

# Delivering a 360° View in Healthcare and Life Sciences

With Agile Data

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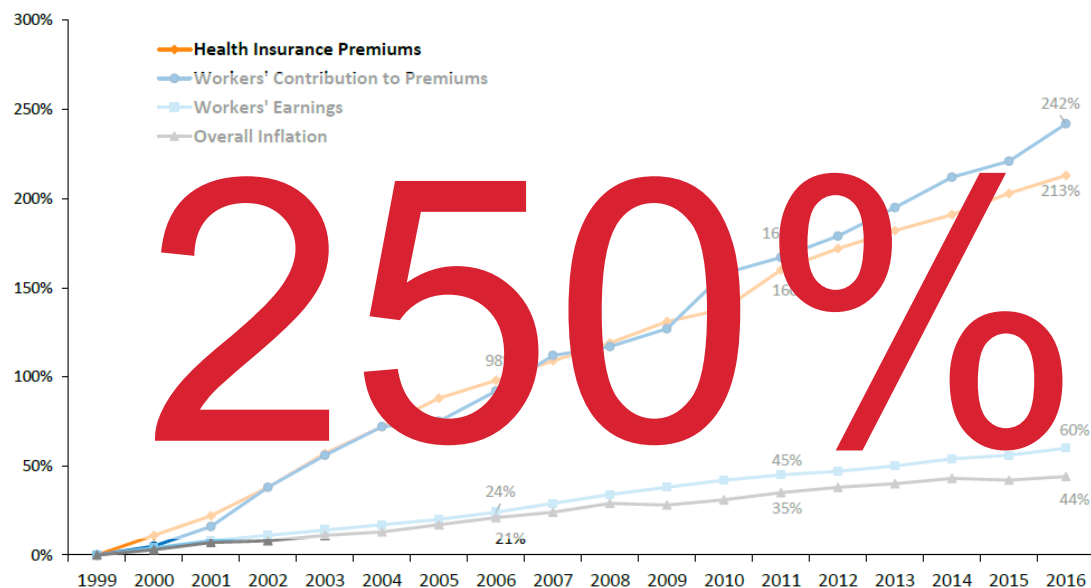
Mark Ferneau, @ferneau, Practice Manager, Healthcare & Life Sciences

A medical chart with a stethoscope and a blue pen. The stethoscope is silver with a teal-colored tube and white earbuds. The blue pen is positioned diagonally in the upper left. The medical chart features a grid with time slots and some handwritten text. A semi-transparent dark grey rectangle is overlaid in the center, containing the title text in white.

# Healthcare & Life Sciences Changes & Uncertainty

# Healthcare Costs Continue to Rise

**Cumulative Increases in Health Insurance Premiums, Workers' Contributions to Premiums, Inflation, and Workers' Earnings, 1999-2016**



Source: [Kaiser Family Foundation](#)

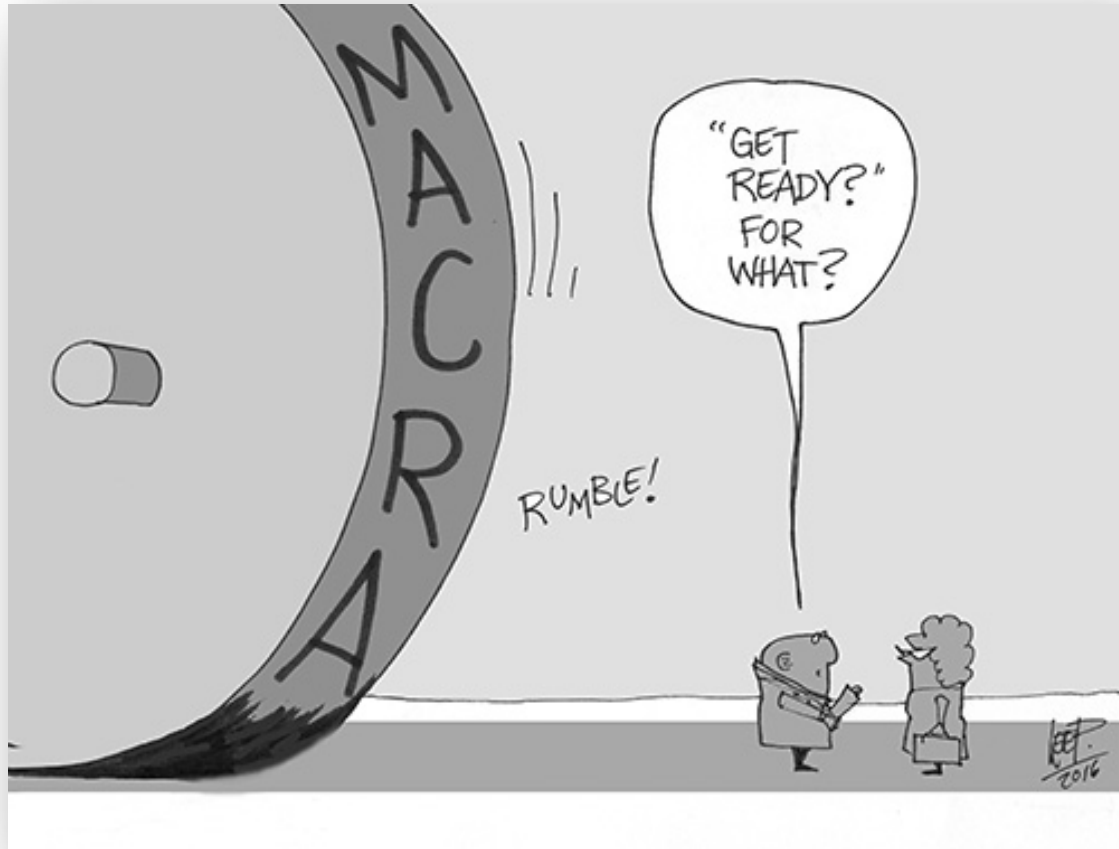
*Percentage of Americans Putting Off Medical Treatment Because of Cost*

Within the last 12 months, have you or a member of your family put off any sort of medical treatment because of the cost you would have to pay?



GALLUP

Rising costs, coupled with stagnant wages, create barriers to care



Sources: [MedAxiom](#), [HealthcareDive](#)

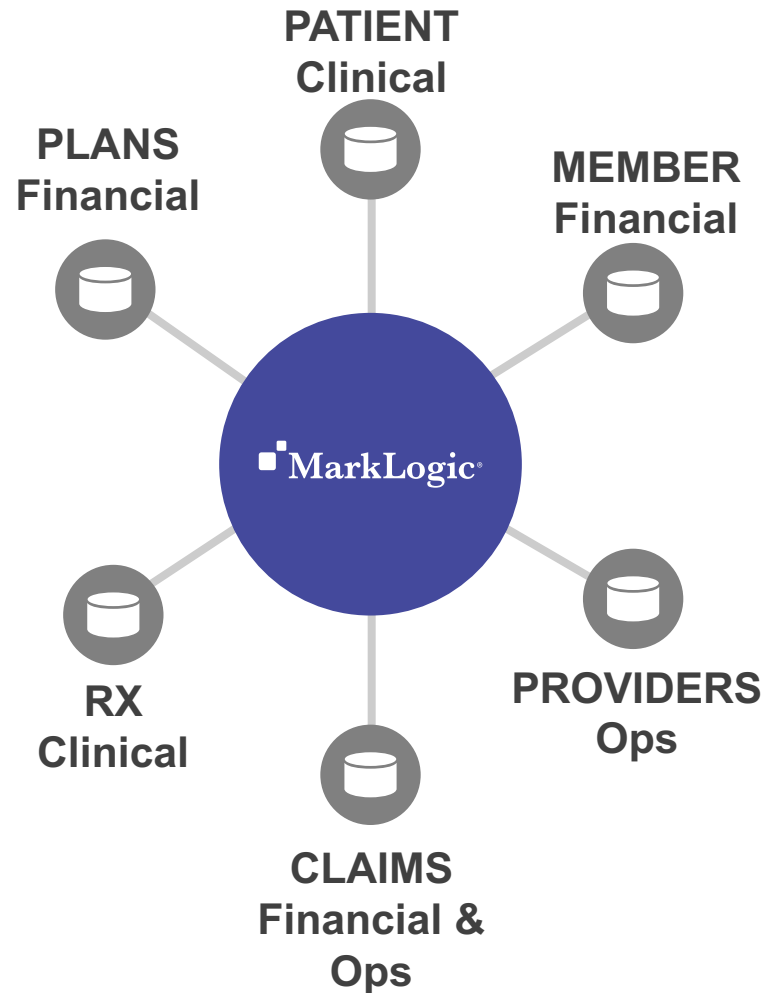
## QUALITY & PAYMENT REFORM

# The Shift Toward Risk-Based Reimbursement

- **Most clinicians don't know what is coming**
- A September 2016 survey found that 28.6% of the responding clinicians said they have not heard of MACRA, 39.2% said they have but do not know a lot about it
- CMS will allow clinicians to "pick their pace" for 2017 reporting / 2019 payment under the final rule

2/3





360° DEGREE VIEW

## HIMSS MACRA Survey

“Success with MACRA requires a joint effort of IT and departmental resources to successfully combine **clinical, financial and operational** data.”

A hand is holding a newspaper. The newspaper features a political cartoon showing several figures in dark suits, some with red hats, in a dynamic, possibly dancing or falling pose. The background of the slide is a blurred image of the newspaper and the hand holding it.

# There is Growing Uncertainty

...

“The Health Care Bill Has Failed. Let the Finger Pointing Begin.”

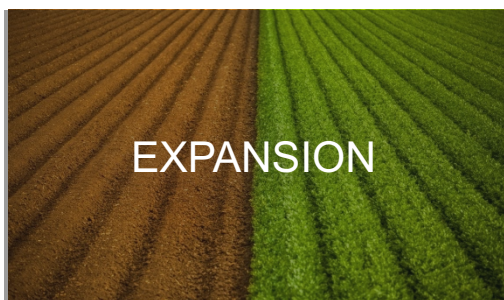
“Some Lawmakers Now Look to Bipartisanship on Health Care”

“Health Bill’s Failure Leaves Supporters in a Political Jam Back Home”

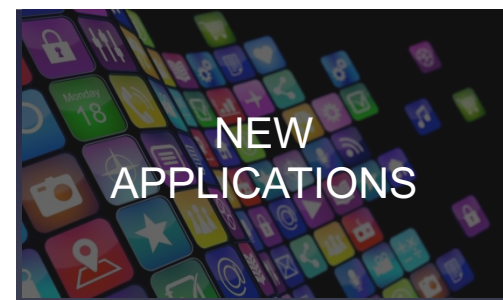
“Health Proposal Would Undermine Coverage for Pre-existing Conditions”

...

## Healthcare & Life Sciences is changing...

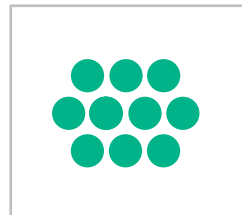


## The **data & infrastructure** are changing...

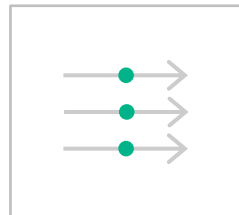


A NEW APPROACH

# Expect That Over Time, *Everything* Can Change, at Any Time



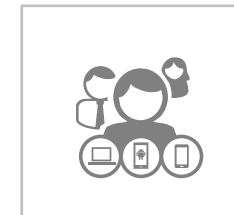
**DATA**



**WHERE DATA  
COMES FROM**



**HOW DATA IS  
ACCESSED**



**WHO ACCESSES  
THE DATA**

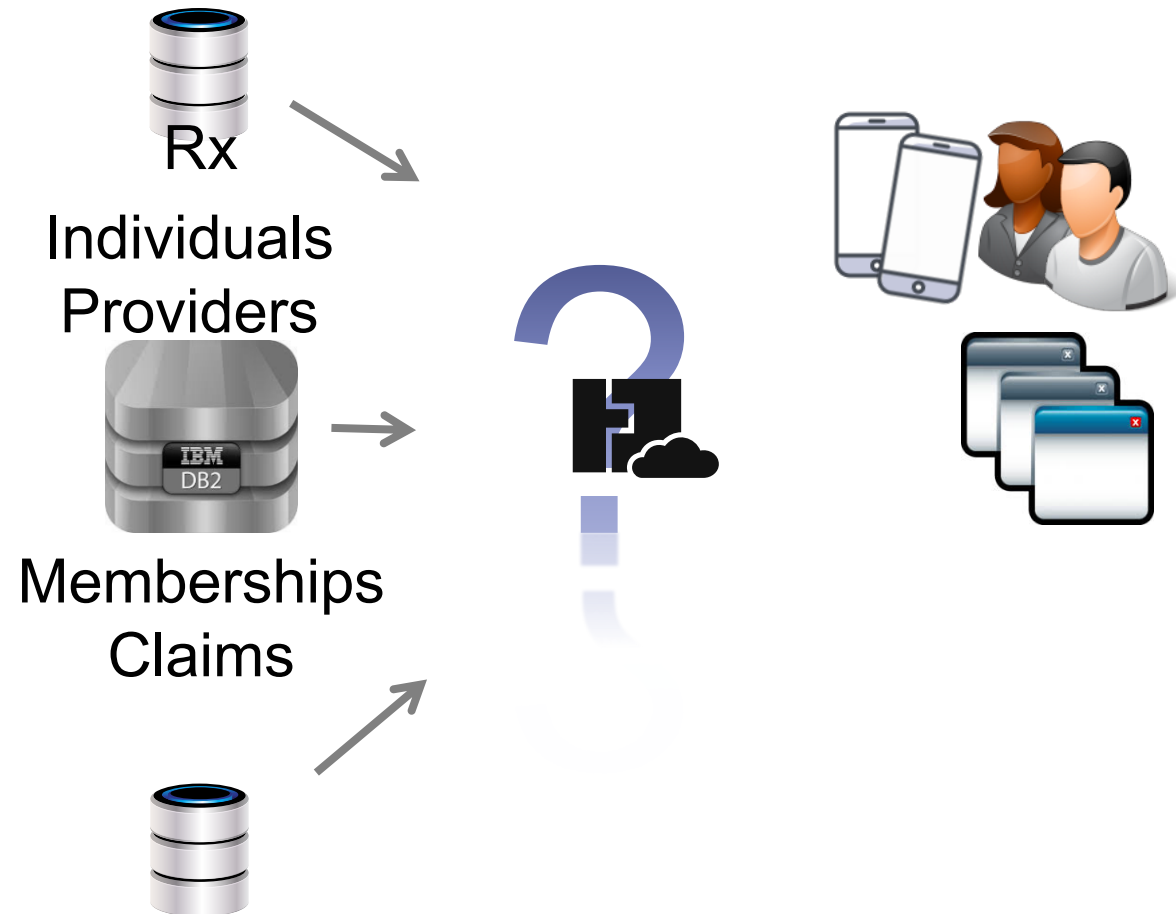




# Healthcare 360 Challenge

# The Challenge

- Legacy systems used mainframes
  - Memberships, Claims, Provider, Individuals & Prescriptions
  - Overloaded ESB
- Needed to:
  - Create a consumer product
  - Move to best-of-breed solutions
  - Create a virtual database layer
    - Decouple HA & Perf SLAs
  - **9 MONTHS** vs YEARS







9 Years?

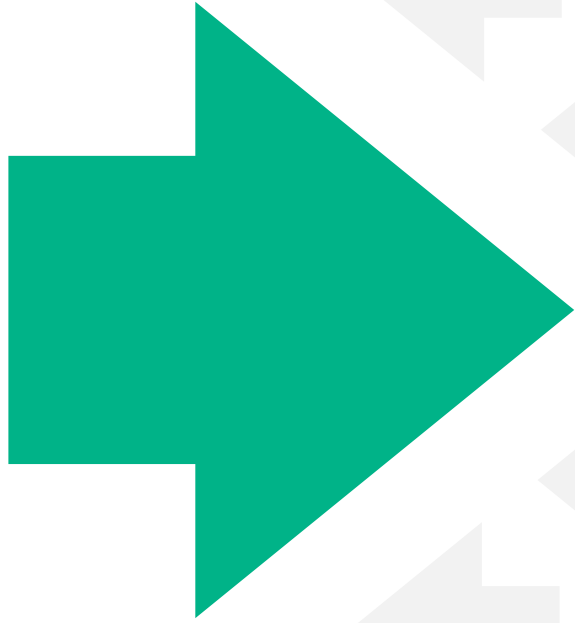




9 Months!  
In Production!

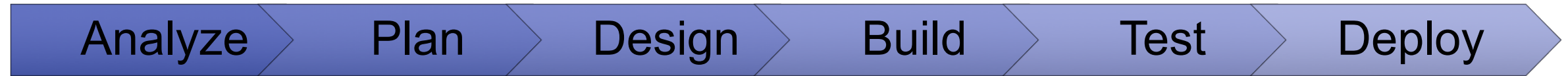


# Change Our Approach

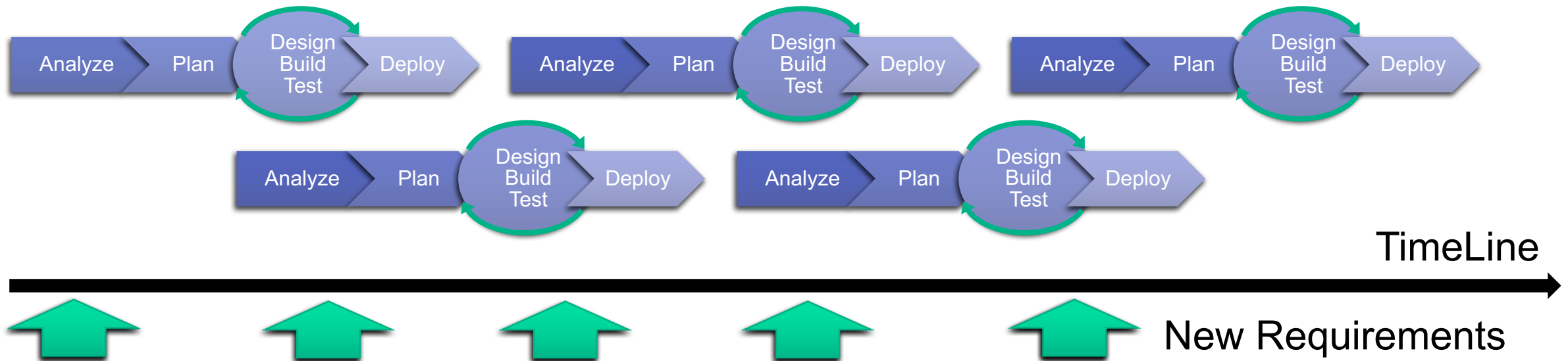


# The Need for an Agile Development Strategy

## WATERFALL



## AGILE



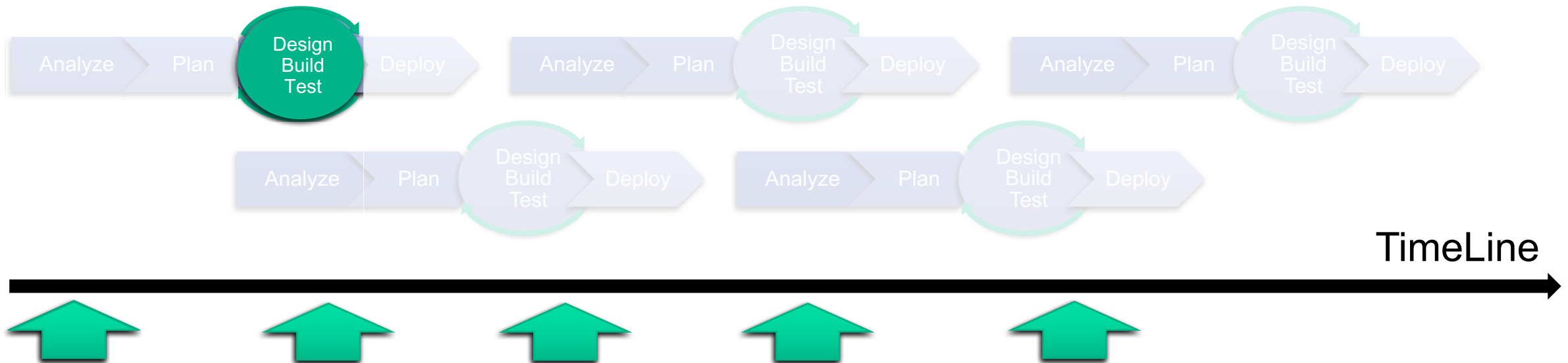
- Ability to react to regulations, user requirements, ops requirements & **changing laws**

# The Need for an Agile Development Strategy

## WATERFALL

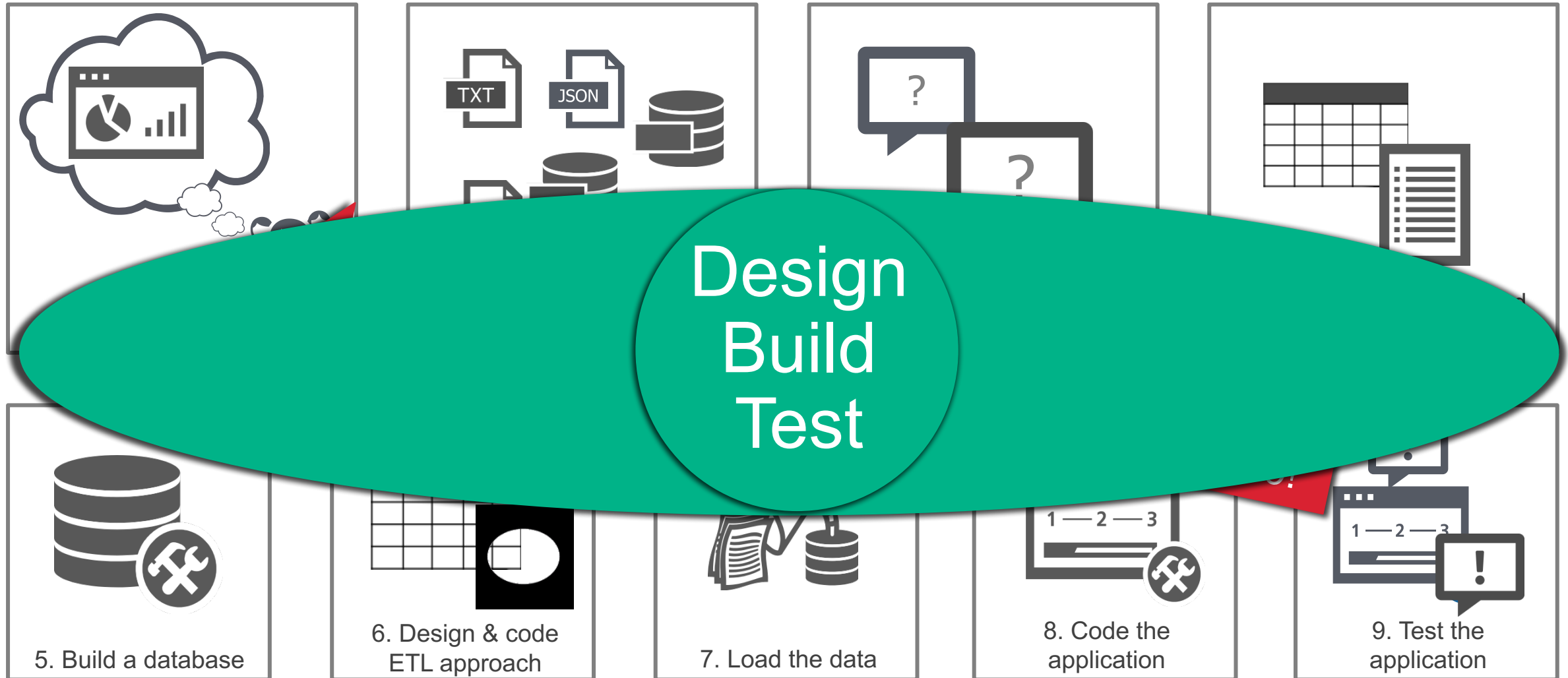


## AGILE



- Ability to react to regulations, user requirements, ops requirements & **changing laws**
- But what about the data?

# Relational DB – Design, Build, Test Problem





WHAT'S FASTER?

# Agile Development on Relational Data



VS



# Agile Development Needs Agile Data

What is agile data?

- Data that is “able to move quickly and easily”

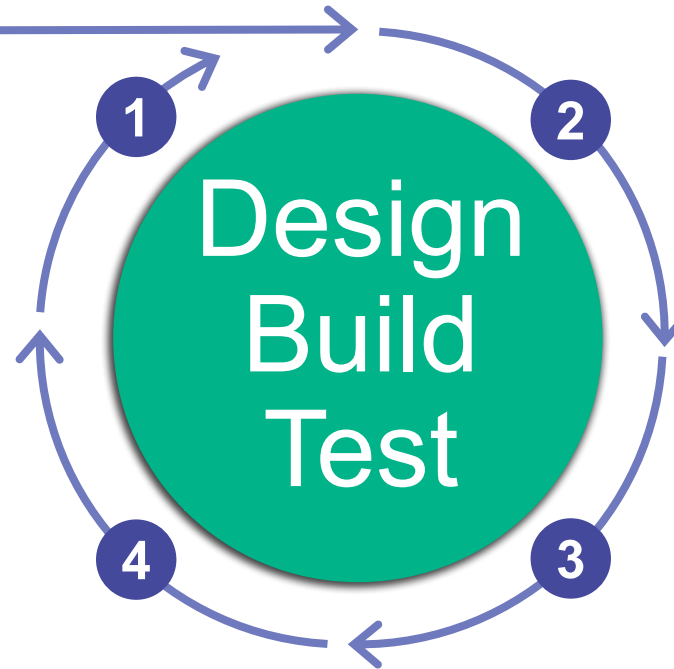
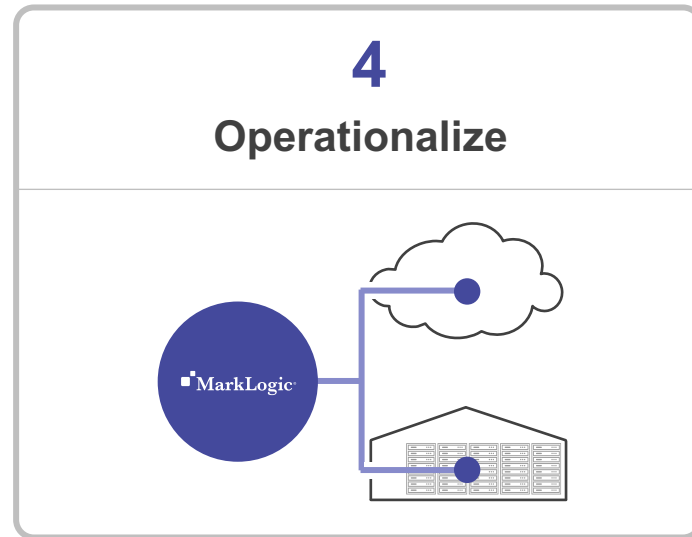
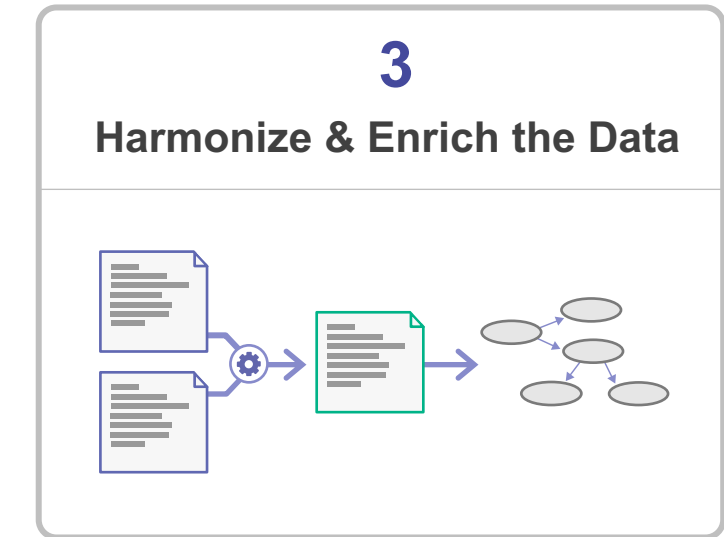
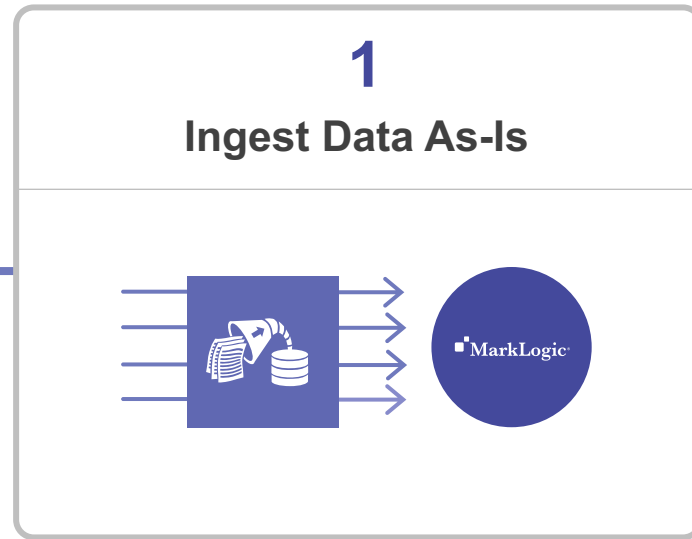
To support agile data we need to:

1. Bring the data in quickly and flexibly
2. Search and query in real-time
3. Harmonize and enrich the data “in situ”
4. Operationalize and expose the data as needed

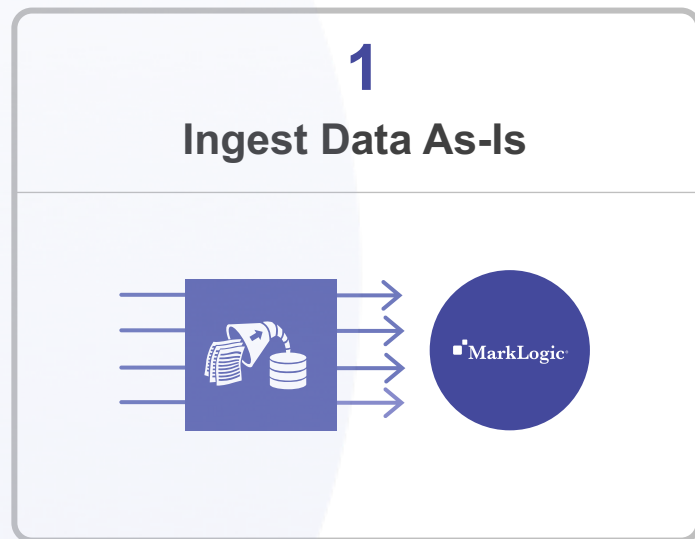


Of course we still need to persist the data in a reliable and secure fashion

MARKLOGIC APPROACH TO  
**DATA INTEGRATION:  
AGILE DATA**







AS-IS

Bring the Data In  
Quickly and Flexibly

# “AS-IS”

- Ingest data “As-Is” =
  - Bring structured, unstructured, semantics, geo data & binary together
  - Keep the data and its metadata together
  - Allow for data changes to flow through
- # AGILE DATA





MULTI-MODEL

# MULTI-MODEL

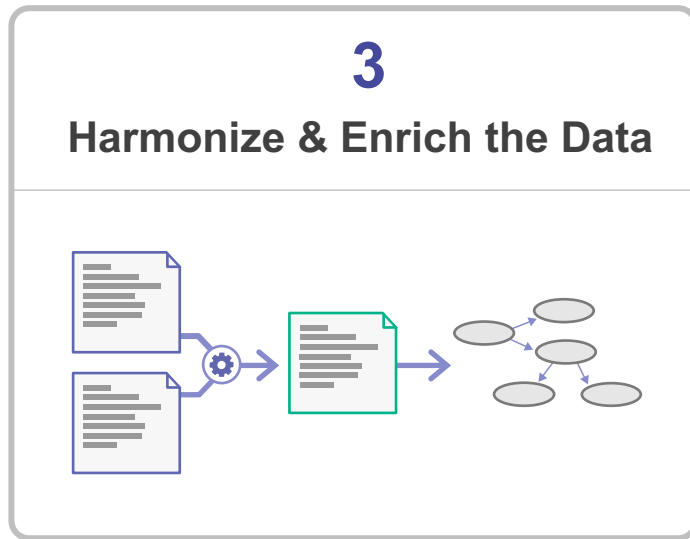
- Universal index allows data to be found in real-time

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# AGILE DATA

- Semantic graphs & links
- Numbers & dates
- Geospatial data
- Virtual tables (rows & cols)

# BIZ OBJECTS + SEMANTICS



■ Create meaningful business objects

■ Harmonize data from different sources

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– Data focused MDM

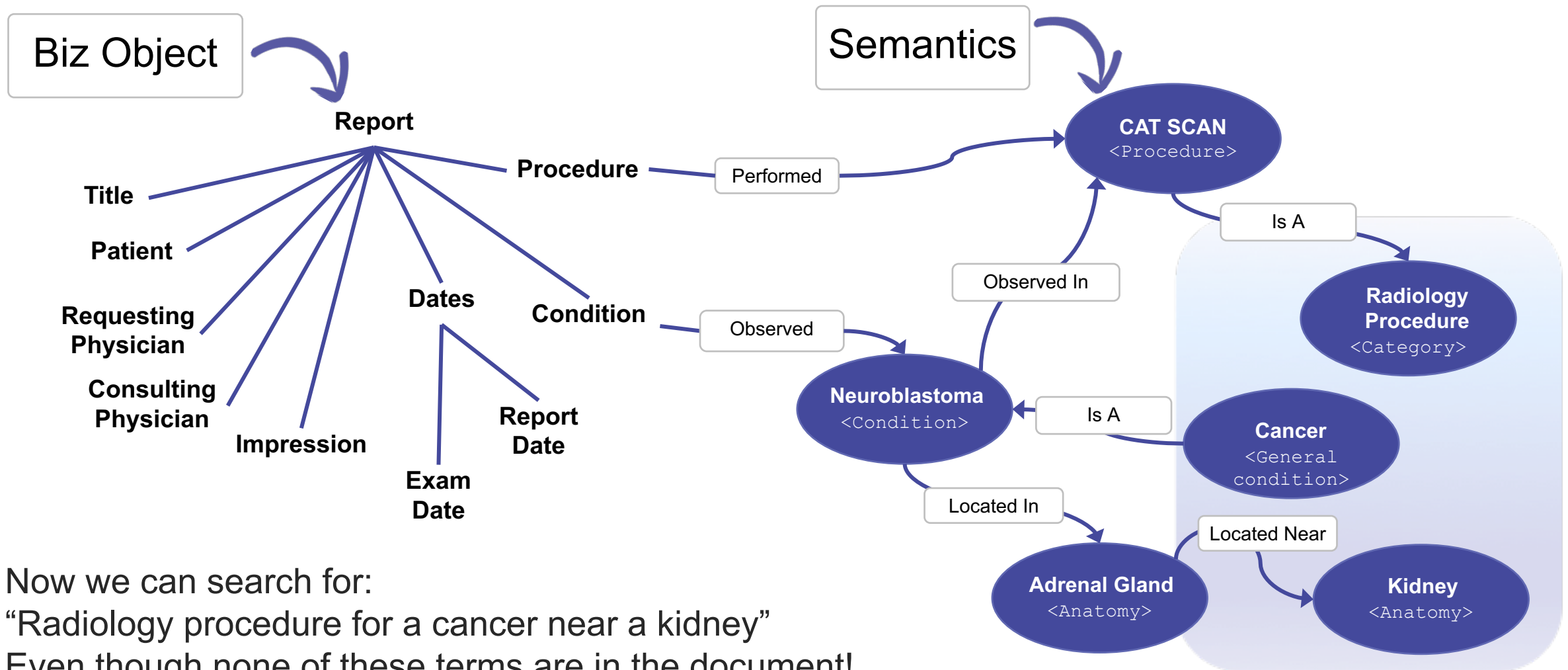
# AGILE DATA

■ Link business objects together semantically

■ Persist the semantics in the database

- Instead of the ORM tool, the code, the developer's head
- Critical to data reusability

# Business Objects + Semantics Example



Now we can search for:  
 “Radiology procedure for a cancer near a kidney”  
 Even though none of these terms are in the document!

# Multi-Model as Far as Needed!

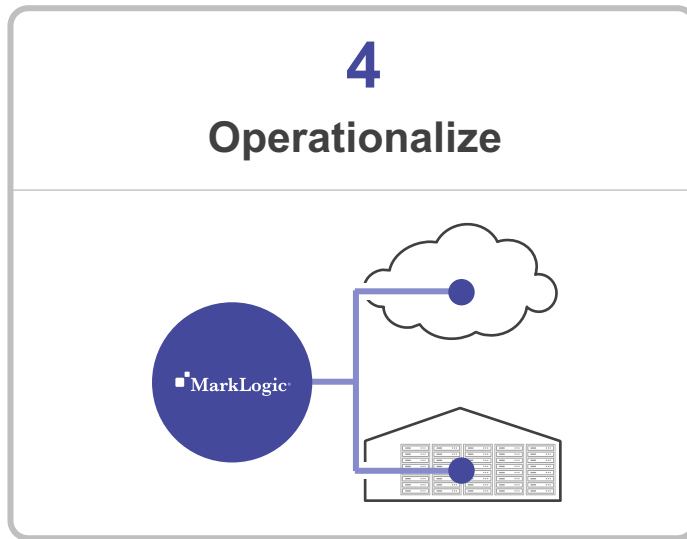
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From:

- Radiology procedure for a cancer near a kidney

To:

- Radiology procedure for a cancer near a kidney, that occurred in the past 12 months, was administered by a doctor who is a member of an HMO, in California, within 20 miles of an ER (geo), where we knew 6 months ago that it wasn't covered by insurance (bi-temp) ....



# OPERATIONAL

Expose and operationalize the data

# FLEXIBILITY

- Real-time access
- Multiple APIs to access the data:
  - Node, Java, REST, XQuery, SPARQL, SQL

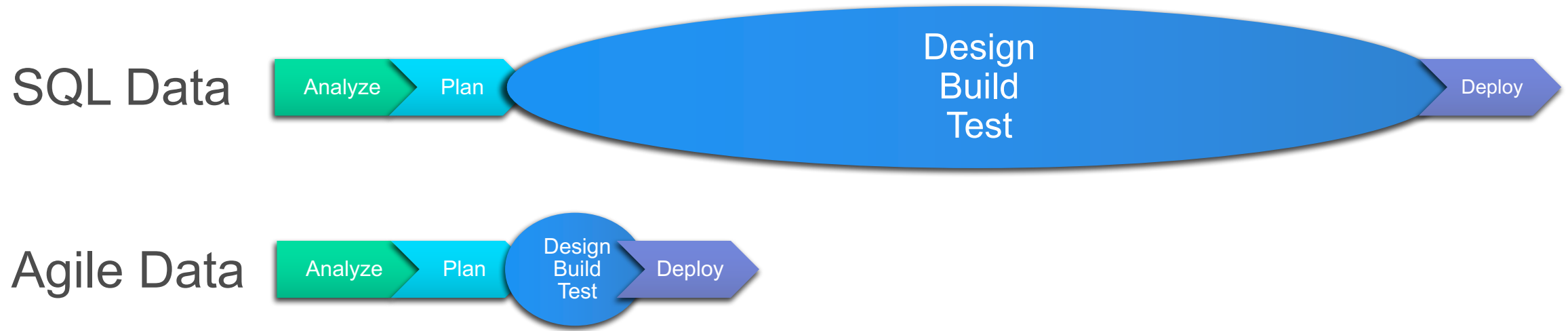
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# AGILE DATA

- High availability
- Security
  - Role based, doc-level, element-level, encryption



# Agile Development Needs Agile Data



3 - 4x faster development

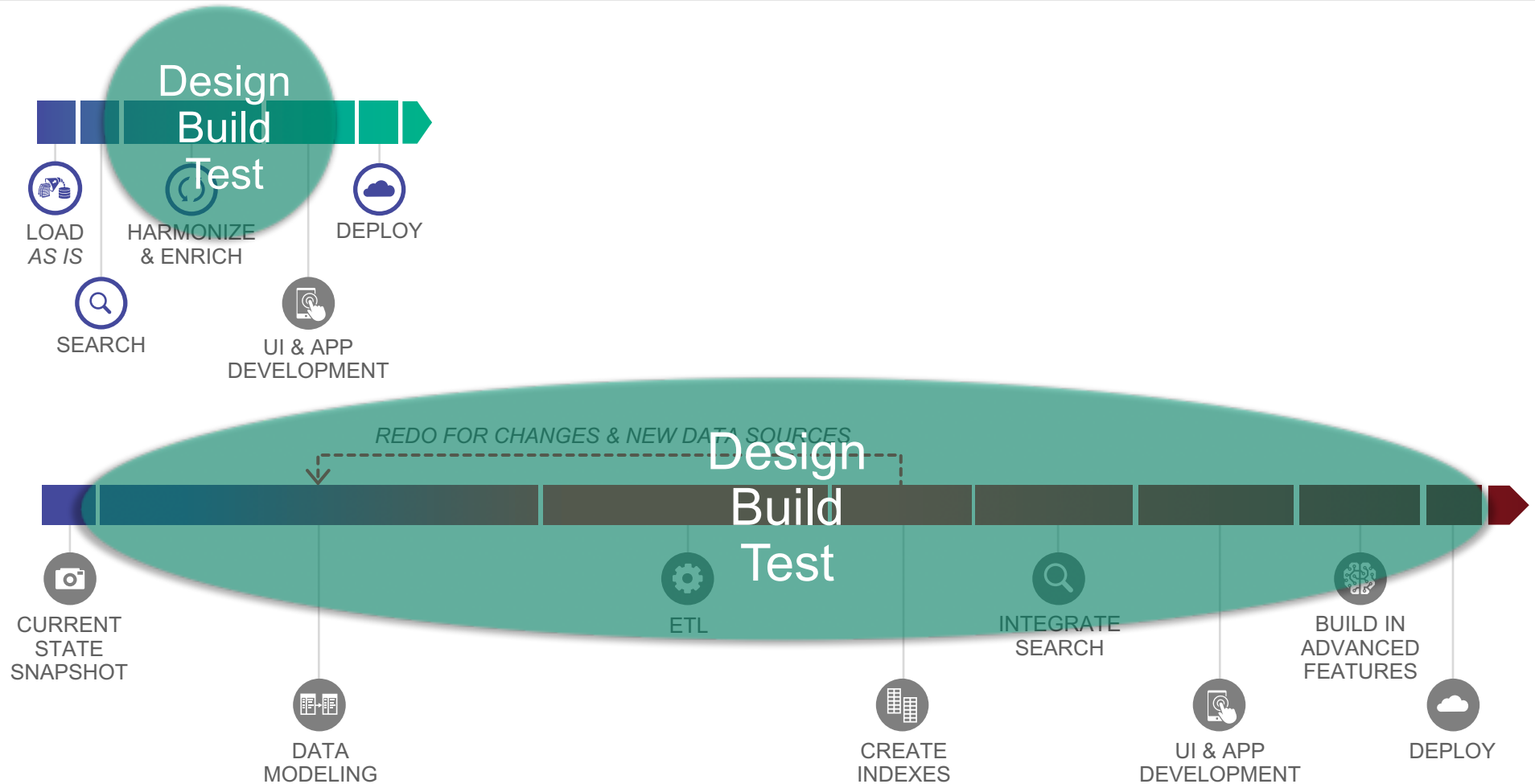
# Immediate Value, Faster Time to Results



**MARKLOGIC  
AGILE DATA  
APPROACH**



**RELATIONAL  
APPROACH**





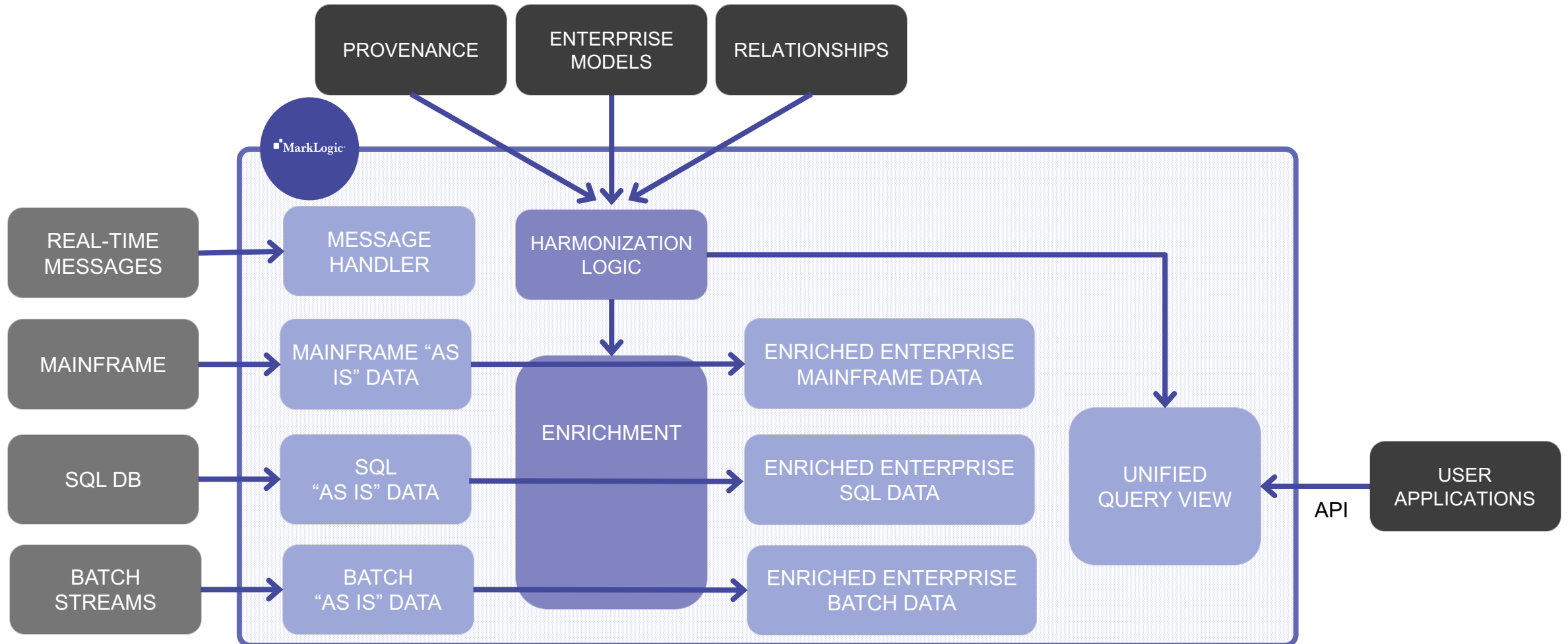
# Healthcare 360 Implementation

# Recap: The Challenge

- Legacy systems used mainframes
  - Memberships, Claims, Provider, Individuals & Prescriptions
  - Overloaded ESB
- Needed to:
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  - Create a virtual database layer
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  - **9 MONTHS** vs YEARS

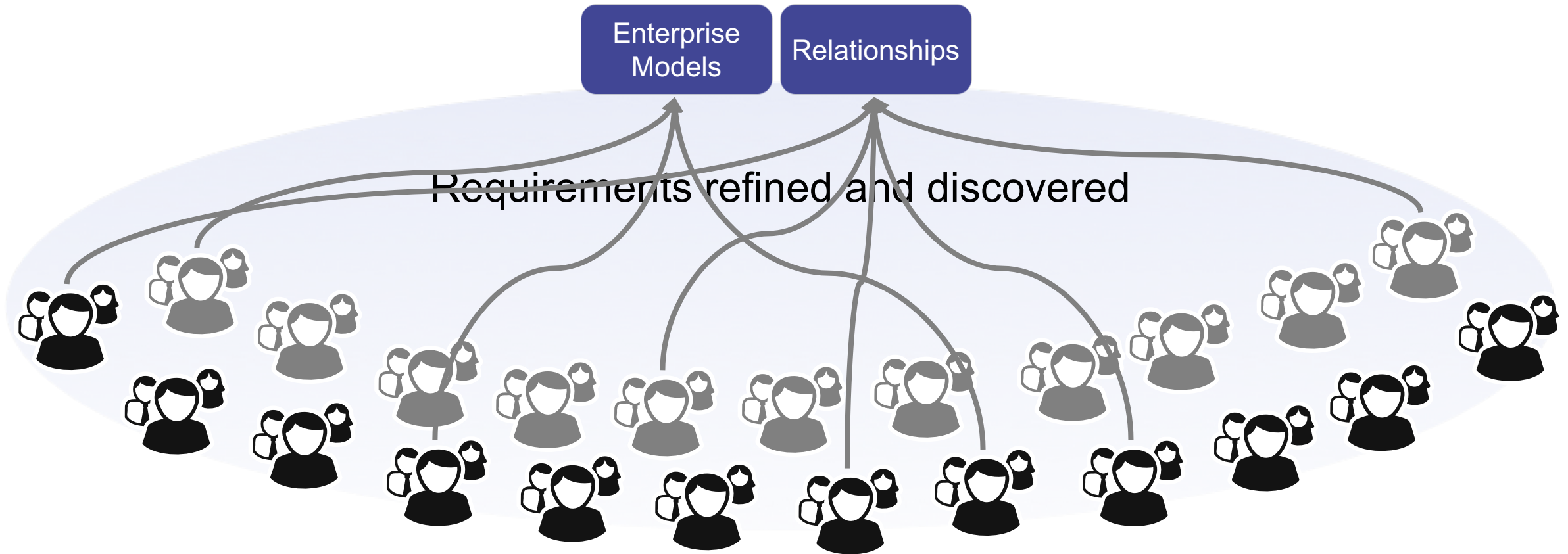


# Architecture





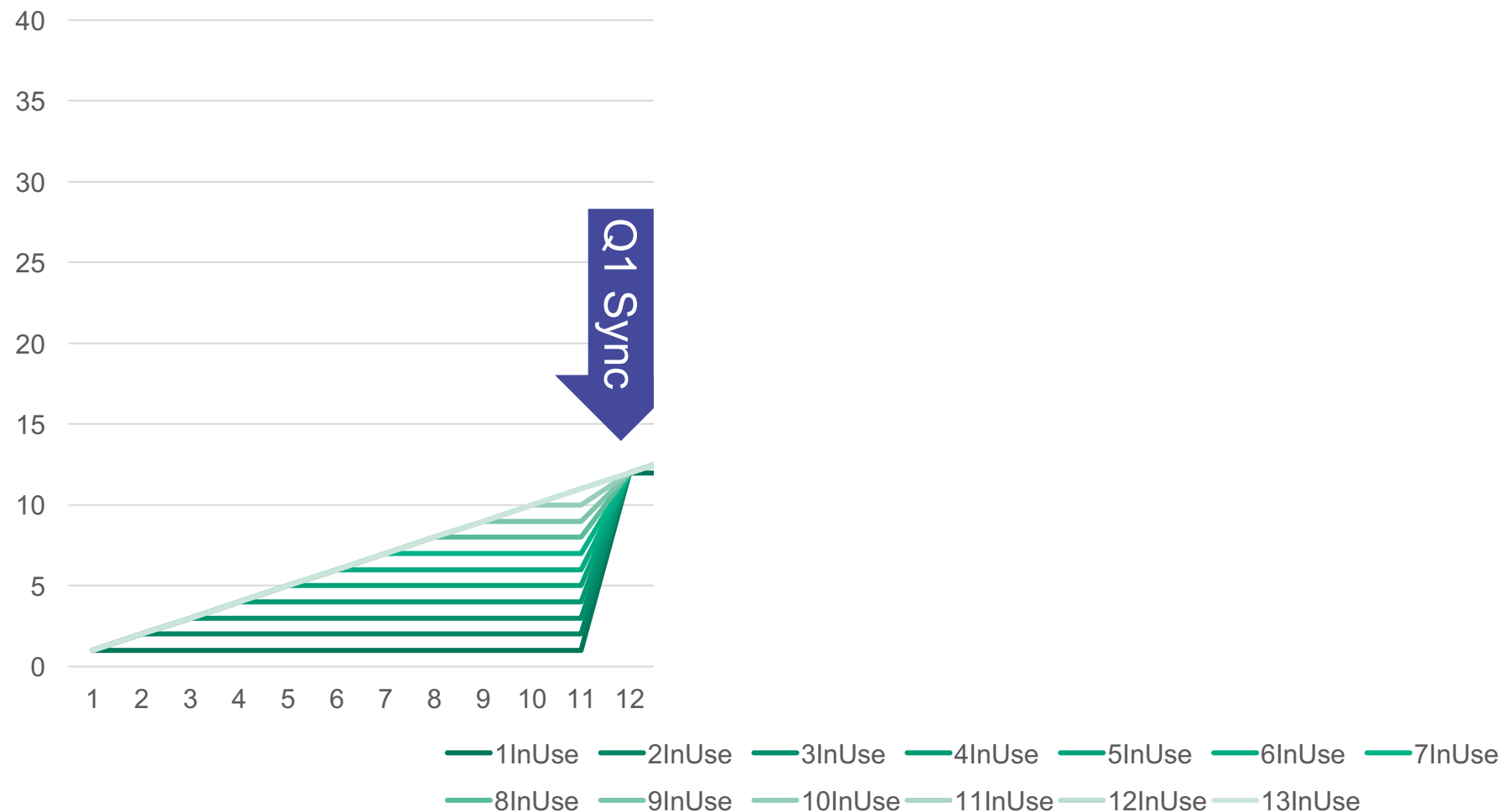
# Agile Parallel Development & Modeling



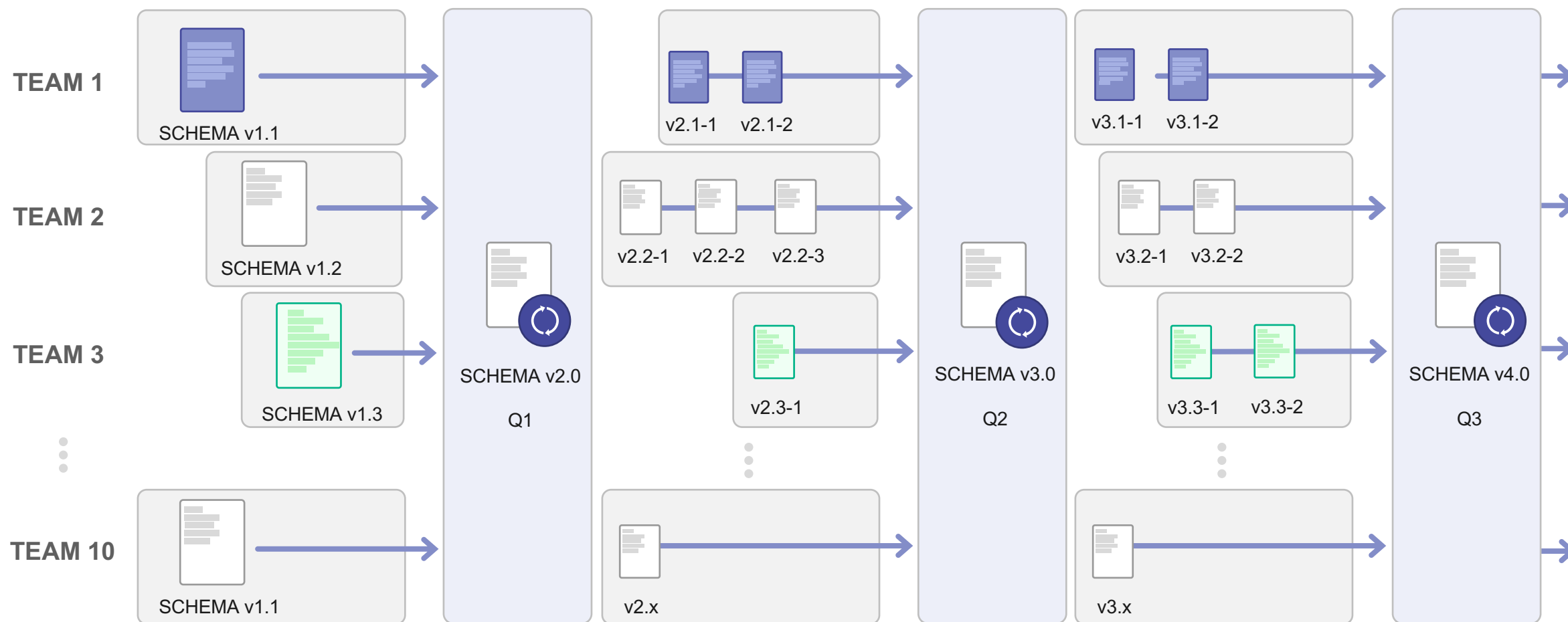
- Aggressive 9 month federally mandated schedule
- Spun up about two dozen scrum teams running in parallel

# Agile Models During Development

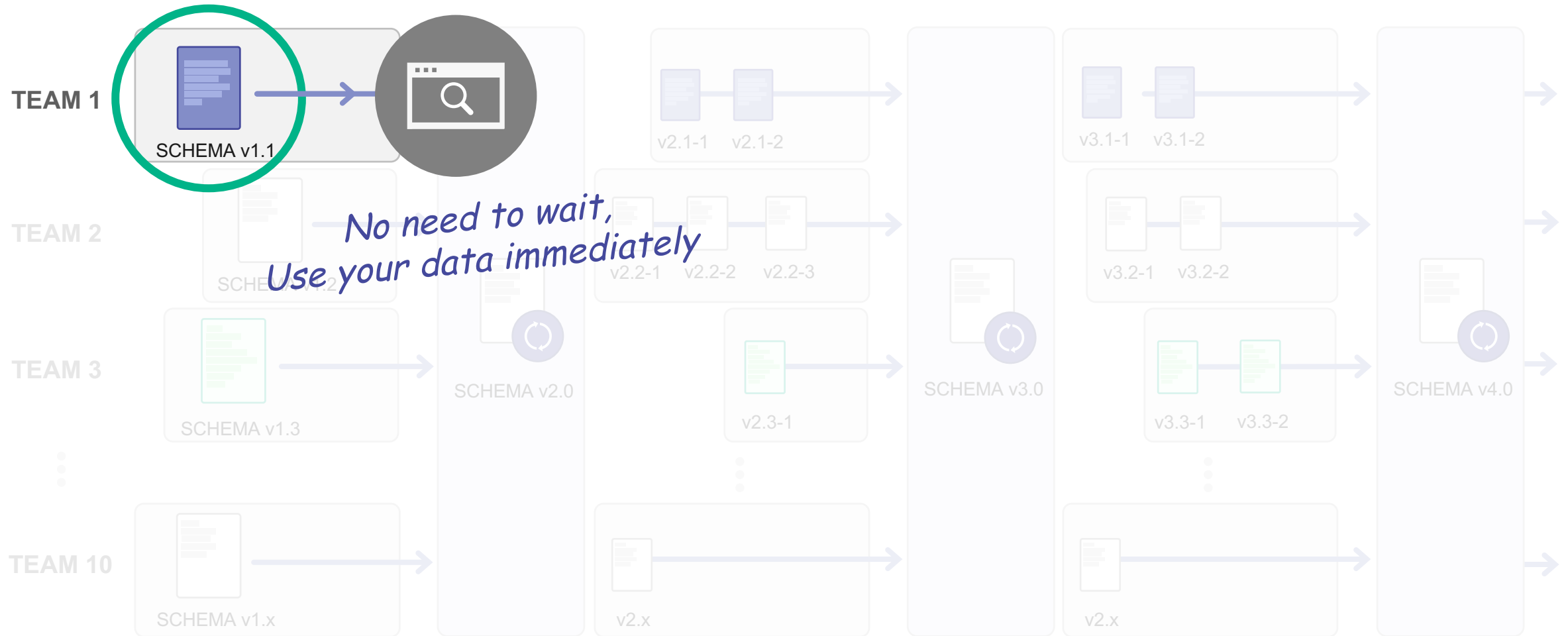
Models used across teams over time (weeks)



# Data Modeling in Parallel

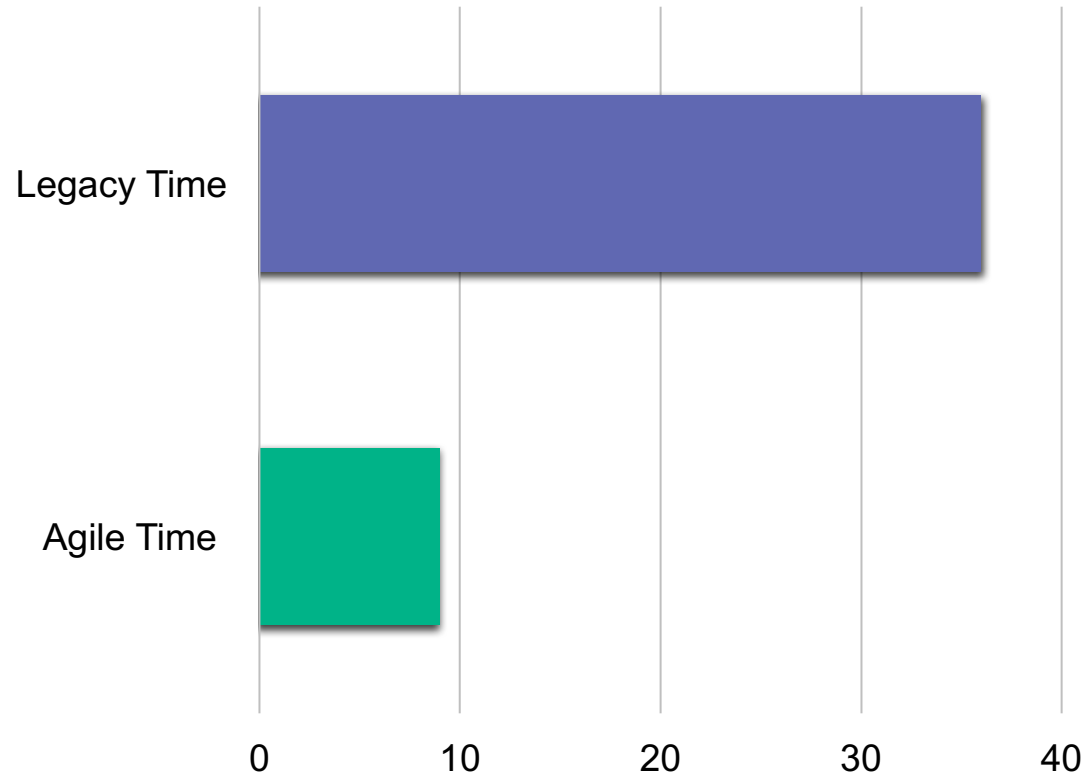


# Data Modeling in Parallel

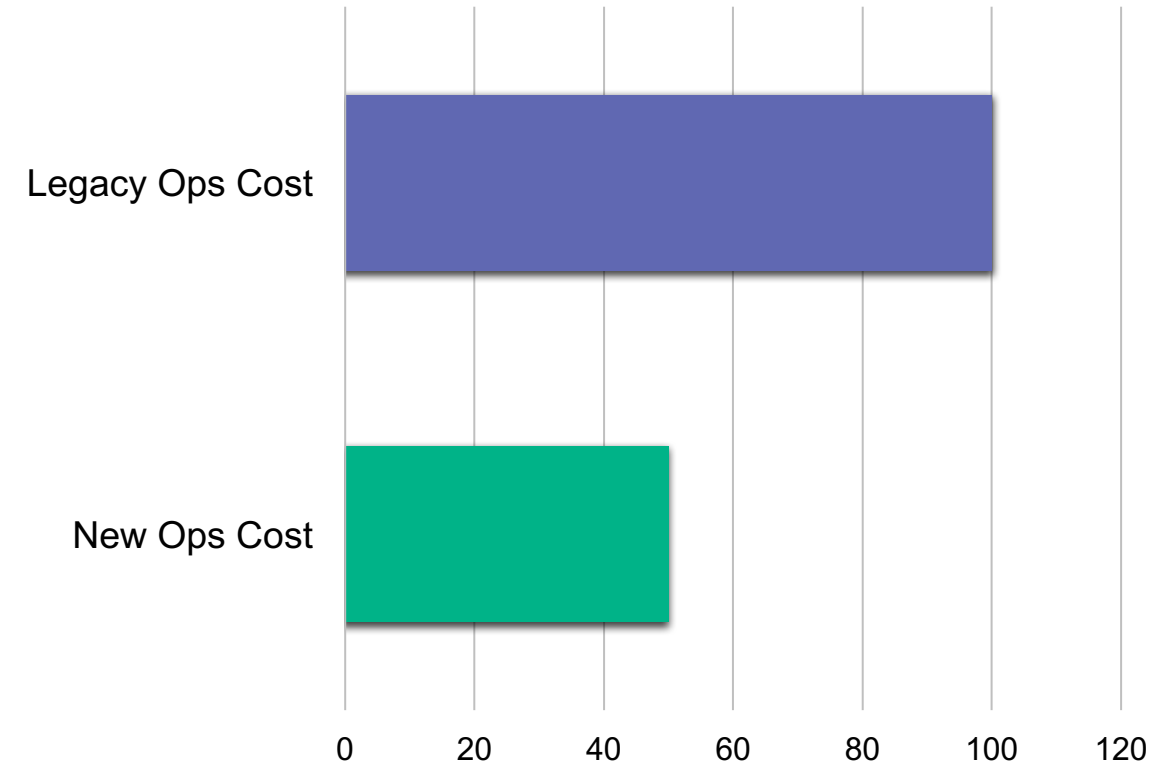


# The Results

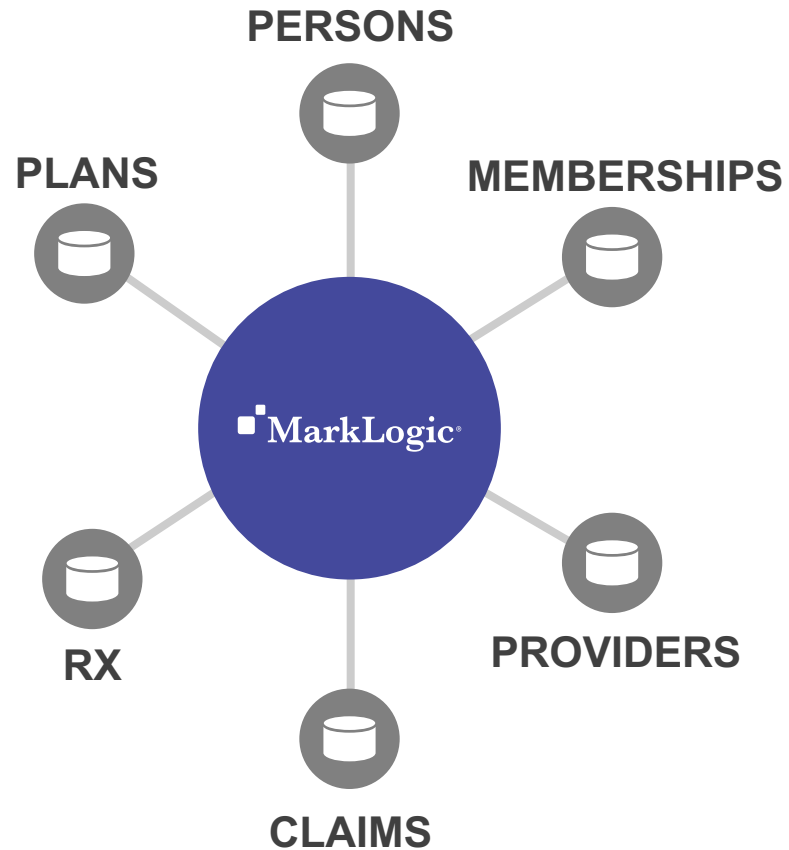
## Development Duration



## Operations Cost %





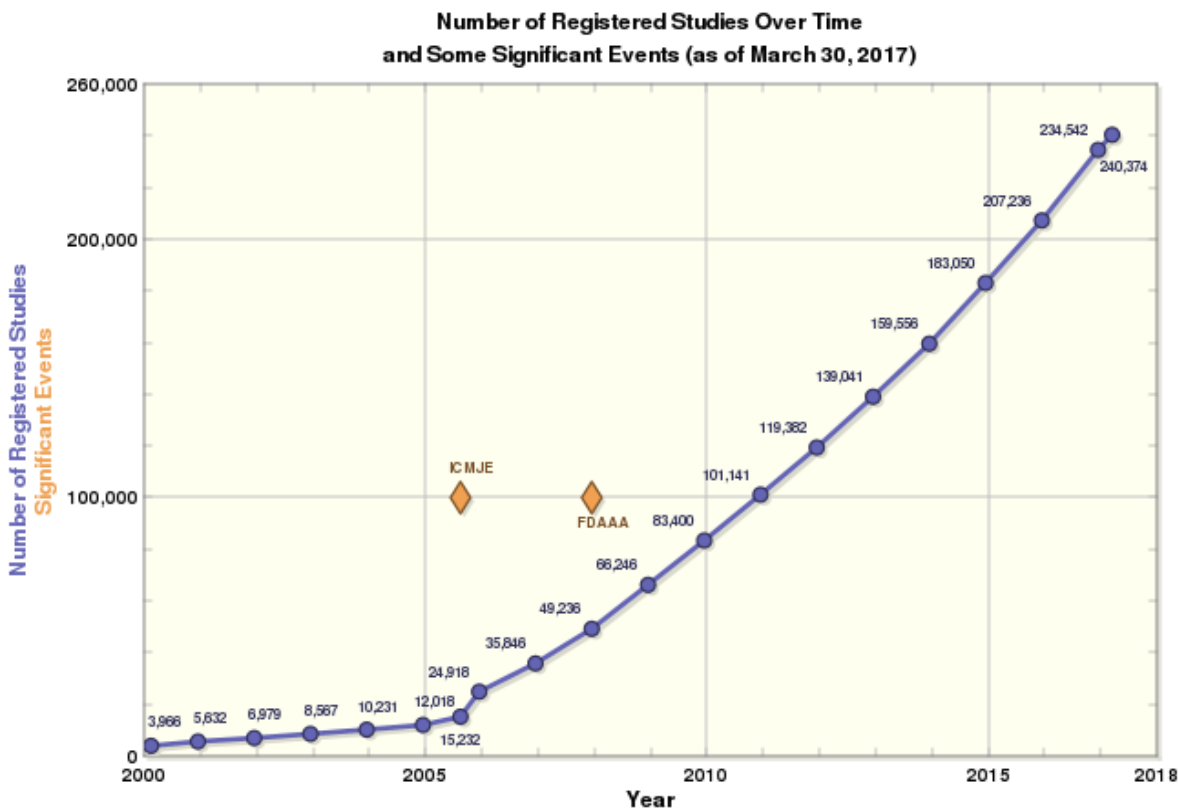


HEALTHCARE 360

## Resulting 360 Views



Life Sciences



Source: <https://ClinicalTrials.gov>

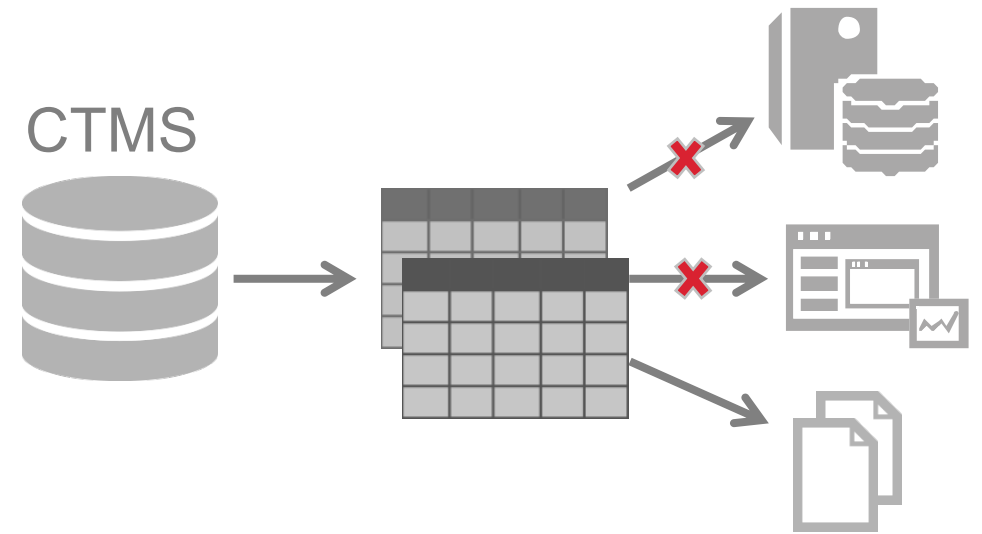
## RAPID GROWTH OF CLINICAL TRIALS

# Background

- Clinical trial management systems (CTMS) provide critical insight into the progress of clinical trials and historical data for research
- The number of clinical trials is increasing at a rapid pace
- Duration and scope of trials is increasing

# The Challenge

- Downstream systems already in place (e.g. BI tools, operational data warehouse) **require a consistent view** of study data for auditing and analytics
- Today's clinical trials frequently have mid-study changes – “adaptive clinical trials” – which results in a **changing data model** that forces data remodeling on downstream systems
- **It can take a month or more for downstream systems to be re-coded.** This process requires programming changes that need to be validated before promotion to production environments



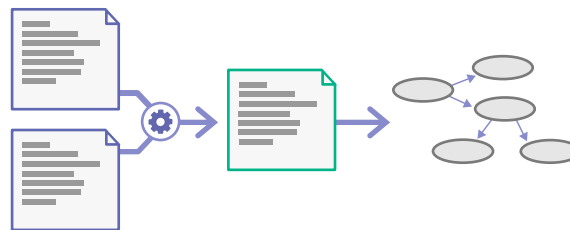


# The Solution: MarkLogic Data Hub Framework

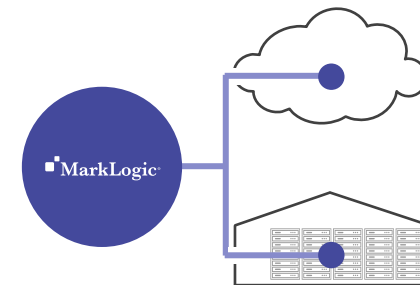
- Ingest as-is allows loading of data regardless of changes
- Harmonization of ingested data creates a canonical representation – a clinical study 360
- Reports and views for downstream systems are based on canonical representation
- Changes to harmonization transformation are created via Template-Driven Extraction (TDE) templates
- Template changes can be implemented by non-programmers
- SQL / ODBC views are used to provide a consistent representation for downstream relational systems



**Ingest Data As-Is**

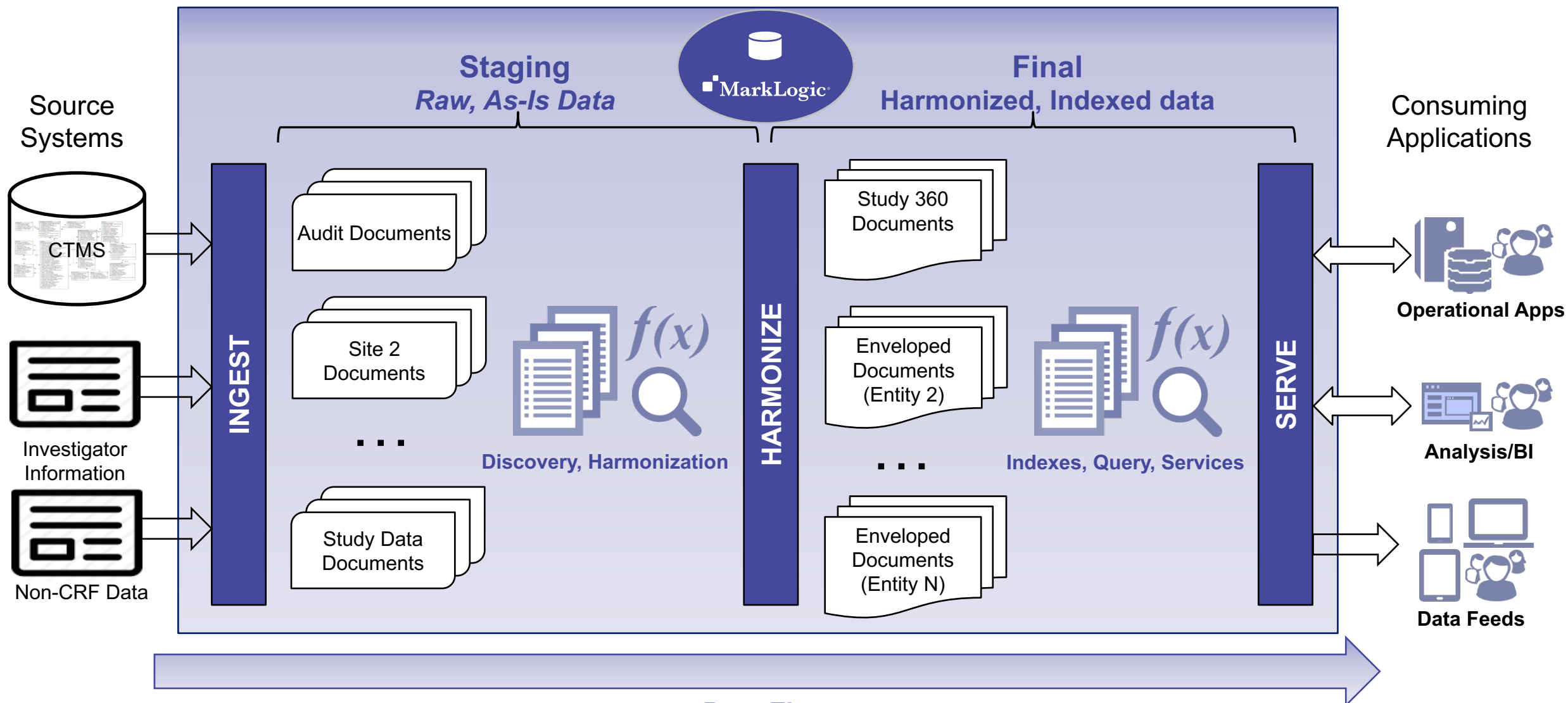


**Harmonize & Enrich the Data**



**Operationalize**

# Target Architecture



# Results

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- Initial implementation completed in **six calendar weeks**
- Single, harmonized model serves as the basis for multiple downstream systems
- Changes in clinical studies are **available within one day** versus one month or more
- Full implementation is underway





Months not Years!



# Thank You

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