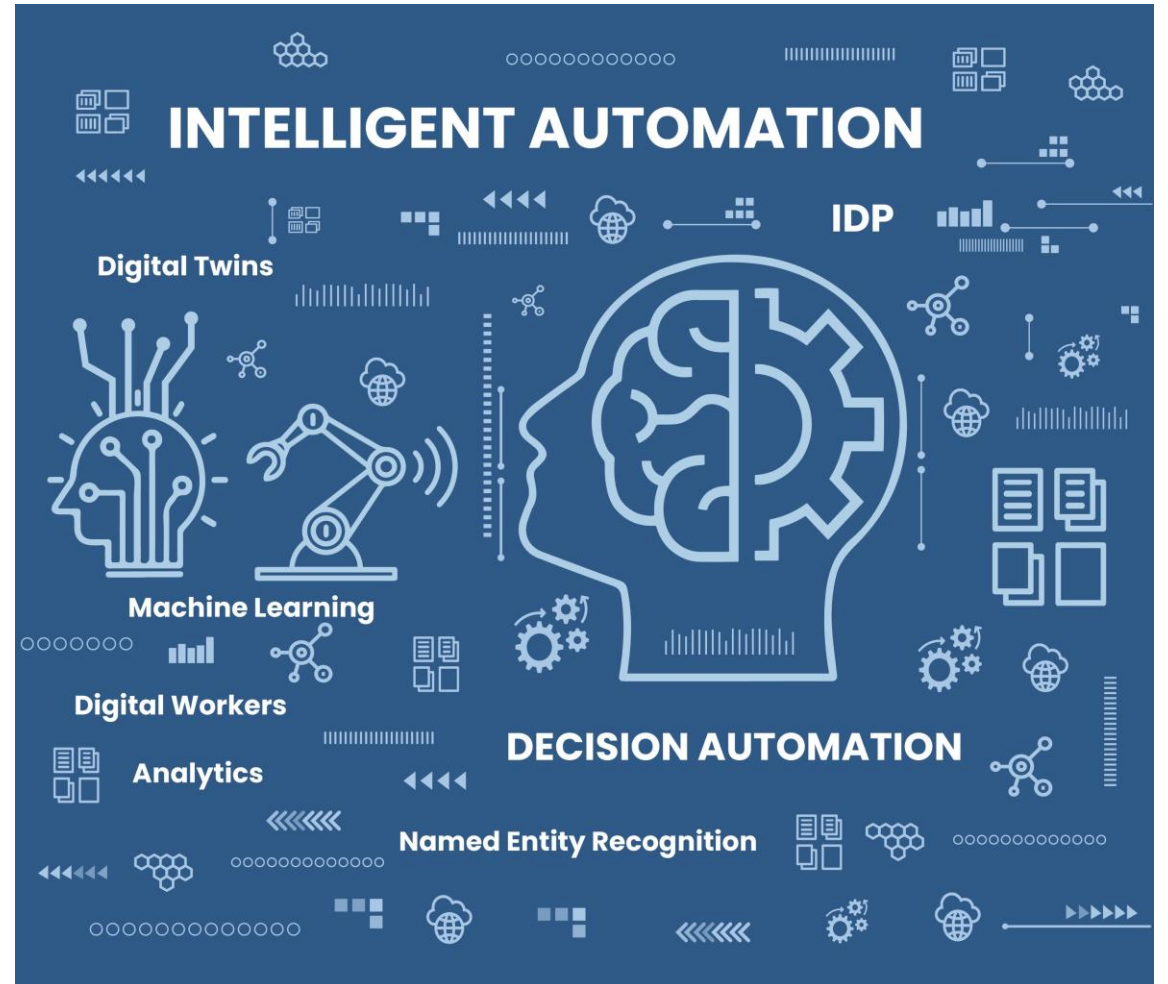# Declarative AI at Scale: Powering a Robotic Workforce

Nathaniel Palmer
Chief Architect, Serco

# The Story of Seven Miracles…

Compound Efficiency Gains Exceeding 500%

Predictable Cost Reductions (contractually guaranteed) Plus Significant Margin Gains

Year-Over-Year Positive ROI on all Intelligent Automation Investments

Previously Manual Complex Case Work Automated by 70% (or more) End-to-End

One-third of Work Volume Performed Without Requiring Human Intervention

Complex Casework Performed 2-4 Times Faster With Greater Accuracy

20X Reduction in Operating Costs While Accommodating Seasonal Bursts and Lulls

# Serco CMS Eligibility Support Business At-A-Glance

**Consumer Interactions**

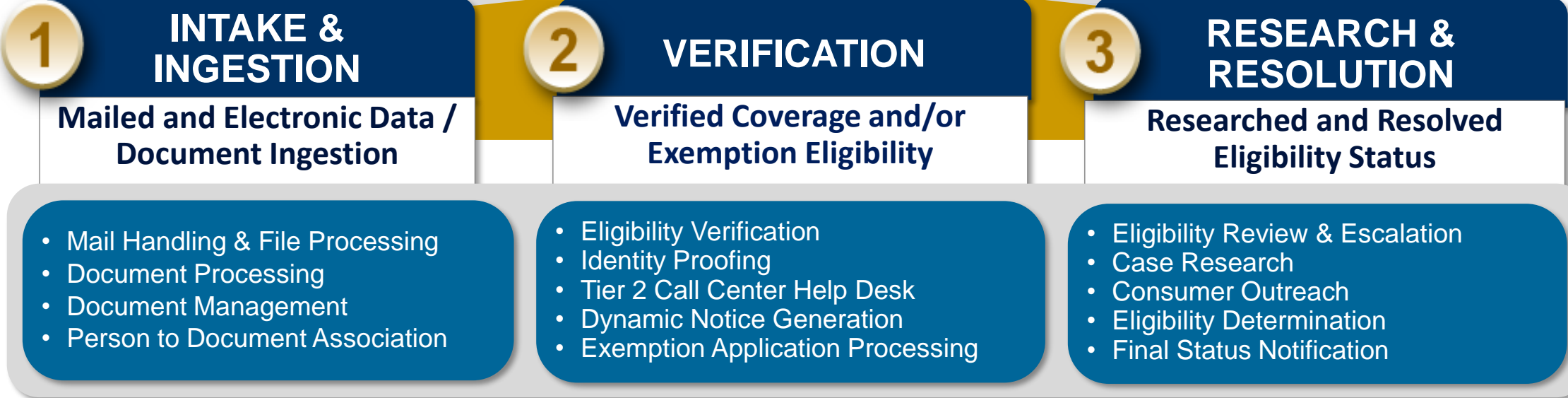| 12M Notices | 8M Phone Calls | 100M Complex Record Queries | 5.0M Adjudications | 45M Documents Analyzed/Classified |
|---|---|---|---|---|

- Mailed Documents
- Uploaded Documents
- Electronic Audit Files / Data

- Outbound Phone Calls
- Returned Calls
- Generated Notices

- Inbound Calls
- Outbound Phone Calls
- Generated Notices

**Business Operations**

**1 INTAKE & INGESTION**

Mailed and Electronic Data / Document Ingestion

- Mail Handling & File Processing
- Document Processing
- Document Management
- Person to Document Association

**2 VERIFICATION**

Verified Coverage and/or Exemption Eligibility

- Eligibility Verification
- Identity Proofing
- Tier 2 Call Center Help Desk
- Dynamic Notice Generation
- Exemption Application Processing

**3 RESEARCH & RESOLUTION**

Researched and Resolved Eligibility Status

- Eligibility Review & Escalation
- Case Research
- Consumer Outreach
- Eligibility Determination
- Final Status Notification

**Enabling Technologies**

- Task Mining & Analytics
- Business Process Management (BPM)
- Knowledge Management
- Machine Learning
- Cloud Native Services
- Named Entity Recognition
- Robotic Process Automation
- Declarative AI
- Intelligent Document Processing

# Our Transformation Journey

How We Made Automation Intelligent

**Phase 1: Document Automation: Greater Automation Efficiency with Reduced Manual Work; Enabling Straight-Through Processing**

Machine Learning and Robots enable intelligent document capture to accurately process tens of millions of documents, automatically extracting key data (versus manual keying) with automated validation

**Phase 2: Assisted Searching & Retrieval: Securely Accessing Government Systems Using Existing Security Controls & Protocols**

Digital Workers securely accesses government systems (with full user authentication and security controls) through API and legacy Web-based user interfaces; tens of millions of complex queries performed with greater accuracy and substantially faster than capable by human workers

**Phase 3: End-to-End Execution: Faster End-to-End Execution; More Precise Analytics; Less Re-training and Required Specialization**

Robot Workers are assigned the same work and perform each step exactly the same as their human co-workers do, with the same program rules and policies applied, while delivering greater accuracy, efficiency, and quality of work; less reliance subjective rule interpretation; more accurate analytics; ensuring program integrity

## FROM

### Operations Designed to Peak Scale vs Seasonality

5,500 production workforce (peak staff)

4 Large Footprint (30,000 sq ft) Processing Centers

Highly manual work requiring extensive training, often involving re-work, adding delays

### Workforce Challenges

Lack of reportable analytics led to challenges in prioritization and efficient staff utilization

Tasks reliant on CSRs following detailed work instructions, training, and manual QA checks

### Low Margins Business Model

"Cost Plus Fixed Fee" (CPFF) model where the U.S. government carried all the risk in exchange for a low margin (e.g., the fixed fee)

## TO

### Significant Reduction in Peak Operational Footprint

1,000 +/- production peak staff

Remote Processing & 3 Small Regional Centers

More automated, streamlined processing with demonstrably higher quality & efficiency

### Optimizing Program Integrity

Consistent performance ensured via enforceable business rules and automation process steps

Clearly defined SLAs reported weekly

Workers freed to focus on supporting the consumer

### Risk Transference & High Margins

Fixed Unit Price where U.S. government faces no financial risk; margins are in our control and performance is both consistent and transparent
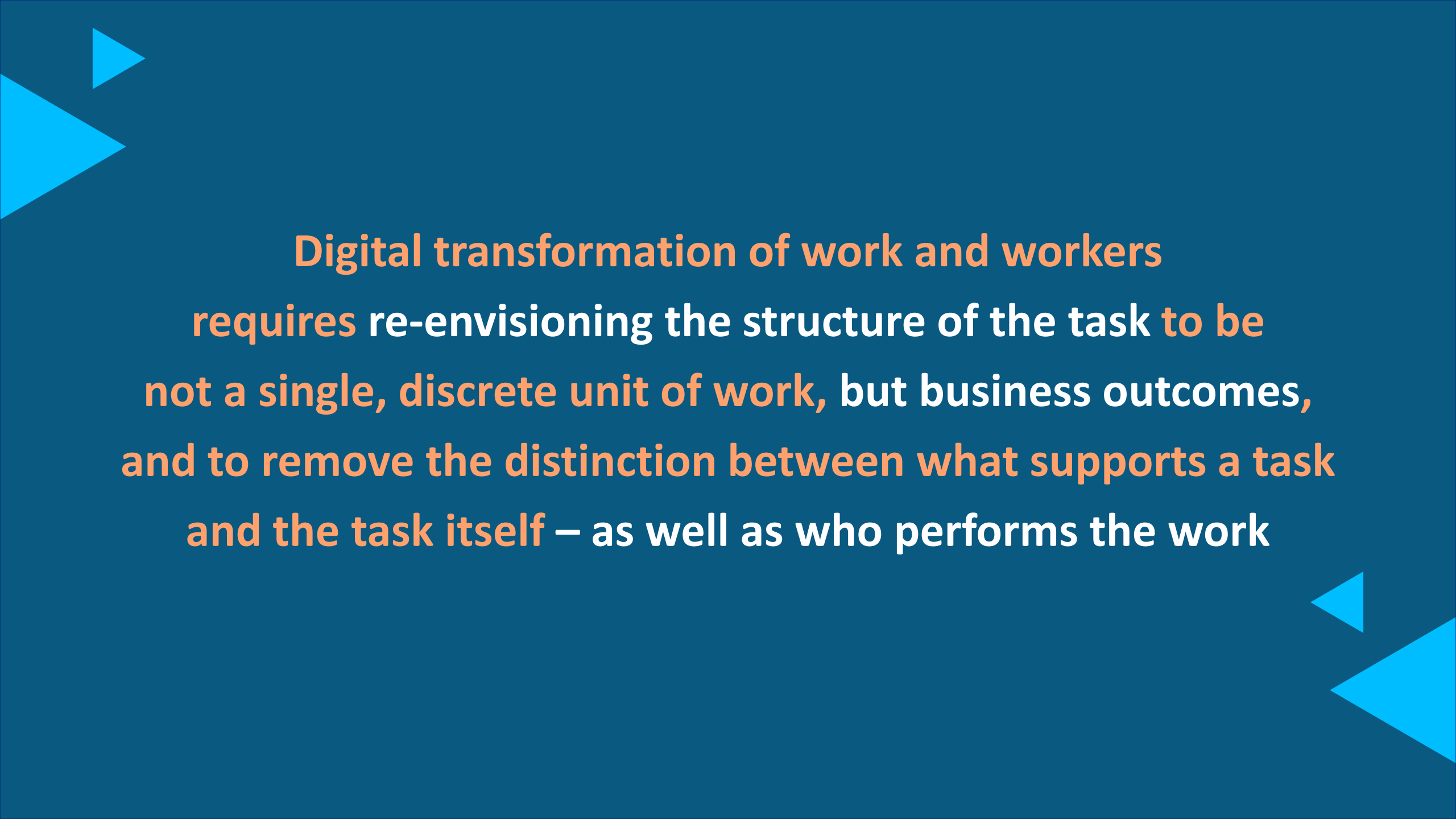
**This transformation was made possible through co-creation with customer stakeholders and the engagement of highly-skilled, domain-specific strategic partners**

**You may ask yourself,**
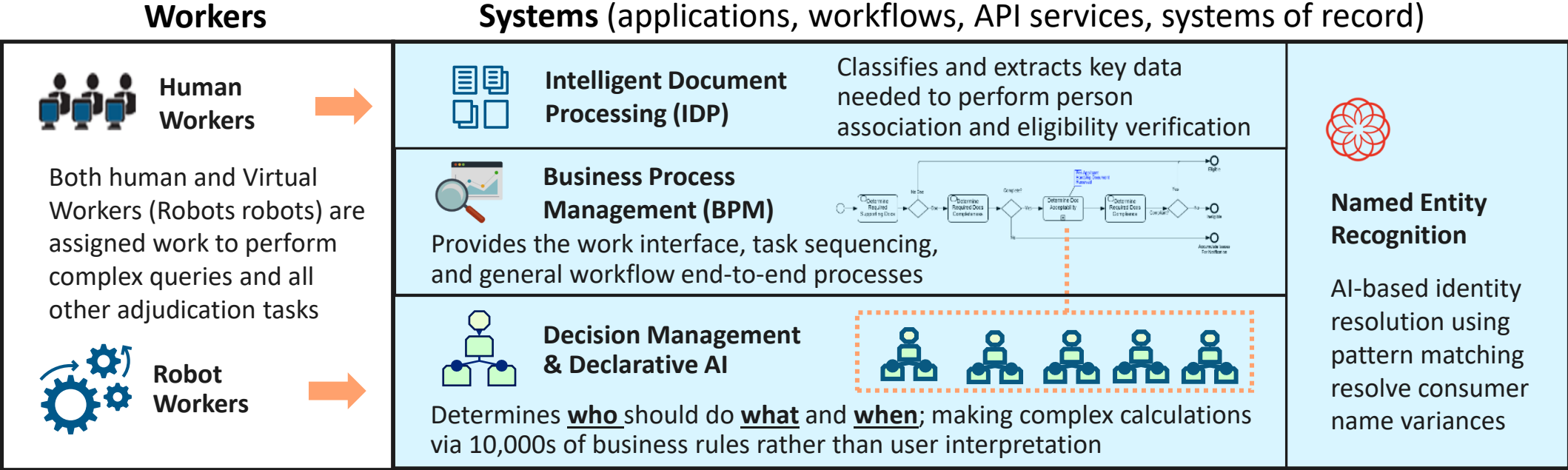
**"WELL, HOW DID I GET HERE?"**

**Digital transformation of work and workers requires re-envisioning the structure of the task to be not a single, discrete unit of work, but business outcomes, and to remove the distinction between what supports a task and the task itself – as well as who performs the work**

# The Focus is on the Worker (Human & Robot)
# Not the System (Robots is not a system)

> Robots and humans log-in to the same core systems, ensuring the same rules and controls are applied, with the same level of reportability, while allowing the same quality assurance to be performed, allowing program integrity to be ensured

**Workers**   **Systems** (applications, workflows, API services, systems of record)



**Human Workers**

Both human and Virtual Workers (Robots robots) are assigned work to perform complex queries and all other adjudication tasks

**Robot Workers**

**Intelligent Document Processing (IDP)**

Classifies and extracts key data needed to perform person association and eligibility verification

**Business Process Management (BPM)**

Provides the work interface, task sequencing, and general workflow end-to-end processes

**Decision Management & Declarative AI**

Determines **who** should do **what** and **when**; making complex calculations via 10,000s of business rules rather than user interpretation

**Named Entity Recognition**

AI-based identity resolution using pattern matching resolve consumer name variances

# **Who Are The Robots?** (the role of RPA)

**Robots follow deterministic scripts performing mechanistically per locally-directed application of rules**



Robots are "taught" what to do through the application of process models created to capture these distinct situations and the cataloguing of the relevant screen shots to facilitate designing the Robot Service

Yet at best robots, still can only do what they are taught to do, typically to follow the same set of actions and reactions to what is presented on screen that a human worker would follow

But each scenario much be anticipated and scripted; robots <u>cannot</u> make on-the-fly judgements or subjective interpretation of business events

# How RPA Works...

✓ Paths are Predefined & Ordered

✓ Path & Order cannot be dynamically altered other than via predefined exceptions



| Predefined | Main Path | Exception Path |
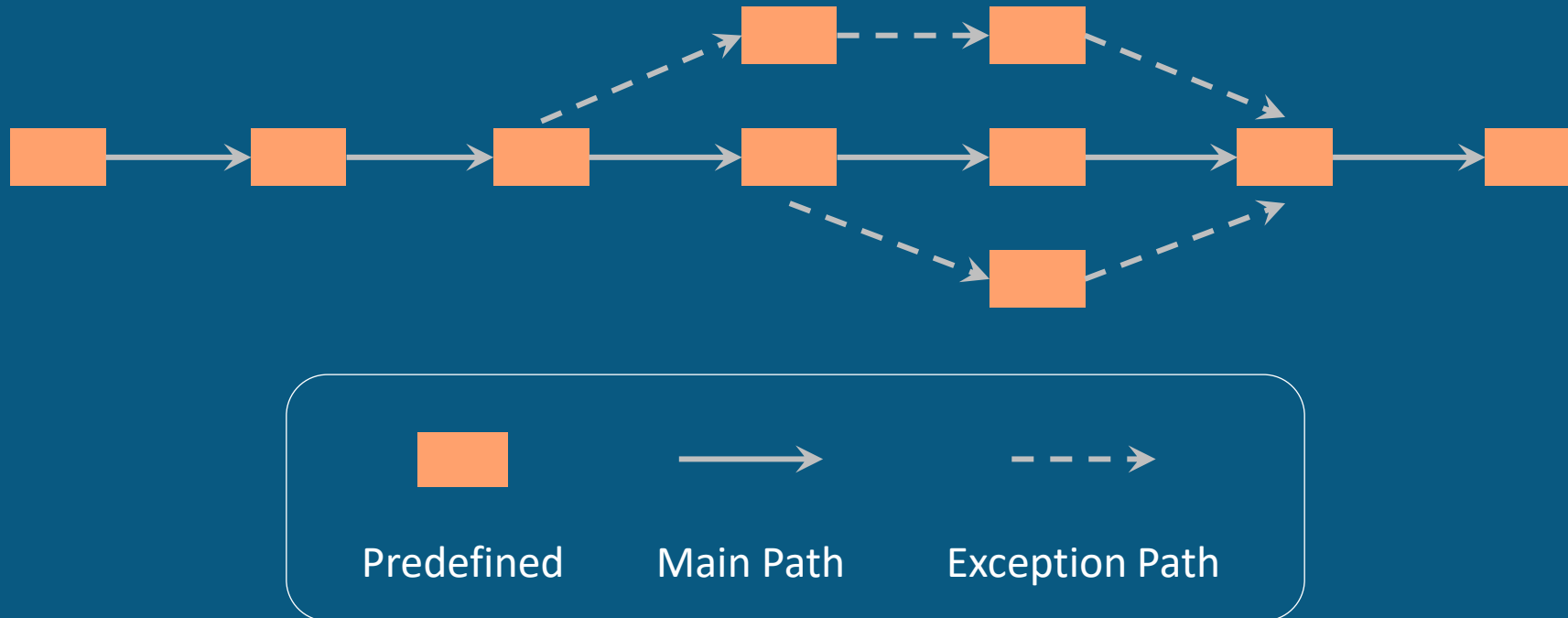
**How many processes actually look like that?**

# "Rule of Fives"?

**Forrester analyst Craig Le Clair recommends that Robots be governed by the** rule of fives: **"No more than five decisions, no more than five apps, and no more than 500 clicks"**

FORRESTER®

Every moment where a user stands in between two sets of data is a robotic opportunity.

But all robots require one thing...

# **R**obots
# **R**equire
# **R**ules



RULES FOR ROBOTS

Saul D. Alinsky

A Pragmatic Primer for Realistic Robots
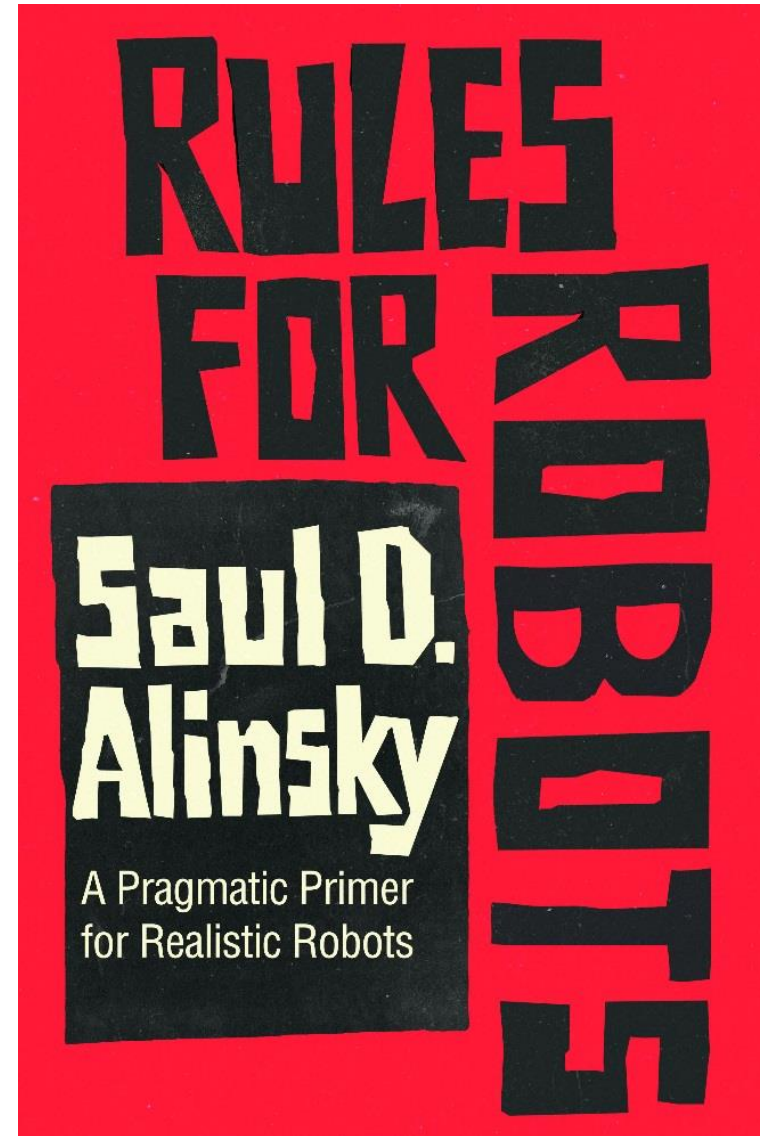
# Intelligent Automation
## Adaptable Processes Driven by Decisions & Business Events
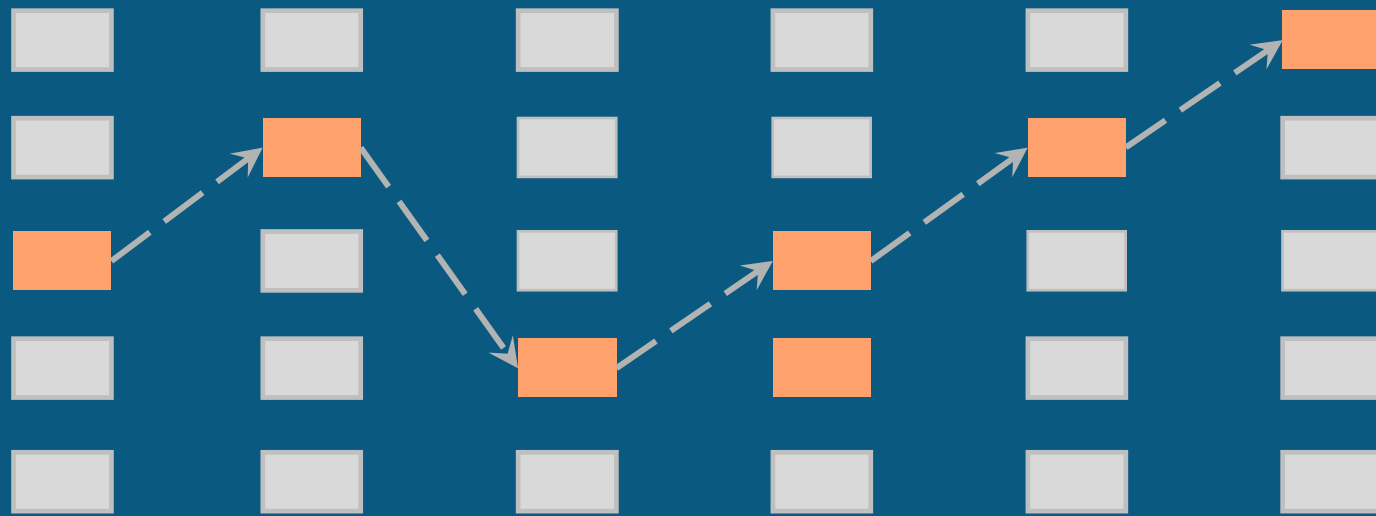
Paths are not Predefined but Prescribed by Decisions

Events Affect the Specific Path & Sequence of Steps

Paths Determined by Context: Dynamically Responding to Event Data, Rules, & Learned Patterns

Eligible    Enabled    Outcome Path
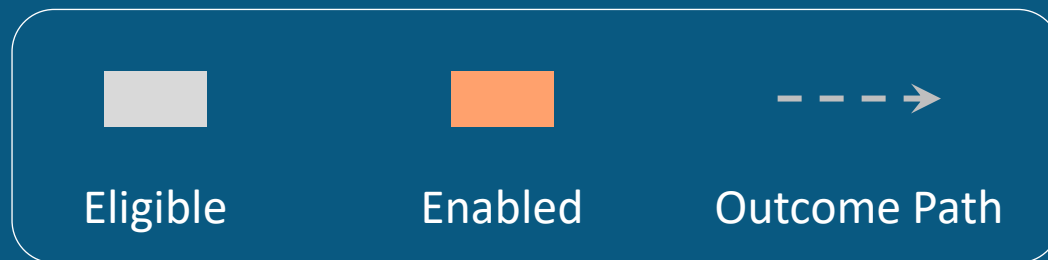
**Success Factor:** Leveraging Process Analysis with Human-Centered Design

# Problems, Issues and Lessons

Robots will do only what they are "taught" to do, which will be to follow the same set of actions/reactions to what is presented on screen that an Regular User would follow

- Robots-eligible work is "low complexity" work that the Robot is able to work to completion after it interprets the evaluation of this possibility by the Eligibility Service

ANY user will have to know what to do for the following and what to do if the following doesn't work

- *Logging on and handling any errors that are thrown*

- *Launching specific processes/sets of screens and handling any errors that are thrown*

- *Navigating specific processes/sets of screens along pre-determined lines of data entry or UI actions*

Robots will be "taught" what to do through the application of process models created to capture these distinct situations and the cataloguing of the relevant screen shots to facilitate designing the Robot Service

- Leverage enterprise modeling and design tools to generate artifacts needed visualize and validate paths robot workers must follow (as they cannot deviate as humans will)

# What is "Intelligent RPA"? (this is our pivot point to Declarative AI in end-to-end automation)

**How we overcame the "Rule of Fives"**

Robots still follow deterministic instructions – but are directed simply to follow the rules... the same policies, logic, controls, and instructions as all workers (human and digital alike)

Digital Workers are constructed from an Robots platform using Human-Centered Design principles

Robots are taught only to be the levers or actors; they are taught how to receive and apply instructions, they are not programed what to do

Intelligent RPA

# Converting Business Policy Into Declarative Business Logic (the most critical step we never saw coming; without it robots would have run amok)

- Transformed 100,000s of Policy Pages and Reduce Days of Training With Manageable and Measureable Decision **Models Owned and Controlled by the Business**, Not Dangerously Locked Inside of Application Code

- Gained Analytics and Audit Reports Based on Actual Decisions and Actions Taken

- Allowed (all) Workers to Leverage Very Complex Decision Rules Using Existing Interfaces
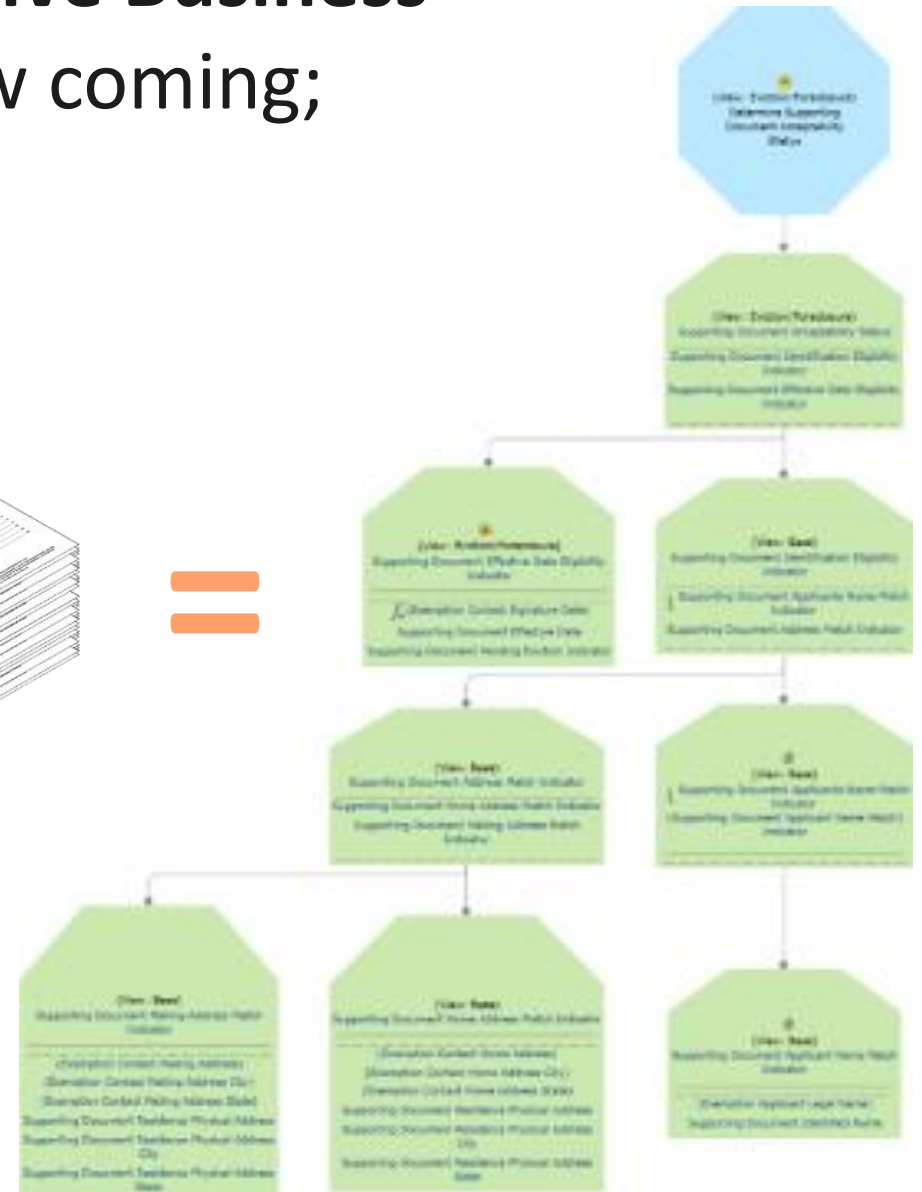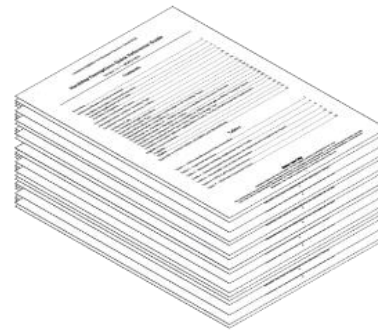
# Dynamic Work Assignment (our first true instance of Declarative AI)

**"Right Task"** to the **"Right Worker"** at the **"Right Time"**

"Right Task" to be worked is based on priority and complexity factors

"Right Worker" to be matched with work is based on automatically set credential-driven authorizations

"Right Time" to be worked is based on operational priorities as set and SLAs to meet
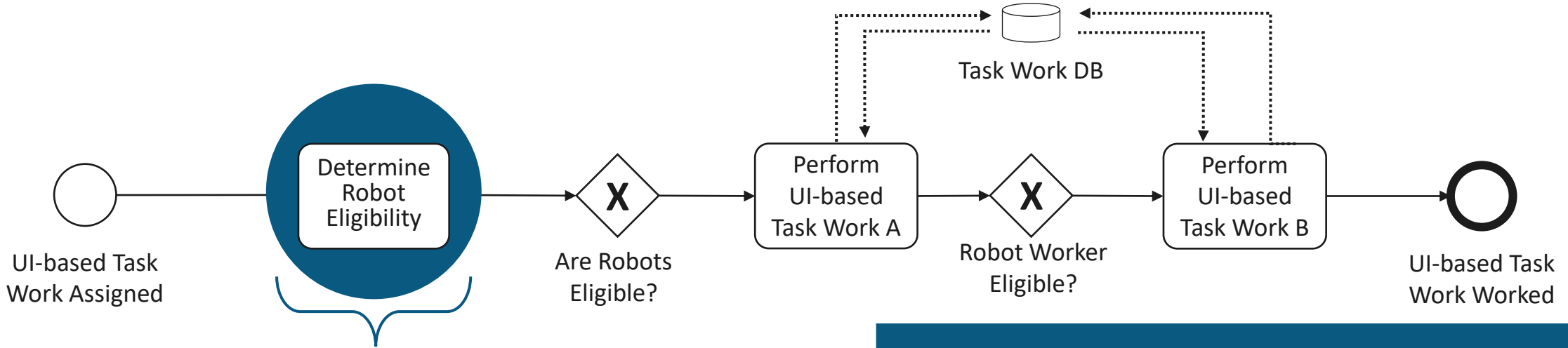
RPA User Service

Get Next Task → Dynamic Work Assignment

Task Work Process

Task-related Data Services

Robots Eligibility Service

Metadata Matching Service
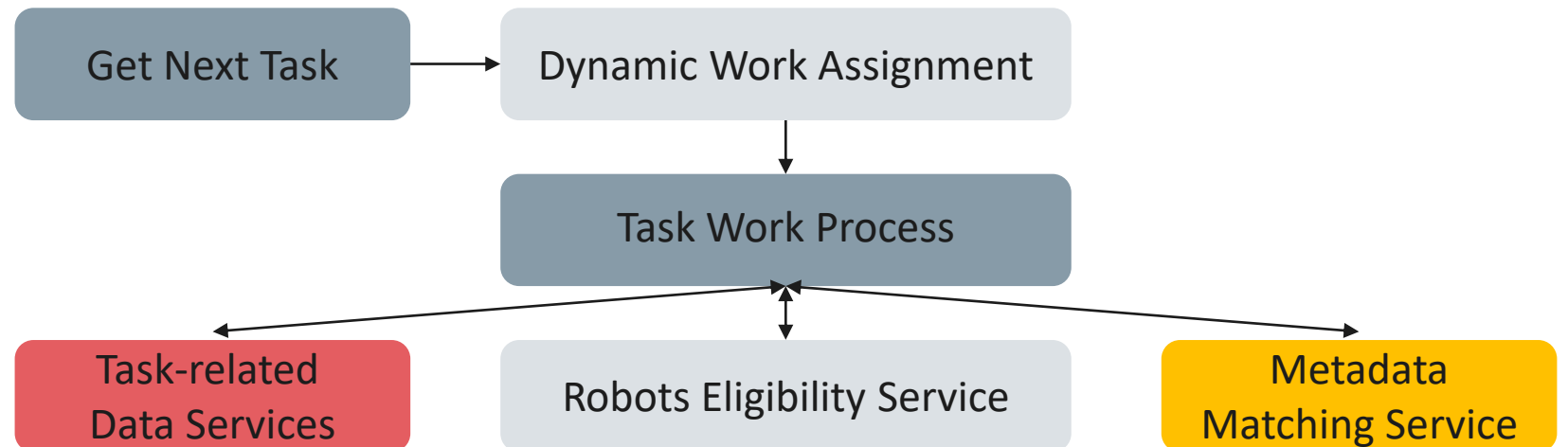
# Robot Eligibility Decision Service

Every task is _potential_ robot work, but not all work is eligible
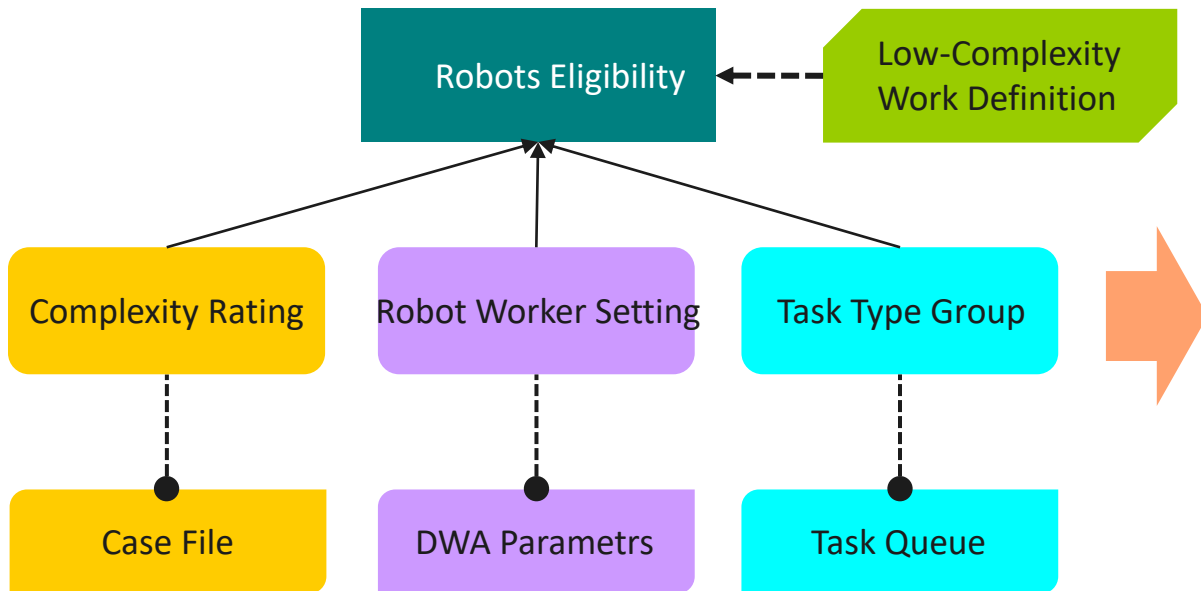


| Robots Eligibility | | | | | |
|---|---|---|---|---|---|
| **U** | **ComplexityRating** | **TaskTypeGroup** | **RobotsUserSetting** | **RobotsEligibility** | **Description** |
| | _Input_ | _Input_ | _Input_ | _Outcome_ | _Informational Note_ |
| **1** | "Low" | "ValidForRobotss" | "RobotsUserOnly", "RobotsAndHumanWorkerUser" | true | Robots online with qualifying task |
| **2** | "High" | | | false | non-qualifying case |
| **3** | | "ValidForHumanWorkerUser" | | false | non-qualifying task type |
| **4** | | | "Human WorkerUserOnly" | false | Robots offline |

# Using Process Mining to Diagnostically Find Robot Candidate Work
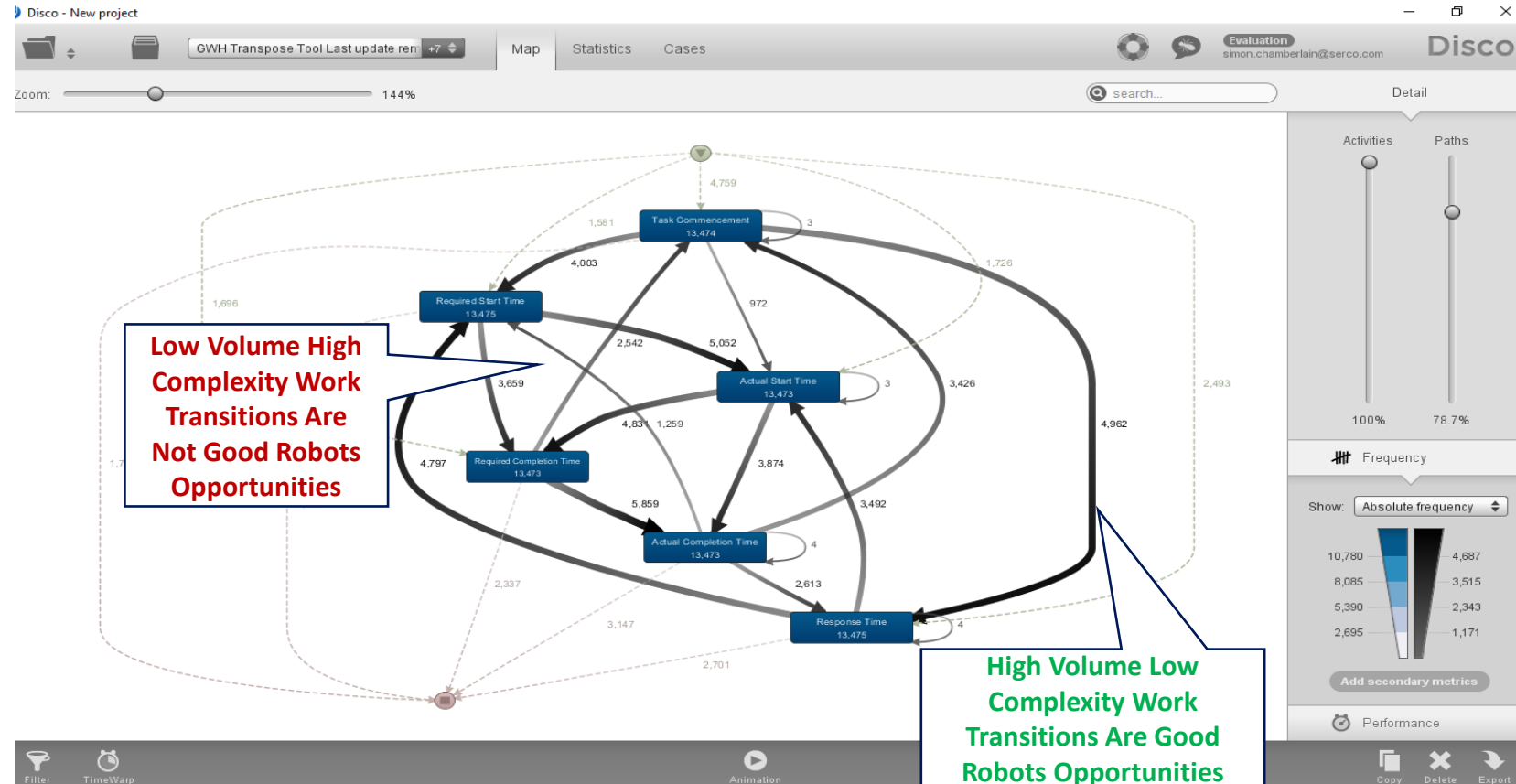


**Source of Process Map:** Material on DISCO Process Mining Tool from Fluxicon (https://fluxicon.com/)

**Process Mining generates maps from audit log data about the transition of work from activity/performer to activity/performer for targeted action**

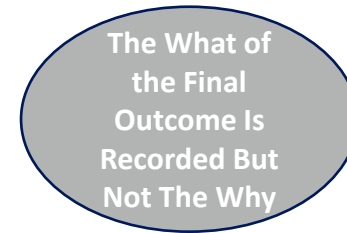# Observable Robot Work (Why We Need the Robot Dossier)

**Without the Robot Dossier**

| Work Task In the System | → | Complete the Work |
| --- | --- | --- |

**Robots emulates human user work, completing what it can and bailing out when it cannot**
**or**
**Bot collects all necessary data, and can loop and complete work faster and with better consistency**

*Interim Steps Taken Are Not Recorded*

**Robots finishes included work or bails out due to excluded work**
**or**
**Bot finishes its work and releases control back to calling context**

*The What of the Final Outcome Is Recorded But Not The Why*

Impossible to calibrate where to improve robot performance or how to identify exclusion points that can be removed

---

**With the Robot Dossier**

| Work Task In the System | → | Record Work Actions Taken | → | Complete the Work | → | Post the Outcome |
| --- | --- | --- | --- | --- | --- | --- |

Robots emulates human user work, completing what it can and bailing out when it cannot
or
Bot collects all necessary data, and can loop and complete work faster and with better consistency

**Robots captures and accumulates "audit log" of actions taken per a defined schema of action types, whether a virtual user or a bot**

Robots finishes included work or bails out due to excluded work
or
Bot finishes its work and releases control back to calling context

**Accumulated entries are posted and transformed into Robot Dossier records, containing the "why" that explains the "what" of robot work**

Easier to calibrate where to improve robot performance – how to refine robot eligibility to do more work than can now be done

# Attended Robots

- Interaction is in real-time with Regular Users who trigger actions in an automated process (e.g., data evaluation actions within a UI that is framing work for the Regular User to do)

- Robots actions facilitate the work done by the Regular User by automating mundane or repeatable steps in the task, saving the Regular User from having to devote costly time to such efforts

**Example:  Data searching actions in associating imaged documents to persons within the case files**
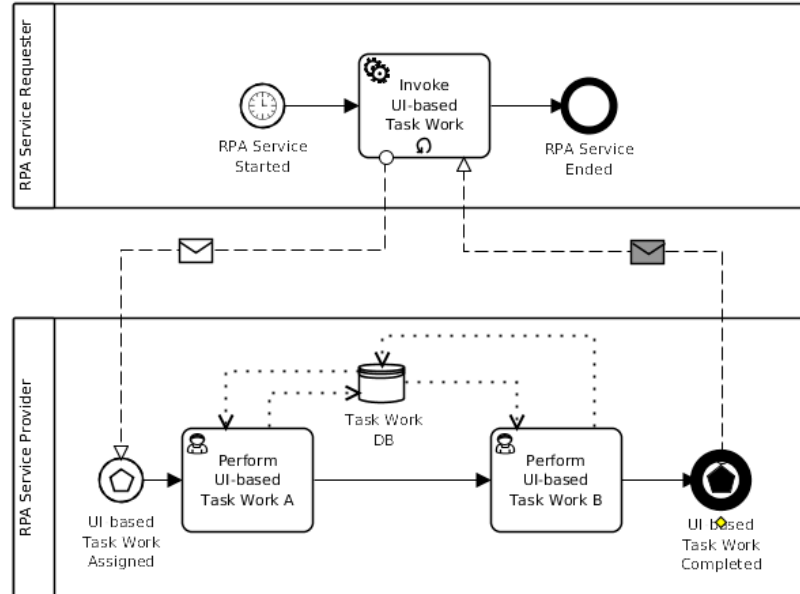


**Robots as a Service…
Service Task in BPMN that
triggers an external provider to
perform certain steps**

# Unattended Robots

- Represents a "headless" execution of a "headful" session by working an existing process/system as if it were a Regular User

- Robots Worker is just a class of users of the process/system that is constrained to simpler workstreams in which to do work

**Example: Resolving document matching issues for an applicant when time has expired for the issues to be addressed**

(Robot Worker)   =   (Regular User)
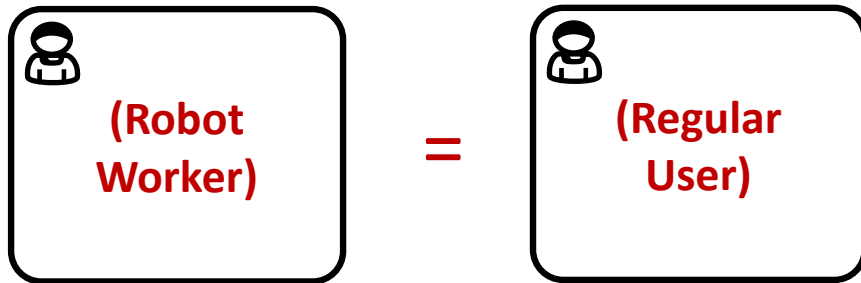
**E2E process has 2 Performers but only 1 is in use at instance-level where task is worked**

# Out Robot Team

## "We have ~~100s~~ of bots!"

### DB Query Bot

- Runs queries automatically to determine recorded relationships in the database based on inputted data, saving human users from having to manually perform such searches and increasing scale of processing

### Facilitation Bot

- Runs actions in parallel to or triggered by human users responding to citizen inquiries about the status of requested services, enabling human users to field more inquiries more quickly

### Robot Worker

- Runs E2E sessions on legacy systems to adjudicate eligibility of applicants for receiving access to government services, allowing human users to do more complex work and raising overall quality of work

### Robot Dossier

- Runs concurrent with Robots Virtual User while it records actions taken, which are combined with system data to explain what was done, facilitating evaluation of Robots' yield on work (can be used for humans)

# Autonomic Innovation

## Analytics-Driven Continuous Optimization

**Document Automation Operational Dashboard**
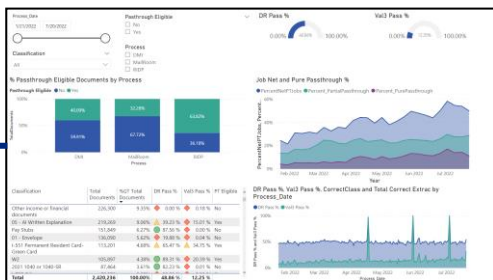


**Robot Dossier**



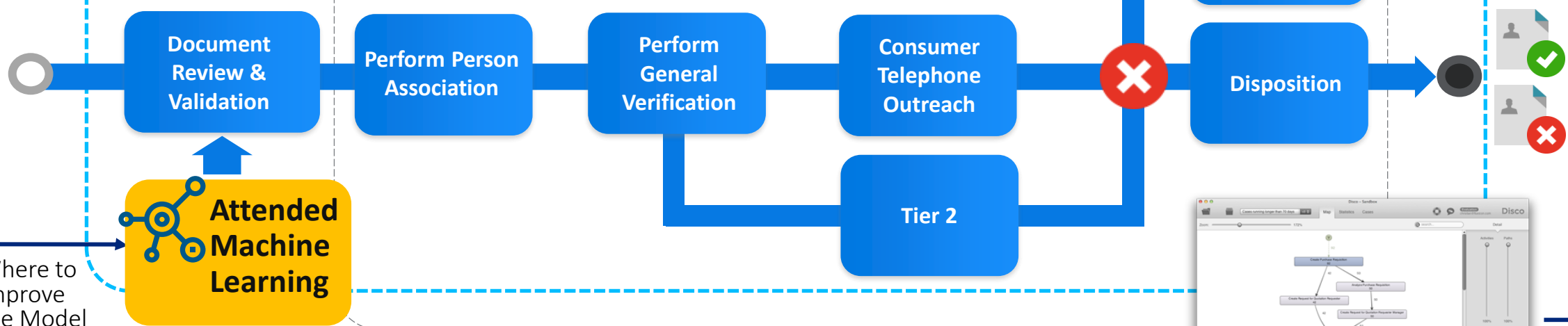Extraction Defects: Why Robots Didn't Resolve
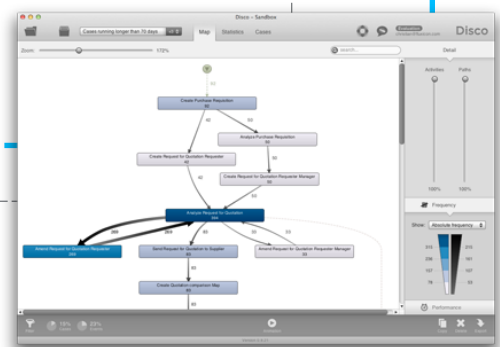
What the Robot Did

**Intelligent RPA**

Automation Targets Prioritized by Process Mining

**Decision Management & Declarative AI** enables ingestion, scoring, assignment, evaluation, execution, escalation, and resolution of all work.

**Expiration**

**Document Review & Validation** → **Perform Person Association** → **Perform General Verification** → **Consumer Telephone Outreach**

**Tier 2**

**Disposition**

**Attended Machine Learning**

Where to Improve the Model

**Automated Benchmarking Tools**

**Process Mining** Captures Task-level Performance Metrics on Each Step and Stage of Adjudication

# Do you remember where you were?

# Do you remember where you were?





*Rick Rescorla,*
*Morgan Stanley Security Director*

# Thank you!

**Nathaniel Palmer**

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