



# Intelligent Service Agent at ZEISS

## Harnessing the Power of Knowledge Graph and Semantic Search Technology

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**Dr. Andreas Pawlik**

Head of Knowledge Management, Carl Zeiss AG, ZEISS Digital Partners

**Maximilian Gärber**

Partner and Technical Consultant, PANTOPIX

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# Should I listen or get a coffee during this talk?

## This is what we are going to talk about...



- Key learnings in a successful implementation of a semantic application driven by
  - Agile project management
  - High user involvement
- Smart information delivery based on
  - Knowledge graphs
  - LLMs/GPT
- Live since March '23
  - Customer service application for ZEISS microscopy, the leading one-stop microscope manufacturer
  - Context-based recommender to support service engineers in service tasks with expert knowhow

Interesting, right?

# About Today's Speakers

## Andreas & Max



**Dr. Andreas Pawlik**

Head of Knowledge Management,  
ZEISS Digital Partners

**Project role: Lead architect in the architectural board**

Key expertise Machine Learning, Natural language processing, LLMs, knowledge graphs, enterprise architecture



**Maximilian Gärber**

Partner and Technical Consultant, PANTOPIX

**Project role: Developer and member of architectural board;**

Key expertise knowledge graphs, technical (product) information, application development





**Klaus Müller**

RMS-XI Head of  
Information  
Architecture and  
Content Development,  
ZEISS Research  
Microscopy Solutions

**Project role:  
Chief Product Owner**

Key expertise  
Information  
Architecture



**Laila Weiland**

RMS-XI Product Owner  
Knowledge  
Management, ZEISS  
Research Microscopy  
Solutions

**Project role: Product  
Owner and UX Lead**

Key expertise  
User Experience  
Research



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**01** Motivation

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**02** Intelligent Service Agent

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**03** Key Aspects of Implementation

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**04** Key Learnings

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**05** What's next?

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**'Our primary objective is to empower new service employees with an intelligent system, ensuring they achieve the same level of knowledge as experienced service technicians.'**

Martin Fischer, Head of Sales & Service at ZEISS Microscopy



## ZEISS Microscopy

- ZEISS Microscopy is the world's only one-stop manufacturer of light, electron, X-ray and ion microscope systems and offers solutions for correlative microscopy
- Products and services for life sciences, materials and industrial research, as well as education and clinical practice



## ZEISS Digital Partners

- ZEISS Digital Partners is the ZEISS-wide partner of choice for designing, developing, scaling and operating the digital and data solutions of ZEISS-SBUs



## PANTOPIX

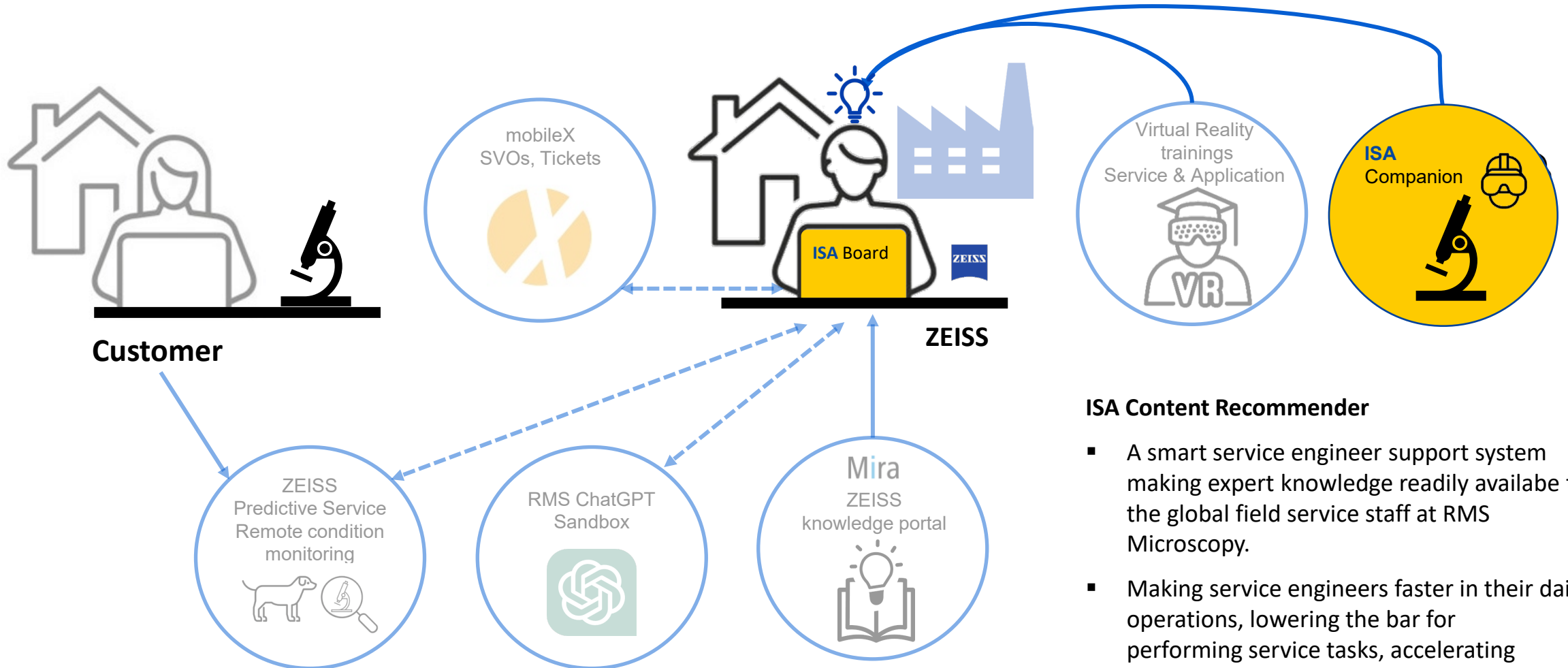
- Turning information into value with intelligent solutions for Technical Documentation
- Data Modeling, Knowledge Graphs, Metadata, AI, CCMS, PIM, iiRDS, DITA, Publication Processes, Service Information



# Intelligent Service Agent



# Our solution - Intelligent Service Agent



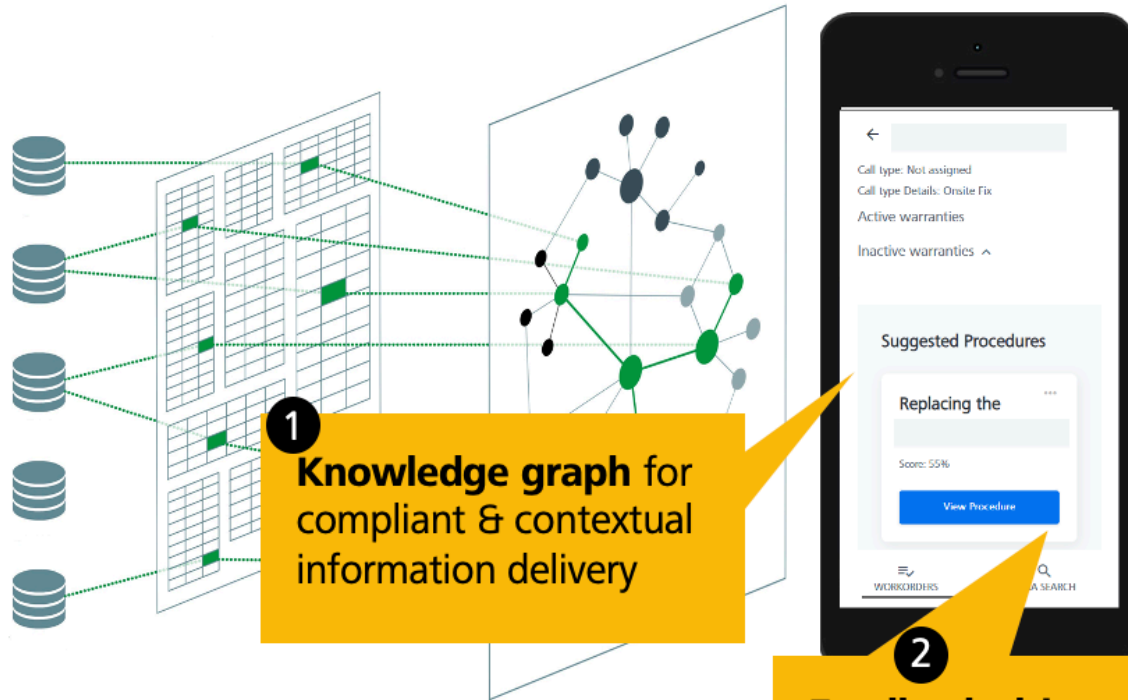
## ISA Content Recommender

- A smart service engineer support system making expert knowledge readily available to the global field service staff at RMS Microscopy.
- Making service engineers faster in their daily operations, lowering the bar for performing service tasks, accelerating onboarding.



# Three pillars of smart information management & delivery

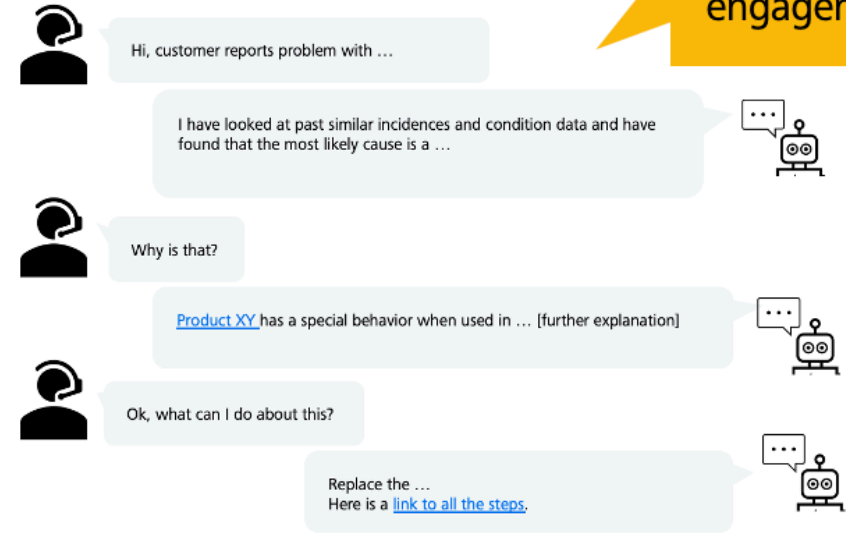
## Context-based recommendation



**1** Knowledge graph for compliant & contextual information delivery

**2** Feedback-driven Machine Learning for highly automated knowledge graph construction

## Smart interaction



**3** LLMs/GPT for conversational interactive engagement

*"Finally ZEISS can know what ZEISS knows!"*

# Use of taxonomies in the authoring process



- EM Components (173)
- LM Components (136)
  - Accessory (0)
  - Adapter (0)
  - Andor (0)
  - Aperture (0)
  - Attenuator (0)
  - Autoimmersion (0)
  - Autoimmersion for Accessories (0)
  - Autoimmersion for Nosepiece (0)

Classes: Component, I

- Details
- SKOS
- Übergeordnete
- LM Components

Centrally distributed metadata

MIC-Metadata

Aktivität

Product Component Hierarchy

Hardwareprodukte

Softwareprodukt

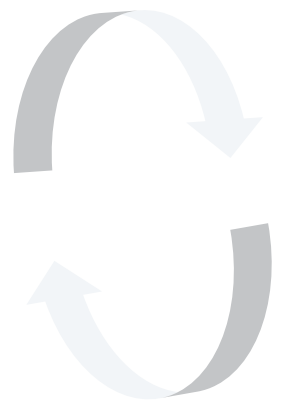
Softwaremodul

Knoten klassifizieren

- LM PCH
  - Accessories
  - Binocular tube
  - Beampath Deflection
  - Control Box
  - Definite Focus
  - Display
  - Condenser
  - Illumination
    - Colibri

- Housing
  - Dokumente
  - Filter
  - Removing the Filter Cover [Axioscan 7]
  - Removing System Housing
  - Adjusting Axioscan Foot
- System Table
- Optics Module
- Prescan
- Length Gauges
- 6-Position Filter Wheel
- External Filter Wheel
- Fuses
- Connector Panel
- Colibri 7 Light Source
- Condenser
  - Dokumente
  - Filter
  - Replacing the Condenser or TL-LED
  - Replacing the PCB in Condenser
  - Installing or Replacing the Circular POL I
  - Replacing the Shutter Motor
- Xylis Light Source
- Transmitted-Light LED

Labeled topics



Propose metadata based on content

n Housing

Object type  
Content component

Eingelesene Metadaten

Metadata

Zu prüfende Metadaten

Activities  
Removing

Hardwarekomponente Lokalis  
Microscope

Hardwarekomponente  
Covers

connected from power supply.

m into the left recess of the microscope system until

and the cover flap opens slightly.

# Key Aspects of Implementation



# Iteration, high user involvement, and team reflection

## “Walk the talk”

- Hackathon
- Prototype
- MVP

## End users as main stakeholders

- Feedback-driven development
- 100% Content

## Experiments!

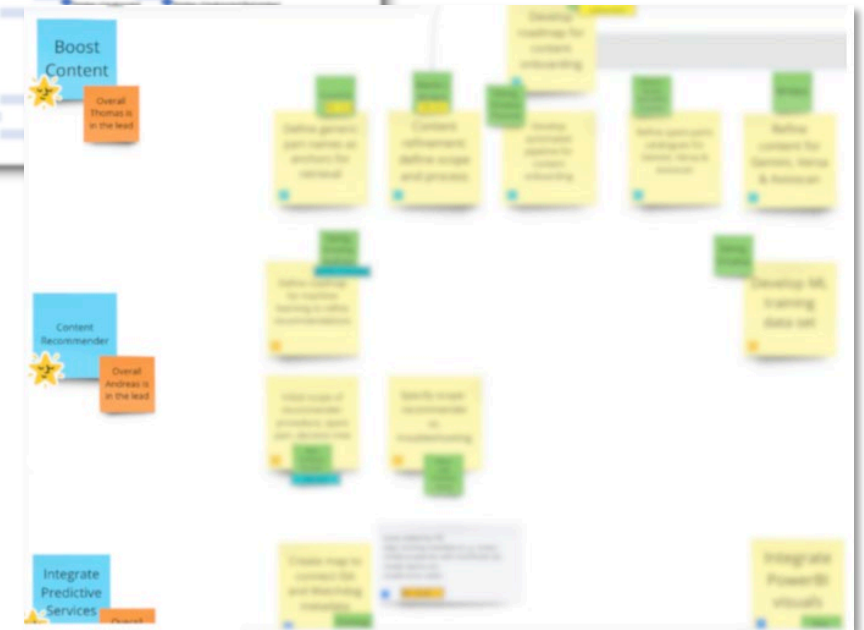
- “Law of 2 feet”
- Change of sprint duration
- Development of team architecture



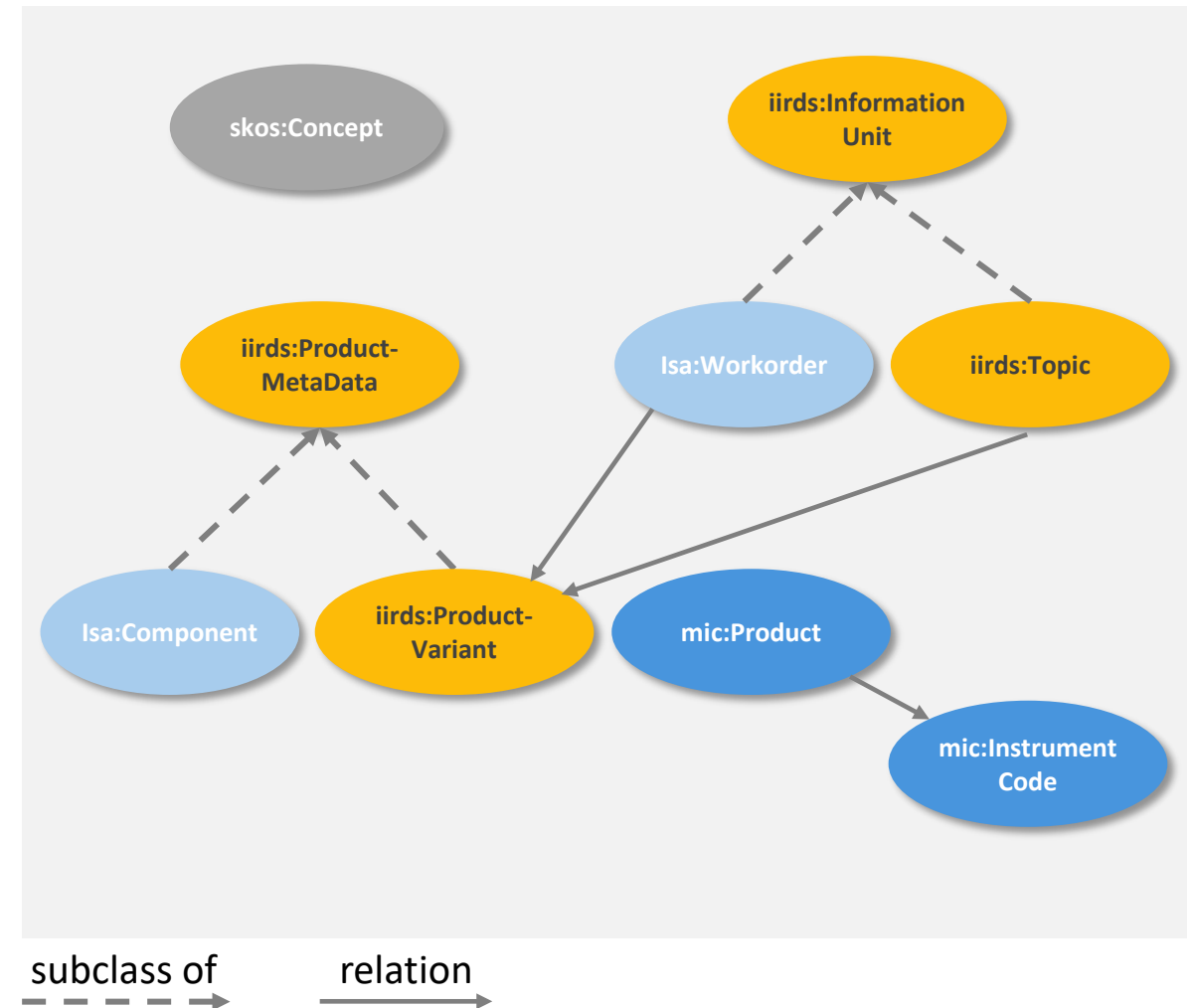
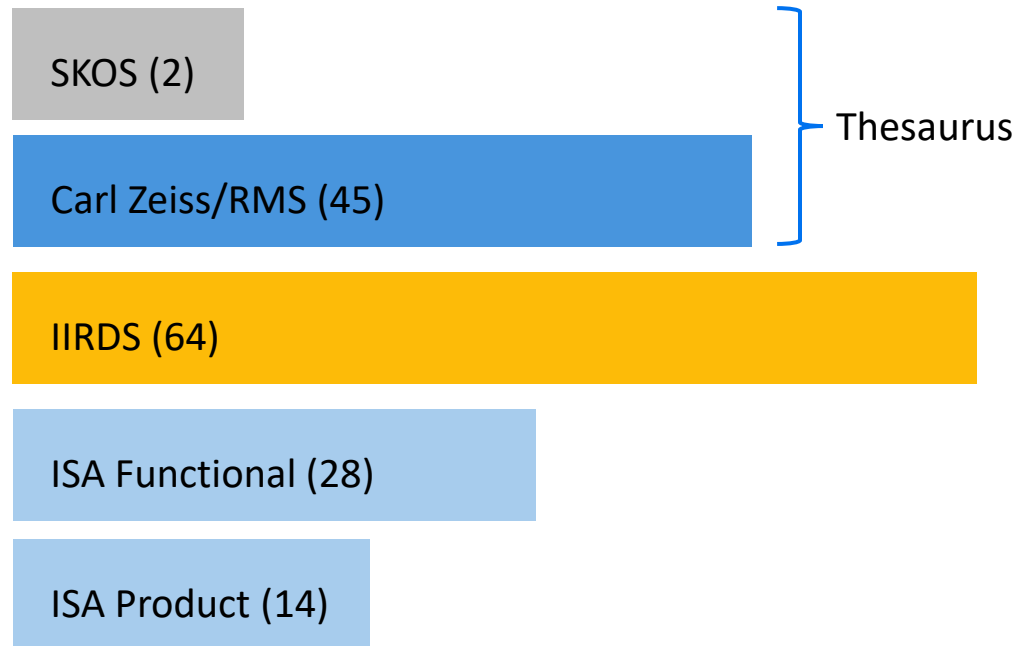
From workstream centered planning & implementation...



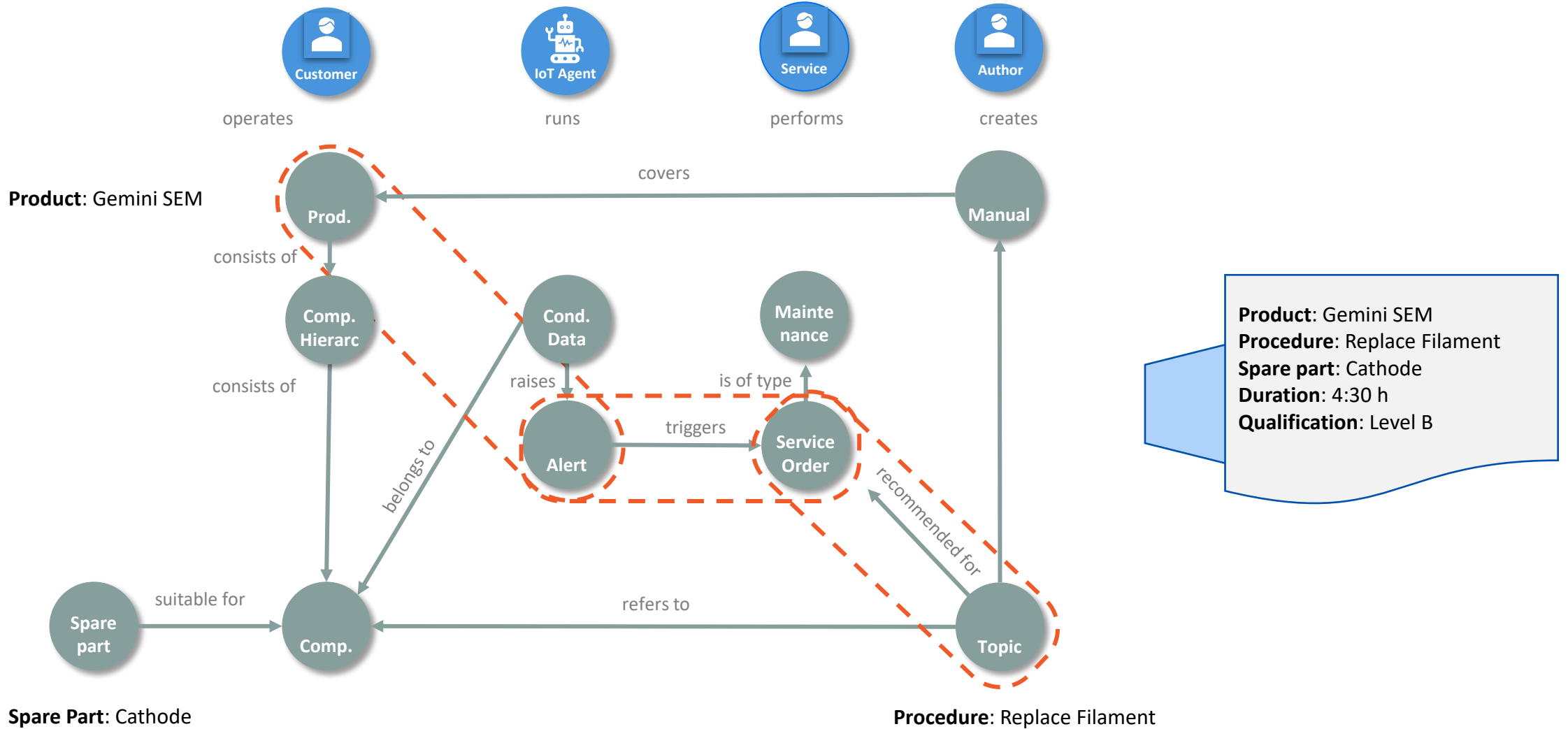
...to team centered planning & implementation



# Modular Ontology plus SKOS-based Thesaurus



# Taxonomy as point of integration for data instances

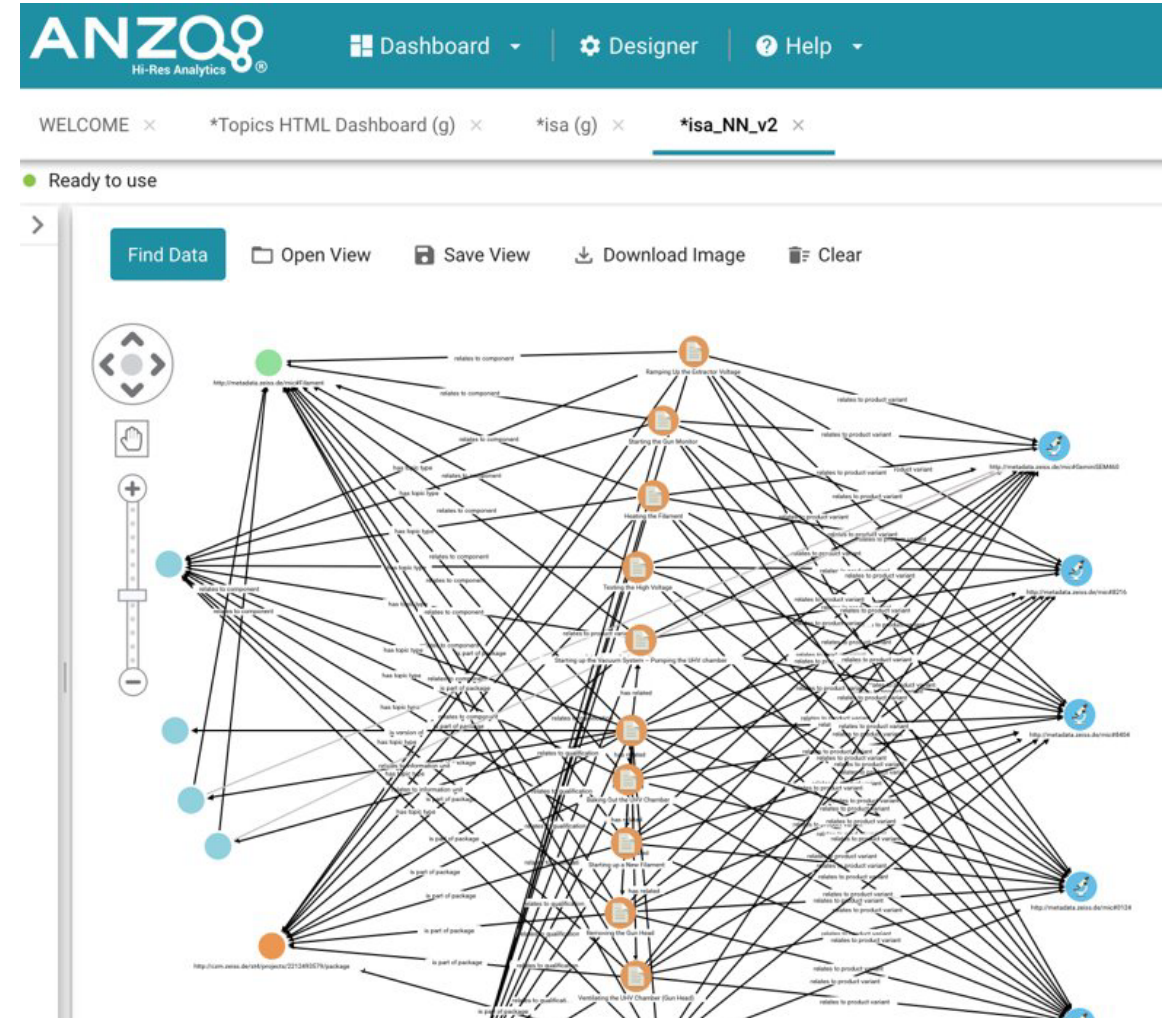


# Key Learnings



# Not all processes can or must be automated ...at least initially

- Avoid premature optimization
- It is more important to gather feedback early
- Examples of manual steps that can evolve
  - Labeling data, e.g. classification of topics
  - Adding metadata to ingestion tasks, e.g. missing relations between spare parts and topics
  - Custom crafted triples to fill gaps in the graph, e.g. simulating topics with pre/post semantics
  - Ontology/Taxonomy publishing





# Dealing with LLM hype during the project



- LLMs/ChatGPT enable conversational interactivity and scalable information extraction
  - The knowledge graph provides regulatory compliance by augmenting and validating results and provides context for situation-specific information delivery
- The Field Service Engineer benefits through better recommendations, relieving the Tech Support who can focus on core tasks, the content developer creates more relevant content faster

**Time taken to reach 1 million users**

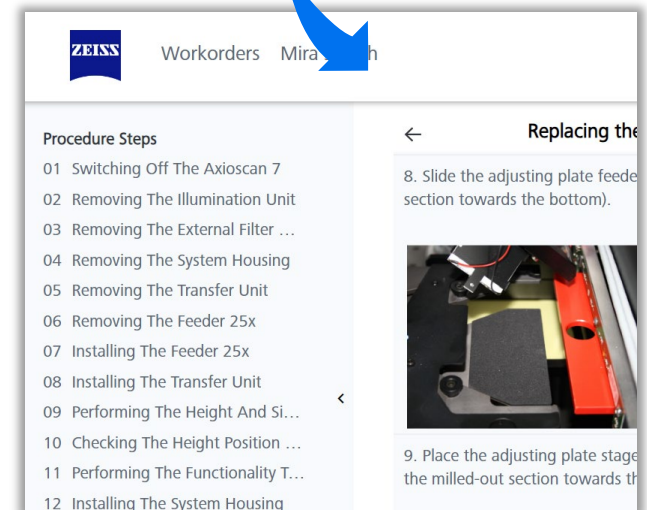
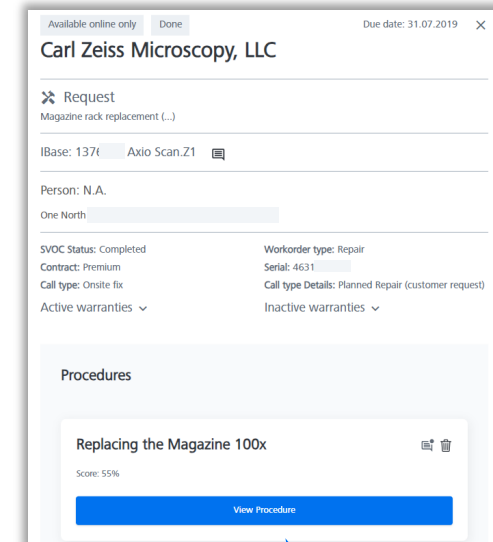
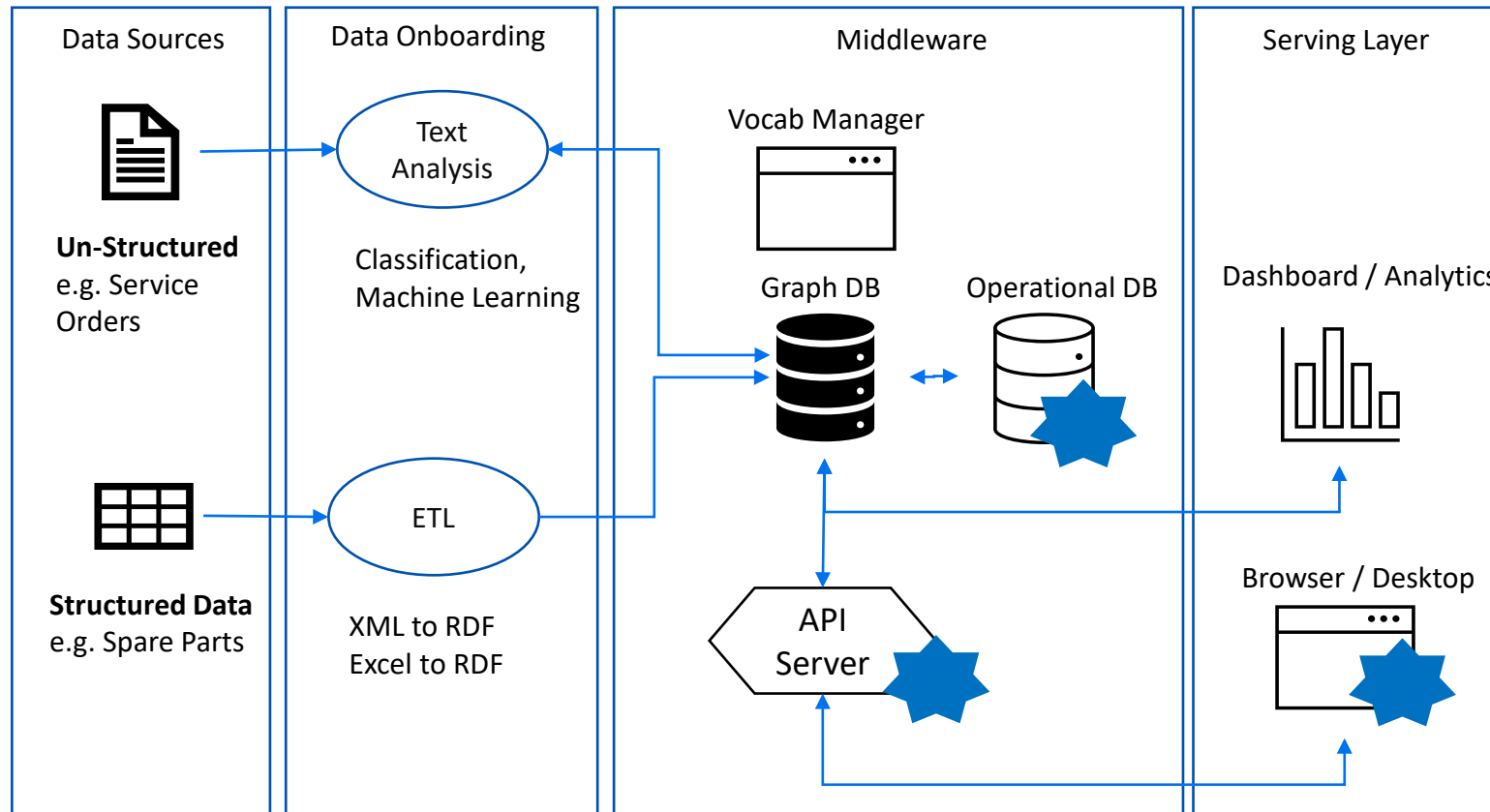
Channel	Time taken to reach 1 million users (Days)
Search	~100
Referrals	~200
Direct	~300
Partners	~400
Events	~500
Advertising	~600
Word of mouth	~700
Direct Mail	~800
Telemarketing	~900
TV	~1000
Radio	~1100
Print	~1200
Direct Response	~1300
Public Relations	~1400
Events	~1500
Partners	~1600
Referrals	~1700
Search	~1800

Examples	Capabilities	Limitations
"Taylor Swift is competing in tennis, right?"	Remembers what user said earlier in the conversation	May occasionally generate incorrect information
"Will you create a plan for 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 260, 270, 280, 290, 300, 310, 320, 330, 340, 350, 360, 370, 380, 390, 400, 410, 420, 430, 440, 450, 460, 470, 480, 490, 500, 510, 520, 530, 540, 550, 560, 570, 580, 590, 600, 610, 620, 630, 640, 650, 660, 670, 680, 690, 700, 710, 720, 730, 740, 750, 760, 770, 780, 790, 800, 810, 820, 830, 840, 850, 860, 870, 880, 890, 900, 910, 920, 930, 940, 950, 960, 970, 980, 990, 1000, 1010, 1020, 1030, 1040, 1050, 1060, 1070, 1080, 1090, 1100, 1110, 1120, 1130, 1140, 1150, 1160, 1170, 1180, 1190, 1200, 1210, 1220, 1230, 1240, 1250, 1260, 1270, 1280, 1290, 1300, 1310, 1320, 1330, 1340, 1350, 1360, 1370, 1380, 1390, 1400, 1410, 1420, 1430, 1440, 1450, 1460, 1470, 1480, 1490, 1500, 1510, 1520, 1530, 1540, 1550, 1560, 1570, 1580, 1590, 1600, 1610, 1620, 1630, 1640, 1650, 1660, 1670, 1680, 1690, 1700, 1710, 1720, 1730, 1740, 1750, 1760, 1770, 1780, 1790, 1800, 1810, 1820, 1830, 1840, 1850, 1860, 1870, 1880, 1890, 1900, 1910, 1920, 1930, 1940, 1950, 1960, 1970, 1980, 1990, 2000, 2010, 2020, 2030, 2040, 2050, 2060, 2070, 2080, 2090, 2100, 2110, 2120, 2130, 2140, 2150, 2160, 2170, 2180, 2190, 2200, 2210, 2220, 2230, 2240, 2250, 2260, 2270, 2280, 2290, 2300, 2310, 2320, 2330, 2340, 2350, 2360, 2370, 2380, 2390, 2400, 2410, 2420, 2430, 2440, 2450, 2460, 2470, 2480, 2490, 2500, 2510, 2520, 2530, 2540, 2550, 2560, 2570, 2580, 2590, 2600, 2610, 2620, 2630, 2640, 2650, 2660, 2670, 2680, 2690, 2700, 2710, 2720, 2730, 2740, 2750, 2760, 2770, 2780, 2790, 2800, 2810, 2820, 2830, 2840, 2850, 2860, 2870, 2880, 2890, 2900, 2910, 2920, 2930, 2940, 2950, 2960, 2970, 2980, 2990, 3000, 3010, 3020, 3030, 3040, 3050, 3060, 3070, 3080, 3090, 3100, 3110, 3120, 3130, 3140, 3150, 3160, 3170, 3180, 3190, 3200, 3210, 3220, 3230, 3240, 3250, 3260, 3270, 3280, 3290, 3300, 3310, 3320, 3330, 3340, 3350, 3360, 3370, 3380, 3390, 3400, 3410, 3420, 3430, 3440, 3450, 3460, 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# How far do you get with standard software, what's left?



Simplified Architecture



# Next Steps

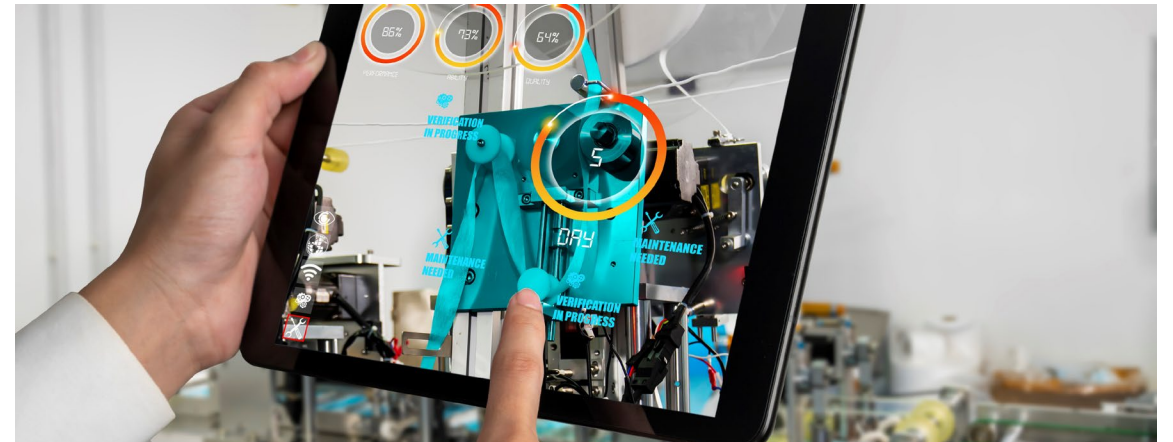


# What's next?



## Scaling is our goal

- Scaling to all products and further stakeholders
- Service across ZEISS segments
- Transfer to similar use cases



## Additional Features

- Predictive Maintenance
- Virtual Reality
- Digital Twin



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Seeing beyond