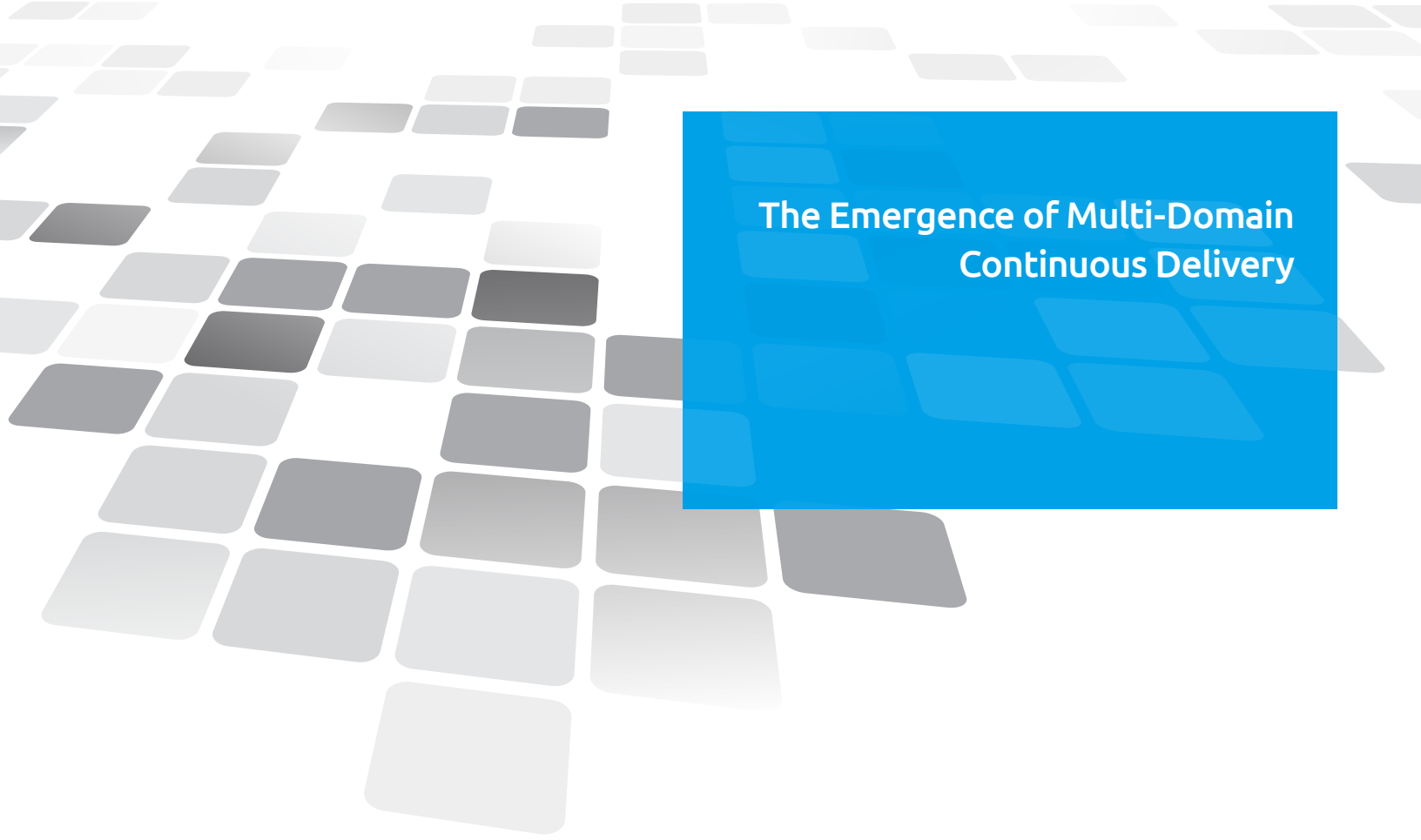
White Paper

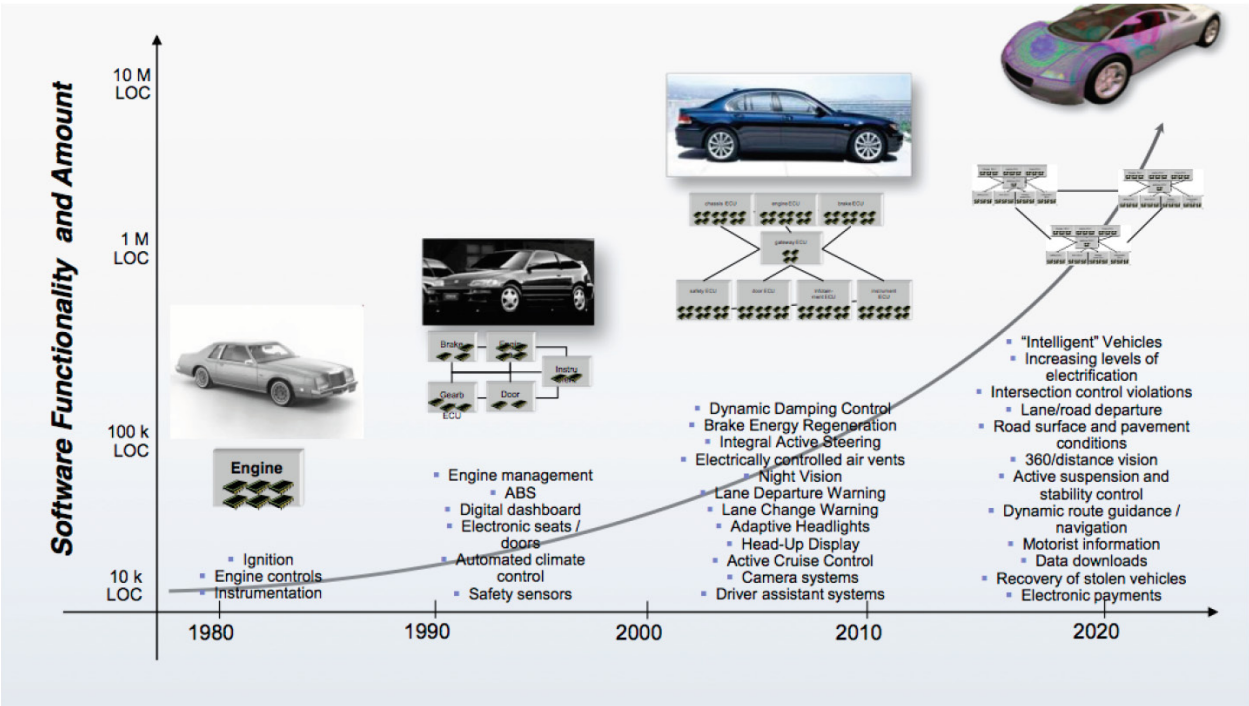
Electric Cloud



The Emergence of Multi-Domain Continuous Delivery

Cars, airplanes, medical devices and other technology products are becoming increasingly more software-centric, with end-users expecting a connected experience similar to today's consumer-focused smartphones. With the importance of software for differentiation in today's market, it's clear that every business needs to become a software business to succeed. While web, enterprise IT, mobile and e-commerce organizations have been focused on delivering software for years, hardware-centric business verticals such as automotive, aerospace, healthcare and heavy industries are now also recognizing the value that software can provide to their users, and are on an unprecedented race to quickly mature their integrated software and hardware product R&D.

Data from VDC confirms this state of the industry with their conclusion that software now represents approximately 45% of costs of embedded system development. With hundreds of millions of lines of software code running on tens or hundreds of distributed microprocessors in many of today's products, engineering complexity is staggering in this new product development environment, as exemplified by below chart from IBM:



Given this, innovation is in transition from a focus on individual components to more of an integrated system-level thinking. This means dramatic shifts and new thinking in terms of how R&D organizations need to approach product development.

Lately, Electric Cloud, Siemens PLM and industry partners have researched emerging needs and trends around product delivery in this complex product development landscape. In this environment, product developers are tasked to deliver system-level integrated artifacts from the multi-domain engineering intersection where mechanical, electrical, electronics and software components meet.

Our takeaway is that there is a clear drive and desire towards realization of a concept we can call Multi-Domain Continuous Delivery, with the goal to enable a state and mindset within the product development organization of constantly shippable product.

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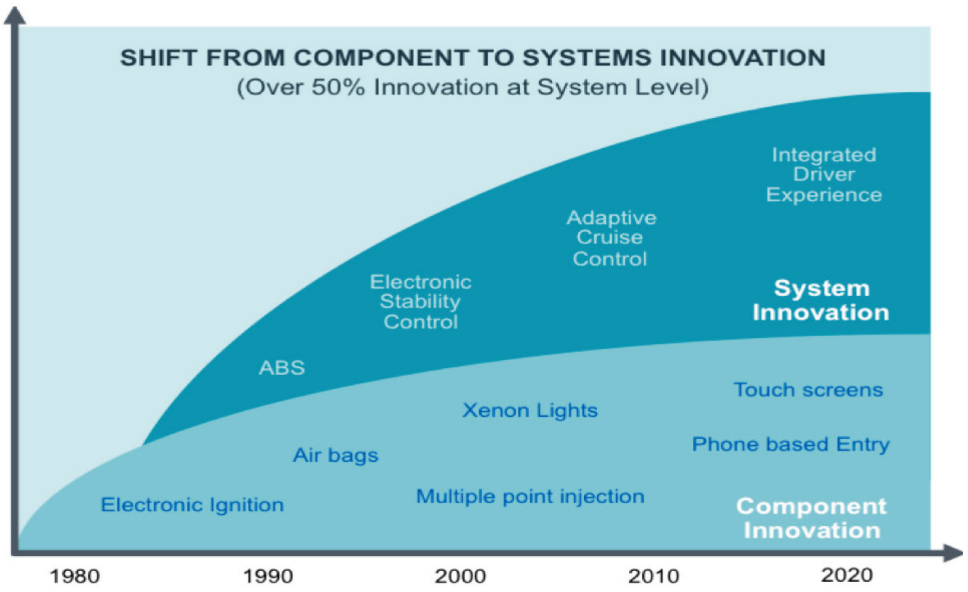
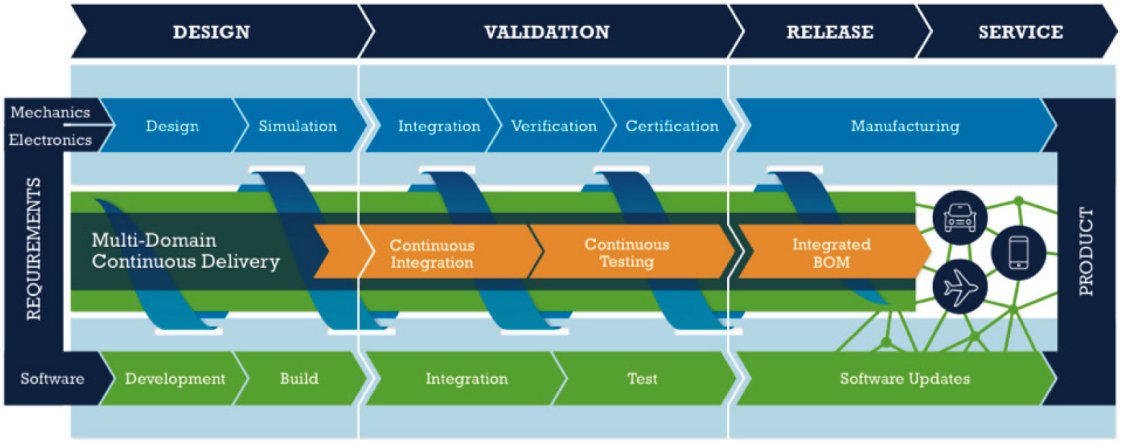


Although similar to the common business goals of any R&D organization looking at implementing a Continuous Delivery strategy – reducing design-to-deliver cycles with higher first-time quality – there are uniquely interesting operational and functional challenges at these Multi-Domain Product Development organizations worth highlighting:

1. how to create an iterative and fast development environment integrated across all mechatronics domains
2. how-to align multi-disciplinary teams early and often
3. how-to eliminate lead-times and bottlenecks in the build-test-release cycle
4. how-to maintain consistency and coordination of relevant product data throughout the parallel multi-domain product development lifecycle
5. how-to integrate all mechatronics components into a single Engineering BOM
6. how-to efficiently visualize and present an integrated up-to-date overall status of product development
7. how-to ensure the expected system-level performance of the product by being able to test the product at any point in time



Let's look at each of these key components of Multi-Domain Continuous Delivery in more detail:

1. Create an iterative and fast development environment across all mechatronics domains

Key to creating an iterative and fast development environment across all mechatronics domains is integrated emulation and simulation techniques.

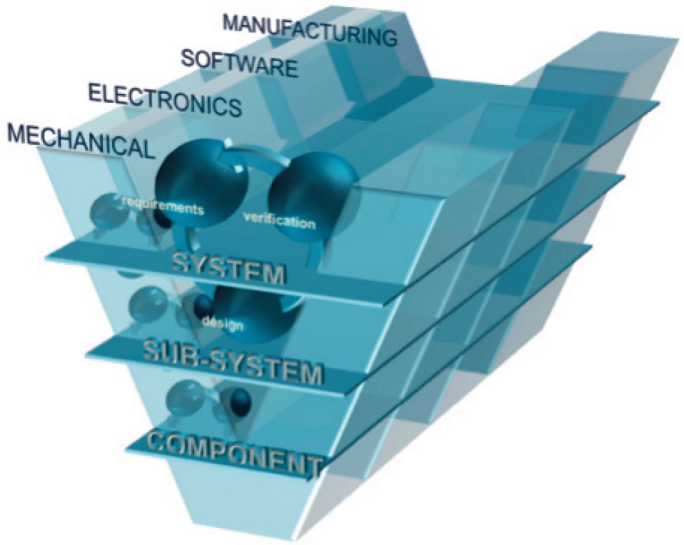
As development organizations try to scale up and increase the pace of development, a likely bottleneck will be access to physical reference models or prototypes of the actual hardware device. This is where the fast availability of virtual full-system or component simulation environments plays an essential role in enabling higher concurrent access to test infrastructure.

Better Software. Faster!
*http://www.synopsys.com/Systems/VirtualPrototyping/vp-book/Pages/defa*ult.aspx

2.Align multi-disciplinary teams early and often

Traditionally, Waterfall or V-model based development has been the standard process for regulated hardware-centric product development. As the software ingredient of these products grows in importance, modern agile development methodologies follows with shorter cycles and more frequent integration points. While it will be difficult for end-to-end multi-domain product development to go all agile (regardless of how one choose to define and implement agile), a cascaded agile way-of-working tightly embedded into the waterfall process seems to be resonating and taking off amongst multi-domain development practitioners - i.e. smaller batches of work with shorter iterations weaved into a larger V-based development cycle.

A Practical Approach to Large-Scale Agile Development: How HP Transformed LaserJet FutureSmart Firmware
http://www.amazon.com/Practical-Approach-Large-Scale-Agile-Development/dp/0321821726



3. Eliminate lead-times and bottlenecks in the build-test-release cycle

Long lead times are detrimental for the productivity of any product development, and making sure the end-to-end cycle time of the integrate-build-validate workflow is as short as possible should be a key priority for anyone implementing a Continuous Delivery environment.

Fortunately there exist mature and sophisticated solutions for build, test and analysis acceleration that can reduce lead times by up to 90-95%, which could mean bringing hours of lead time in a development cycle down to a few minutes if not seconds.

"A Global 500 banking company was able to achieve over 2000% increase in their build times using ElectricAccelerator."

4. Maintain consistency and coordination of relevant product data throughout the product development lifecycle

For enterprise large-scale R&D organizations, maintaining consistent and coordinated product data throughout the development lifecycle can be a massive challenge. It is key for organizations to tightly integrate their PLM, ALM and build/test deployments, such that orchestration across the end-to-end lifecycle for all various product input are synchronized and referenced wherever possible. Once data is integrated across these systems, product development organizations have a powerful closed-loop federation managing inventory, changes and compatibility across the matrix of dependent software and hardware components.

Accenture's outlook on Unified ALM-PLM
http://www.accenture.com/us-en/outlook/Pages/outlook-online-2013-maximizingroi-unified-application-lifecycle-management-product-lifecycle-management-almplm.aspx

5. Integrate all mechatronics components into a single Engineering Bill of Materials (BOM)

BOM management is an important but difficult aspect of efficient product development. With higher frequency and shorter release cycles driven by market pressure and agile adoption, along with new key technology domains such as software becoming crucially important, the problem of making sure BOM's are consistent, reliable and a complete representation of reality across all Mechatronics domains is an absolute necessity to resolve

Beyond PLM's outline of industry state of unified BOM's
http://beyondplm.com/2014/01/24/how-to-combine-engineering-and-softwareboms

6. Visualize and present an integrated up-to-date overall status of product development

As disparate development organizations collaborate across geographic boundaries and technology domains, having an automated back end system to track and accumulate data management is of utmost importance for an integrated up-to-date overall status of projects and product development. This requirement is even more apparent for highly regulated environments, where it is essential to provide end-to-end traceability in order top ass certification and regulatory gateways.

"A Global 500 industrial manufacturing company purchased Electric Cloud in order to solve long delays between product releases; lack of test automation leading to high number of escaped bugs; error-prone manual handoffs in product delivery process;time wasted managing home-grown scripts; inability to reuse scripts, tools or best practices across a variety of teams; lack of reporting and visibility into product delivery pipeline; and inadequate access control for changes, process and data."

7. Ensure expected system-level performance of the product by the ability to test the product at any point in time

Rising time-to-market and quality pressures together with emerging concepts like Continuous Delivery creates demand for continuous testing of release-ready product throughout development project lifecycle. This concept may present a steep hurdle to pass and is at odds with traditional view of design, implementation and integration cycle - but the rewards are enormous for the successful organizations that are able to enable system level integrated testing at the push of a button.

A Practical Approach to Large-Scale Agile Development: How HP Transformed LaserJet FutureSmart Firmware

http://www.amazon.com/Practical-Approach-Large-Scale-Agile-Developmentdp/0321821726

The Electric Cloud and Siemens PLM Solution

Electric Cloud and Siemens PLM is uniquely positioned to enable state-of-the-art Multi-Domain Continuous Delivery for any product development organization that is working across multiple domains of software, mechanics and electronics. The tight integration between Siemens PLM Team center and Electric Cloud brings together the rigor of multi-domain product engineering and state of the art software delivery mechanisms such as Continuous Integration and Delivery, forming the foundation for next-generation accelerated product delivery.

The combined product offering enables a closed-loop solution by integrating and automating key steps such as build, test and simulation across mechatronics and software teams - enabling product components to be built and tested early and often, resulting in a dramatic reduction of the overall engineering cycle.

Watch video:

http://youtu.be/eynrTjuDlRU

Electric Cloud Multi-Domain Continuous Delivery solutions page:

http://www.electric-cloud.com/solutions/plm.php

Conclusion

Markets today are becoming more and more competitive for every day - reducing design to-deliver cycles are key to maintain or take over time-to-market advantages. The growing importance of software for product differentiation adds another dimension to the challenge for product development organizations to stay competitive.

Given this we have found an emergent need for Multi-Domain Continuous Delivery to assist in optimizing development and delivery of integrated mechatronics and software product development. While there exist established and rigorous processes and methodologies for mechatronics and software development from an individual perspective, there is a clear need to define and introduce a new way of working for an integrated and iterative multi-domain product development landscape. We believe Multi-Domain Continuous Delivery is the answer for next-generation accelerated product development and delivery - enabling speed and end-to-end visibility across domains, at global scale.

Electric Cloud

About Electric Cloud

Electric Cloud powers Continuous Delivery. We help mobile, embedded systems and enterprise web/IT providers deliver better software faster by automating and accelerating build, test, and deployment processes at scale. Industry leaders like Qualcomm, SpaceX, Cisco, GE, Gap, and E*TRADE use Electric Cloud solutions and services to boost DevOps productivity and Agile throughput.

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