“Empowering the Digital Transformation via Digitalization within the Integrated Lifecycle”

MBE Summit 2018

siemens.com

SIEMENS
Ingenuity for life

Topics of Discussion

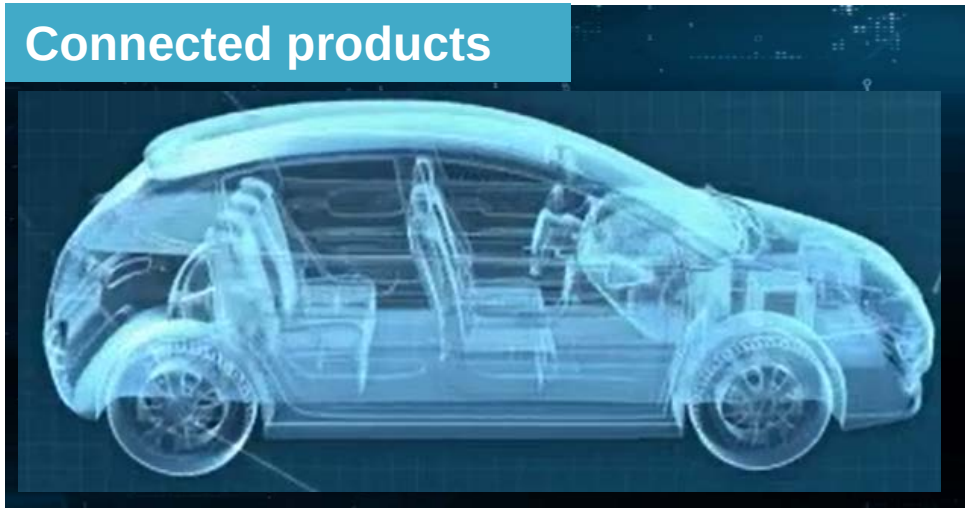
SIEMENS
Ingenuity for life

- *Introductions*
- *The Changing World Around Us*
- *Digitalization*
- *Program Execution Excellence*

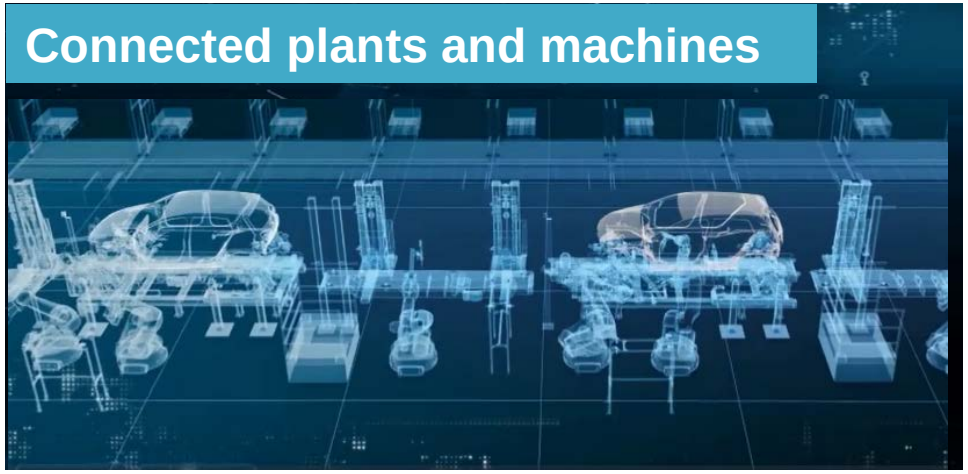
Complexity is Skyrocketing! - The Internet of Everything

SIEMENS
Ingenuity for life

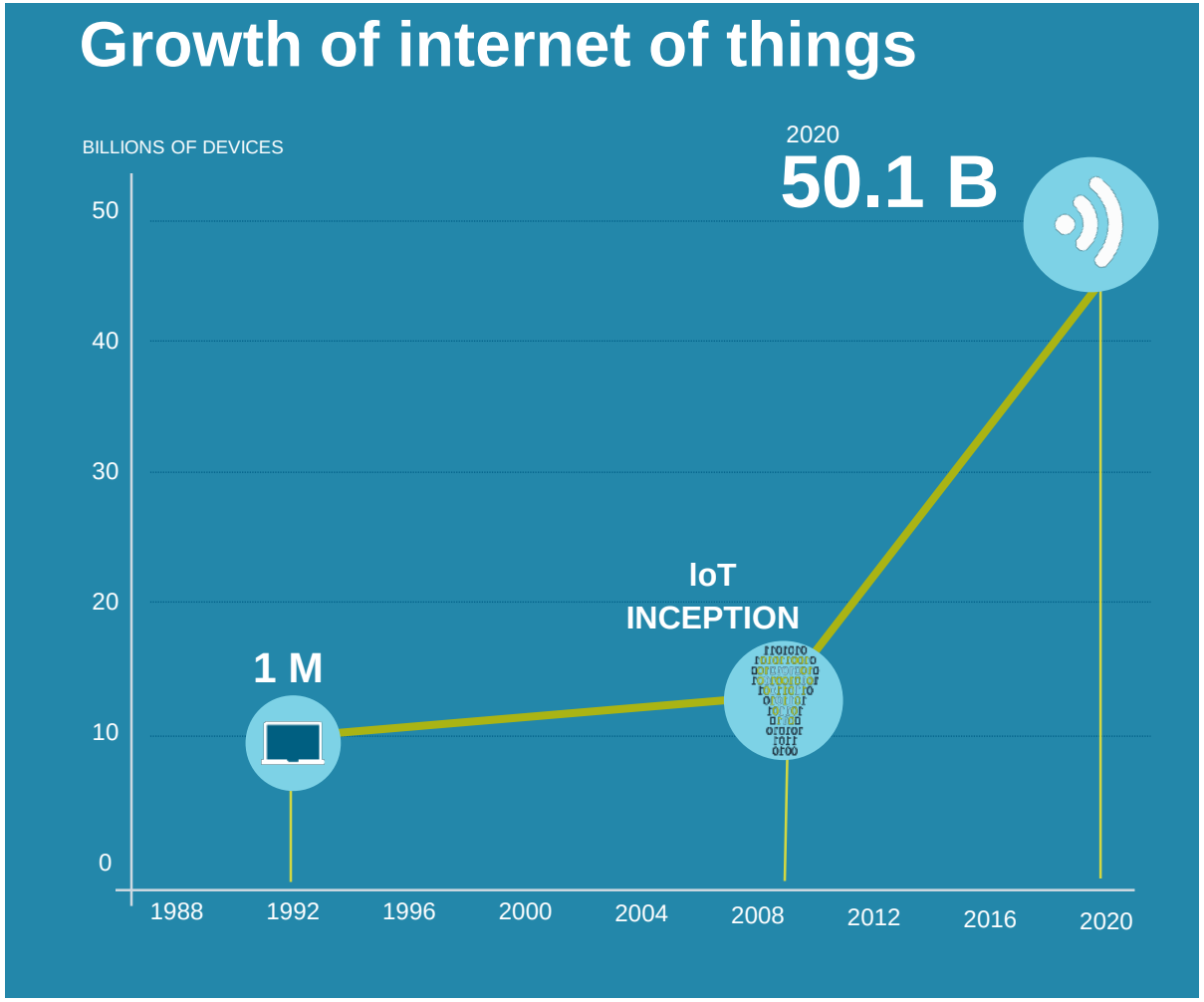
Connected products



Connected plants and machines



Growth of internet of things

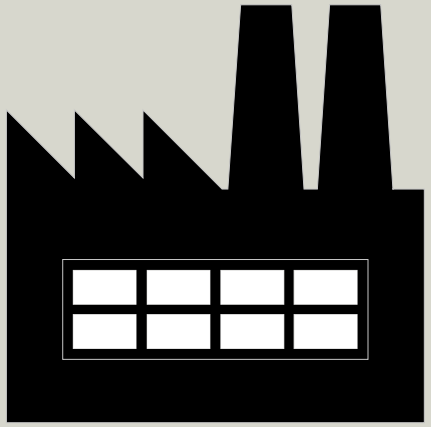


The Enterprise Focus

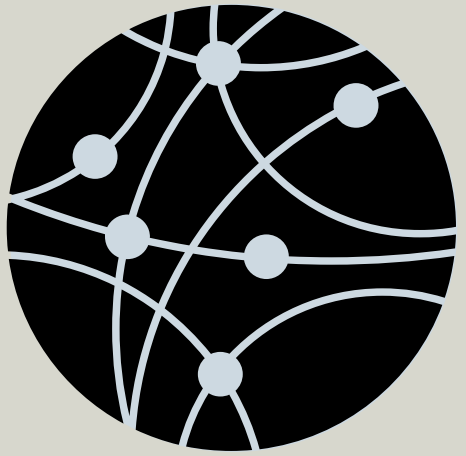
SIEMENS
Ingenuity for life

How is my product performing?

How is my plant performing?



How is my supply chain performing?



How do I Gain Product (Profitability) Intelligence?

Profitability is difficult to achieve in a global value chain

SIEMENS
Ingenuity for life

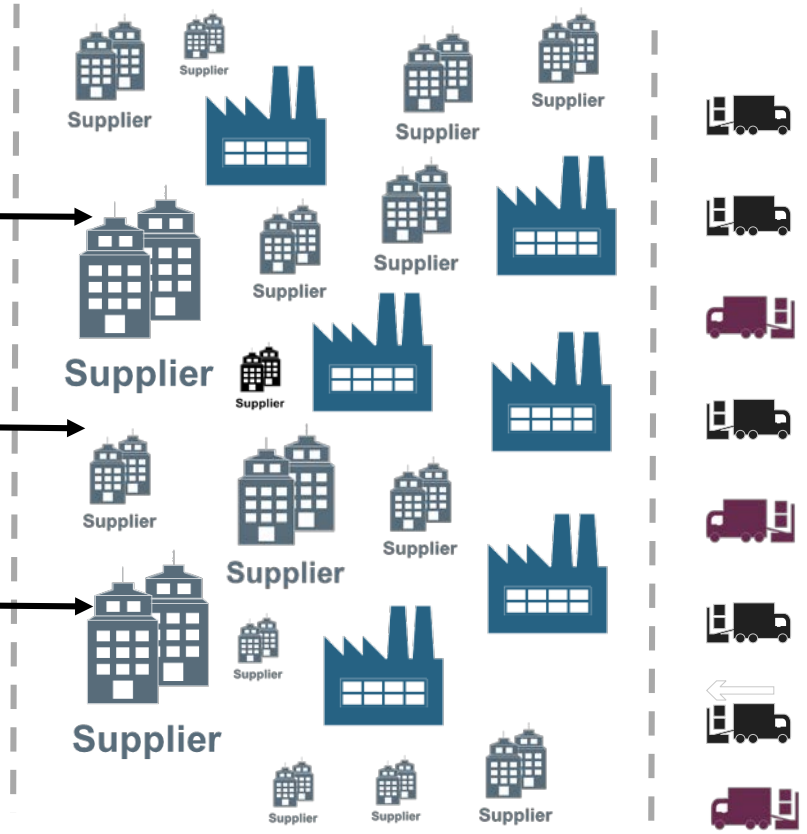
DESIGN

Product 1

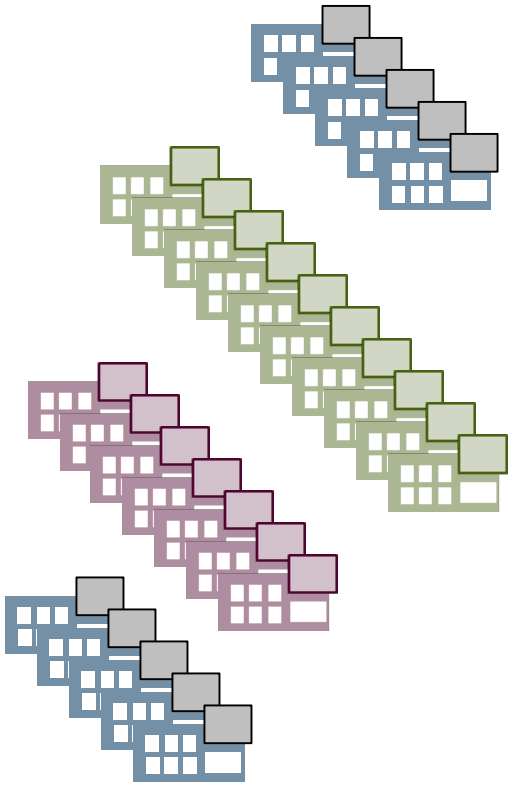
Product 2

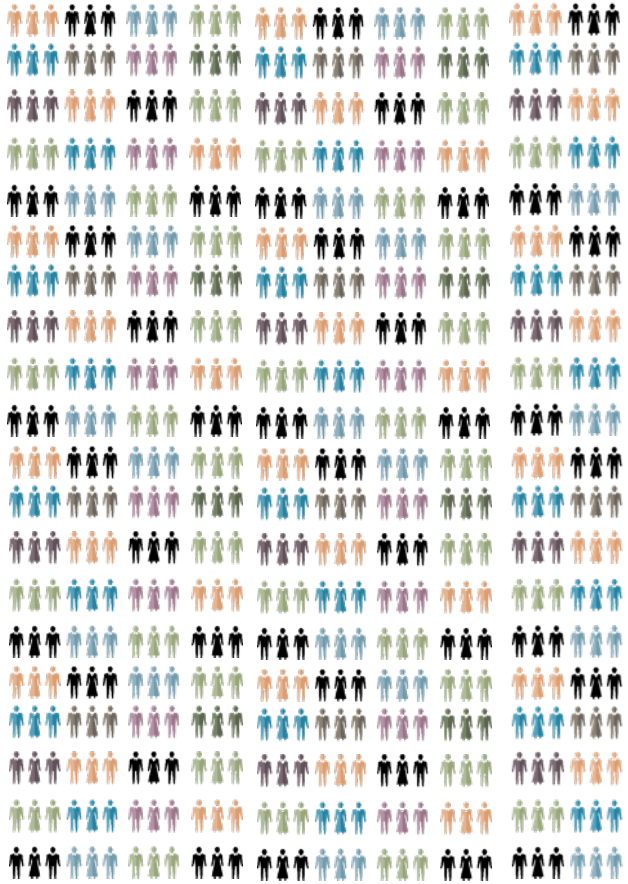
Product N

MANUFACTURING



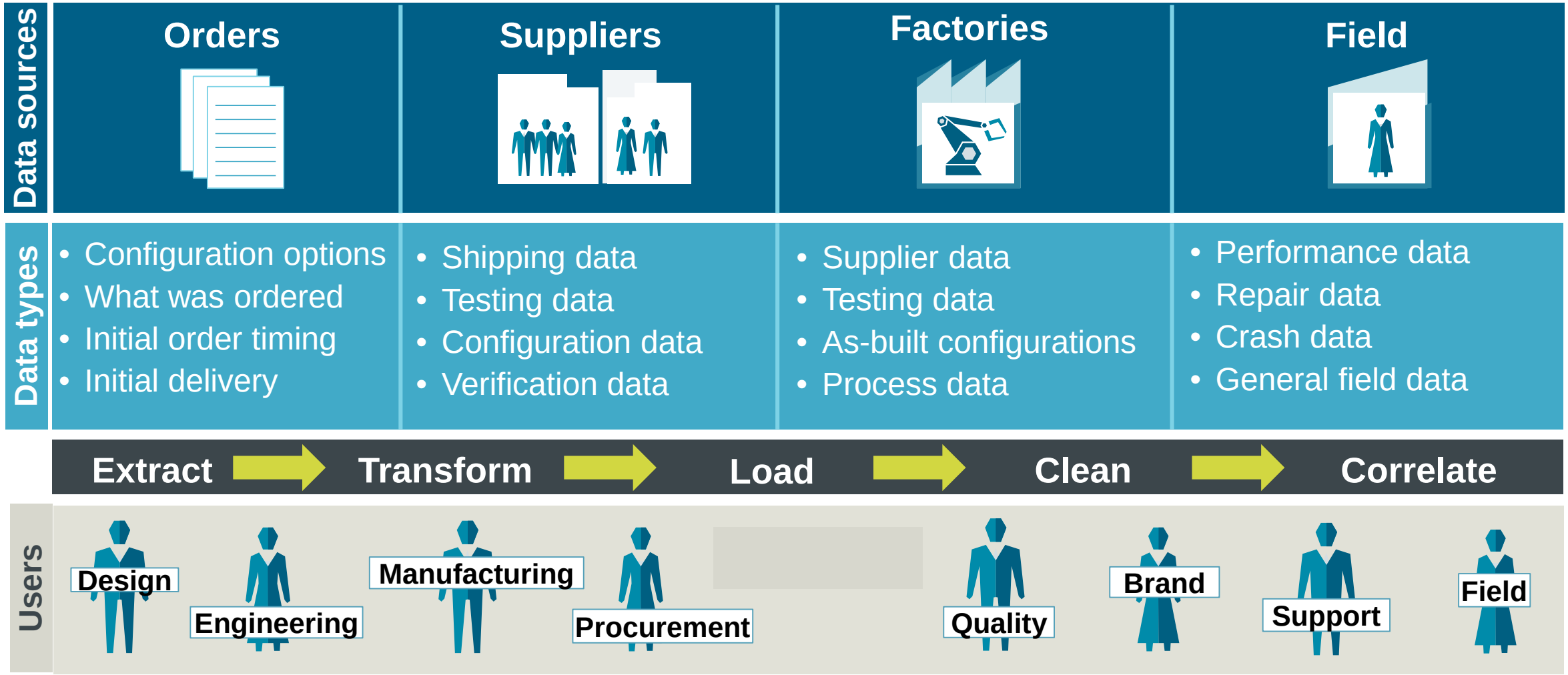
DISTRIBUTION & CUSTOMERS





Data across the Enterprise is at the Root of Success

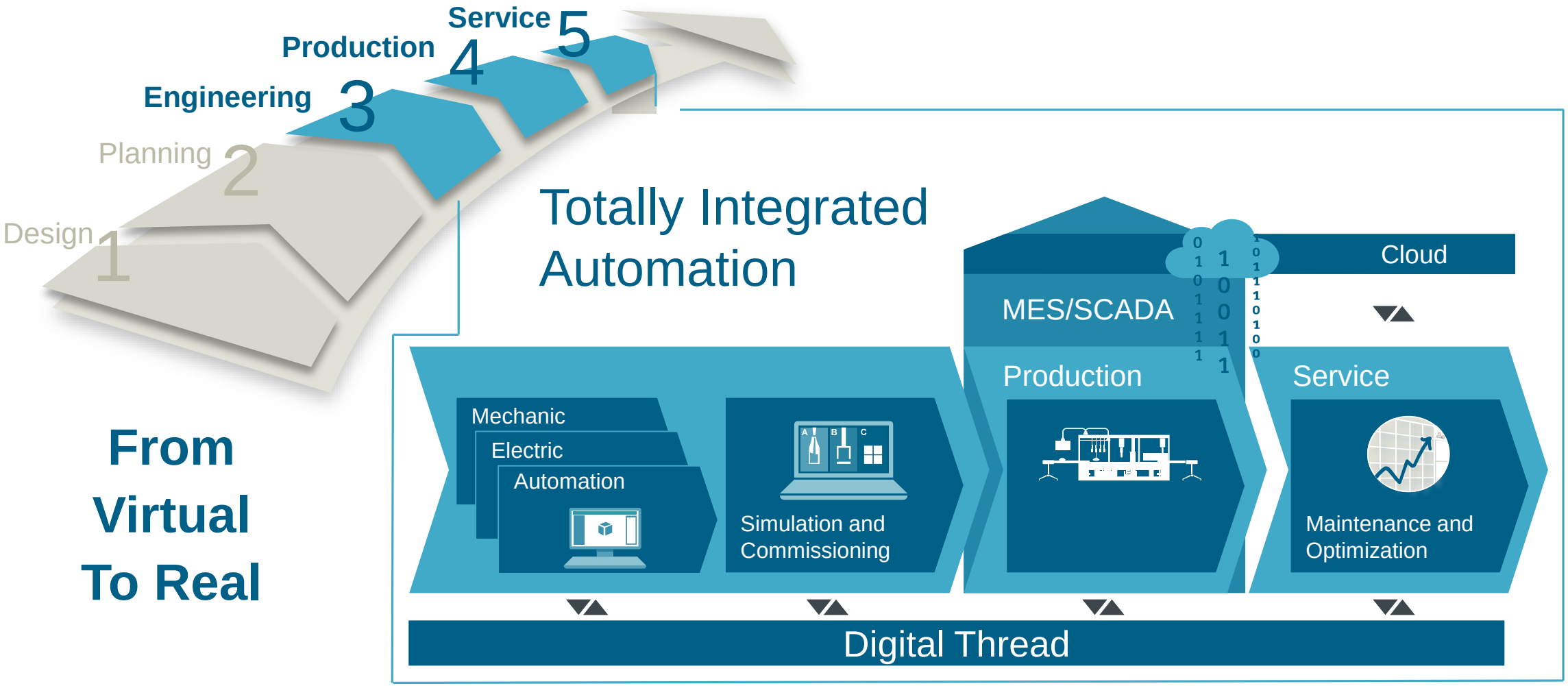
SIEMENS
Ingenuity for life



Engineering Automation

Value through digitalization with Horizontal and Vertical integration

SIEMENS
Ingenuity for life

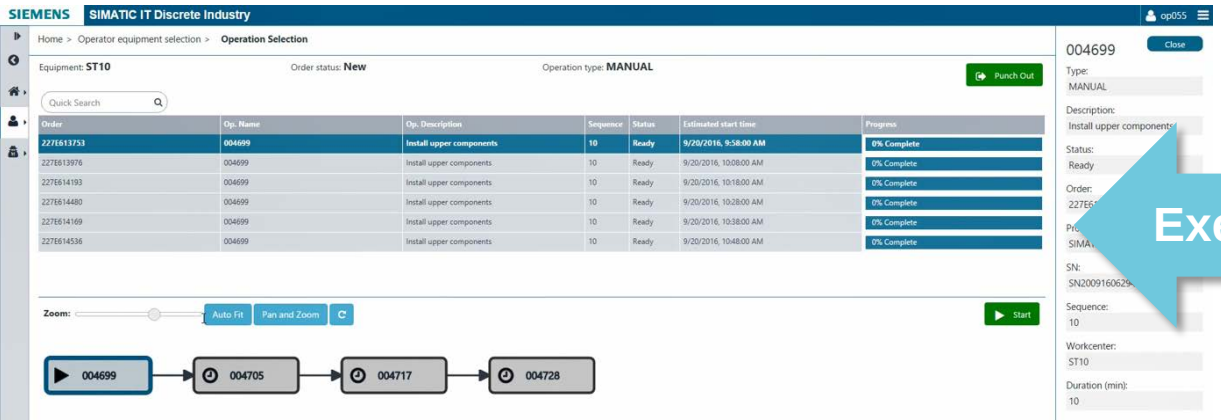


The Digital Enterprise Value Chain
Bill of Process Execution

SIEMENS
Ingenuity for life

1 Product design | 2 Production planning | 3 Production engineering | **4 Production execution** | 5 Services

In **SIEMENS** Amberg 1 million products a month are delivered with 24h lead time and 10dpm and 9 times increase in efficiency



Execute Production

Achieving Digitalization / Business Transformation

SIEMENS
Ingenuity for life

Source: 2016 World Economic Forum

Digitalization changes everything – Digital disruption is our opportunity

SIEMENS
Ingenuity for life

The reality is that the challenges facing global and high-growth innovation manufacturing enterprises are not trivial

- Complex products or processes
- Rapid innovation cycles
- Detailed traceability requirements
- Regulatory requirements
- Complex genealogy
- Massive documentation requirements

> **The IoT is being called the fourth industrial revolution, and is expected to have a value of over 10 trillion dollars by 2025.**
>
> McKinsey Global Institute

> **Digital is the main reason just over half of the companies on the Fortune 500 have disappeared since the year 2000.**
>
> Pierre Nanterme, CEO Accenture

The solutions for the enterprise that wins in this environment require a fundamentally new approach, with new technology architected to meet these demands

Siemens View on Digitalization

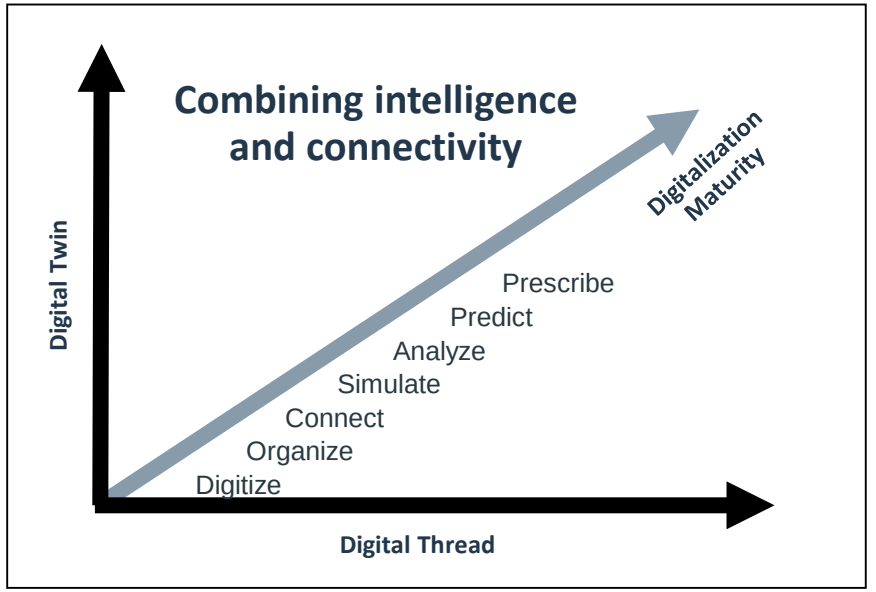
SIEMENS
Ingenuity for life

Digitalization is supported by a Model Based Strategy

SIEMENS
Ingenuity for life

Wikipedia defines

- **Digitization** – is defined as *"the **CONVERSION** of analog information into digital form"* or as a verb - The act of scanning or converting paper or other descriptive elements into electronic paper - such as drawings into PDF's
- **Digitalization** – is the act of ***TRANFORMING*** a paper based processes and artifacts into the Digital and connected world. Unlike digitization, *digitalization is the actual 'process' of the technologically-induced chanNASA*within these industries. This process has enabled much of the phenomena today known as the Internet of Things, Industrial Internet, Industry 4.0, Big data, machine to machine communication, blockchain, cryptocurrencies etc
- **Digital Transformation -** is described as *"the total and overall **EFFECT** of digitalization".* Digitization has enabled the process of digitalization, which resulted in stronger opportunities to transform and chanNASAexisting business models, socio-economic structures, legal and policy measures, organizational patterns, cultural barriers, etc.
- **Digitization (the conversion), Digitalization (the process) and the Digital Transformation (the effect).**



Re-thinking the product Development Process
Towards “Model-Driven Development”

SIEMENS
Ingenuity for life

Traditional

Design

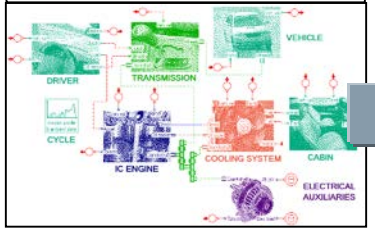
Mechanical functions

Control & Software Functions

Manufacturing

Future

Vehicle Model – Synthesis & Analysis



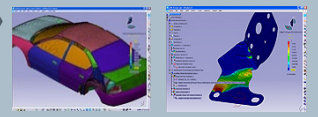
Model Based System Engineering

Thermal Functions

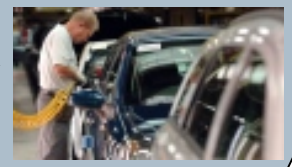
Mechanical Functions

Control & Software Functions

3D Design



Manufacturing



Product Architecture

Detailed Design Subsystems

Integration & Calibration

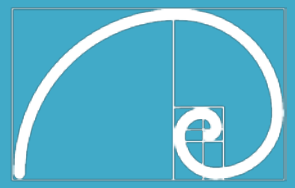
How Digitalization affects Trends in Product Development

SIEMENS
Ingenuity for life

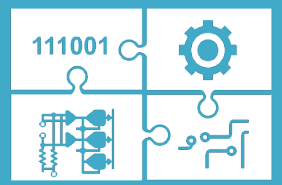
Changing the way *systems* come to life

Changing the way *systems* are realized

Changing the way *systems* evolve



GENERATIVE DESIGN

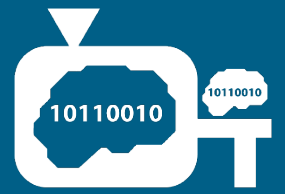


INTELLIGENT MODELS

MACHINE LEARNING

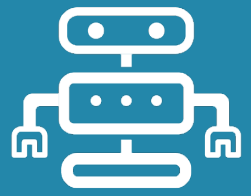
ADDITIVE MANUFACTURING

CLOUD TECHNOLOGY



KNOWLEDGE AUTOMATION

SYSTEMS OF SYSTEMS

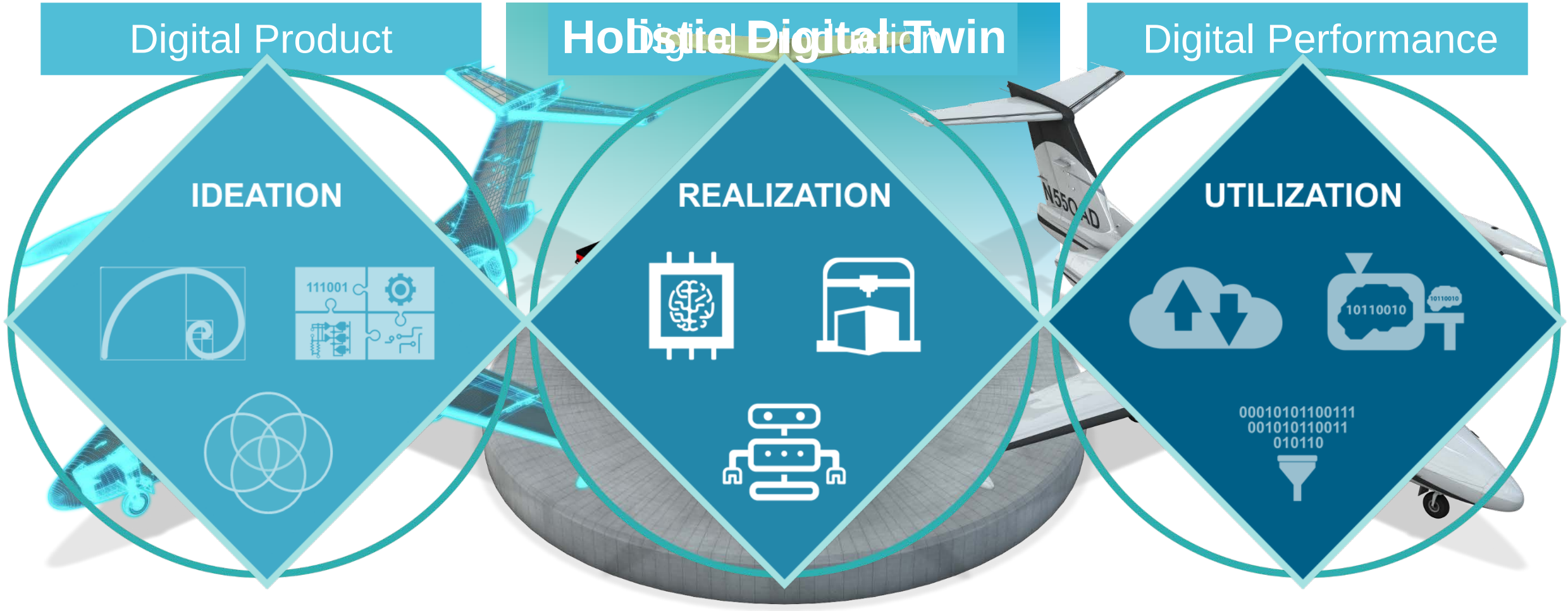


ADVANCED ROBOTICS

BIG DATA ANALYTICS

Comprehensive and precise Digital Twin

SIEMENS
Ingenuity for life



Model Based Approaches can have a Positive Impact on Digital Transformation Challenges from Tip to Tail

SIEMENS
Ingenuity for life

The Digital Enterprise Suite : Powering Digital Transformation

Model Based Systems Engineering and Definition

Model Based Manufacturing , Compliance, Quality…

IDEATION

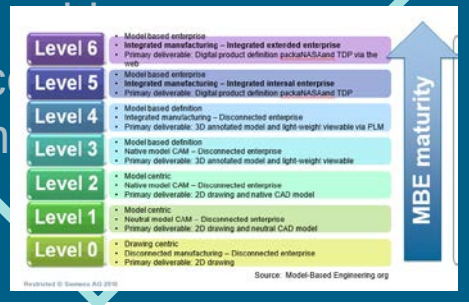
Use Modeling and Simulation to capture Design Intent and achieve foresight using the Virtual World

REALIZATION

Seamlessly coordinate and control the extended resources in the real world

UTILIZATION

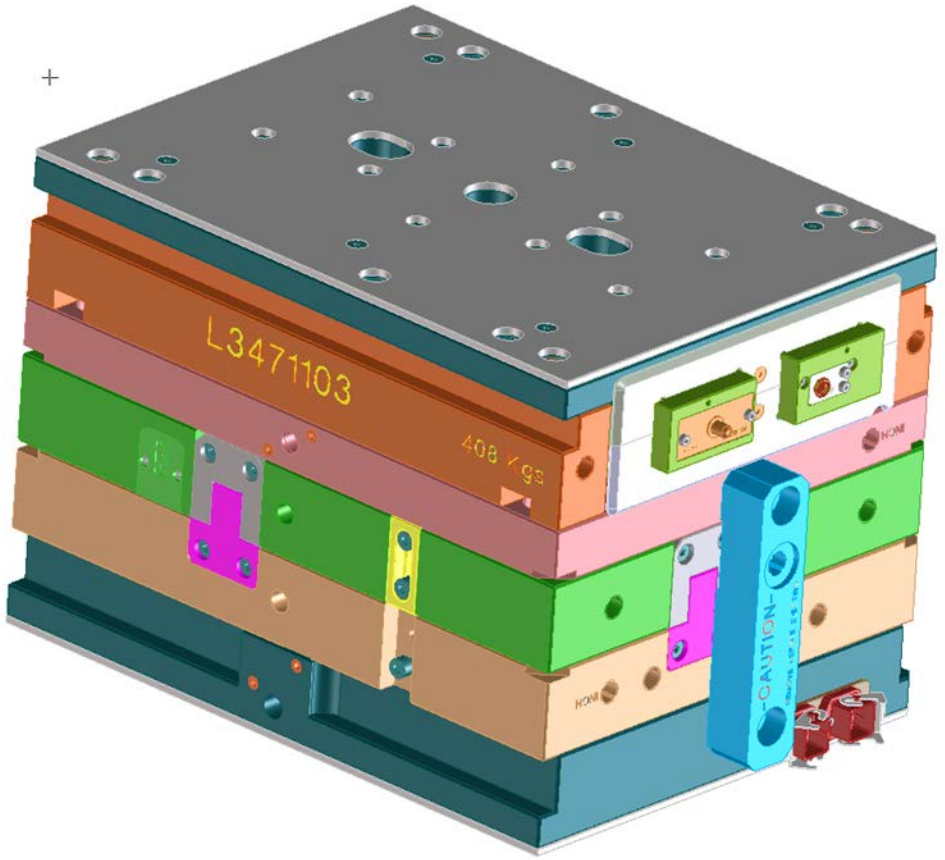
Use Big Data Analytics to gain insight and



Model Based Enterprise

A Leading Practice is to Enable Excellent Performance on Every Program

SIEMENS
Ingenuity for life



Critical Success Factors

Fully support a Model Based Enterprise, Digital Twin – Digital Thread to better meet cost, technical and schedule program goals

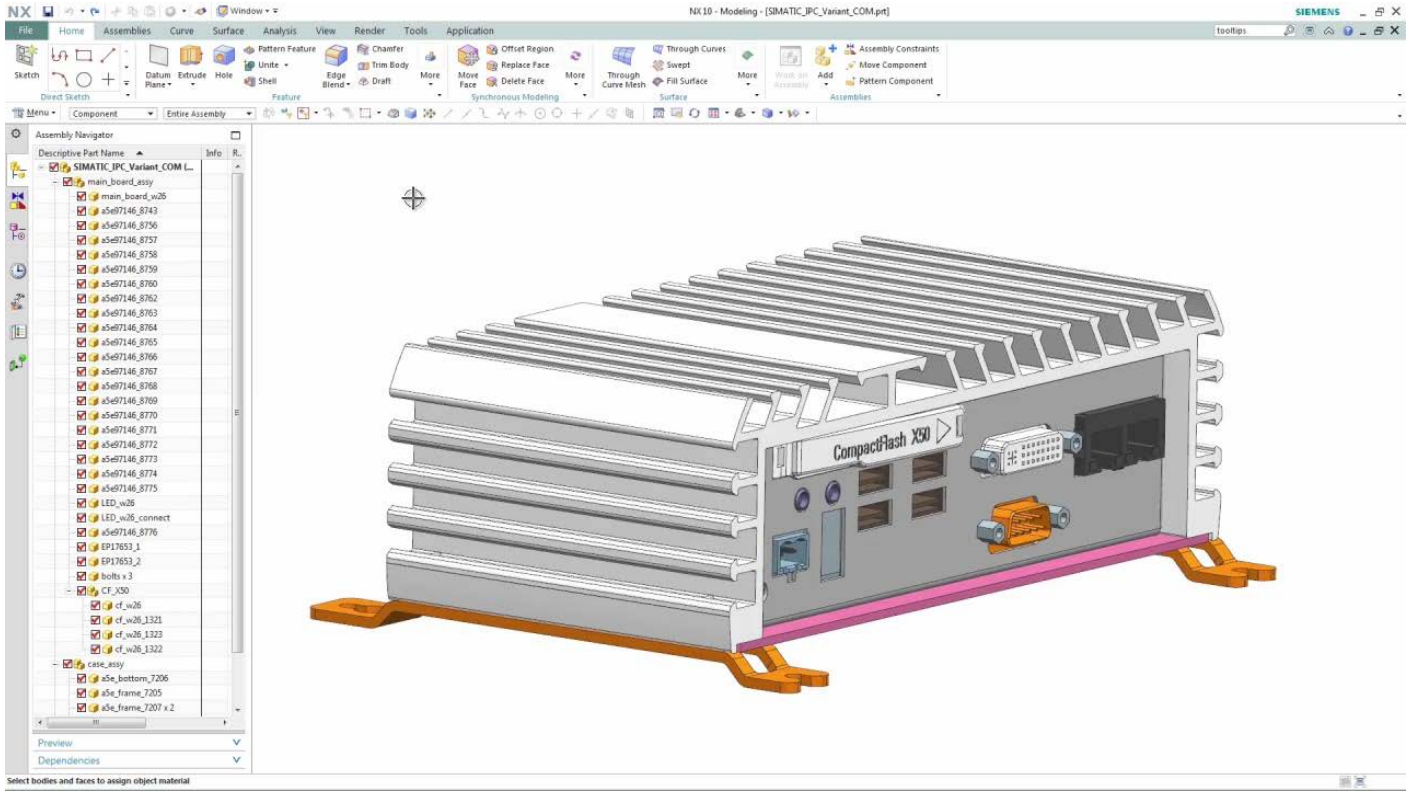
Provide pre-configured technology to focus on the automation of specific Mfg value streams to provide a potential competitive advantage

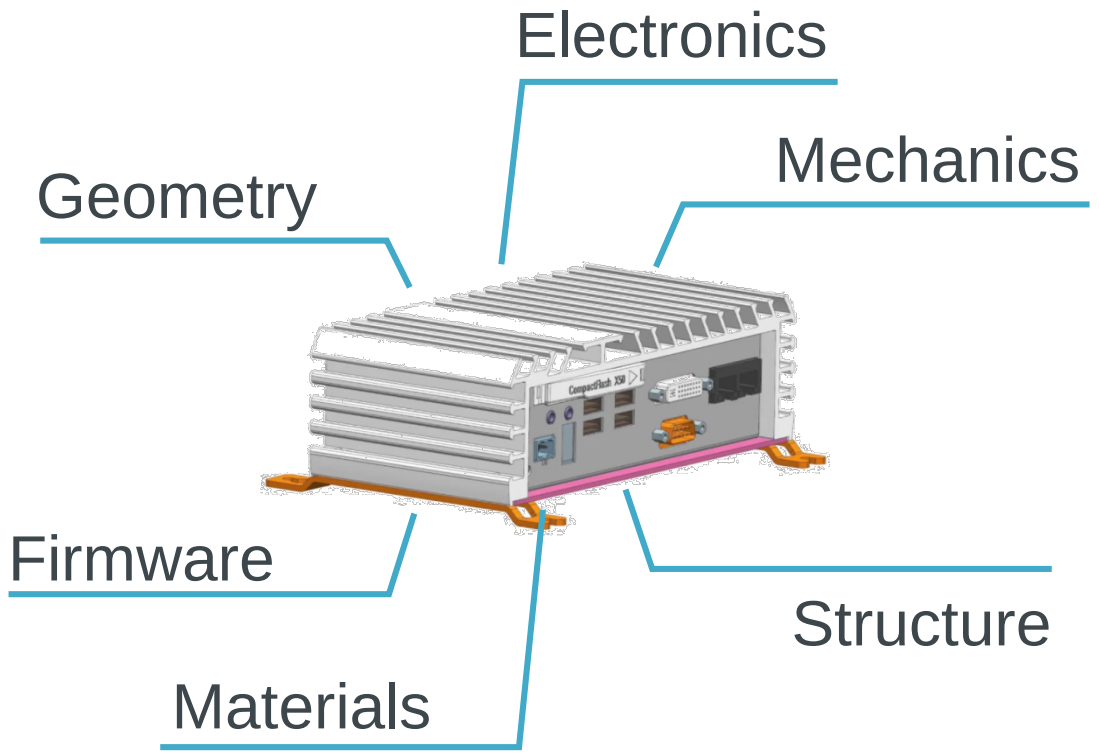
Leverage the smart innovation Portfolio to enable product knowledge & definition to be shared to improve performance in production, support and future bids

The Digital Enterprise Value Chain
System Driven Product Development

SIEMENS
Ingenuity for life

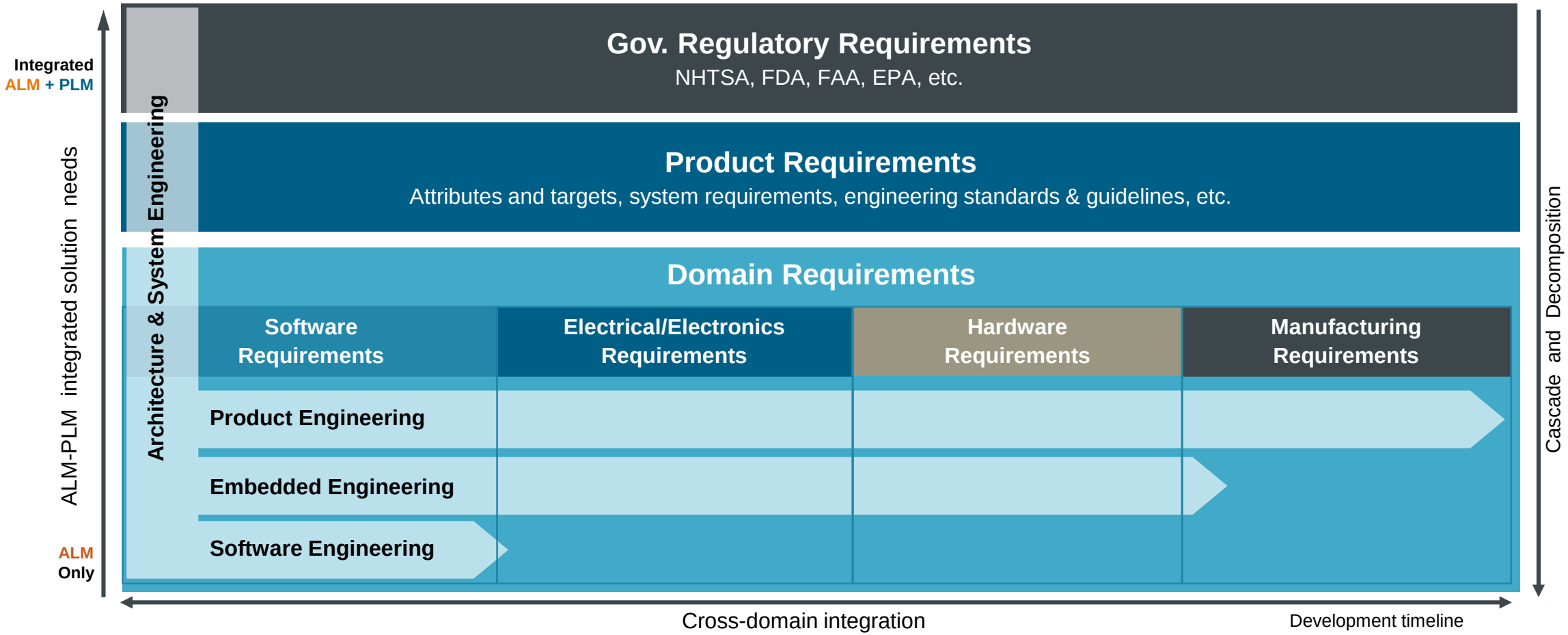
1 Product design | 2 Production planning | 3 Production engineering | 4 Production execution | 5 Services





ALM/PLM integration bring an integrated framework that helps you manage requirements at all levels

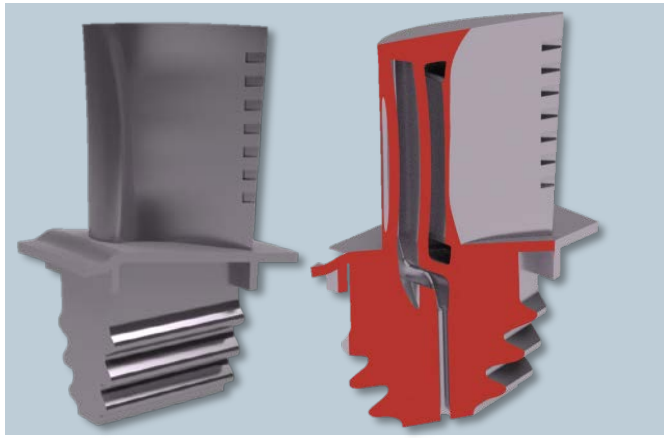
SIEMENS
Ingenuity for life

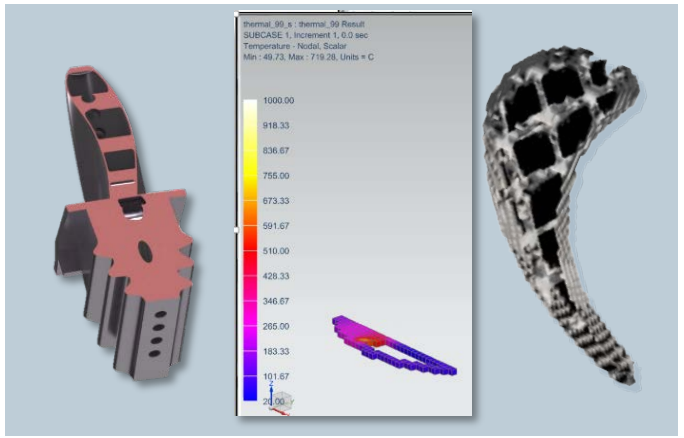


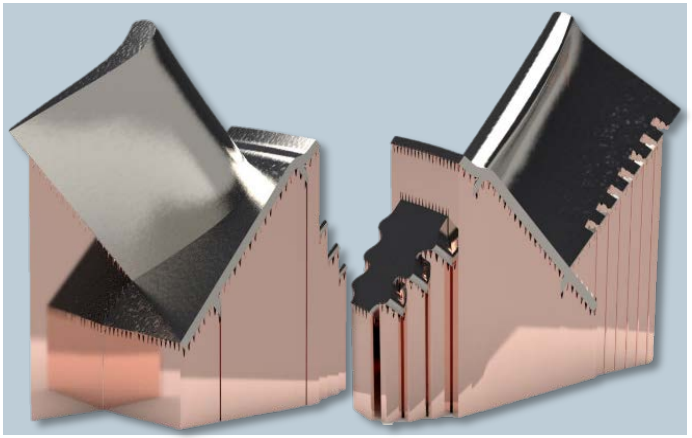
Requirements need to be closely integrated to facilitate continuous verification at all levels

Additive Manufacturing Focus Includes:

SIEMENS
Ingenuity for life







Design (CAD)

- Mesh modeling functionality
- Design of light weight / lattice struct.
- Surface Textures
- Additive Mfg design rules
- Multi-material design

Analysis (CAE)

- Topology optimization tools
- Structural and Thermal analysis
- Laser power regulation
- Layer based process analysis

Manufacturing (CAM)

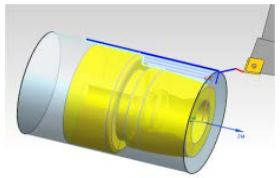
- Powder Bed Fusion (PBF)
- Multi-Axis (ME & DED)
  - ME - Material Extrusion
  - DED - Direct Energy Deposition
- Hybrid Manufacturing

Data Management and Shop Floor Connectivity

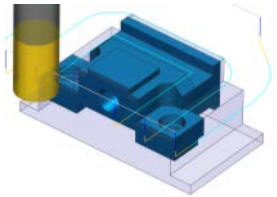
Siemens Production Software and MES Systems

Model Based Design for Manufacturing – enabling …

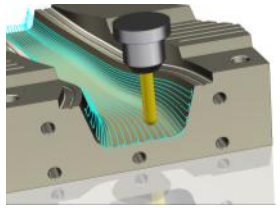
SIEMENS
Ingenuity for life



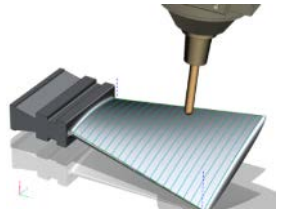
Turning



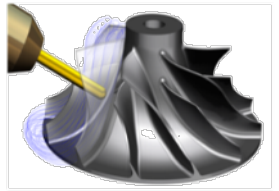
2 ½ axis milling



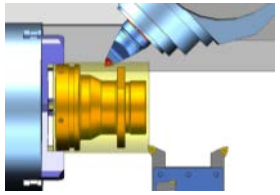
3 axis milling



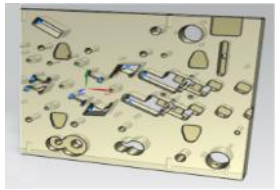
5 axis milling



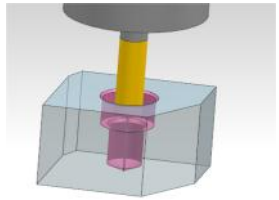
Turbo machinery milling



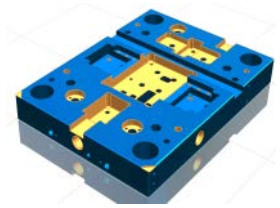
Mill turn



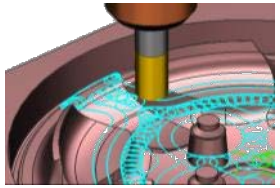
Wire EDM 2 & 4 axis



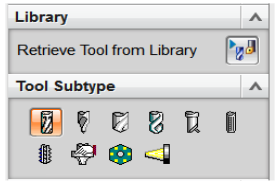
Hole making



Feature based machining



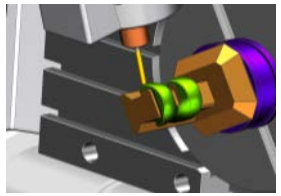
High speed milling



Tool libraries

Shop floor documents

On machine probing



Machine tool simulation

Post processing

Additive Manufacturing

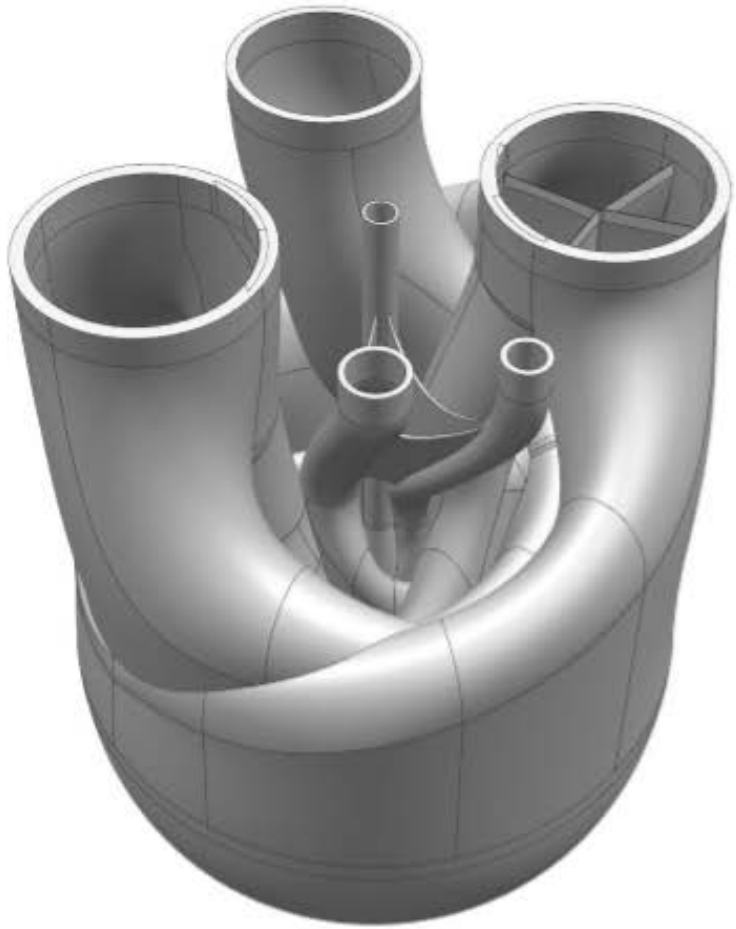
SIEMENS
Ingenuity for life

Reimagined products and system

SIEMENS
Ingenuity for life

AM Thinking:

Vast improvement opportunities in every area of design, manufacturing and business



Product:
Simplified, standardized mounting assembly
Reduced size
Reduced mounting effort

Manufacturing:
Reduced lead time, faster assembly
Reduced parts by over 50%
Reduced welds by approx. 50%
Reduced assembly complexity, steps

Business:
Accelerated speed to market
Adjustable design for customer-specific combustion requirements
Simplified repair

Reshaping the business of power generation

SIEMENS
Ingenuity for life

Conventional thinking

Additive Manufacturing thinking

13 → 1 parts
system simplification

26 → 3 weeks
lead time reduction

22%
weight reduction

In serial production

Function & performance improvement

Designed in NX

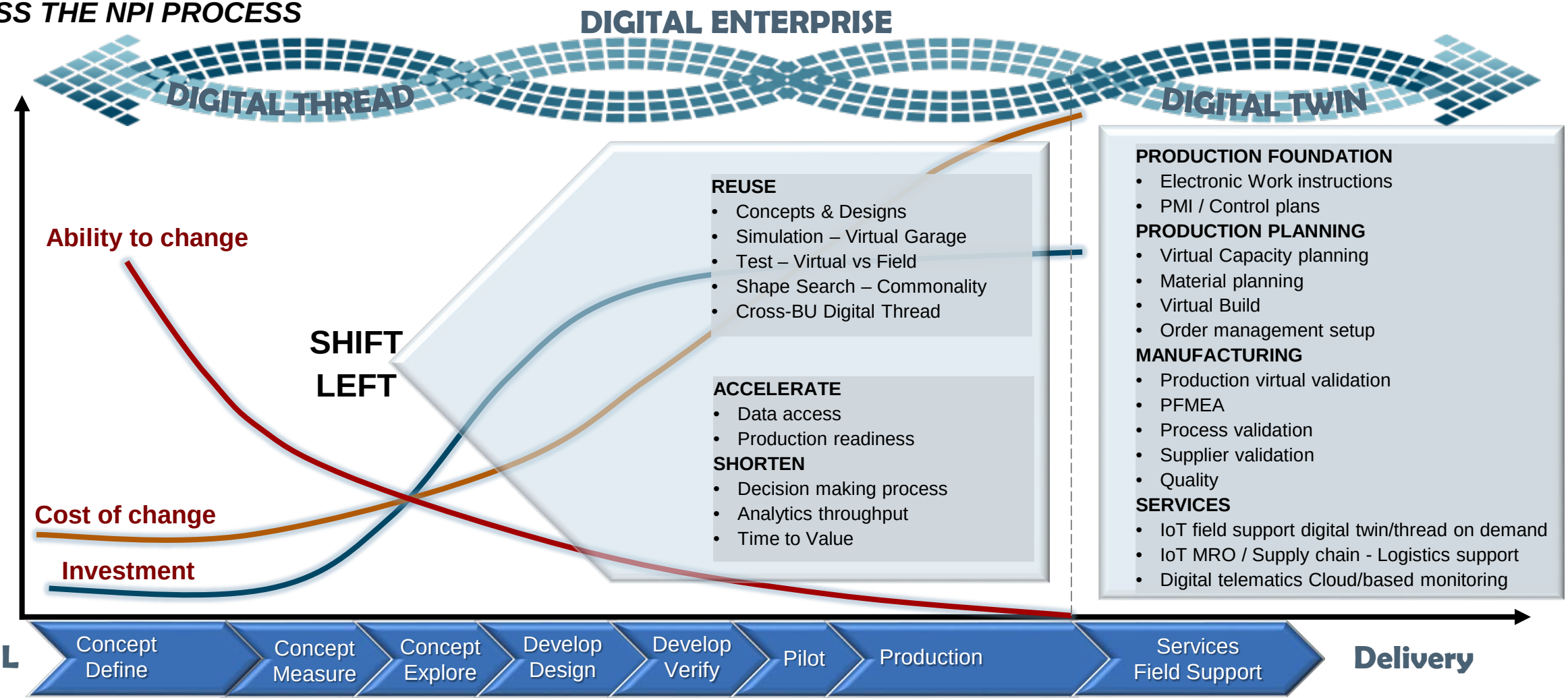
Combustion System
Burner
Swirler/Nozzle/Filter/Mixer

Utilization Strategy

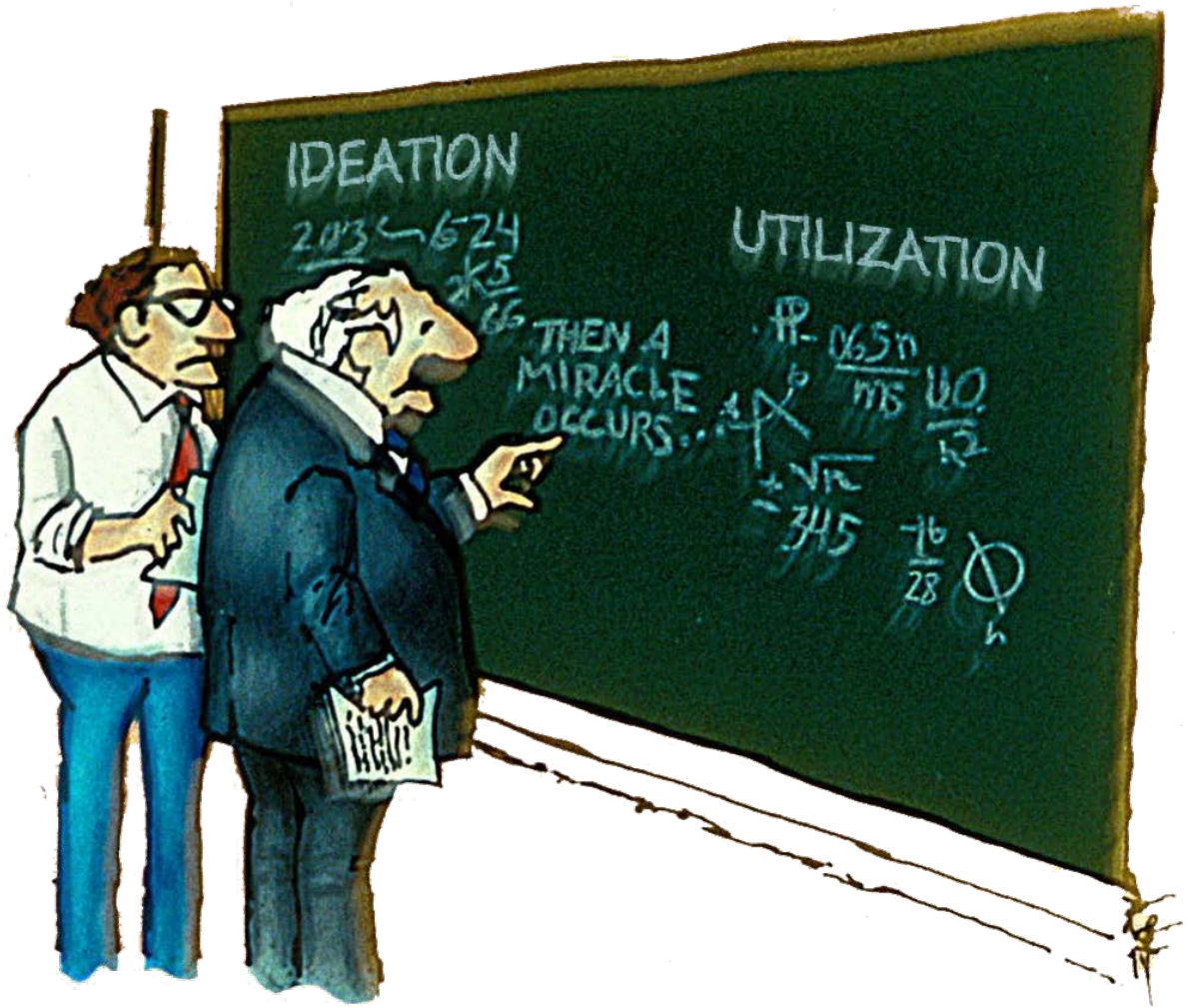
Create a disruptive dominance in the industry

SIEMENS
Ingenuity for life

COMPRESS THE NPI PROCESS



SIEMENS
Ingenuity for life



We think there is one more thing to remember !

Its not just the problems we face today but the Challenges and Decisions we make and face for our children and beyond

One view - Leverage Data Strategically to Transform the Business

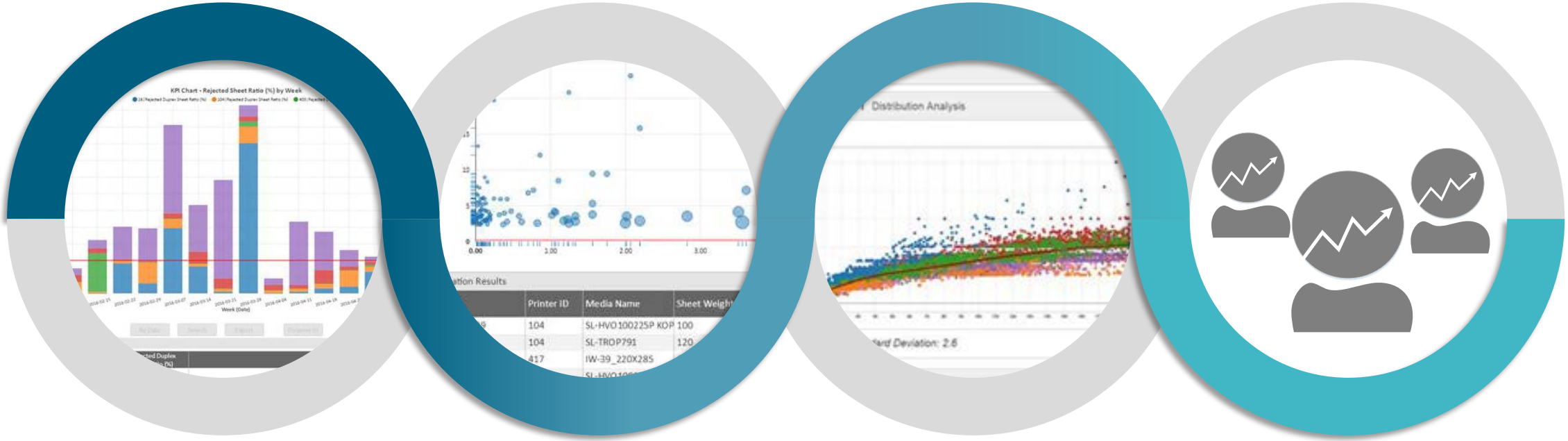
SIEMENS
Ingenuity for life

Descriptive
What happened?

Diagnostic
Why did it happen?

Predictive
What happens next and when?

Prescriptive
When this happens, take these steps.



The Digital Enterprise provides a holistic approach improving all processes along the entire value chain

SIEMENS
Ingenuity for life

IDEATION

REALIZATION

UTILIZATION

1 Product design

2 Production planning

3 Production engineering

4 Production execution

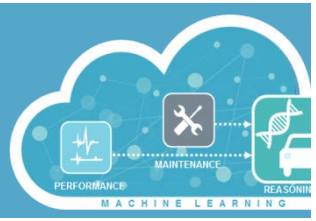
5 Services

The End State Vision Comes to Life

SIEMENS
Ingenuity for life

Use Simulation to achieve foresight in the Virtual World

Use Big Data Analytics to gain insight and drive continuous improvement



1 Product design

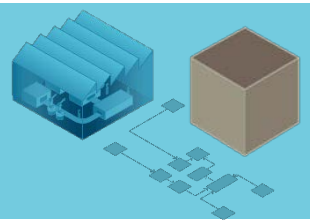
2 Production planning

3 Production engineering

4 Production execution

5 Services

Seamlessly coordinate and control resources in the real world

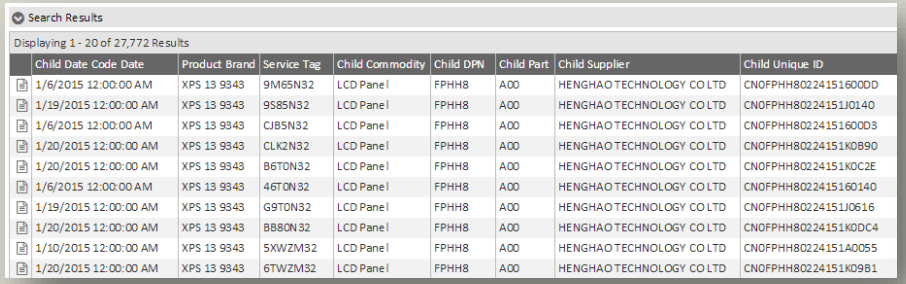


Addressing small problems before they become BIG problems

SIEMENS
Ingenuity for life

At recent launch of Dell XPS13, a LCD was flickering on 2 of 6 demo units. The problem was isolated and identified:

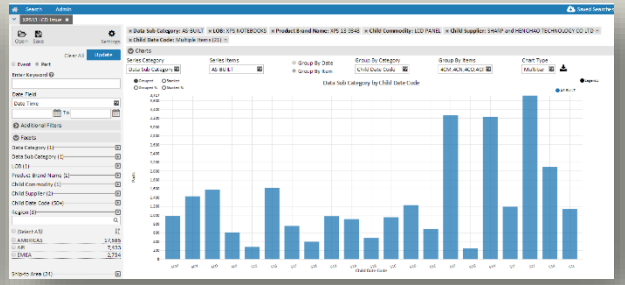
In 3 hours versus 3 days



Search Results

Displaying 1 - 20 of 27,772 Results

Child Date Code Date	Product Brand	Service Tag	Child Commodity	Child DPN	Child Part	Child Supplier	Child Unique ID
1/6/2015 12:00:00 AM	XPS 13 9343	9M65N32	LCD Panel	FPHH8	A00	HENGHAO TECHNOLOGY CO LTD	CN0FPHH80224151600DD
1/19/2015 12:00:00 AM	XPS 13 9343	9S85N32	LCD Panel	FPHH8	A00	HENGHAO TECHNOLOGY CO LTD	CN0FPHH80224151J0140
1/6/2015 12:00:00 AM	XPS 13 9343	CJB5N32	LCD Panel	FPHH8	A00	HENGHAO TECHNOLOGY CO LTD	CN0FPHH80224151600D3
1/20/2015 12:00:00 AM	XPS 13 9343	CLK2N32	LCD Panel	FPHH8	A00	HENGHAO TECHNOLOGY CO LTD	CN0FPHH80224151K0B90
1/20/2015 12:00:00 AM	XPS 13 9343	B6T0N32	LCD Panel	FPHH8	A00	HENGHAO TECHNOLOGY CO LTD	CN0FPHH80224151K0C2E
1/6/2015 12:00:00 AM	XPS 13 9343	46T0N32	LCD Panel	FPHH8	A00	HENGHAO TECHNOLOGY CO LTD	CN0FPHH80224151600140
1/19/2015 12:00:00 AM	XPS 13 9343	G9T0N32	LCD Panel	FPHH8	A00	HENGHAO TECHNOLOGY CO LTD	CN0FPHH80224151J0616
1/20/2015 12:00:00 AM	XPS 13 9343	BB80N32	LCD Panel	FPHH8	A00	HENGHAO TECHNOLOGY CO LTD	CN0FPHH80224151K0DC4
1/10/2015 12:00:00 AM	XPS 13 9343	5XWZM32	LCD Panel	FPHH8	A00	HENGHAO TECHNOLOGY CO LTD	CN0FPHH80224151A0055
1/20/2015 12:00:00 AM	XPS 13 9343	6TWZM32	LCD Panel	FPHH8	A00	HENGHAO TECHNOLOGY CO LTD	CN0FPHH80224151K09B1



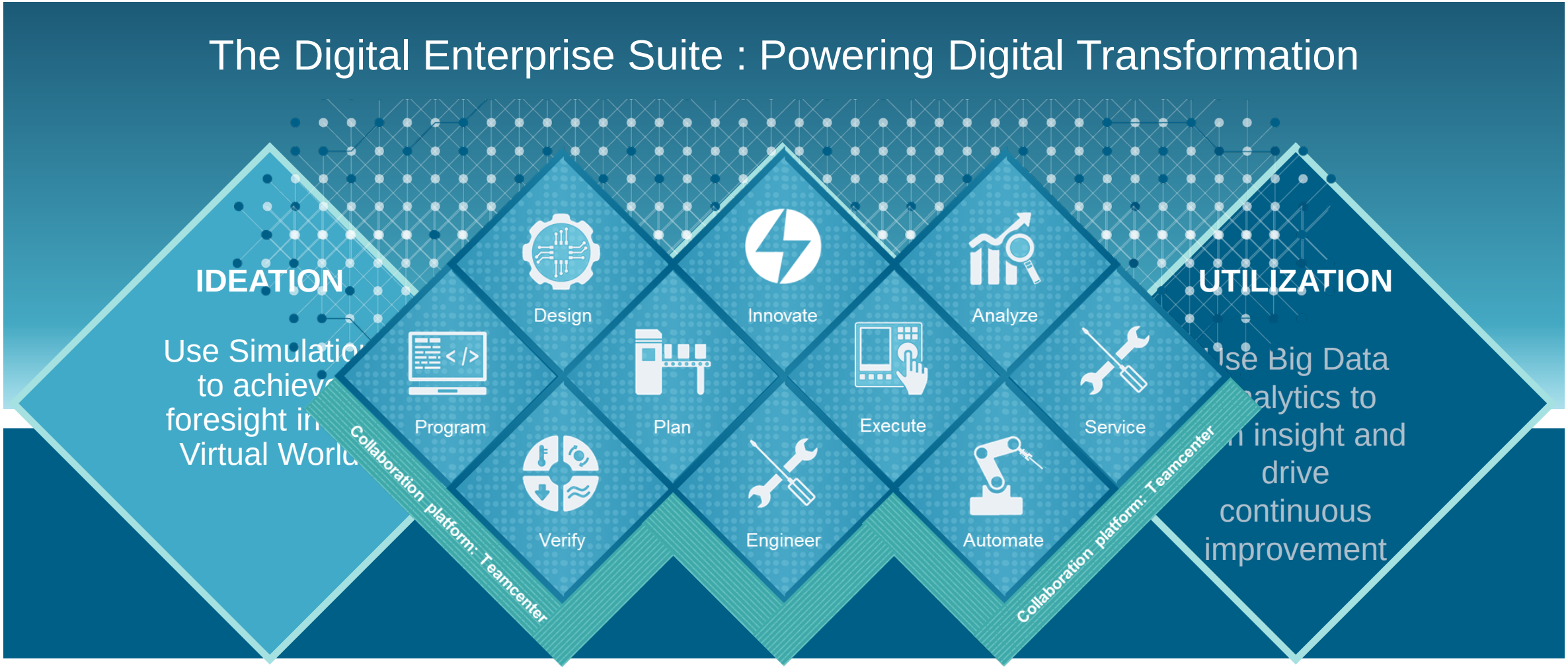
"Analytics at the Speed of Thought"

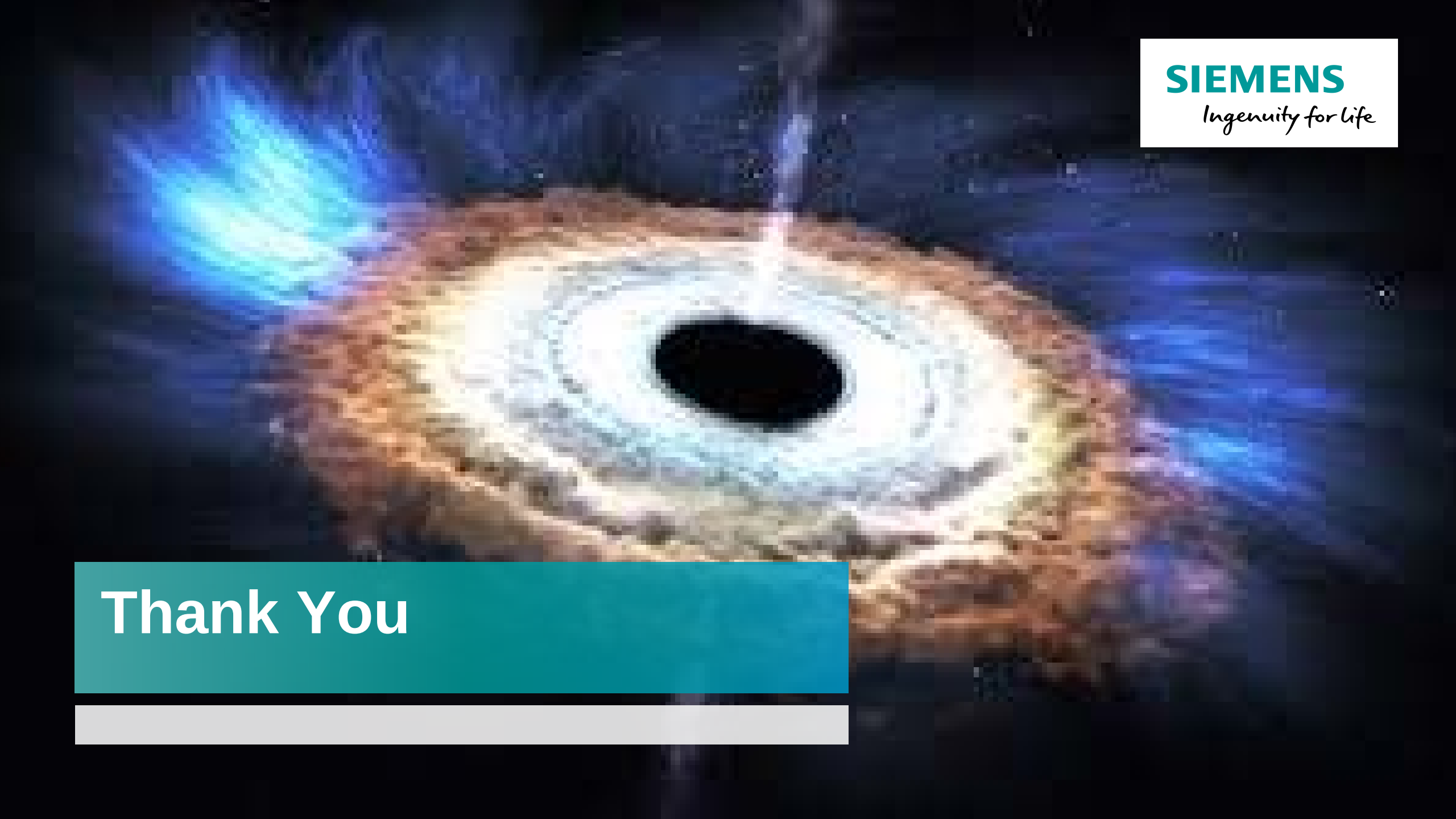
Michael Shepard
Sr. Strategy Director


E*TRADE FINANCIAL

Helping our customers solve their Product Development Challenges

SIEMENS
Ingenuity for life





Thank You