



DIGITAL TRANSFORMS PHYSICAL

MODULEWORKS AND PTC, AN EFFECTIVE PARTNERSHIP TO EMPOWER THE DIGITAL TRANSFORMATION IN MANUFACTURING.

Jose Coronado

Director, Creo Product Management



June, 2022

AGENDA

- Emerging Technology Investments in Creo
- Creo: The renaissance of design
- How to deploy new manufacturing solutions faster?
 - PTC-Moduleworks partnership
- Remarks

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CREO FOR INTEGRAL DESIGN, MANUFACTURING & SIMULATION CAPABILITIES

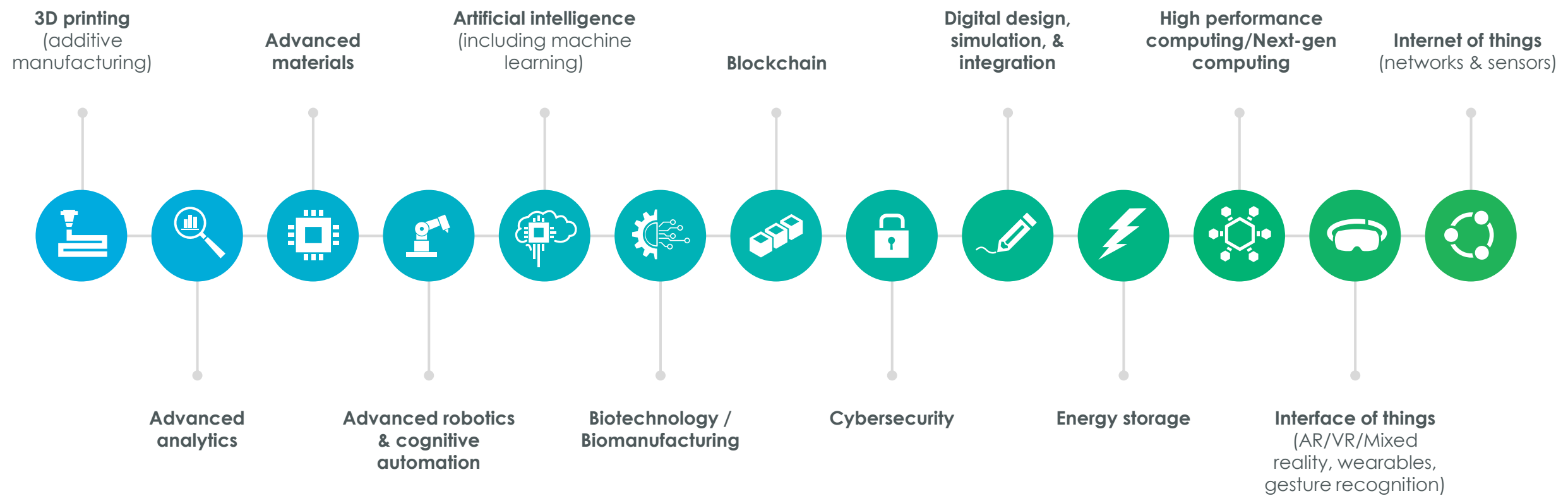
CAD



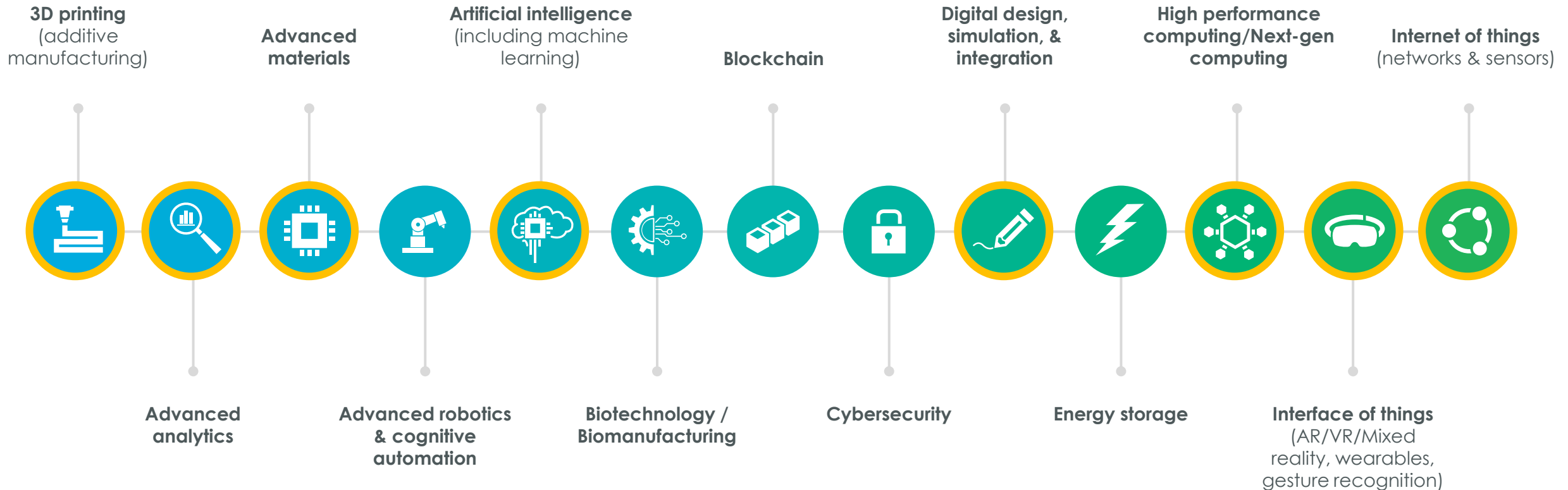
- 2D & 3D Concept Design Tools
- Parts & Assembly Modeling
- Automatic 2D Drawing Creation & Update
- Fully Semantic Model Based Definition
- Multi-CAD Collaboration & Data Exchange
- Assembly Management & Performance Tools
- Parametric & Freeform Surface Design
- Sheet Metal Part Design Tools
- Mechanism Design
- Molded/Cast Part Design Tools
- Structural Framework & Weldment Design
- Photorealistic Rendering & Animation
- Direct Modeling with Creo Flexible Modeling
- Design Reuse & Automation
- Volume Production & Mold Machining Capabilities
- Associative Mold & Die Design
- Broad Array of Simulation Technology for Engineers



EMERGING TECHNOLOGIES



EMERGING TECHNOLOGIES



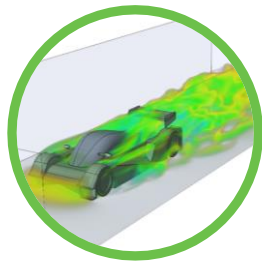
Deloitte.

Acceleration of tools for product design

EMERGING TECHNOLOGIES ARE CHANGING DESIGN AND MANUFACTURING

Only Creo delivers these technologies deeply integrating into the design environment...

...while delivering integral design, manufacturing & simulation capabilities supporting the entire digital and physical product lifecycle.



Real-Time Simulation



AI-Driven Generative Design



IoT-Driven Design



AR Collaboration



Design for Additive Manufacturing



OPERATION

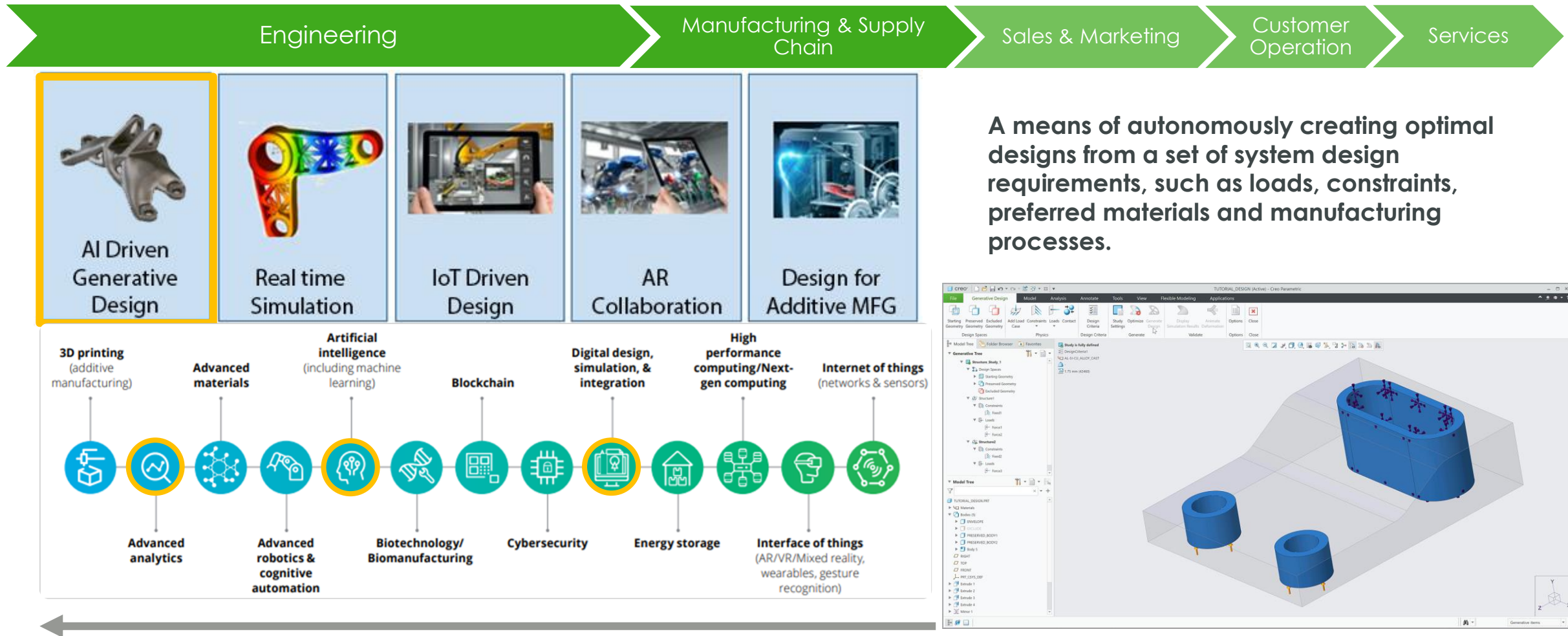
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THE TIME IS NOW: RENAISSANCE OF DESIGN



Creo as a platform unites technology trends into the design process



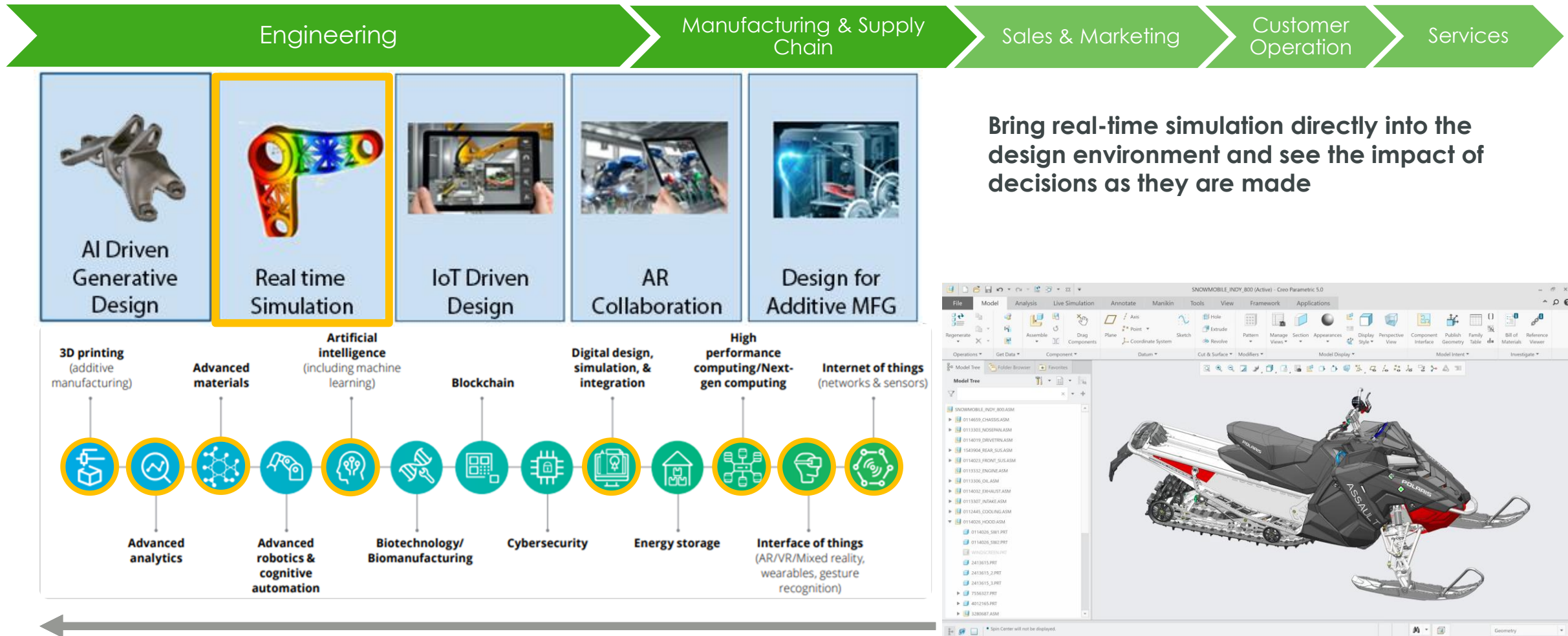
A means of autonomously creating optimal designs from a set of system design requirements, such as loads, constraints, preferred materials and manufacturing processes.



THE TIME IS NOW: RENAISSANCE OF DESIGN



Creo as a platform unites technology trends into the design process




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graph LR
    A[Engineering] --> B[Manufacturing & Supply Chain]
    B --> C[Sales & Marketing]
    C --> D[Customer Operation]
    D --> E[Services]
  
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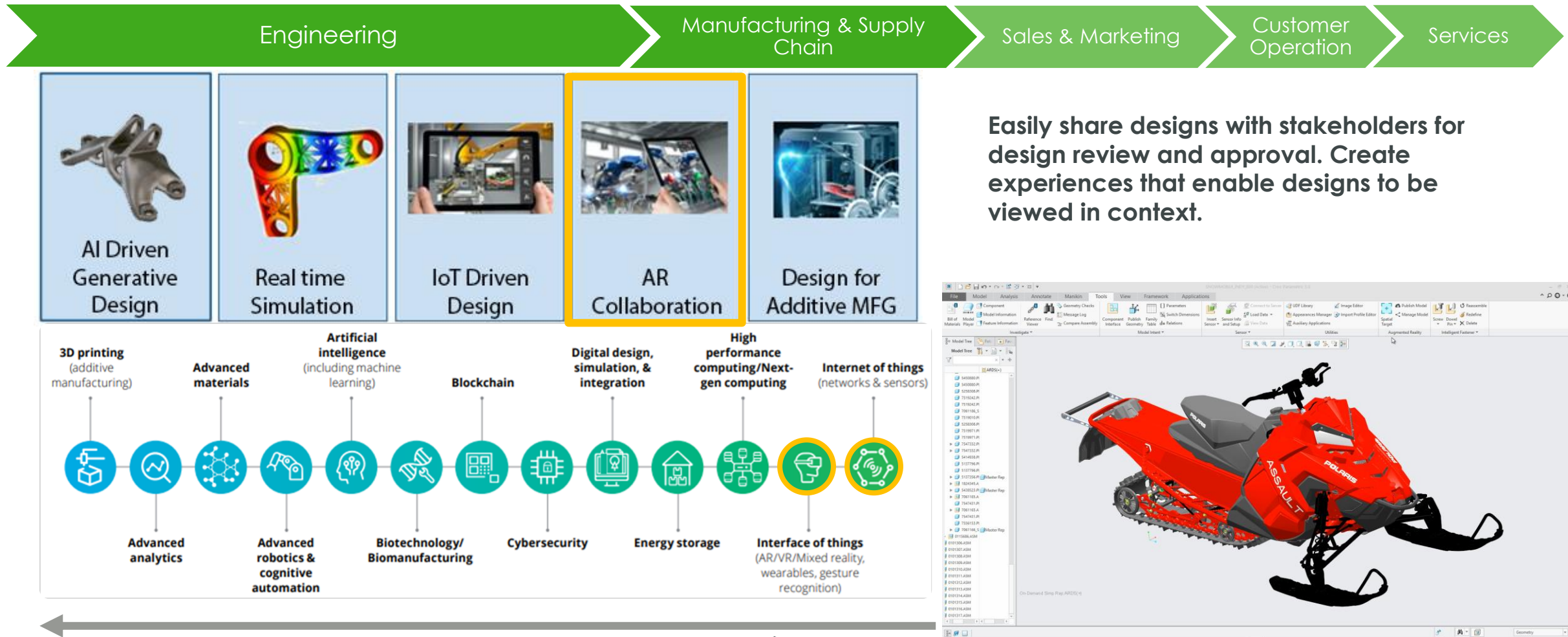
Engineering Manufacturing & Supply Chain Sales & Marketing Customer Operation Services



THE TIME IS NOW: RENAISSANCE OF DESIGN



Creo as a platform unites technology trends into the design process



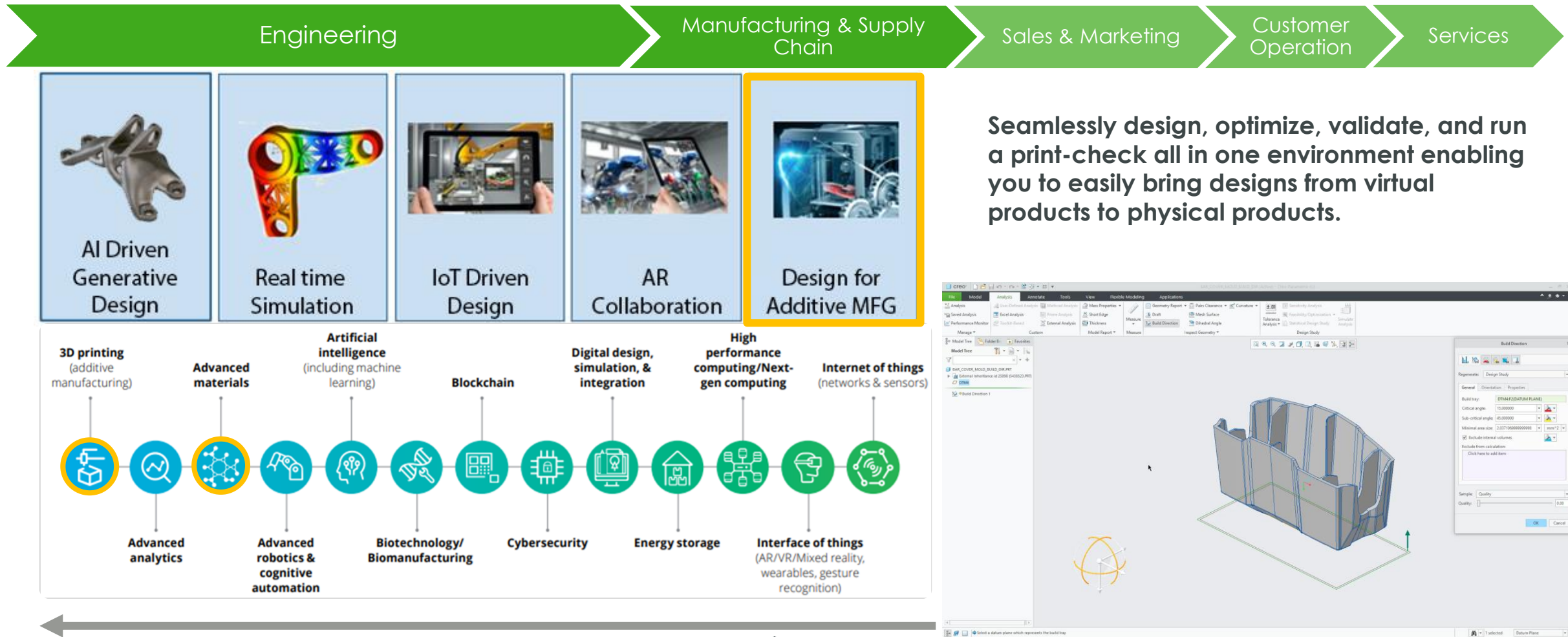
Easily share designs with stakeholders for design review and approval. Create experiences that enable designs to be viewed in context.



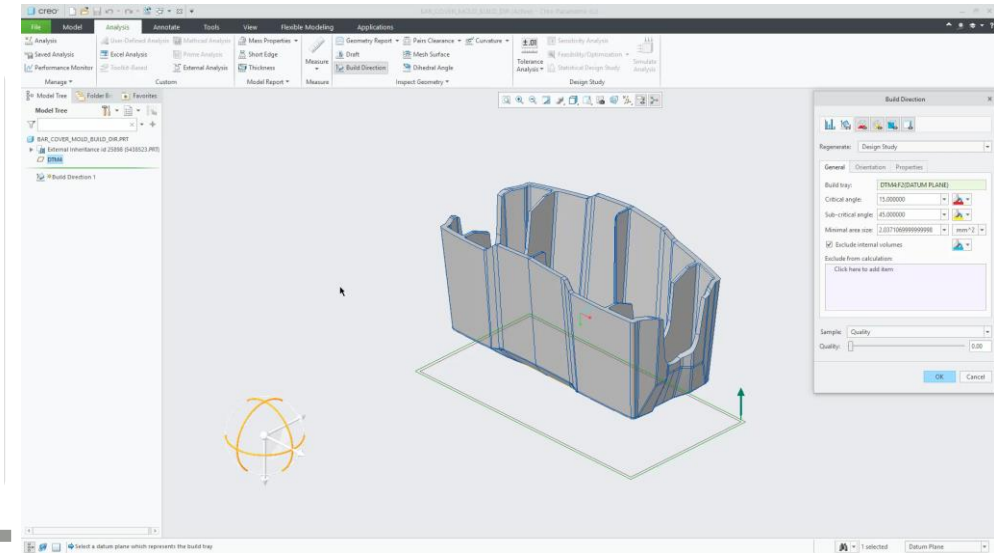
THE TIME IS NOW: RENAISSANCE OF DESIGN



Creo as a platform unites technology trends into the design process



Seamlessly design, optimize, validate, and run a print-check all in one environment enabling you to easily bring designs from virtual products to physical products.

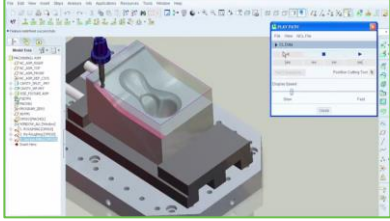


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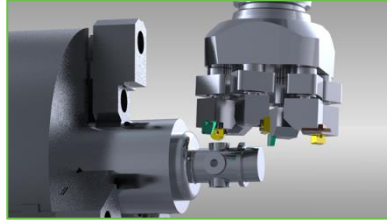
CREO MANUFACTURING SOLUTIONS PORTFOLIO

Creo Prismatic & Multi-Surface Milling



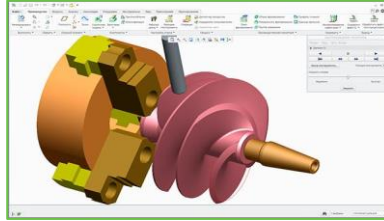
Multi-Surface 3-axis milling with high-speed machining support

Creo Production Machining Extension



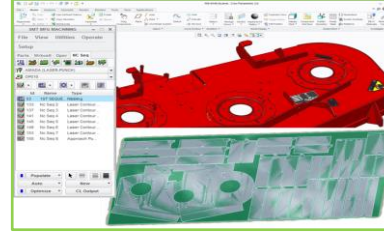
Added support for 4-axis turning and wire EDM

Creo Complete Machining Extension



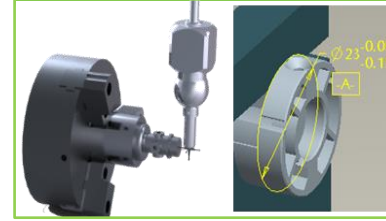
2.5- to 5-axis milling, multi-axis turning, multi-task machining and 4-axis wire EDM

Creo NC Sheetmetal



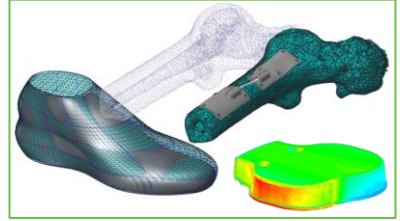
NC programming for turret punch presses, contouring laser/flame machines, nibbling and shearing

Creo Computer-Aided verification



Digital inspection and verification of machined parts and assemblies

Creo Reverse Engineering Extension



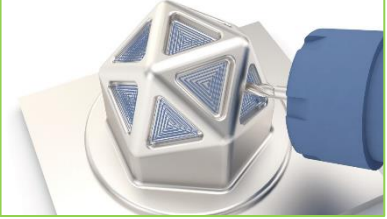
Reverse engineer from point cloud or faceted model geometry

Creo High Speed Milling Extension



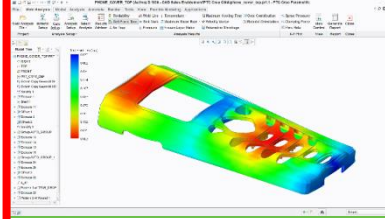
Specialized capabilities to speed 3 axis HSM

Creo High Speed Milling Plus Extension



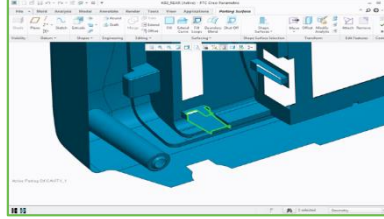
Specialized capabilities to speed 3 and 5 axis HSM

Creo Mold Analysis Extension



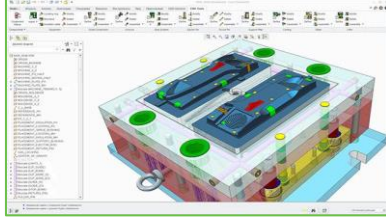
Mold filling analysis

Creo Tool Design Option



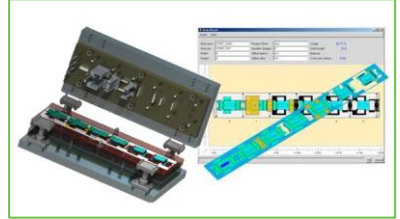
Accelerate the design of production mold and cast tooling

Creo Expert Moldbase Extension



Automate and speed moldbase design

Creo Progressive Die Extension



Automate and speed progress die design

Creo Parametric



Connectivity with polymer printers and service bureaus

Creo Additive Manufacturing



Parametrically controlled lattice structures and data-managed tray assemblies

Additive Manufacturing plus for Materialise



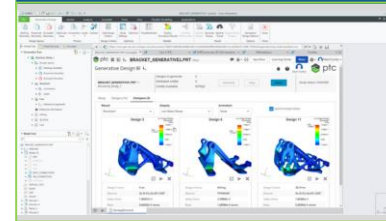
Creo AM functionality plus Support structures for metal and build processors

Generative Topology Optimization



Find the most efficient distribution of material within a user-defined design space

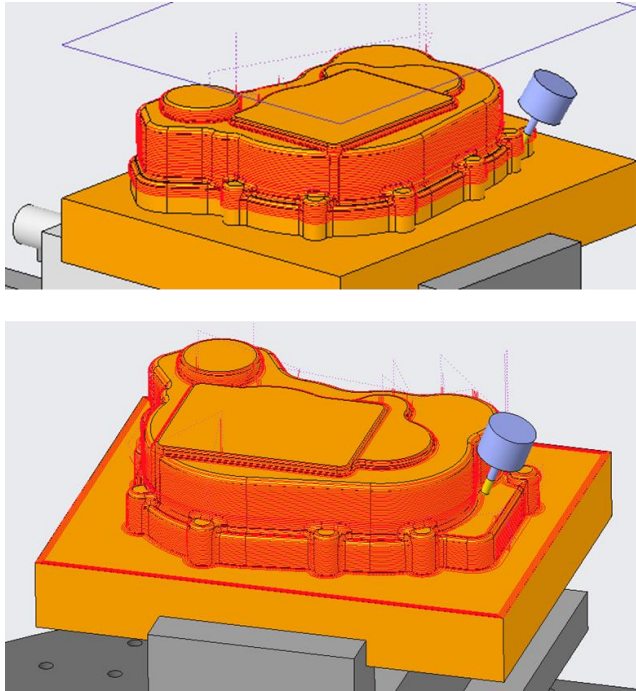
Generative Design Extension



Consider many scenarios in parallel and quickly with cloud-based GDX

STRATEGY

Creo Manufacturing Solutions are aligned with customer's requests



Subtractive

- Multi-Task Machines programming
- High Speed Milling
- NC Process Automation
- Mixed workflows for Additive-Subtractive

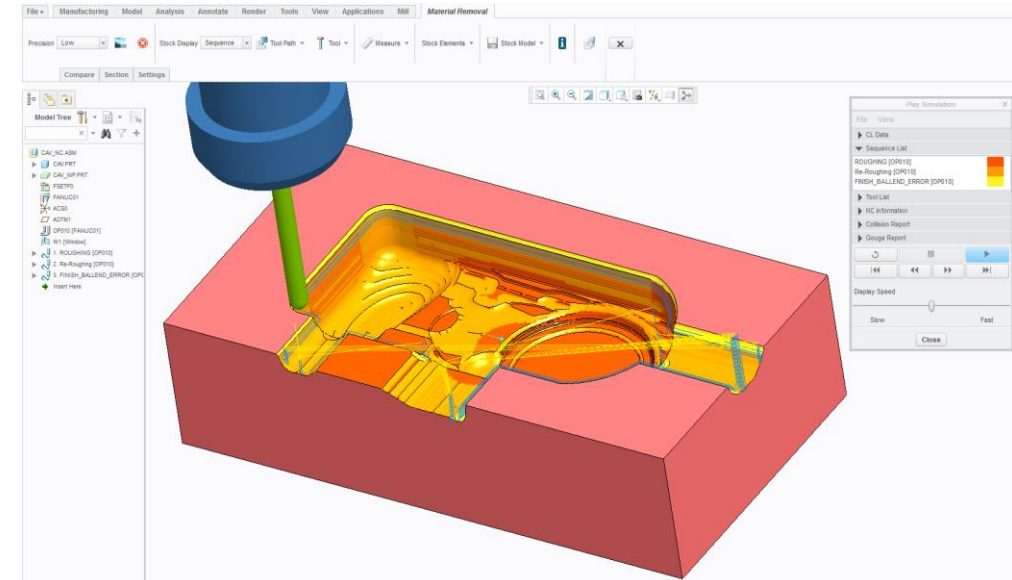
Fully embedded into the Creo design environment

TIMELINE OF PTC-MODULEWORKS PARTNERSHIP

2016	Material Removal Simulation (Creo 4.0)
2018	3 Axis Mold Machining Extension (Creo 5)
2018	5-axis Laser Deposition toolpaths (POC not shipped)
2019-2020	Mold Machining Extension Performance Improvements (Creo 6 and 7)
2019	PTC Partner's Machine Simulation Integration for Creo (not a PTC product)
2021	5 Axis Mold Machining Extension (Creo 8)
2022	5-Axis Geodesic finish (Creo 9)
2023	Barrel Tools support (Creo 10 – Planned)

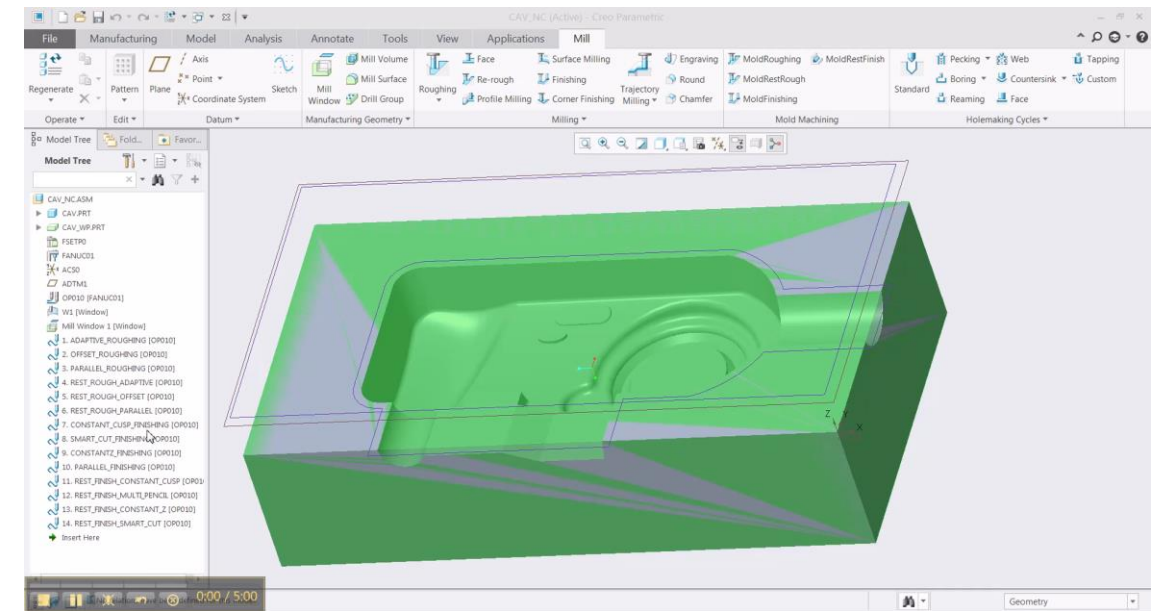
MATERIAL REMOVAL SIMULATION IN CREO 4.0 – 2016

- Material Removal Simulation is a dynamic simulation of material removal on the computer screen.
 - It allows you to view a step-by-step simulation of material removal as the tool is cutting the workpiece
- The Material Removal tab provides an integrated simulation environment where you can view the material being removed from the stock.
 - By simulating the material removal, you can analyze the cutter locations and check for collisions and gouges.
 - You must first create assemblies, operations, and NC sequences to simulate the material removal.
 - You can save the in-process stocks for use later or create simulation models to be transferred to manufacturing.



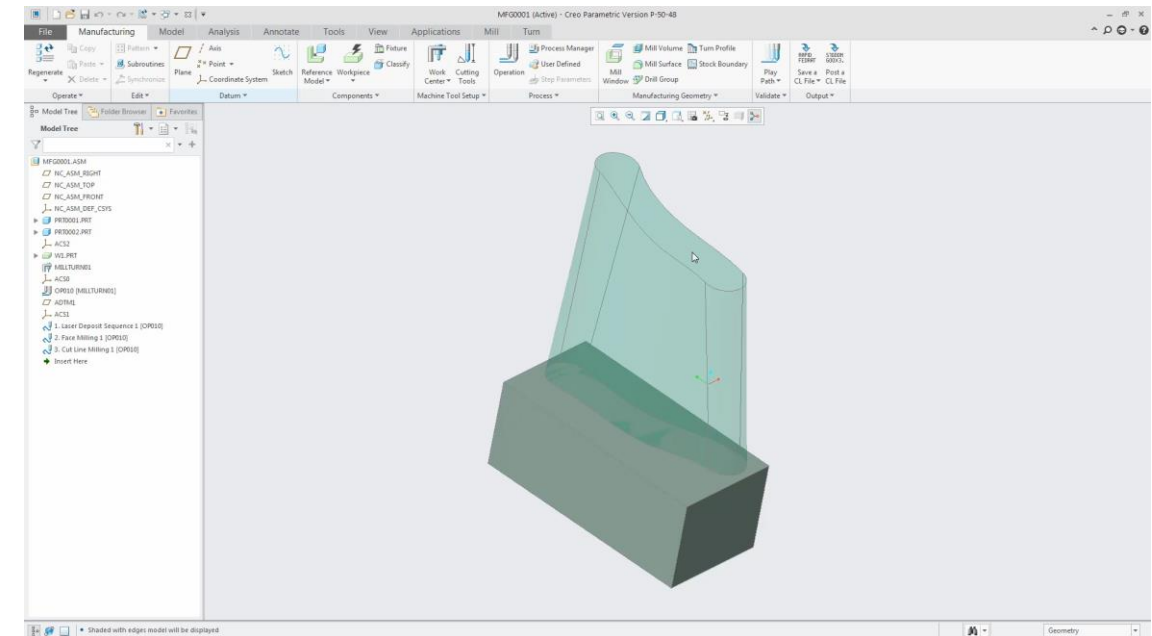
3 AXIS MOLD MACHINING EXTENSION IN CREO 5 - 2018

- High performance, robust 3-axis Mold machining functionality which complements native Creo toolpaths
- Enables PTC users to stay in the Creo ecosystem for 3-axis Mold machining, rather than use external CAM system
- Reduces the programming time and machining time for Mold machining
- Includes high value Adaptive Roughing strategy at an affordable price (e.g. compared to)



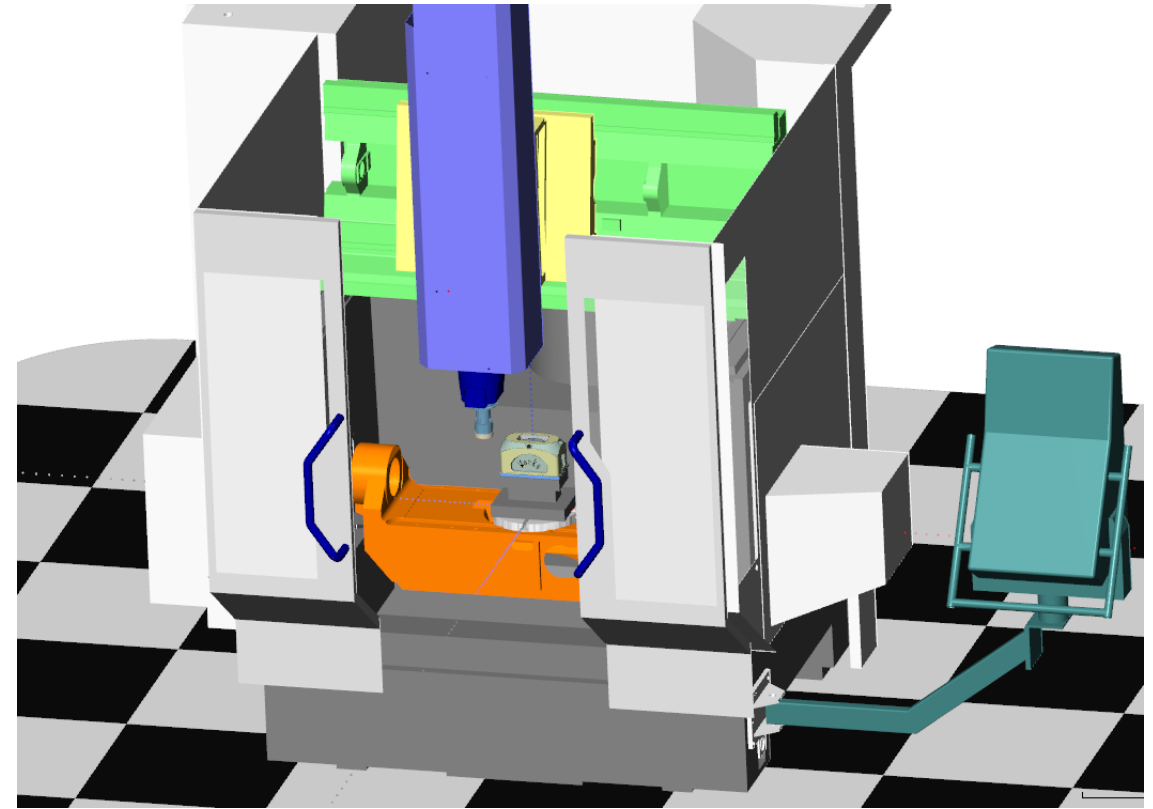
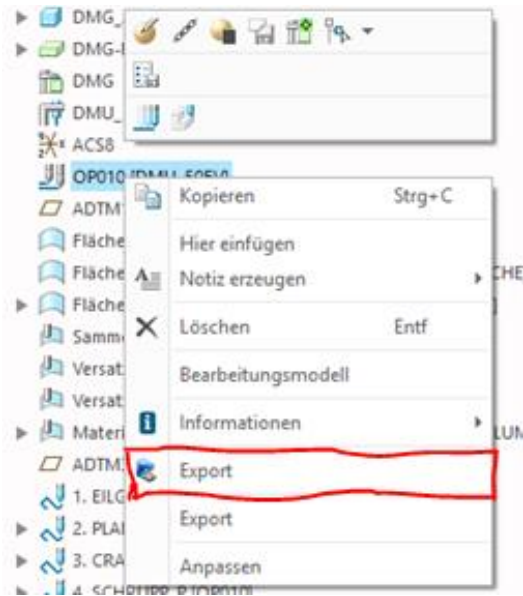
5-AXIS LASER DEPOSITION TOOLPATHS (POC NOT SHIPPED) - 2018

- The Laser deposition toolpaths are accessible from inside Creo NC extensions
 - Creo Prismatic, Production machining, Complete machining ...
- This integration allow the user to define laser deposition sequences in the same environment than 5 Axis concurrent milling toolpaths
 - Both additive and subtractive toolpaths are supported on Moduleworks-based material simulation/stock management functionality
 - The initial use-cases have been expanded based on customer's feedback.

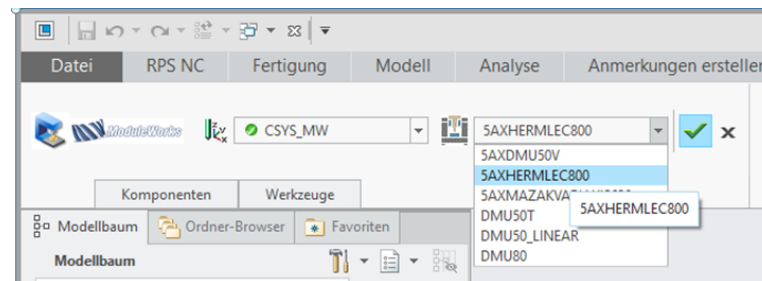


PTC PARTNER'S MACHINE SIMULATION INTEGRATION FOR CREO (NOT A PTC PRODUCT) – 2019

- Activation of machine simulation directly with export from the model tree

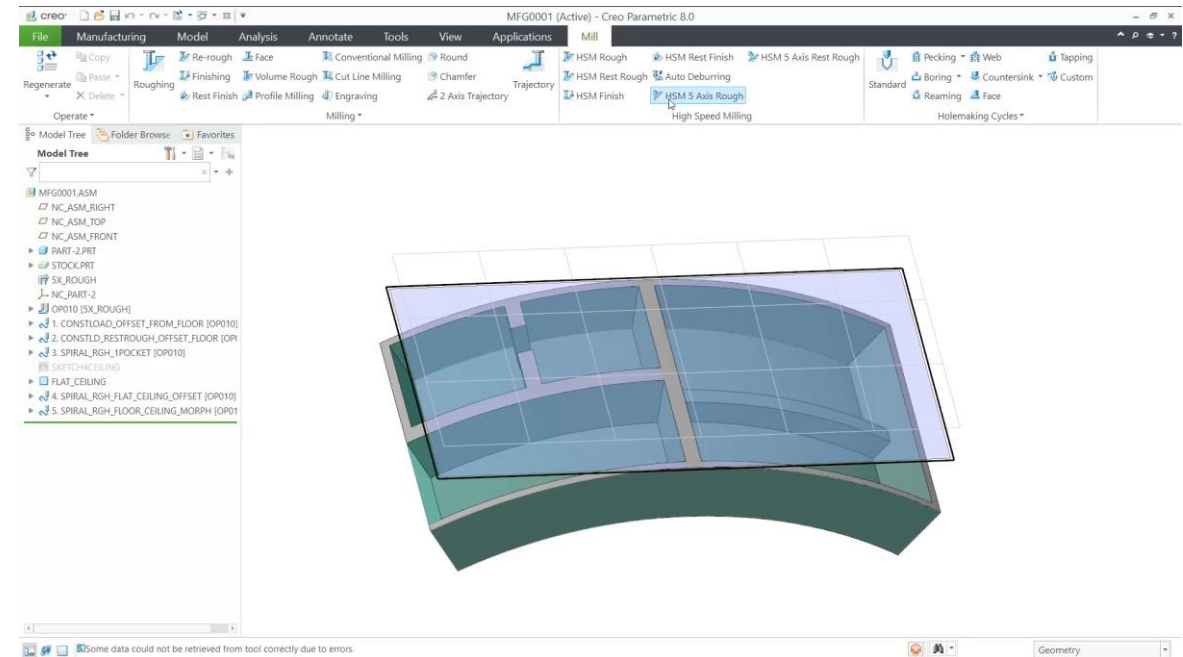


- Choice of machine



5 AXIS MOLD MACHINING EXTENSION IN CREO 8 - 2021

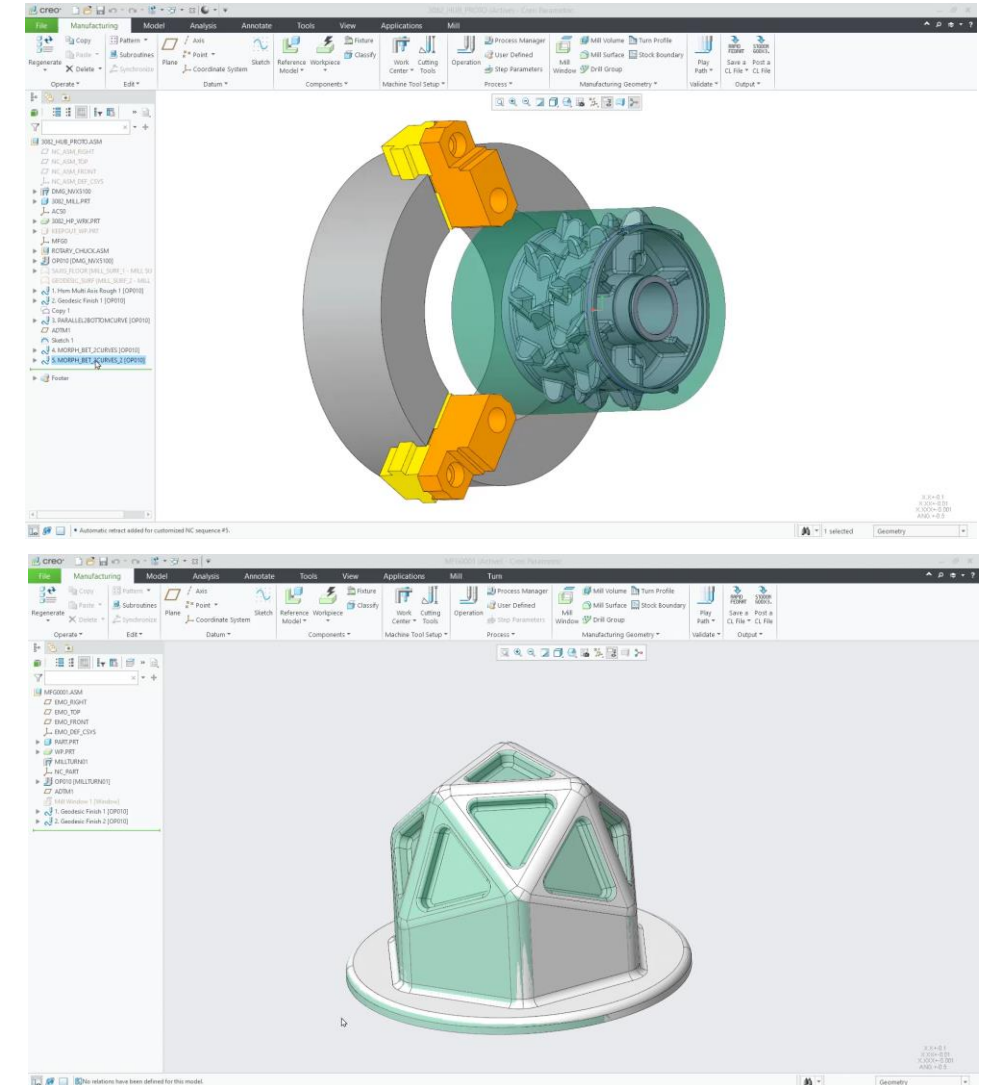
- A dedicated machining extension which simplifies 5-axis programming
- High-value, easy-to-use simultaneous 5-axis and 3+2-axis collision free toolpaths
- Can be used for both Mold & Die and production parts
- It complement existing 5-axis Creo toolpaths
- It can work on Creo Solid Geometry and on Imported Tessellated objects (facet features)



- **3Axis Mold Machining rebranded as High Speed Milling Extension - HSM**
- **3 and 5 Axis Mold Machining branded as High Speed Milling Plus Extension – HSM Plus**

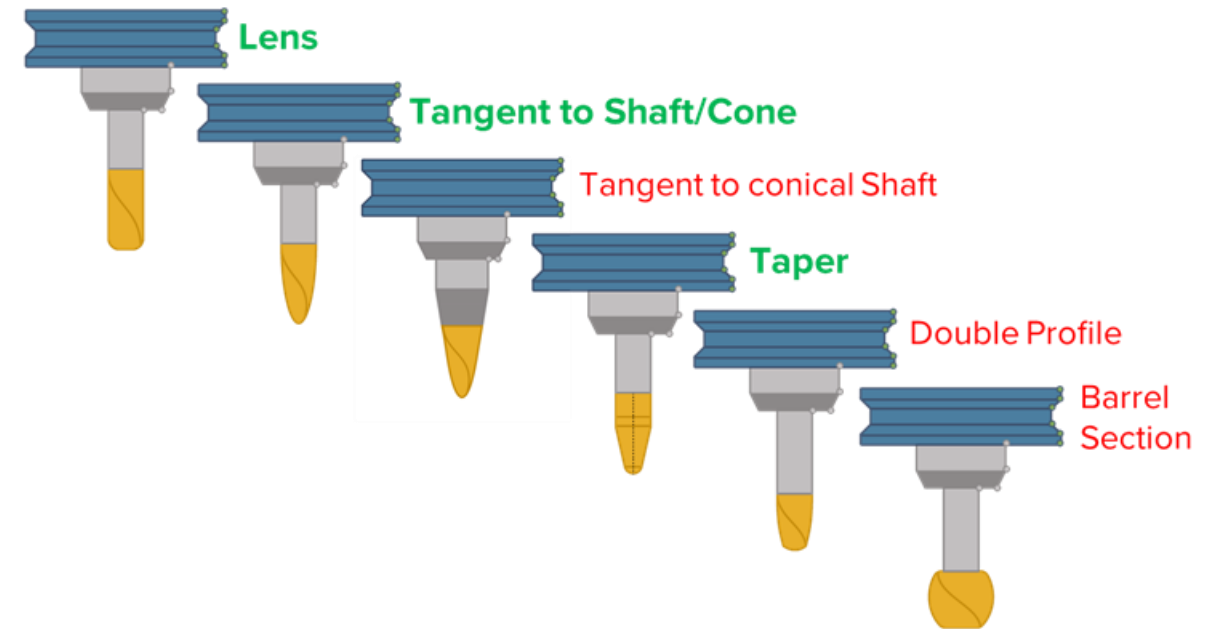
5-AXIS GEODESIC FINISH IN CREO 9 - 2022

- Complements the finishing toolpaths included in the 5 Axis HSM Extension, adding capabilities such as:
 - Automatic holes filling, use of containment curves laying on the surface, morph between two curves laying on the surface, multiple controls for Tilting
- Geodesic machining creates a toolpath that is optimized for spherical tools in terms of collision avoidance, machining area and micro pattern features without being limited by a fixed machining direction
- A powerful 5-axis finish NC sequence that creates smooth toolpaths with a constant stepover on complex parts with undercuts



BARREL TOOLS SUPPORT IN CREO 10 – 2023 PLANNED

- Support of barrel tools in the tool manager functionality
- 2 new finishing toolpaths
 - Wall machining
 - Floor machining



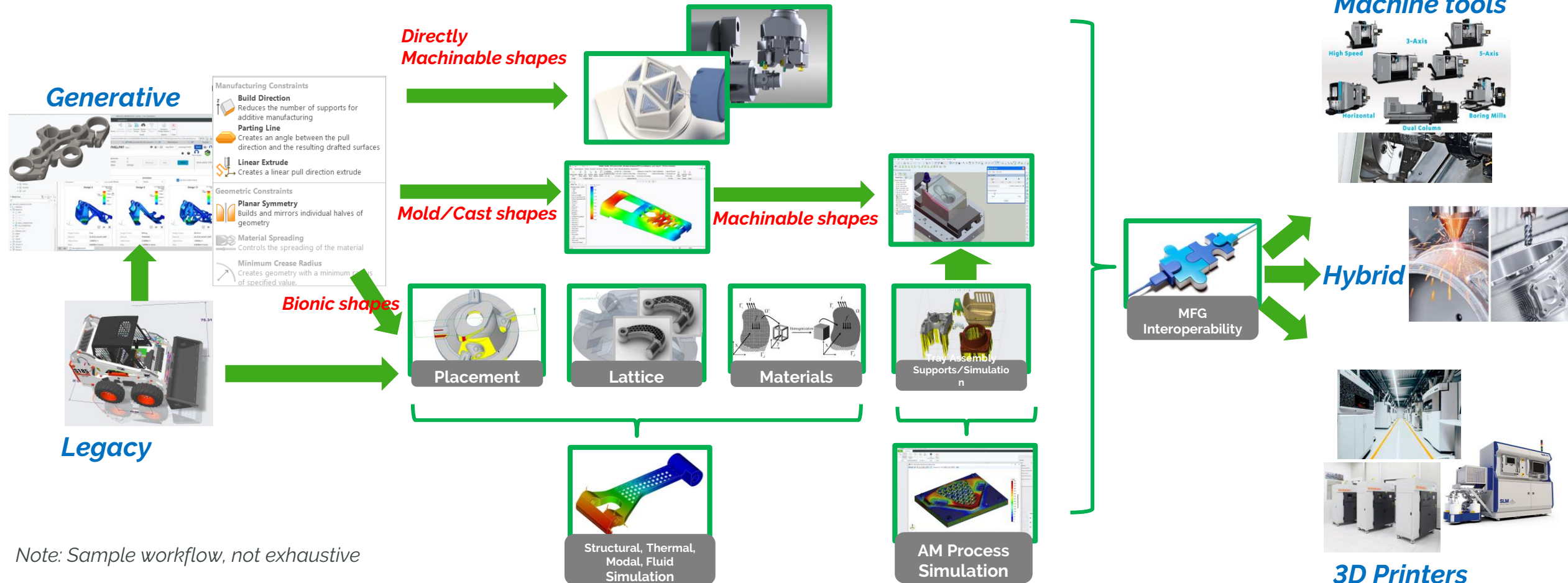
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INTERTWINED WORKFLOWS

Faster exploration of innovative design alternatives and selection of the most efficient manufacturing processes



Note: Sample workflow, not exhaustive

PTC – MODULEWORKS A PARTNERSHIP BASED ON TRUST

- ModuleWorks is the Go-To partner for CAD/CAM software components
- At PTC, we have more than 30 years of experience helping our customers solve key business challenges to achieve their goals with digital solutions in real-world applications
- The synergies of this partnership established a strong foundation for years to come





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THANK YOU

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