3 Trends Accelerating Electronics Development

Solving the Broken Data Pipeline Between Engineers and Manufacturers

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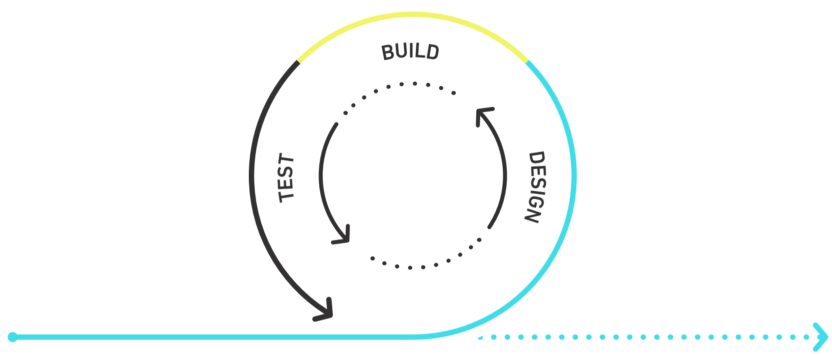
Introduction

IN ALL ENGINEERING DOMAINS, DEVELOPMENT IS DEFINED BY A DESIGN, BUILD, AND TEST (DBT) CYCLE. In the Design Phase the project team defines a set of performance requirements and develops a design to meet those requirements. In the Build Phase the design is transferred to a manufacturer who constructs a physical device and sends it back to the team. In the Test Phase the project team takes that device and tests it against the performance criteria identified in the Design phase. If more refinement is needed, another cycle starts with a new Design Phase.



Each time a project goes through this cycle, ideas are validated, deficiencies are discovered, and solutions determined. The key characteristic of the DBT Cycle is its speed, which dictates how far product performance can be pushed within the project schedule and how fast the product can get to market.

Electronics project teams have consistently struggled with a DBT Cycle that is fundamentally slower than other engineering domains. Software engineers can create prototypes in minutes. Mechanical engineers can create prototypes in hours with 3D printing. Contrast this with electronics prototyping, where cycles are weeks or even months long. The delay for electronics teams most often occurs during the Build Phase. During build set up, information sent to a Contract Manufacturer (CM) can be lost, misinterpreted, or changed often with no visibility into why decisions are made. This slow and error prone synchronization of design intent can take days to resolve all the questions. Furthermore, status during the build is often unknown and delays come as a surprise to the awaiting engineer. To make this worse, many times the build is on the critical path so that when issues appear, not only does it take engineering time to resolve them, but the whole project is delayed.

In recent years, the Electronic Manufacturing Services (EMS) industry has taken steps to address these issues and has made progress helping engineers speed up the Build Phase of the DBT cycle, however, these efforts have mainly focused on internal process improvements of the Build Phase. These technologies have already shown their power in areas ranging from build traceability, automated stock sensing and reorder, and predictive capacity management and preventative maintenance.

The resulting improvements are critical, but they are not enough by themselves to produce the cycle efficiencies needed. **To produce fundamental change, it is essential to solve the broken data pipeline between project teams and manufacturers.**

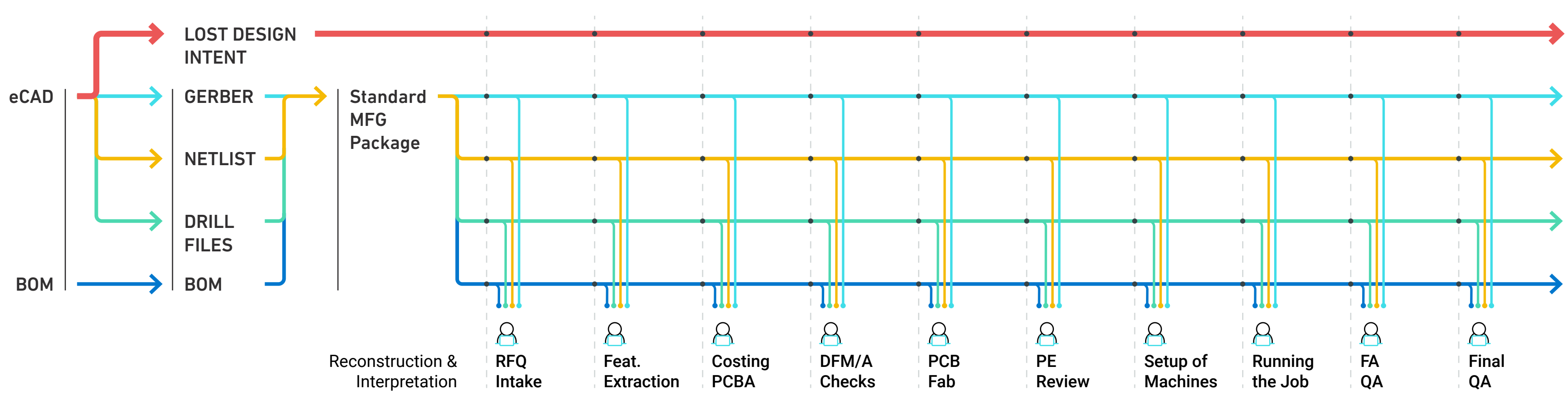
The Broken Data Pipeline

CURRENTLY, THE VAST MAJORITY OF COMMUNICATION BETWEEN ENGINEERS AND MANUFACTURERS IS LOW BANDWIDTH, TRANSACTIONAL, AND REACTIVE. Communication is often limited to a specific build and when it does occur it is typically limited to exchanging Gerber files, email, FTP uploads, and phone calls.

The critical failure of the current electronics development model is that traditional EMS data standards are limited and cannot capture the same data richness of today's eCAD tools. Instead, separate data repositories are created and must be continuously constructed and interpreted at each stage of the Build process. At every touchpoint there is an opportunity for costly human error and misinterpretation. *(See diagram below)*. This fragmented and broken data pipeline results in critical miscommunications between engineers and manufacturers and slower electronics development.
A richer data standard and communication platform must be used.

Broken PCBA Manufacturing Process

Multiple data source for PCBA builds are continually deconstructed & reconstructed from different file types, with assumptions of original design intent at each stage

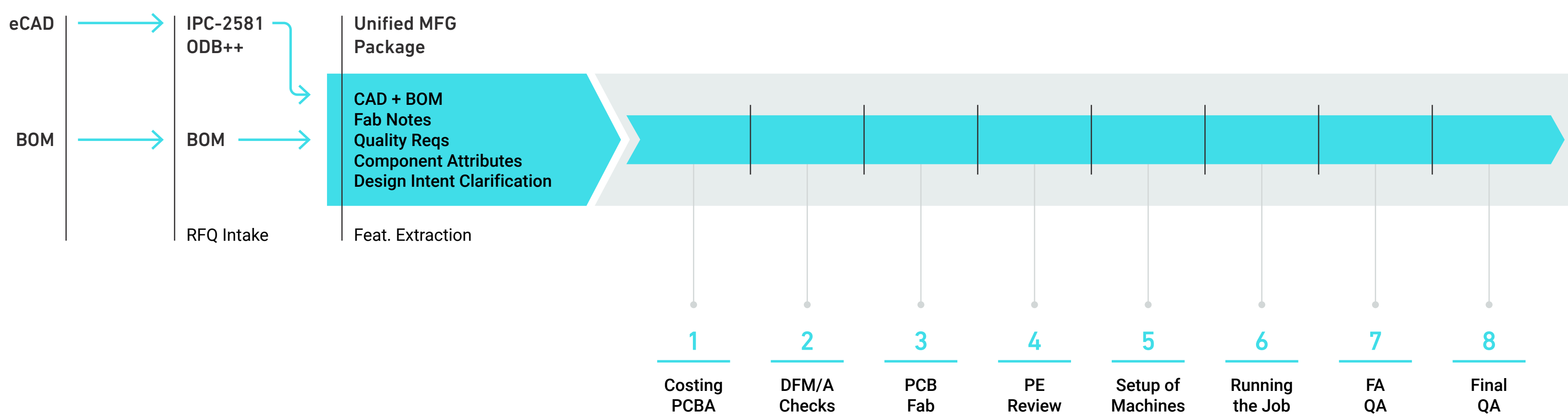


Fixing the Pipeline

Solving the information pipeline problem presents an enormous opportunity for the electronics manufacturing industry to deliver the speed needed for present day innovation, as well as change the industry's relationship, communication, and transparency with engineering teams.

Visibility Into the Manufacturing Process

Singular data source for the entire build remains unchanged and intact: CAD-extracted data w/ Engineer's original design intent



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There are three trends that will accelerate electronics development.

TREND 1

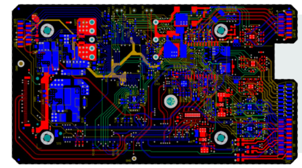
High Fidelity Data Transfer

To resolve the problems with data transfer, the industry is moving toward formats that provide a unified system for storing all the information needed to manufacture a board. This includes layout, stackup, BOM, fabrication and assembly notes, etc. Currently, only the IPC-2581 and ODB++ formats provide the comprehensiveness required.

BENEFITS

- A single source of truth which minimizes errors and delays
- Programmatically parseable which supports automation of the production process
- Universal so they are not tied to a specific vendor and can constantly improve

Automated Data Intake



AUTOMATED FEATURE EXTRACTION & PRESERVATION OF DESIGN INTENT

EXTRACTED BOM & CAD DATA

SMT placement count	315
Through hole placement count	0
Leadless placement count	9

Board specs	
Board Height (in)	4.72
Board Width (in)	2.79
Layer Count	4
Minimum Finished Hole Size (in)	0.01
Minimum Trace Width (mil)	5
Minimum Trace to Trace Spacing (mil)	5.7
Buried Vias	No
Blind Vias	No
SMT Placement Sides	Single
Number of Via-in-pad	1

TREND 2

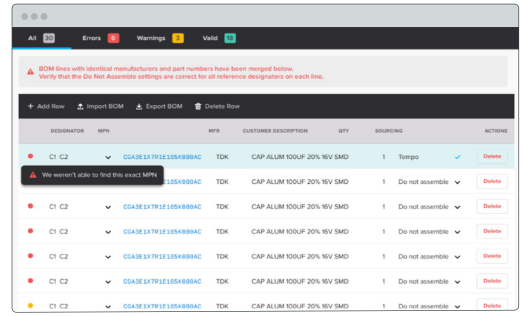
Transparent Operation

Cloud portals and IoT technologies are becoming better integrated into factories, which makes it possible to give engineers unprecedented visibility into the manufacturing process.

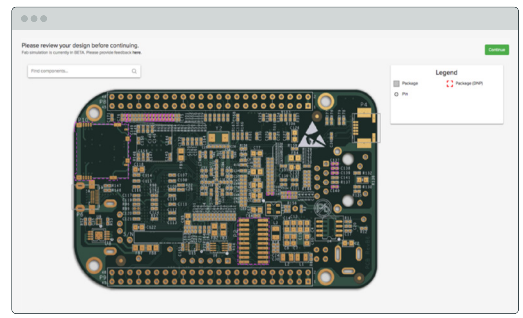
BENEFITS

- Instant component availability feedback which minimizes sourcing time
- Board visualization provides instant validation that design data was processed correctly
- Real-time build status enables more accurate project planning

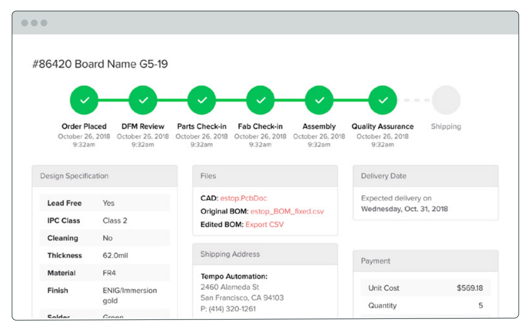
Visibility Into the Manufacturing Process



REAL-TIME BOM FEEDBACK



FAB SIMULATION



LIVE ORDER STATUS TRACKING

TREND 3

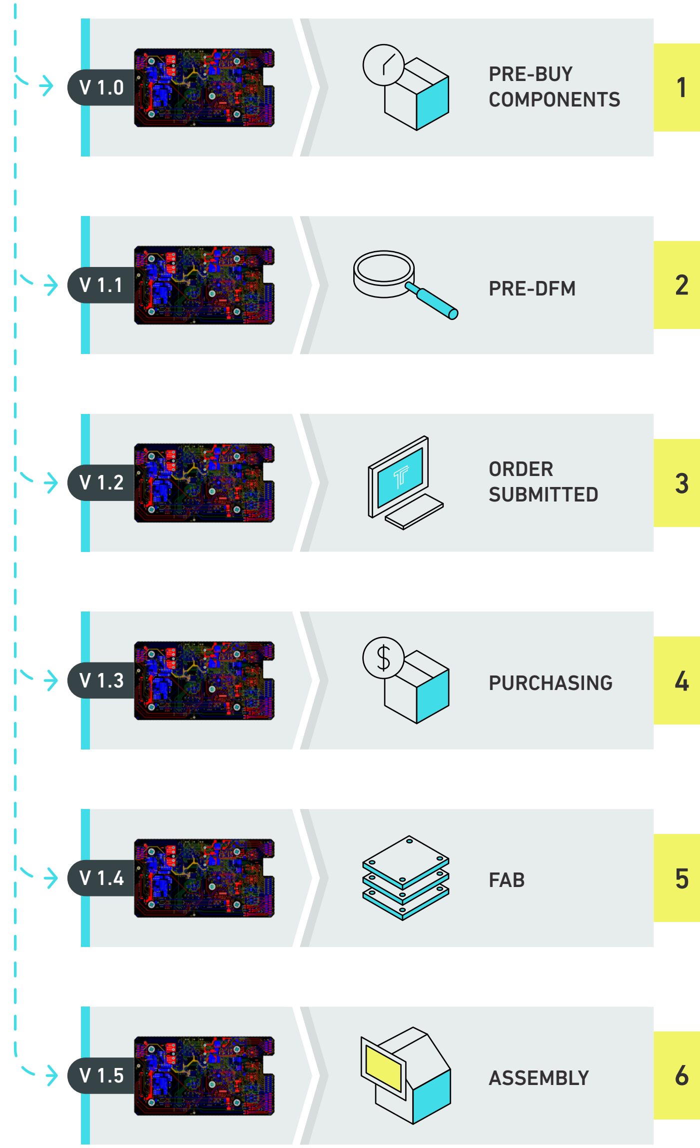
Seamless Change Management

Increased pipeline bandwidth and data fidelity is allowing manufacturers to handle design updates and schedule changes with greater agility.

BENEFITS

- "Just in Time" data permits file updates until the data is needed on the factory floor, giving project teams more time to push the performance of their projects
- Automatic propagation of design changes down to the factory floor
- In context communication allows for quick resolution of design intent ambiguity

Change Management



The Engineer Driven Factory

THE CULMINATION OF THESE TRENDS IS THAT INTERACTION WITH MANUFACTURERS WILL BECOME TRANSPARENT AND SEAMLESS.

It will be as if the engineer is driving the build process directly. Engineers will have full visibility throughout the whole DBT Cycle of the manufacturing implications of their design decisions so they can optimize for cost, lead time, and yield. Quote, sourcing, and DFM feedback will be surfaced automatically for quick resolution. Once an engineer starts a build, their design data will flow seamlessly to the factory floor without any unnecessary translation steps. The Build Phase duration will no longer be a limitation on DBT cycle speeds. Project teams will be able to iterate faster, push the performance of their designs further, meet their milestones, and hit their product launch window.

Realization

At Tempo Automation we are dedicated to streamlining and accelerating the DBT Cycle for PCBA. Our software-driven smart factory merges rich design data, analytics, and automation to deliver new levels of speed, quality, and insights for rapid prototyping and low-volume hardware development.

LEARN MORE AT TEMPOAUTOMATION.COM

About Tempo Automation

Tempo Automation is transforming the way electronic product companies innovate and bring new products to market. Tempo's breakthrough, software-automated PCBA manufacturing platform delivers unprecedented speed, quality and transparency at the most critical time in a product's lifecycle – prototype through new product introduction – when fast iteration and time to market are imperatives. Customers who count on Tempo Automation for this strategic advantage include the leading innovators in aerospace, medical technology, semiconductor, industrial technology, automotive and other key industries.

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