



IBM Engineering Lifecycle Management Software Portfolio

A series of papers exploring the product
and software development process

IBM Engineering Lifecycle Management

Today's products are becoming increasingly more complex and sophisticated. Wrist watches are becoming fitness trackers and health monitoring devices, automobiles are automatically braking to avoid collisions, industrial equipment is performing self-diagnostics for preventive and predictive maintenance.

Pressures to bring products to market faster with more features and functions, that perform flawlessly and cost less to develop—mandate that businesses are leveraging the right engineering lifecycle management tools to respond to a dynamic and impatient market. Competitive pressures and global competition means that companies need to adopt new processes and practices sooner rather than later. This paper highlights the IBM Engineering Lifecycle Management portfolio which enables companies to successfully meet development challenges and evolve their processes and practices faster.

Consumers have always been demanding, and each generation is more sophisticated and technologically savvy. We are no longer content to patiently wait years for the next big thing. Consumerism is demanding faster product iterations resulting in shorter product lifespans. If a product is not an over-night success, it is quickly relegated to the trash heap.

As technology becomes more transient, the situation is compounded. Small competitors can spring up literally over-night, secure substantial seed funding and become competitive challengers to market leading companies. This further shortens product lifespans; every company is learning that if they get too comfortable, they will quickly find their products eclipsed in features, functions and technology.

If this were not challenging enough, companies still have to deliver on ROI—shortened product lifespan or not. This pressure is driving companies to launch products in multiple markets across the globe in the hopes of recovering development costs earlier and accelerating revenue realization.

Shrinking product lifespans were happening before Internet of Things (IoT) or artificial intelligence (AI) and analytics, but these have become accelerants to the pace of change. Products can leverage an exponentially expanding sea of data that is coming from an ever increasing array of microprocessors that are becoming more powerful and inexpensive (so inexpensive that they are finding uses in disposable implementations).

The volume and type of new data that is being produced (structured and unstructured) needs to be parsed, categorized, manipulated, and identified so that it becomes useful in product design and performance. Both the data and connectivity are accelerating the amount of software usage in what was commonly viewed as purely mechanical systems. For example, Ford at CES2016 indicated the new F-150 Pickup has 150 million lines of software. These accelerants enable companies to add new features and functions through software much more easily than going through a mechanical redesign. This feeds our consumption mentality; we get new features and functions more quickly which in turn makes us want even more features and functions.



Watches are now a complex product that doubles as a fitness tracker and monitoring device

But there are consequences to these market dynamics. As products become more connected and more complicated and intelligent, companies need to leverage more partners and suppliers for specialized expertise and to meet the demand for parallel engineering development. As customers demand more customization, companies are forced to provide more variants on their base product development. Both of these drive more need for compliance and regulatory requirements to help manage the systems-of-systems and the implications of crossing geographic boundaries or dealing with governmental agencies.

Systems engineering has reached a tipping point in product complexity. Traditional engineering development practices are no longer able to efficiently develop competitive, complex products in a timely fashion. Sequential or linear development practices cannot successfully address these challenges. Companies cannot afford to hire more engineers to address growing complexity, and even if they could, they would not be able to find them.

Office products (such as spreadsheets and word processing) cannot sustain the engineering processes required to develop cutting-edge products. Stand-alone engineering management products can only address one silo of the engineering process. And in many cases siloed products can cause more issues through sub-optimization and can create the need for translation or conversion of engineering information between processes.

Successfully developing more intelligent or complex products that will have shorter lifespans across more dispersed engineering teams requires a more disciplined end-to-end engineering lifecycle management strategy. This strategy is based on adopting and accepting a continuous engineering model, leveraging engineering management tools focused on the four key pillars of the development process: requirements, modeling, testing, and workflow.

Let's explore how the IBM Engineering Lifecycle Management solution supports an end-to-end development process.

Requirements Management

Requirements management represents the foundation of every product lifecycle. It is the DNA of the product. Requirements describe how the product will function, what its capabilities should be, how it will react under different circumstances, and other important factors. If your requirements are not correct then you will not develop the product you have envisioned.

Given this importance, you not only need to create comprehensive requirements to properly define what the development team is going to build, but you must manage these requirements throughout the development process. You must ensure that everyone is working on the same requirements, that the requirements are linked to subsequent development processes, and that there is clear auditability for the entire program.

IBM Engineering Requirements Management DOORS® Next is the next-generation, web-based collaborative requirements management tool for supporting complex requirements such as the Internet of Things (IoT). This product provides a single platform for managing requirements to help teams work more effectively across disciplines, time zones, and supply chains.

Key benefits of the IBM Engineering Requirements Management DOORS Next are that it:

- Supports collaborative, intuitive and scalable management of requirement specifications
- Helps enable simpler creation of links and powerful traceability views across requirement specifications, designs and tests
- Provides automatic notification of changes that can impact related requirements, designs and tests
- Leverages Watson AI to remove risk and ambiguity in requirements authoring, modeled on the INCOSE Guidelines for Writing Good Requirements, pre-trained, provides coaching to improve quality of the requirements being written
- Helps integrate requirements into the lifecycle as a core component of the IBM Engineering Lifecycle Management solution for systems and software engineering, and with third party tools, through support of Open Services for Lifecycle Collaboration (OSLC)

Requirements management serves as an essential practice and framework for product lifecycle management. Effective requirements management can save time and money by properly controlling project scope and staying on track to meet dynamic market and business needs. It drives better insights for product development with traceability across the product lifecycle and improved collaboration among teams to achieve shorter development cycles and higher-quality products.

IBM Engineering Requirements Management DOORS Next delivers the requirements management capabilities to enable you to better develop complex products, deliver higher quality, accelerate time to market, as well as reduce cost to meet revenue objectives.

Systems Design

As product complexity increases so does the need to provide better model-based approaches to prototyping and design. Systems design provides a way to visually construct systems architectures for requirements. It provides a way to simulate and test designs for validation and analysis, helping manage the shrinking development lifecycle.

IBM Engineering Systems Design Rhapsody products provide a collaborative design and development environment for systems engineers and software developers. It enables them to create, test, and document systems and software designs. It provides the foundation for digital transformation and for leveraging the digital twin modeling strategy.

Diverse teams can collaborate to analyze requirements, optimize design decisions and validate functionality early in the development lifecycle. They can perform design reviews, and automate the delivery of innovative, high-quality products. The product integrates with the overall product development lifecycle, from specification and development through test and delivery.

Key benefits of IBM Engineering Systems Design Rhapsody are that it provides:

- Support for modeling with UML, SysML, AUTOSAR, MARTE, DDS, MODAF*, UPDM*, multicore, MISRA-C, MISRA-C++; creation of custom profiles for the development of domain-specific languages (DSL)
- Profiles, settings, stereotypes, tags, and APIs with which you can extend and configure the product
- Requirements modeling and traceability features with integration to leading requirements management tools
- Advanced requirements synchronization, impact, and coverage analysis capabilities*
- Static checking to ensure that the design is consistent
- Interfaces to MathWorks Simulink*, UNICOM System Architect, and IBM Rational Statemate®
- Support for safety standard development: ISO 26262, IEC 61508, IEC 62304, EN 50128, DO-178B, and DO-178C

** The marked capabilities are provided with optional add-on products. IBM Engineering Systems Design Rhapsody provides a way to visually construct systems architecture from the requirements, while automatically generating many of the deliverables that used to be done by hand. Unlike low-cost modeling tools or manual methods, the IBM solution provides a way to simulate and test designs for validation and analysis and create software (code generation for safety critical systems) and text-based deliverables directly from the application design.*

Test Management

What does this competitive environment mean for businesses seeking to deliver high-quality products and services? Certainly, effective quality management creates opportunities to deliver key business benefits, such as higher customer satisfaction and increased brand equity. But myopic quality focus cannot serve as the single guiding principle by which products are produced and delivered.

Time to market is also key. Costs and risk factors must also be part of the balancing act. Get any of these things wrong, and you may face unsustainable costs, missed windows of opportunity, unhappy customers, even a massive recall or the complete failure of a system at a critical moment. Get these things right, and you can deliver positive return on investment from the efficiencies gained in development activities.

The IBM Engineering Test Management solution is a collaborative, web-based tool that offers comprehensive test planning, test construction, and test artifact management features throughout



IBM's tools support automation of the creation and maintenance of relationships throughout the development lifecycle

the development lifecycle. The test case design-and-construction features support defining the overall design for each test case.

Each test case includes a rich-text editor that you can use to include background information. A test case can also include links to development items and requirements which provides automated traceability.

You can associate a test case with other test artifacts, such as test plans, test scripts, and test case execution records. In addition, test cases can be combined into test suites.

IBM Engineering Test Management includes a set of predefined reports to help you determine the status of your project. In addition, you can see live, test execution status just by opening a test plan, or by browsing a list of test plans and opening the execution view. You can trace the relationship between test artifacts, requirements, and development artifacts by browsing a list of certain test artifacts and opening the traceability view.

Key benefits of the IBM Engineering Test Management solution are that it helps:

- Define business and test objectives
- Establish a review and approval process for the test plan and for individual test cases
- Manage test cases, and establish the interdependencies between the two
- Estimate the size of the test effort
- Define the schedule for each test iteration and track the dates of other important test activities
- List the various environments to test and generate test configurations
- Create a read-only snapshot of the test plan at a particular point in time
- Define quality goals, entrance criteria, and exit criteria
- Create and manage test cases
- View test execution progress

Everyone can rationalize that the cost of a defect increases dramatically during the progression of the development process. Finding a defect early in development process is a lot less expensive than having a defect reported after product has been released. Adopting an integrated test solution, such as the IBM Engineering Test Management solution, helps integrate testing throughout your product development lifecycle. It provides extreme clarity for immediate feedback, maximizing efficiency and reducing the cost while developing quality products.

Engineering Workflow

Workflow is a core element in successful end-to-end engineering lifecycle management. Enabling meaningful collaboration in real-time, identifying who is working on what, and who should be notified when, and being able to design and deliver timely reports is critical to success across dispersed, large, or multi-disciplined engineering teams.

How many quality issues can be directly tied to poor communication between siloed teams? As your internal or external engineering team grows their communication challenges grow exponentially faster. Adding one engineer to a team of four can increase the communication paths by eight.

The IBM Engineering Workflow Management offering provides a fully integrated change, configuration and build management environment. It also includes integrated agile project planning and dashboards that supply metrics and reporting. The solution helps companies develop better products and systems with an all-in-one agile environment for development teams. This includes agile, formal and hybrid planning and reporting that are all on a common platform.

Engineering Workflow Management makes it easy to exchange information directly in the context of your work. If an enhancement request changes, you and other team members are notified of the change automatically. You can reference the change in chat sessions and link to artifacts. Business stakeholders can also automatically stay informed of the status of any task changes that interest them.

Key benefits of the IBM Engineering Workflow Management solution are that it:

- Provides an integrated team environment, including integrated source control, work item, build and project management capabilities which “think and work” in unison
- Enables real-time and offline “in-context” collaboration across distributed project teams
- Supports out-of-the-box and custom defined process configuration, which keeps the team on a consistent, repeatable path to success
- Provides real-time project health information and transparency of status through automated data gathering, web dashboards and metrics and reporting
- Provides a broad choice of client environments including Eclipse, Visual Studio, Web Browser, command-line

IBM Engineering Workflow Management offers an open, extensible architecture which provides collaboration in context, a streamlined agile development model, automation of governance, scaling with the enterprise, and help to unify diverse teams within in the enterprise. It supplies the backbone for tackling complex product development.

Engineering Lifecycle

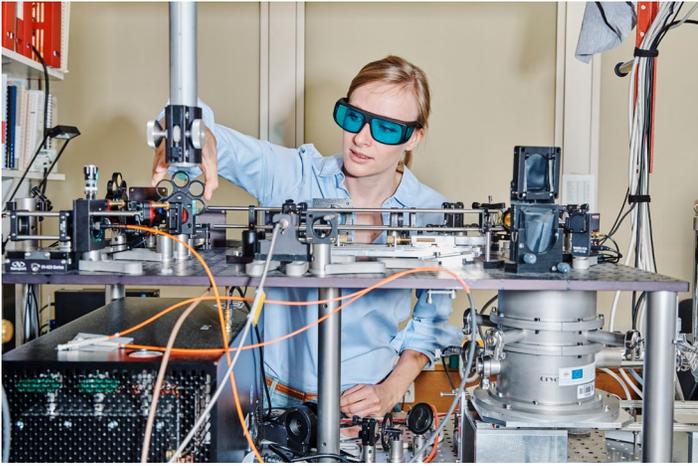
Taking a holistic view of the development process, it is clear that leveraging an end-to-end engineering lifecycle management solution delivers greater productivity than the sum of the parts.

The IBM Engineering Lifecycle Management portfolio can help companies transform to a systems approach for developing smart products. Capabilities and data are tightly linked between engineering processes. The IBM solution enables your engineering team to leverage traceability throughout the development lifecycle. It provides access to all engineering information, so engineers can query, analyze and organize information from all disciplines and collaborate between engineering disciplines. This enables engineers to collaborate in near real-time between multiple tools from multiple vendors. These integration capabilities enable better product compliance, managing teams to teams, visibility, agile and agile at scale processes. IBM’s portfolio provides an integrated set of capabilities, practices and services that:

- Ensure developed products meet customer requirements by making requirements visible across all engineering domains throughout the complete lifecycle of the product
- Deliver the right product at the right time by prioritizing investments and resources in products that will most impact profitability, and delivering products in windows of opportunity
- Improve product quality by using model driven systems development to simulate complex interactions of systems of systems early in the development process
- Improve development efficiency and minimize late discovery of errors and integration issues by uniting engineering disciplines throughout the product and systems development process
- Enable effective re-use of engineering assets across variants, proper management of commonality and variability, enabling parallel development of core platform and multiple variants while providing accurate upstream and downstream change propagation
- Reduce costs and time to market by effectively propagating change and enhancement requests across the different design domains and with partners and suppliers

The IBM Engineering Lifecycle Management portfolio eliminates the need for your teams to build and maintain interfaces between primary engineering management functions. You will not have to invest in the repetitive tasks of translating and migrating data from one program to another. Your team can focus on developing your company’s products and not maintaining tools used to manage the engineering process.

IBM’s solution supports open standards enabling you to interface cleanly with third party offerings or your own developed tools so you do not have to worry about being locked in.



IBM's Engineering Lifecycle Management portfolio allows your team to focus on development rather than maintaining tools

The end game is to successfully compete in developing increasingly complex products.

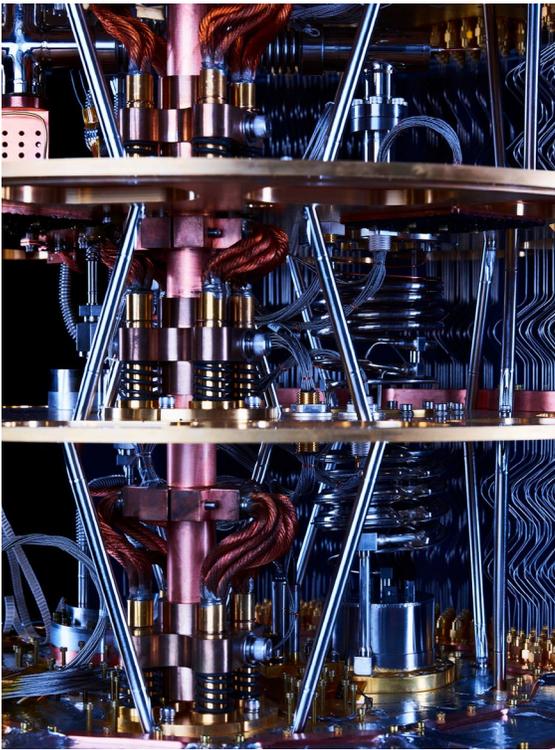
Your engineering teams have always been and will always be learning and stretching their own capabilities. Adopting an end-to-end engineering lifecycle model that will help ensure your company's success should be an easy decision.

Learn more

Learn more about how the IBM Engineering Lifecycle Management solution can help your business succeed in today's competitive marketplace. Contact your IBM Business Partner.

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