



# LIVEWORX

A NEW ERA IN PRODUCT LIFECYCLE INNOVATION

SESSION ID: PL1127B

# INTEGRATION PATTERNS: PLM FOR THE DIGITAL THREAD

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# DIGITAL THREAD

Hemant Shadra

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A **digital thread** creates a closed-loop between the physical and digital worlds that spans the entire product lifecycle, ensuring accurate product and process information is available:

to the right  
person



at the right  
time



and in the  
right context

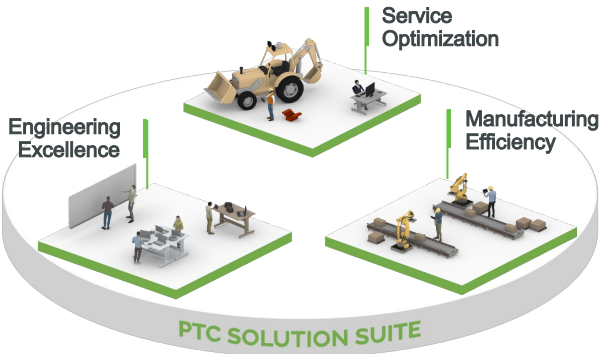


across the extended  
value chain

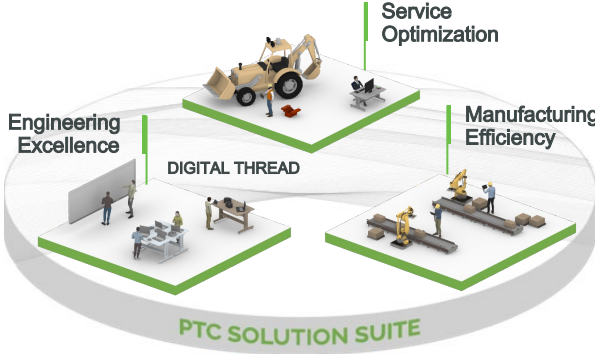
# PTC ENABLES ENTERPRISE DIGITAL TRANSFORMATION WITH THE DIGITAL THREAD

Transforming existing business processes to enhance customer experience, create new business models, and improve efficiency and productivity.

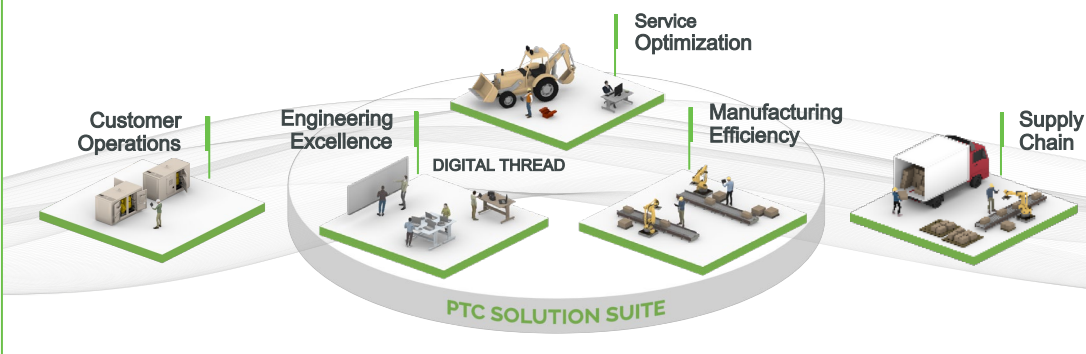
## WITHIN FUNCTIONS



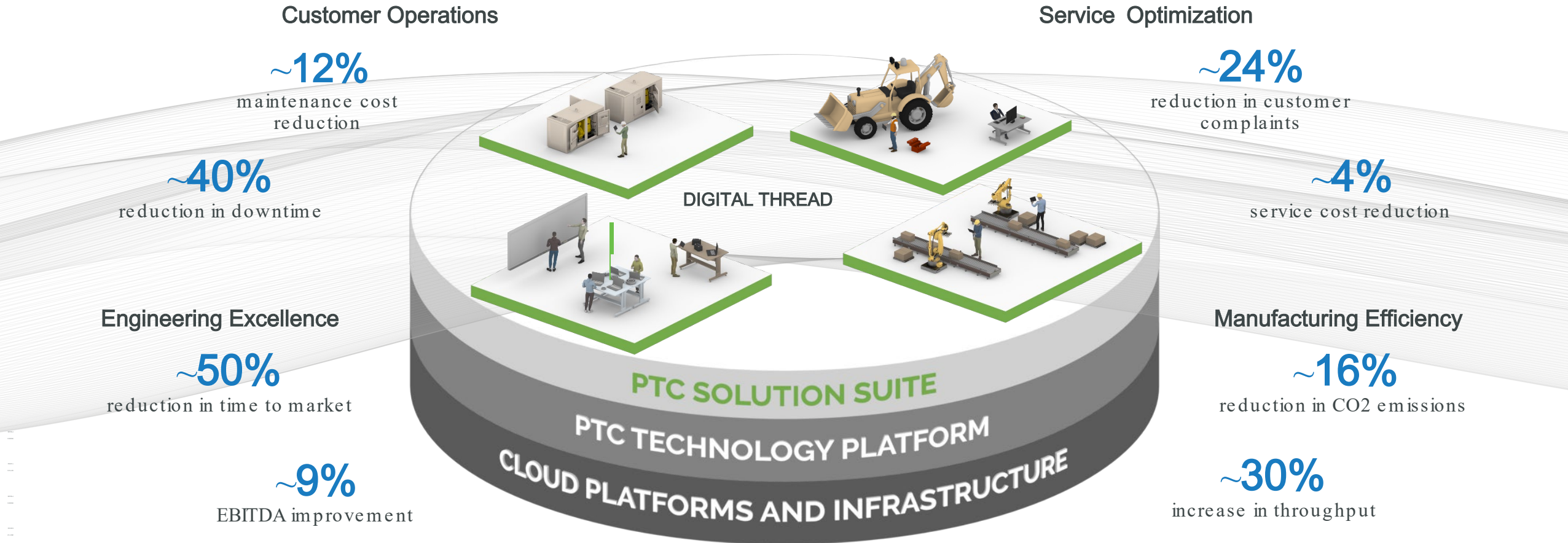
## BETWEEN FUNCTIONS



## ACROSS THE VALUE CHAIN



# CREATING IMPACT WITHIN & BETWEEN FUNCTIONS





# INTEGRATION PATTERNS FOR BUILDING A DIGITAL THREAD WITH WINDCHILL

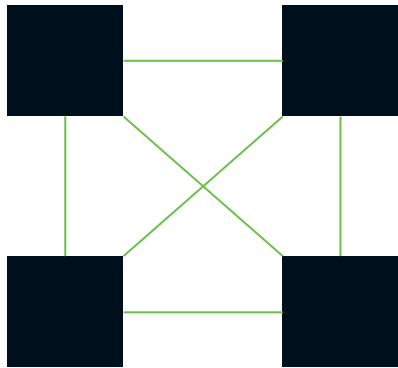
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# INTRO

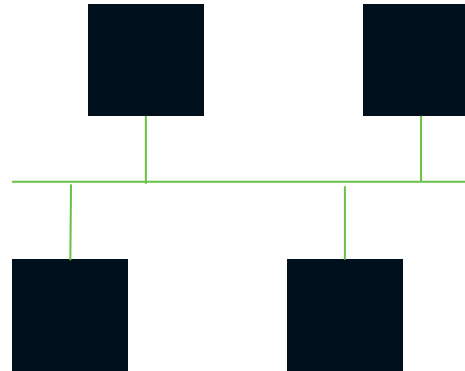
# INTEGRATION PATTERNS

## Point to Point



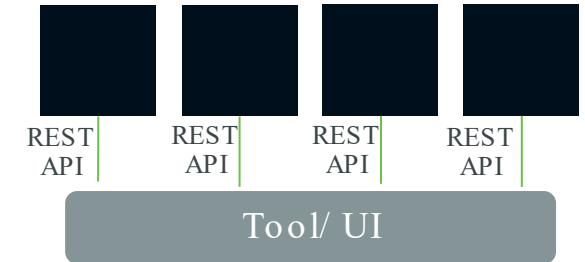
- $n! / 2! * (n - 2)!$  integrations to build and manage
- Number of integration points become large and unmanageable even within a company

## ESI Bus



- A common application schema acts as a bus that each system can connect to
- The common schema becomes large and unmanageable across extended enterprise
- Based on messaging technology (JMS) which is not available everywhere

## API Orchestration



- Each application exposes their own capabilities via REST APIs
- No common schema
- Based on HTTP for universal connectivity across the extended enterprise

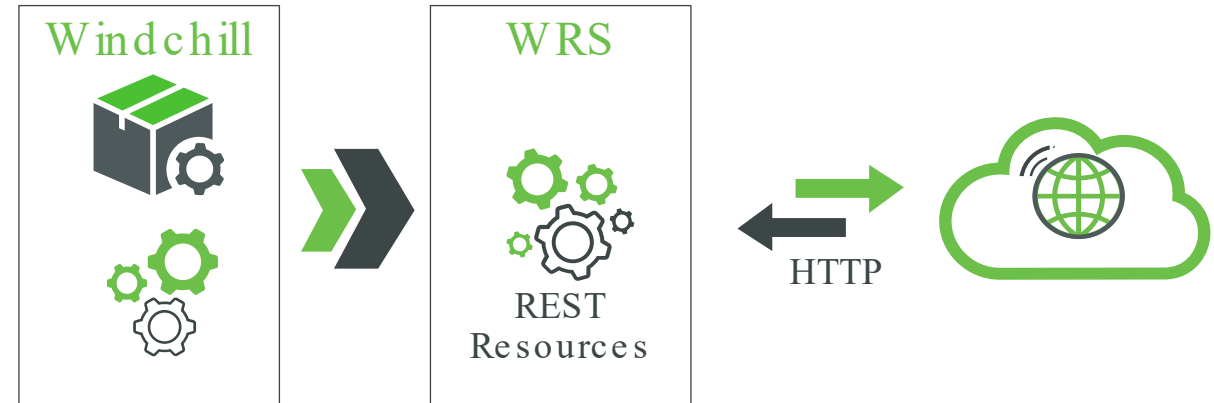




# WINDCHILL REST SERVICES

# WINDCHILL REST SERVICES OVERVIEW

- A module that allows Windchill objects to be accessed as REST resources
- Follows OData Standard V4.0X
- Includes PTC provided domains with endpoints for different functional areas of Windchill
  - Product Management
  - Document Management
  - CAD Document Management
  - Data Administration
  - Principal Management
  - Etc.
- Available on all active maintenance releases of Windchill
- WRS 2.6 bundled with opportune CPS releases
  - 13.0.0
  - 12.1.2.4
  - 12.0.2.13



# WHY WRS?

## Foundation for Modern UX

- Strong separation of concerns
  - Javascript for UX
  - RESTful resources to represent business entities on the backend
- Run on mobile platforms
  - Data represented in lightweight formats like JSON



HTTP

HTTP



## Foundation for Cloud API Integrations

- Emphasis on integration with business systems in the cloud
  - Based on HTTP
- Support API orchestration pattern of integration
  - API orchestration tools like Atlas Flow



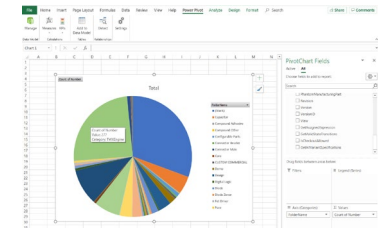
HTTP

HTTP



## Foundation for an Open PLM

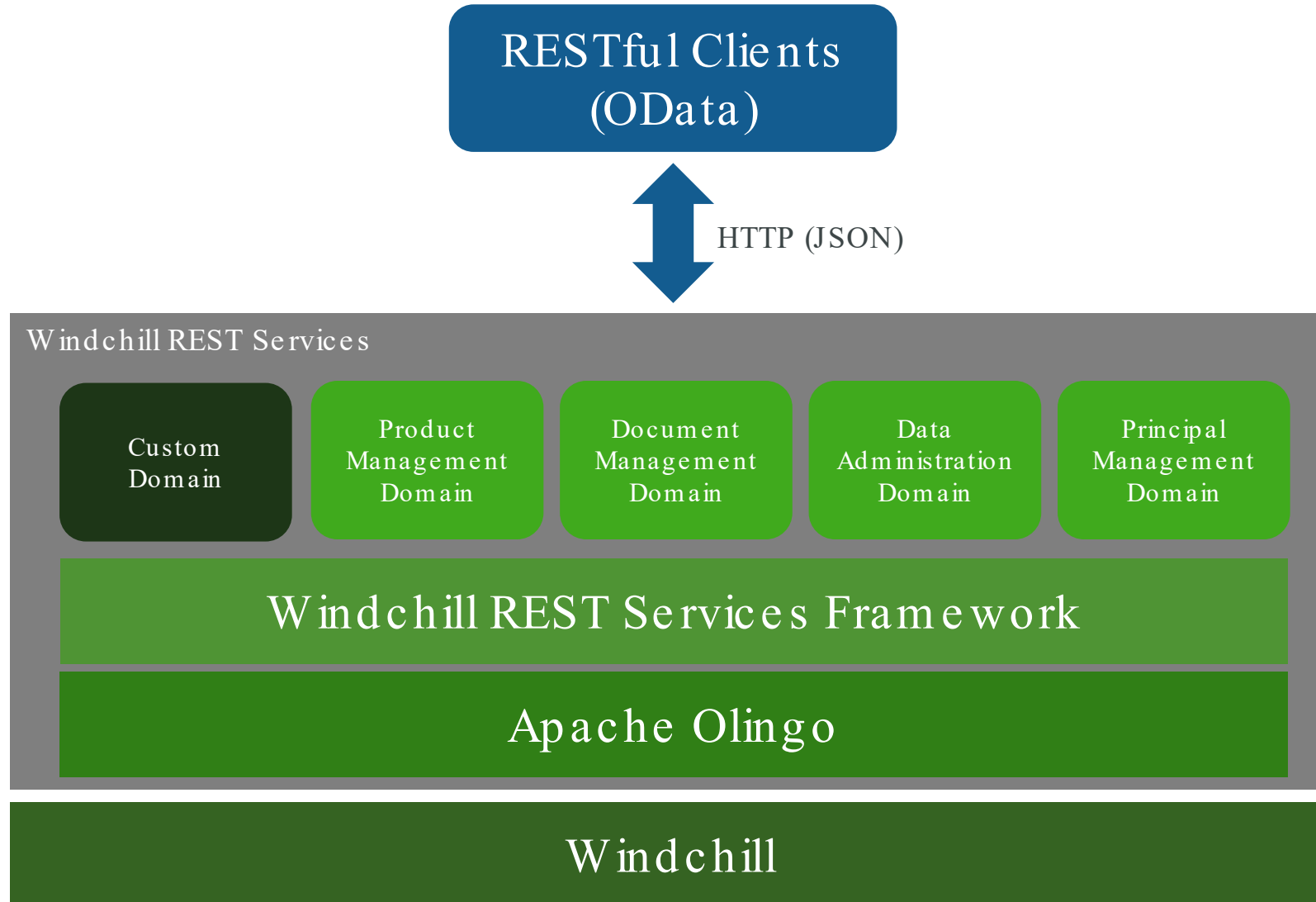
- Enterprise business processes depend on access to data from business systems for
  - Analytics
  - Intelligence



HTTP



# WINDCHILL REST SERVICES MODULE ARCHITECTURE



# ODATA SERVICES (DOMAINS) IN WRS

Thing Worx

OData Clients

HTTP Client

↕ HTTP (JSON)

↕ HTTP (JSON)

↕ HTTP (JSON)

B  
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N

Product Management	Document Management	CAD Doc Management	Change Management	Principal Management	Data Administration
Nav Criteria	Workflow	Effectivity	Visualization	Event Management	Reporting
Saved Search	Administration	Business Admin Change	PDM		
Product Platform Mgmt	Manufacturing Process Mgmt	BOM Transformation	ESI	Audit	QMS
CAPA	NC	CEM	Regulatory Master	UDI	Supplier Management
Classification Structure	Dynamic Doc Management	Part List	Service Info Management		

Windchill

# HIGH PRIORITY AREAS

## Change Management

- Change Request
  - C
- Promotion Request
  - CRUD



## CAD Document Mgmt

- CAD Document
  - Associated changes
  - Where used
  - Referenced by
  - Advanced revise (with related parts)
  - Create from template
  - Save as
  - Rename
  - Move
  - Edit attachments
  - Checkout/Checkin
  - Auto associate
- Workspace
  - CRUD



## Product Management

- Related Documents
- Related CAD Documents
- Related Enterprise Data
- Related Plant Specific Functional Data
- Related Change Requests
- Affected By Change Notices
- Resulting From Change Notices
- Related Baselines
- Managed Baseline
  - R



# HIGH PRIORITY AREAS

## Document Management



- Document
  - Advanced Revise (including associated objects)
  - Associated Issues and Variances
  - Associated Change Requests
  - CRUD Part Instances

## Principal Management



- Group
  - CRUD Members
  - Enhance filter criteria
  - Recompute
  - Purge from cache
- User
  - CRUD Group Membership
  - CRUD License Group
  - Enhance filter criteria
  - Purge from cache
- License
  - Get entitlements
- License Profile
  - R Members

## Manufacturing



- Actions
  - Replace Peer Equivalent Parts
  - Synchronize Structure Associativity
  - Fix Unresolved Consumption Paths
  - Mass Updates
  - Assign Part Tags

# UPCOMING ITEMS IN WRS 2.6

## Framework

- Support for Java 17
- Tools to detect circular dependencies between domains

## Domains

- Product Management
  - New Actions
    - SingleLevelConsolidatedBOM
    - MultiLevelConsolidatedComponentsList
  - Support for creating supplier parts for specified suppliers
- CAD Document Management
  - New Actions
    - SingleLevelConsolidatedBOM
    - MultiLevelConsolidatedComponentsList
- Regulatory Master
  - Support for Regulatory Submissions





# FLOW

Holly Lancey

# PTC ATLAS PLATFORM



arena<sup>®</sup>  
 onshape<sup>®</sup>  
**SERVICEMAX**  
a ptc technology

vuforia+<sup>™</sup>   
 windchill+<sup>™</sup>   
 kepware+<sup>™</sup>   
 creo+<sup>™</sup>

[

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]

PTC Business Operation Systems

## Developer Services

Digital Twin Services	Visualization Content Services	Applied Analytics Services	Application Services
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## Data Integration & Orchestration Services

**Platform Core Services**

 Tenant Mngt	 Identity & Access Mngt	 Analytics	 Collaboration
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## IaaS / PaaS

### A Trusted Platform

- Security
- Privacy
- Compliance
- Availability
- Regionality
- Recovery

# PTC ATLAS PLATFORM



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A Trusted Platform



Security



Privacy



Compliance



Availability



Regionality



Recovery

PTC Business Operation Systems

Developer Services

Digital Twin Services

Visualization Content Services

Applied Analytics Services

Application Services

Data Integration & Orchestration Services



Tenant Mngt



Identity & Access Mngt

Platform Core Services



Analytics



Collaboration

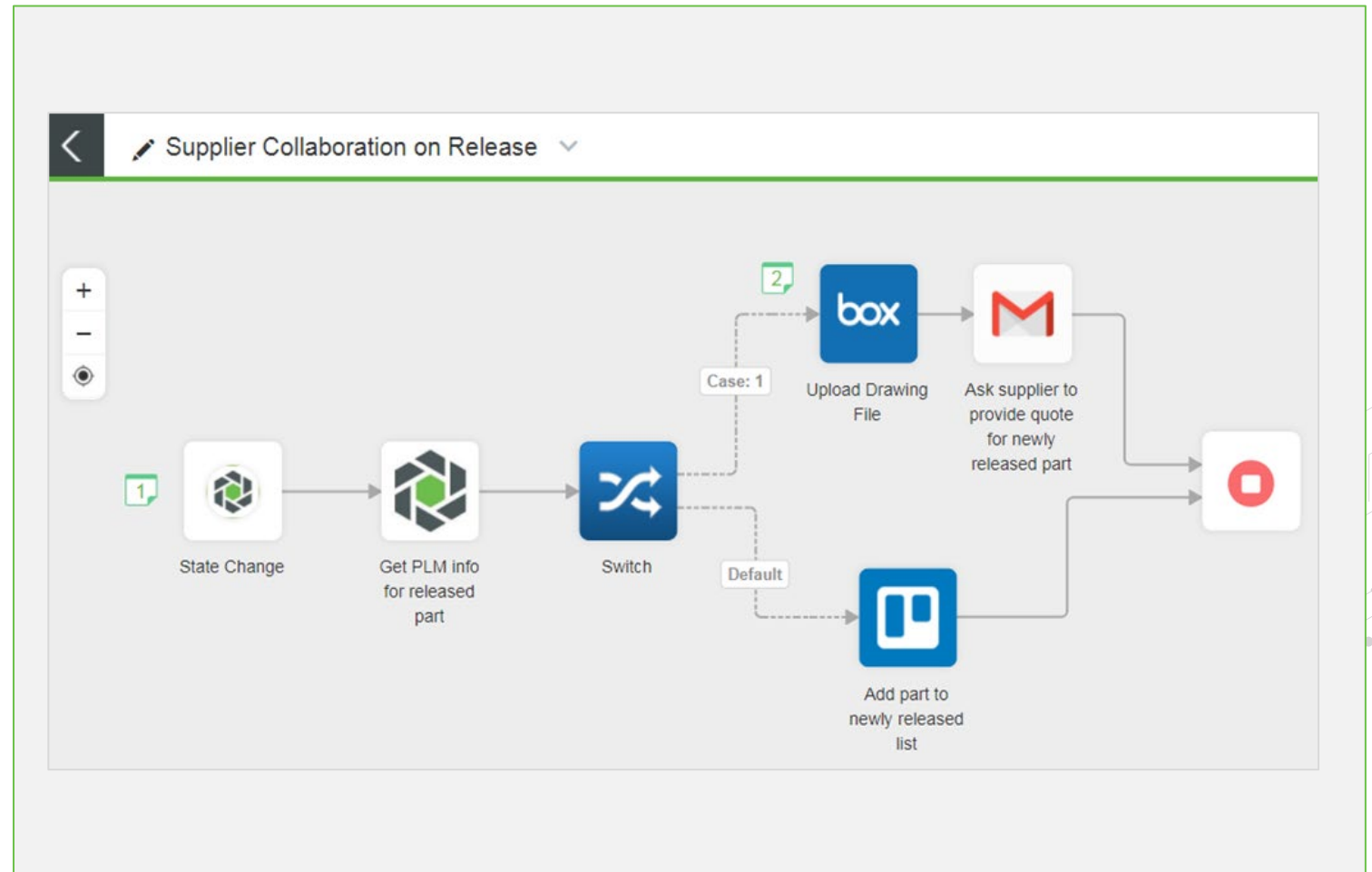
IaaS / PaaS

# FLOW OVERVIEW

Flow – low-code/ no-code workflow engine

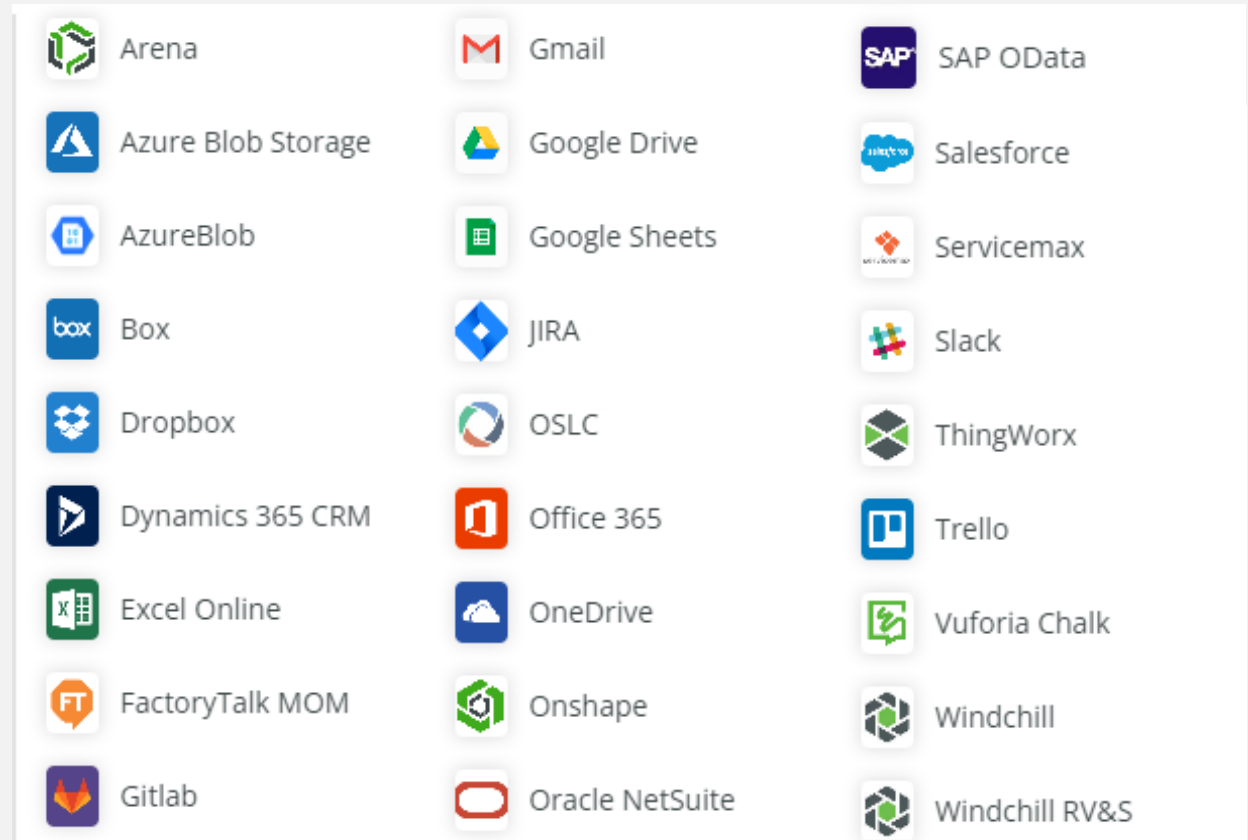
Workflows connecting data systems and streamlining business processes

OOTB templates with built in logic



# FLOW OVERVIEW

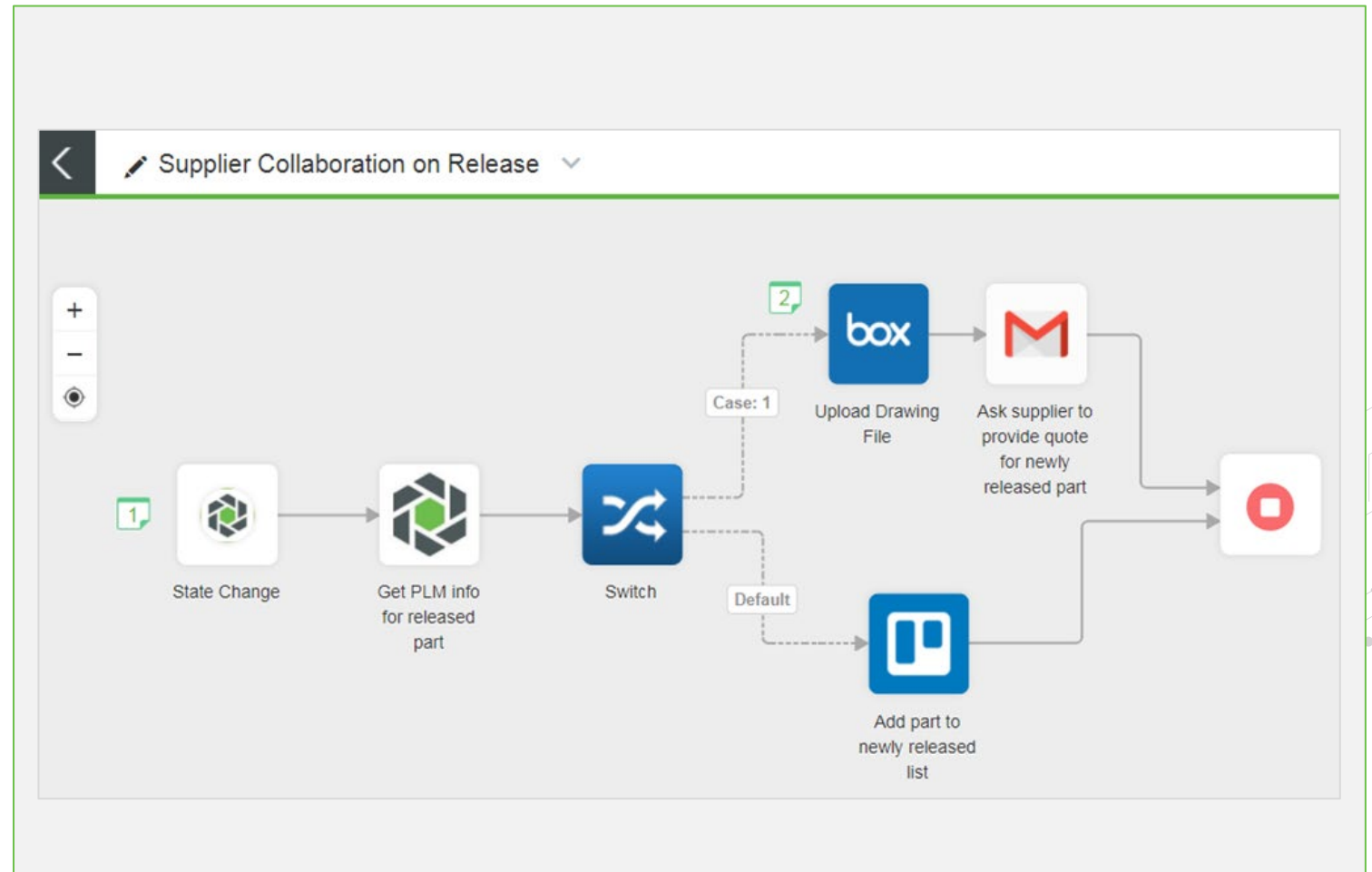
- Connectors
  - Authorization
  - Lookups
  - Triggers
  - Actions
- PTC and 3<sup>rd</sup> party business systems related to the Digital Thread



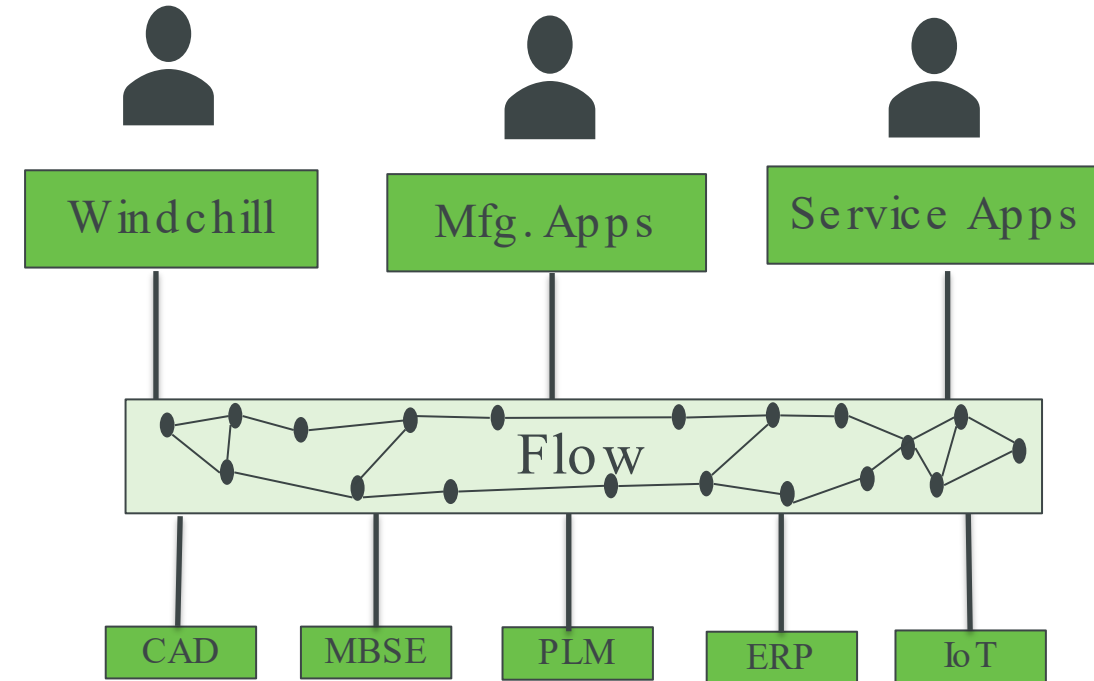
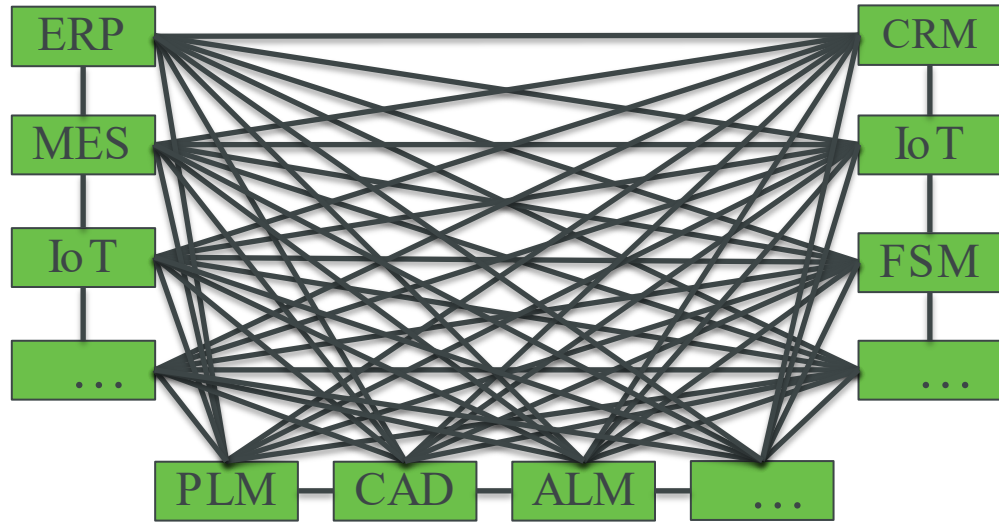
# FLOW OVERVIEW

## ■ Flows

- Trigger (start) on connected system event
- Look-up data from connected system
- Execute system action with data acquired in any previous connection or as parameters
- Branch to next action(s)



# FLOW FOR THE DIGITAL THREAD



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# FLOW MISSION SHIFT

- Flow's mission is shifting from a build-it-yourself, integration toolkit to delivering **Pre-built** and **configurable integration templates**
- Workflows built with Flow can be offered OOTB in PTC applications, making integrations seamless to end-users
- Flow will focus on integration patterns relevant to the Digital Thread that are common and repeatable, some examples of these integration patterns are:
  - **Coordinate Change**
  - **Get Configuration**
  - **Get Fleet Summary**
  - **Sync BOM/BOP**
  - **Get Instruction**
  - **Open New Order**
  - **Get CAD Metadata**
  - **Get Part Cost and Inventory**
  - **Link Design Item**
  - **Open New Issue**



# HIGH PRIORITY AREAS

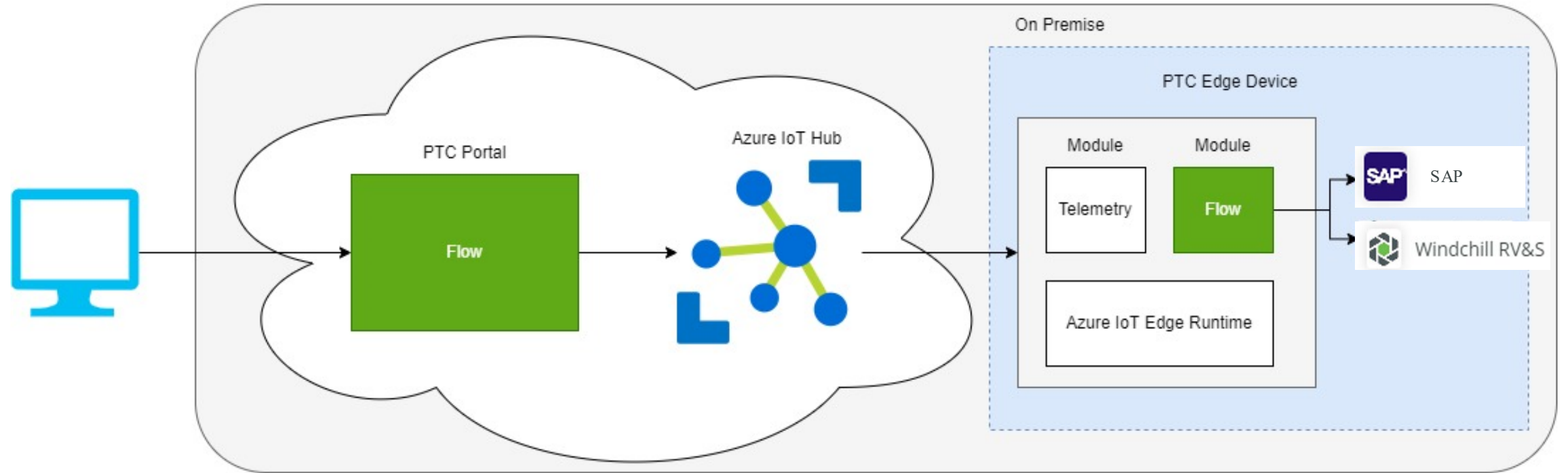
## Short Term

- Template feature
- ERP Connector Template
- Flow GA for Windchill+
- Collaboration use cases

## Mid-Term

- DPT / OSLC Templates
- PLM – ERP Templates
  - SAP Connector
- PTC Integrations – Vuforia, ServiceMax, etc.
- Flow Edge– support for on-prem execution

# FLOW ARCHITECTURE





# QUESTIONS?

Thank you! You can find me at:



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**in**



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# THANK YOU

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