)
- Retains “before” and “after” data

## Who made the proposal

- User, tool, date, etc

## Who reviewed it

- User info
- Review state (Accept, Reject, Undecided) and review notes
- Can be multiple users with different review states

## What objects does EDMD schema track today

---

- Board outline
- Regions (keep in/out, etc)
- Components (attributes and properties – not geometries)
- Mechanical components (do not perform net list related function)
- Mechanical holes
- Vias
- Nets
- Test points

## Sample EDMD

This is only a small section of a larger EDMD transaction that tracks this change

Change proposal was rejected

```

=<idx:HistoryRecord index="1">
  <idx:TransactionState>ICMIDX_TRANSACTION_STATE_REJECT</idx:TransactionState>
  <idx:UserName>John Smith</idx:UserName>
  <idx:Login />
  <idx:Email>jsmith@ptc.com</idx:Email>
  <idx:PhoneNumber>+1 781 370 7960</idx:PhoneNumber>
  <idx>Date>Oct 13, 2008; 4:30:52 PM GMT</idx>Date>
  <idx:ToolName>PV Validate</idx:ToolName>
  <idx:ToolRevision>9.0</idx:ToolRevision>
  <idx:ToolType>ICMIDX_TOOL_VALIDATION_MANAGER</idx:ToolType>
  <idx:Comments>
    This proposal will result in significant redesign of the power planes. Can we shift the mechanical hole instead?
  </idx:Comments>
</idx:HistoryRecord>

```

John Smith rejected it

There is a note as to why it was rejected

# Agenda

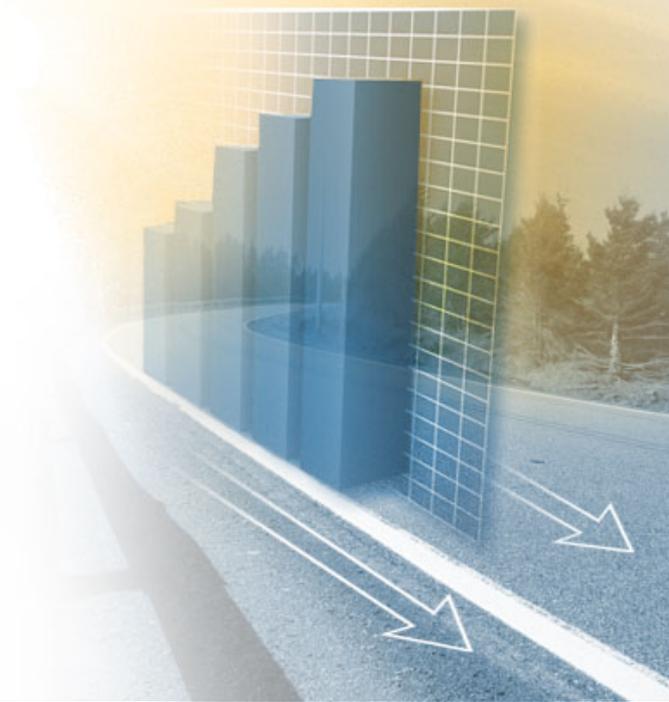
---

Mechatronics

Enhanced ECAD-MCAD Collaboration Process

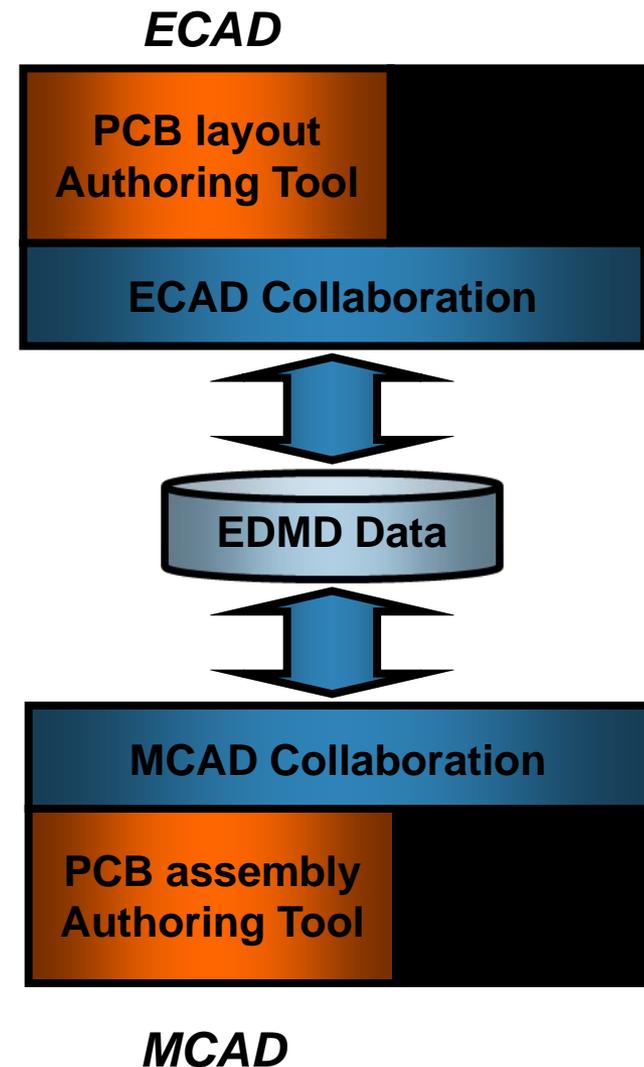
Solution Details

Summary



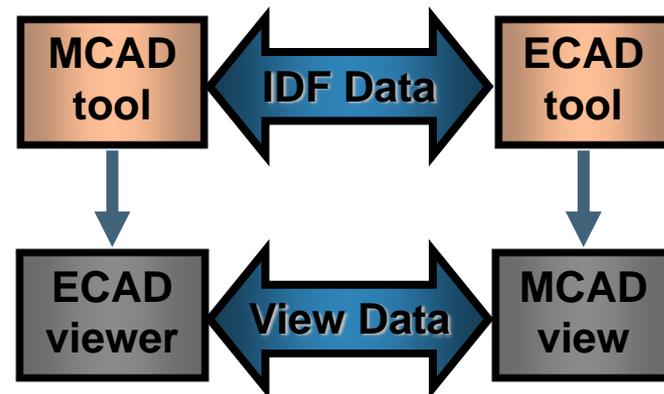
## EDMD Collaboration Platform

- Same core responsibilities
- Same look and feel
- Interactive cross-domain viewer using whatever data extraction is available to the vendor
- Tool specific collaboration granularity (data and functionality)
- EDMD XML schema encoded data to communicate – **this is THE integration**
- Message (synchronous) or file (asynchronous) based communication
- PLM functions are not part of the EDMD definitions and remain within the vendor domain



## ECAD-MCAD Collaboration Process

- 1 - **Baseline** – use a format like IDF to establish a fully aligned baseline in both domains
  - 2 - **Visualization** – use viewers to provide insight between the domains
- A PLM integrated flow is not required but it greatly enhances this process



## ECAD-MCAD Collaboration Process

**3 - Explore** – make sure that a change makes sense using the viewer

**4 - Propose** – generate a change proposal (WIP not ECO!)

**5 - Share** – deliver the proposal to the other domain (file or otherwise)

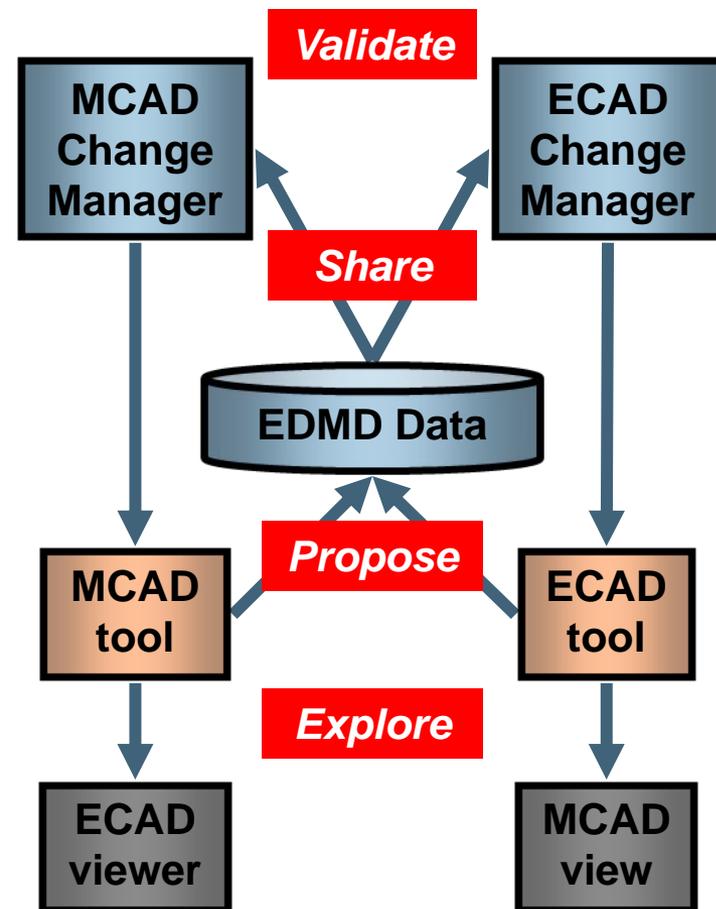
**6 - Validate** – examine the proposed changes and return with an Accept or Reject state

Process repeats and can be initiated from either side

Proposal can contain a single change or a group of changes

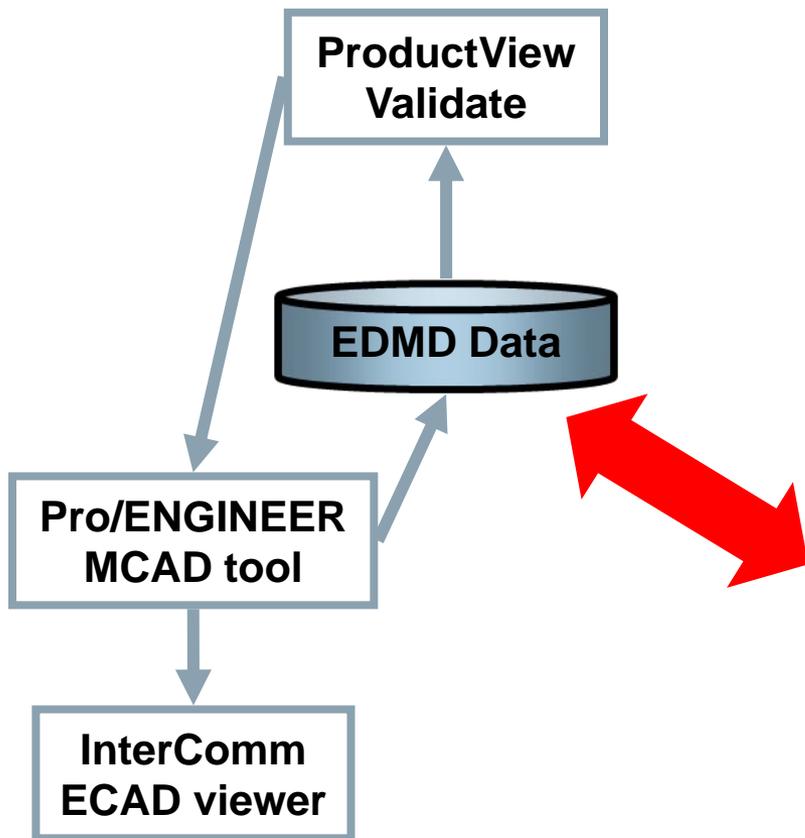
EDMD data knows all about the change - but it does not manage the native data base

A good PLM integrated flow is not required but it greatly enhances the process

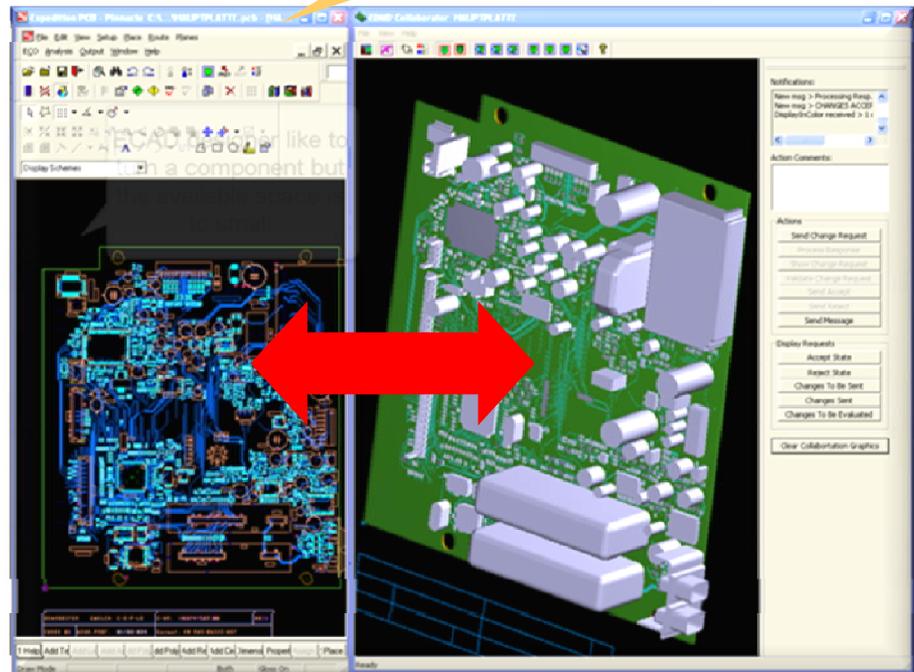




# Mentor Expedition 2008 Collaboration Environment

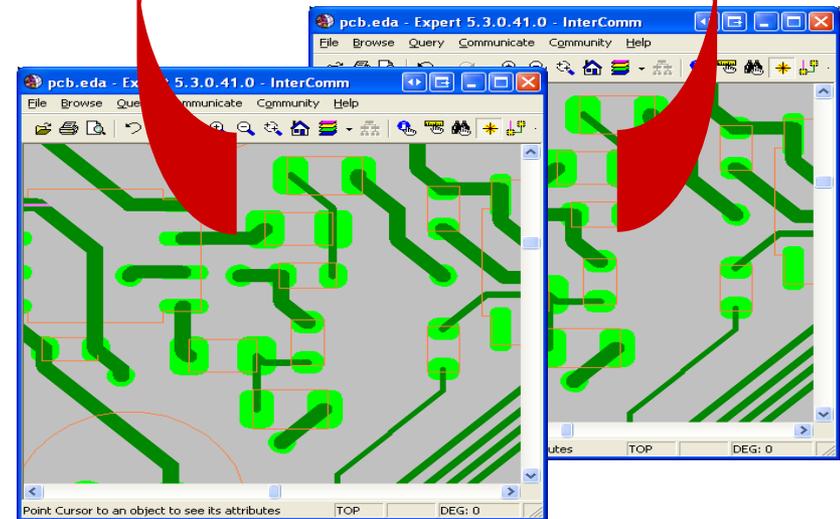
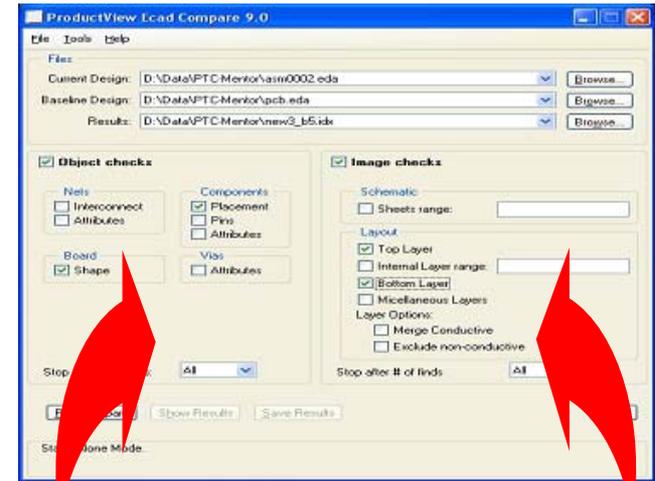
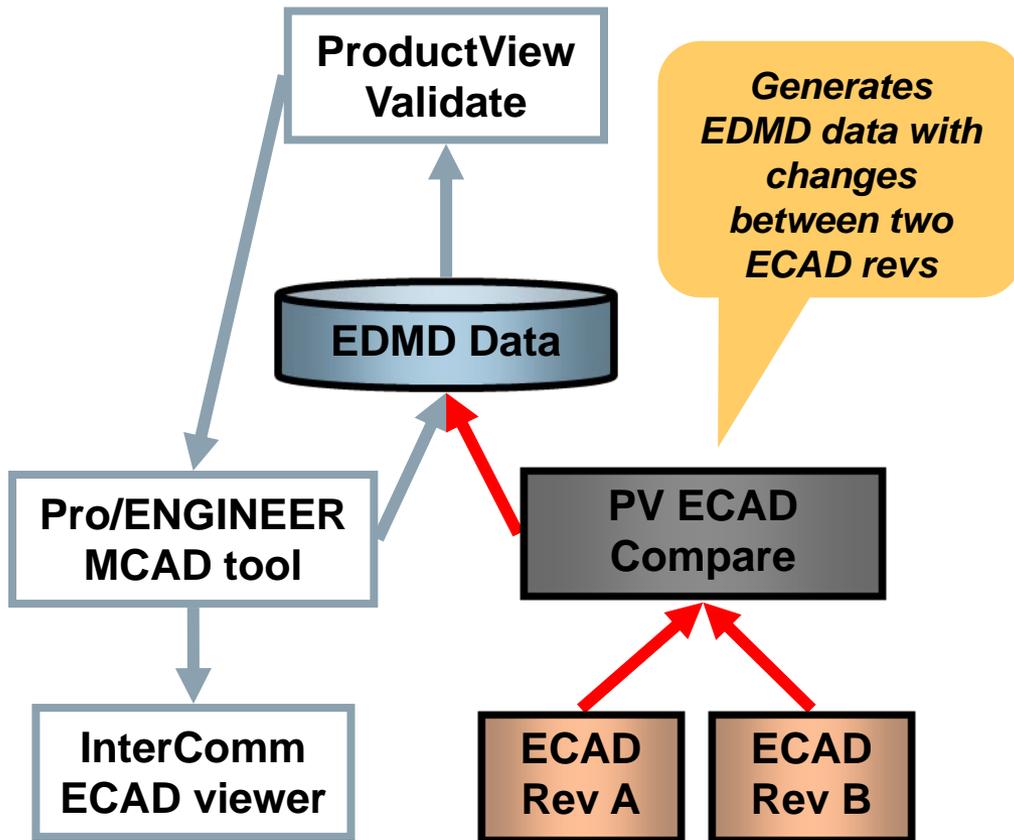


*Mentor native support of EDMD data*



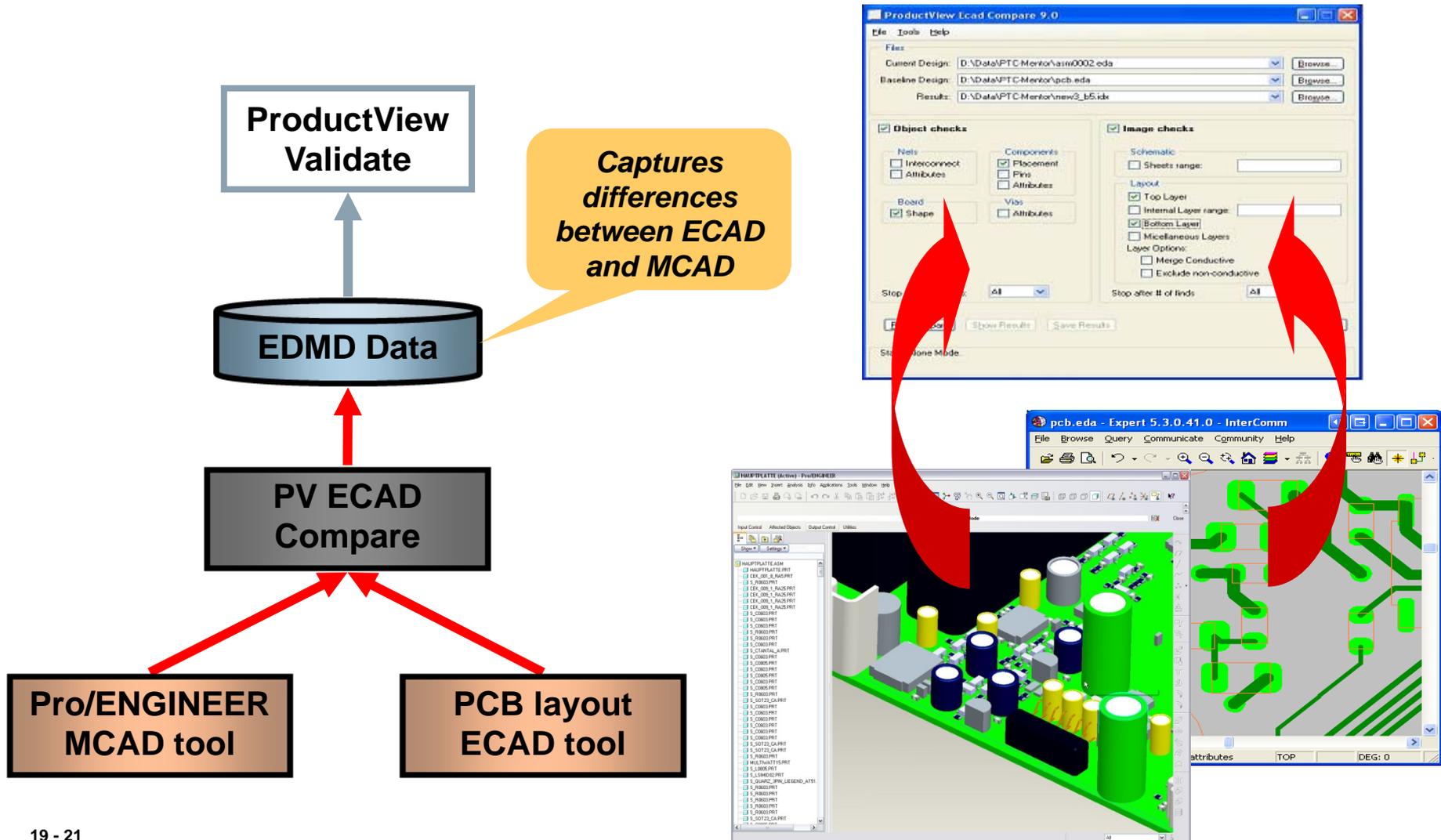
# PTC Pro/ENGINEER Collaboration

## Propose - ECAD Tools Without Native EDMD





# PTC ECAD-MCAD Verification After Collaboration Phase Is Over



# Agenda

---

Mechatronics

Enhanced ECAD-MCAD Collaboration Process

Solution Details

Summary



## What to expect in the future

---

### More vendors to embrace the process

### More objects types

- Board material stack-up
- Expended ECAD areas (beyond IDF defined keep in/out)
- Copper shapes
- Annotations

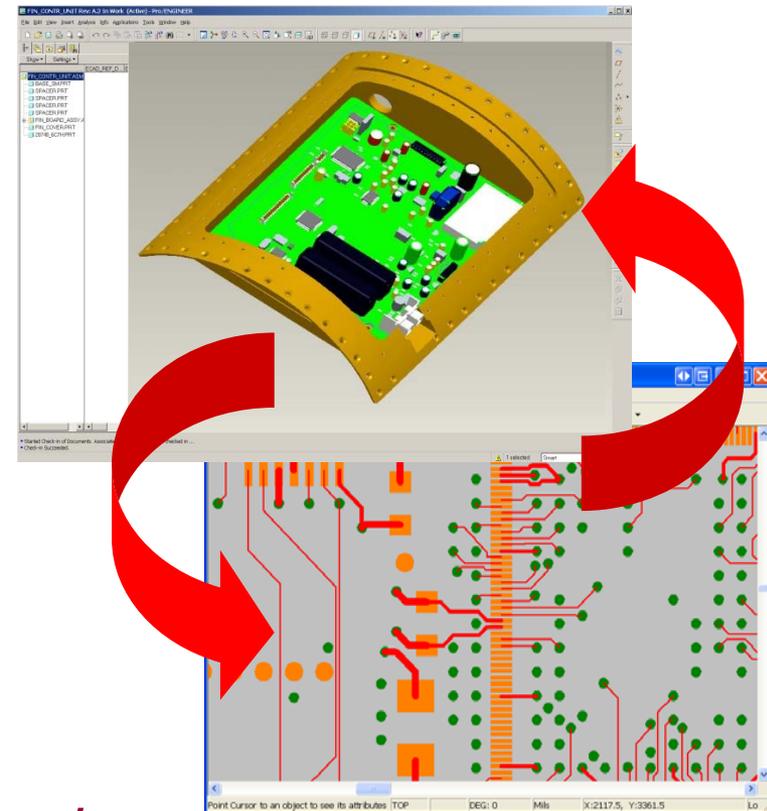
### More object details

- Forced and finalized Accept/Reject
- Merging of collaborative data (rev A vs. rev B vs. rev C)
- Integration with PLM tools

### Inclusion of the ECAD-MCAD library co-design and verification

## Values of the Incremental ECAD-MCAD Collaboration Process

- Communicate more often and with less disruption
- Understand impact before proposing a change
- Identify unanticipated consequences of a change
- PTC solution works with ECAD tools which do or do not have native support for EDMD data



*Without shifting the traditional ECAD and MCAD responsibilities between the teams*



**Thank You!**