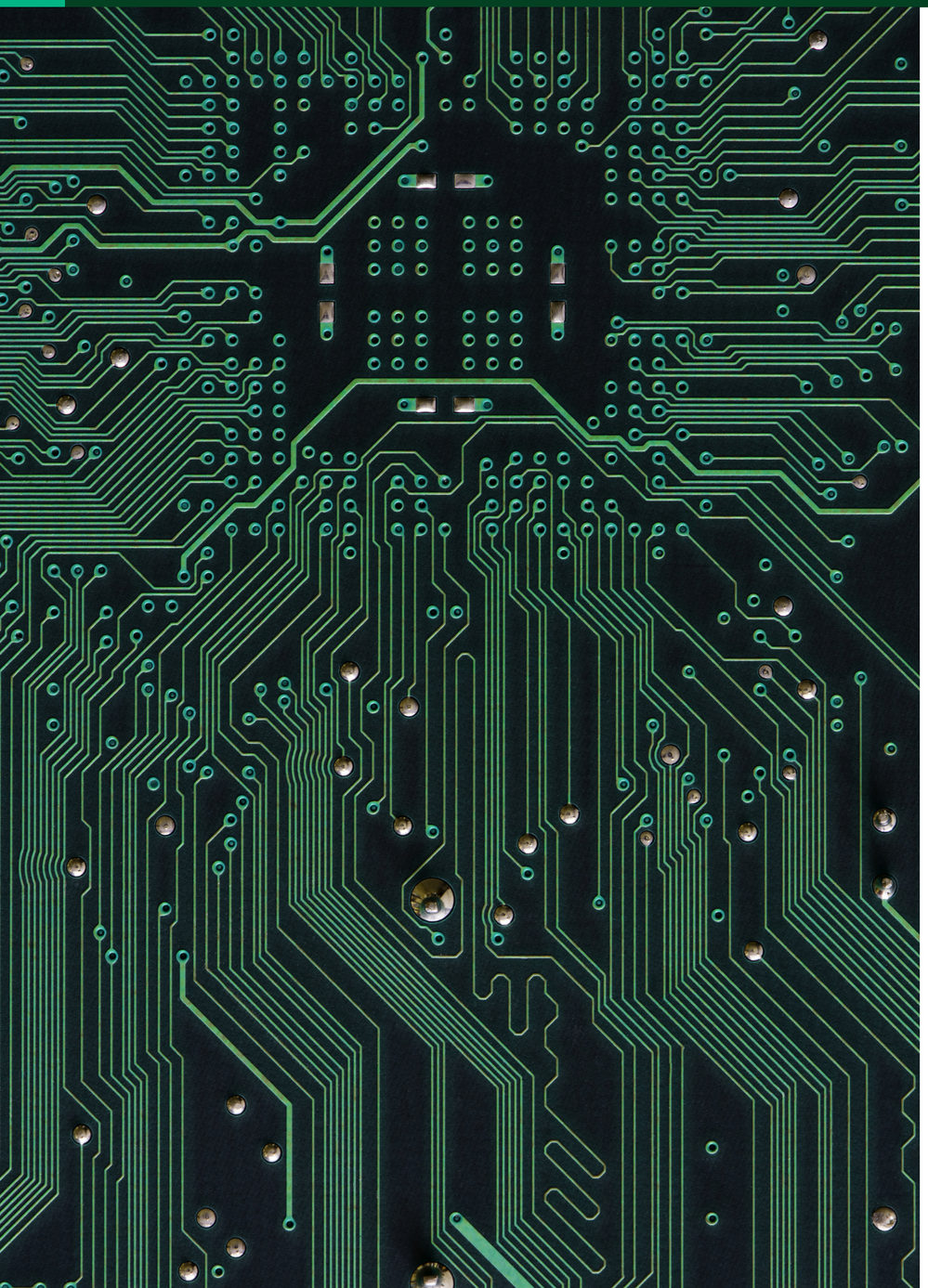
Connected Life-Cycle Management

INTRODUCTION

Connecting Data Silos across Your Product Life Cycle: From Lab to Fab and Beyond

Did you ever play the telephone game as a kid? While sitting in a circle of friends, you whispered something into the ear of the person next to you, who then repeated what you said to the next person and so on until the message got back to you. Only what you heard wasn't what you originally said at all! The words have changed so much from being passed around that everyone giggled at how ridiculous they were.

Without open communication, a lot is lost in translation. Sharing and transcribing data can often feel like a game of telephone. With different tools, languages, and experts across the process of creating semiconductors and chips, information has to pass through a lot of teams to inform a final product. Each stage has its own set of experts and accompanying data, but there's a tendency to operate in silos. It works, because highly intelligent engineers excel in each of their respective stages or domains. They're so smart, they have the ability to translate and analyze this disconnected data. But how much better would things be with seamless integration? How much more capability could you unlock if your engineers could stop playing telephone?



PART 01

Why Data Silos Exist

Before we work to connect our data, we should look into why these silos exist in the first place.

Tight deadlines are an organic—sometimes unfortunate—part of the semiconductor industry. When working on chips for a product like a cell phone that releases a new version the same time each year, a three-month delay is a catastrophic problem. The time constraints the mobile market puts on design can feel like any revisions are “do or die.” Each team must hustle to meet deadlines, which doesn’t always leave time for collaboration. The constant workflow makes it easy to accept things as status quo, even if passing data between teams is cumbersome as the chip moves through each process.

But it’s not just about timing. There’s a lot of history that has created these silos. Many semiconductor companies have been around for generations, which means they’ve either created tools or purchased third-party ones to handle their data. From behavioral system models to production test, each stage has its own tool with data in a different format. That means a design engineer uses a tool that pulls data from the simulation model in one language, whereas a validation engineer’s tool speaks a different language, and a test engineer tests in yet a different programming language.

Additionally, acquisition is a common source of growth. Every acquired company has its own system, and leadership seldom finds a reason to change it to conform with what’s already in place. After all, if it isn’t broke, why fix it? But connecting data silos isn’t about fixing broken systems. Companies have made do with this disjointed toolchain for years. Sure, it’s possible to push through these complications with a team of very smart people and a big enough budget to buy as many tools as you can afford to fit into a workflow, but there’s a better way. There’s opportunity to optimize and streamline.

PART 02

What You Can Gain by Connecting Your Data

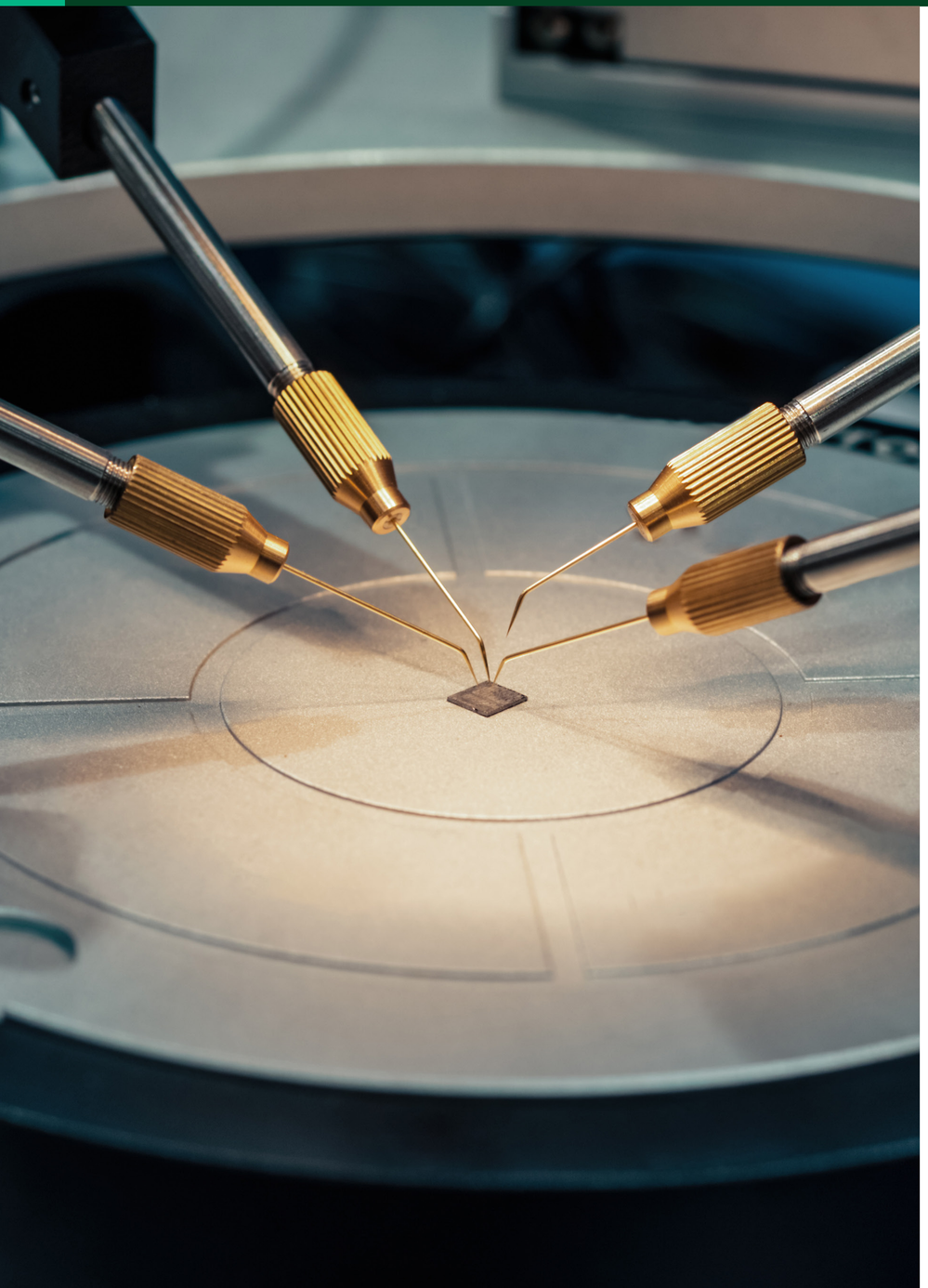
If the status quo of multiple data systems isn't halting production, why even mess with an established process? From creating smarter production rules to risk mitigation, streamlined data fuels both current and future success.

Smarter Production Rules

A key way to optimize your test is incorporating a rules engine. At a high level, it determines if X or Y happens, to stop the flow of the material in the line before a failure occurs. It gives engineers an opportunity to put the test on hold and decide if the chip itself is bad or if it was not tested correctly for some other reason. But the parameters in a rules engine aren't plucked from thin air. They're informed by data, and the more data you can put into the decision or rule, the better.

Incorporating validation data across chip development stages allows engineers to build smarter production rules. The data alerts and informs to sensitivities in the test itself. For example, if you have data from production validation that informs you'll have a very sensitive test that's tightly controlled, you'll know the importance of identifying when things move off center in production—even if only by a fraction. When things start to shift in the manufacturing process, you have the opportunity to pause and adjust before a catastrophic failure develops. Knowing these sensitive parameters with the addition of data input allows the freedom to ramp up production quickly while still keeping a tight watch on things that could change.

By having your data all in one place instead of it being disconnected between the development teams, you gain the ability to perform health checks periodically. Having easy access to this data is the key to efficiency. Crossing domains and connecting data enables engineers to do a better job when moving into high-volume manufacturing while also having a sense that the established limits will hold.



Faster Risk Mitigation

Unfortunately, it's not a question of if something will go wrong in validation, but when. Having access to validation data enables faster risk mitigation. Often, the status quo for semiconductor is that production has to relearn how to work through issues when things inevitably go wrong. The data available that could help them is inefficient at best, commonly stored on an Excel file someone has on their laptop that may or may not be available to others down the line. Even if you can find the data, it's not likely to be in the right format to compare with the system that needs to diagnose the problem. Afterall, how could you compare a validation limit to a test parameter? One might measure leaking, while another measures power. With a unified data system, the manufacturing team is able to troubleshoot issues much quicker with easy access to usable data from design and development.

Better Design Iterations

While quickly troubleshooting problems is a huge help to production, perhaps the greater advantage of streamlined data is the ability to prevent socme of those problems from happening in the first place. Data that connects each team from design to manufacturing will inevitably inform smarter design right from the start. A centralized system carries knowledge forwards and backwards. Historical information will inform specific decisions, such as using simulation variation data to accurately inform where to set limits for splits later in validation. This is essential for ramping up high levels of fast production. Without this data, engineers have to make their best guess at production limits because they don't know all of the assumptions made in design and can't translate validation measurements to the tester driven measurements. Such data can identify the percentage of product that is likely to fail so it could be identified before it gets all the way down the manufacturing pipeline. Or better yet, grant the opportunity to design a better product from the start.

Superior Collaboration

Production rules and product failures all are easily tracked through analytics, but a less tangible benefit to connecting your data silos is the time your team will save. There are many key players when it comes to producing a chip, and each needs to make sure their part of the process is accomplished to make a product successful.

With so many tools and systems that don't communicate with each other, engineers from each stage have to take hours to extract and align the data. Sometimes it's a full day's worth of work extracting data just to be able to begin their analysis. With a connected system, the same effort can be done in 20 seconds, giving time back to engineers so they can do what they do best.

PART 03

Connecting Your Data

With all the benefits, it's easy to understand why it's a good idea to connect data silos. A better question is, how can you get everything into one system?

It's not about starting over. You have mountains of data already coming in through your systems and have for years. Don't think of it as replacing but rather stringing together what you already control. You keep all the data you need but now have an easier time drawing conclusions. From product engineers to production yield engineers, each role in the process shares common goals:

ALL ARE TRYING TO MEET THE SCHEDULE.

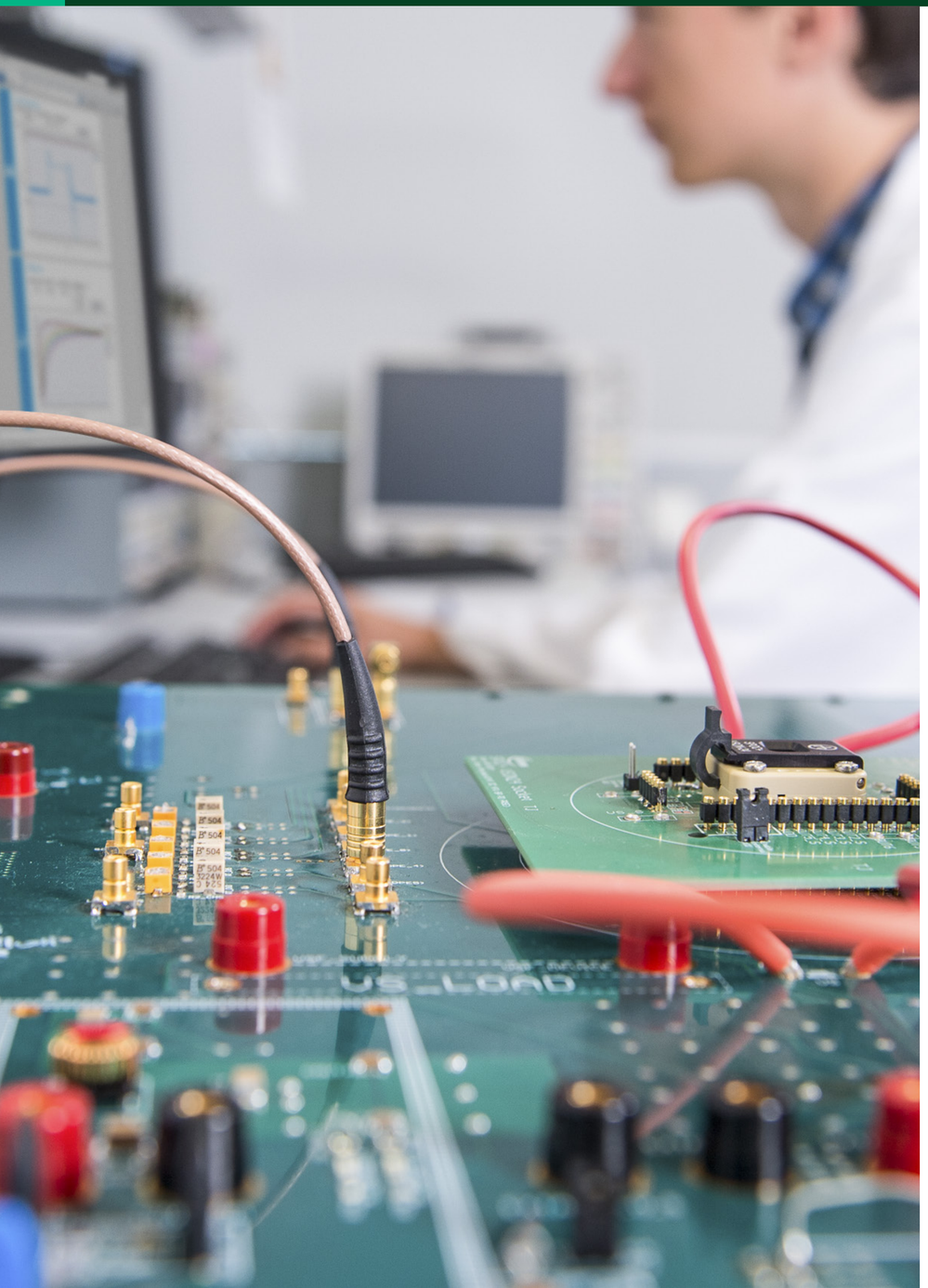
ALL HAVE TO RESOLVE PROBLEMS AND BUGS.

ALL NEED TO KNOW HOW CLOSE THEY ARE TO TAPE OUT, RELEASING TO MANUFACTURING, AND SHIPPING TO CUSTOMERS.

ALL WANT TO OPTIMIZE THEIR PART OF THE PROCESS.

By adopting an open data analytics solution that integrates with your existing tools, you better enable your team to work together towards their common goals. These systems ensure the substantial data you've collected is correct and complete. Right now, there may be useful insights in your data that are close to impossible to find. Engineers can ask the siloed buckets of data for very explicit things, but there are also useful trends buried between the tools and languages. By removing the effort needed to extrapolate the information, an open data analytics solution grants access to such conclusions. It takes the years you've spent optimizing your data and adds the necessary tools to stitch it together.

When paired with machine learning, you can automate rules from these data-based conclusions. Fueled by the massive amounts of data, you'll end up with a rule that knows what to do should a certain situation replicate. Such a conclusion means an engineer doesn't have to go in every time to repeat what they did to arrive at that determination. When the machines learn what to do based on the rules, organizations stop needing to rely on a human to repeat analysis after analysis to arrive at the same conclusion. The more data you connect from the silos, the more data the machine has. Increasing the data increases the accuracy of decisions.



CONCLUSION

Data collection has been a part of semiconductor and chip production for decades. The past 30 years has been about optimizing information in each of the silos. That optimization will continue going forward, but it's time to start thinking beyond each individual unit. Up to now, businesses have been forced to traverse the entire flow of differentiating tools and language, but there's an easier future with a data solution that can collect, translate, and store information.