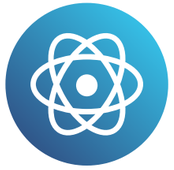
Machine learning and data pyramid

MACHINE LEARNING FOR BUSINESS



Karolis Urbonas
Head of Machine Learning & Science, Amazon

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Machine Learning applications

ML is applying statistical or computer science methods on data to:

1. Draw causal insights

   > "**What is causing** our customers to cancel their subscription to our services?"*

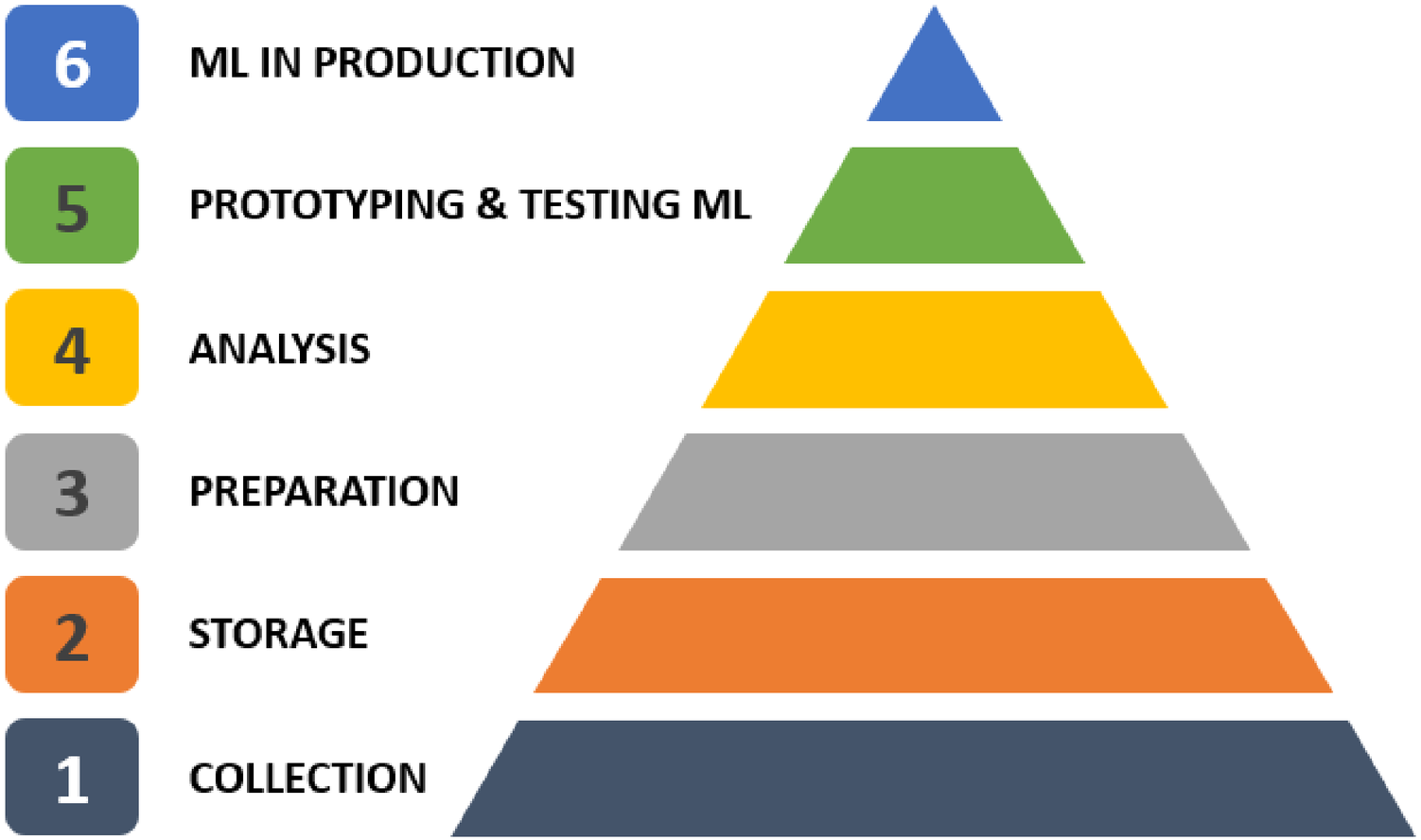
2. Predict future events

   > "**Which customers** are likely to cancel their subscription next month?"*

3. Understand patterns in data

   > "**Are there groups of customers** who are similar and use our services in a similar way?"*

Data hierarchy of needs



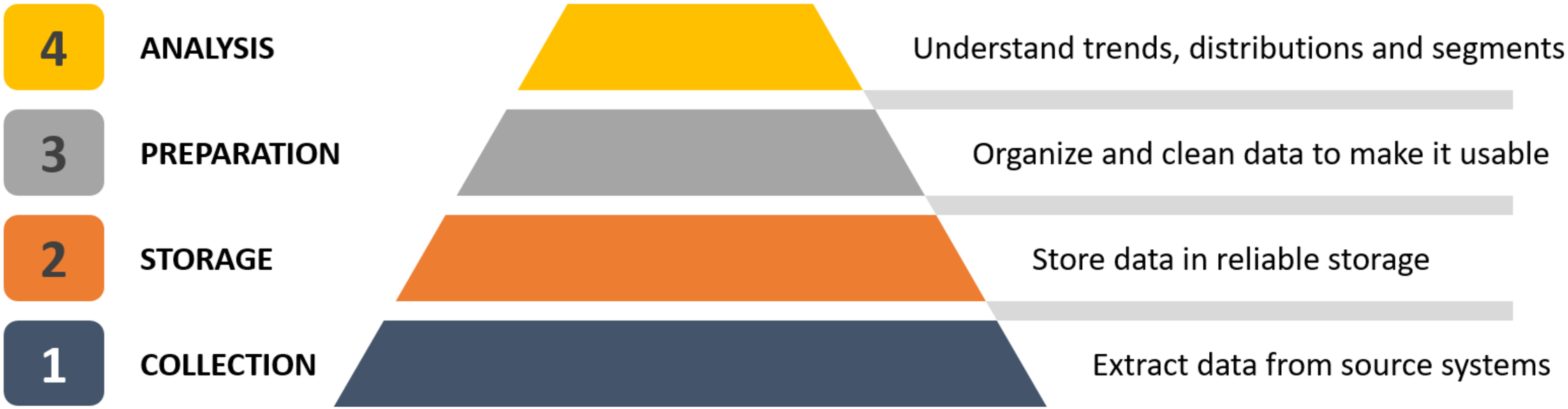
Collection

Storage

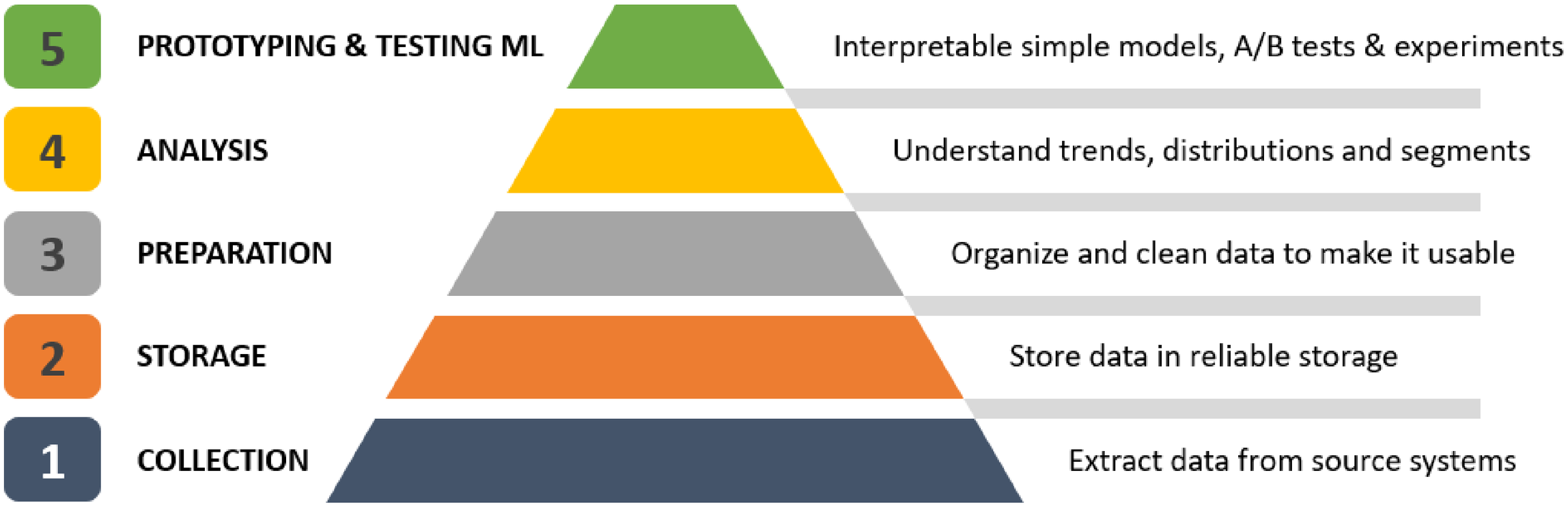
2
STORAGE
Store data in reliable storage
1
COLLECTION
Extract data from source systems

Preparation

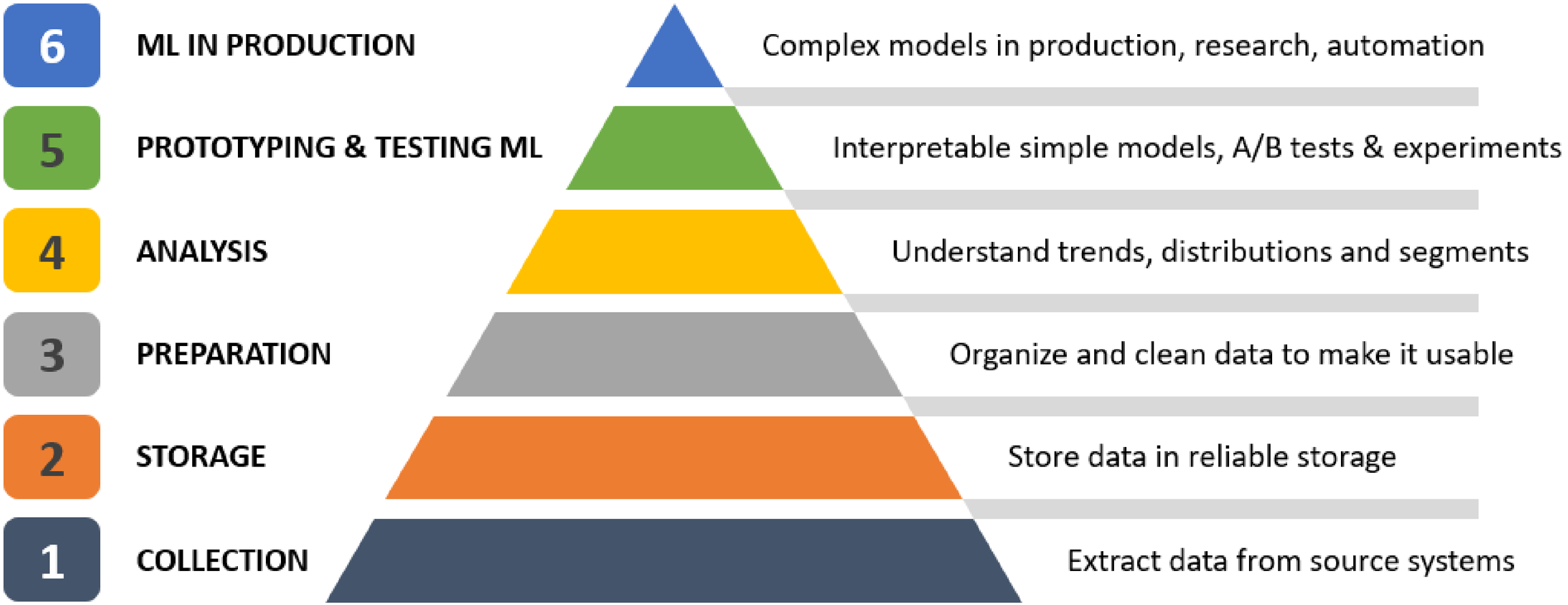
Analysis


4
ANALYSIS
Understand trends, distributions and segments
3
PREPARATION
Organize and clean data to make it usable
2
STORAGE
Store data in reliable storage
1
COLLECTION
Extract data from source systems

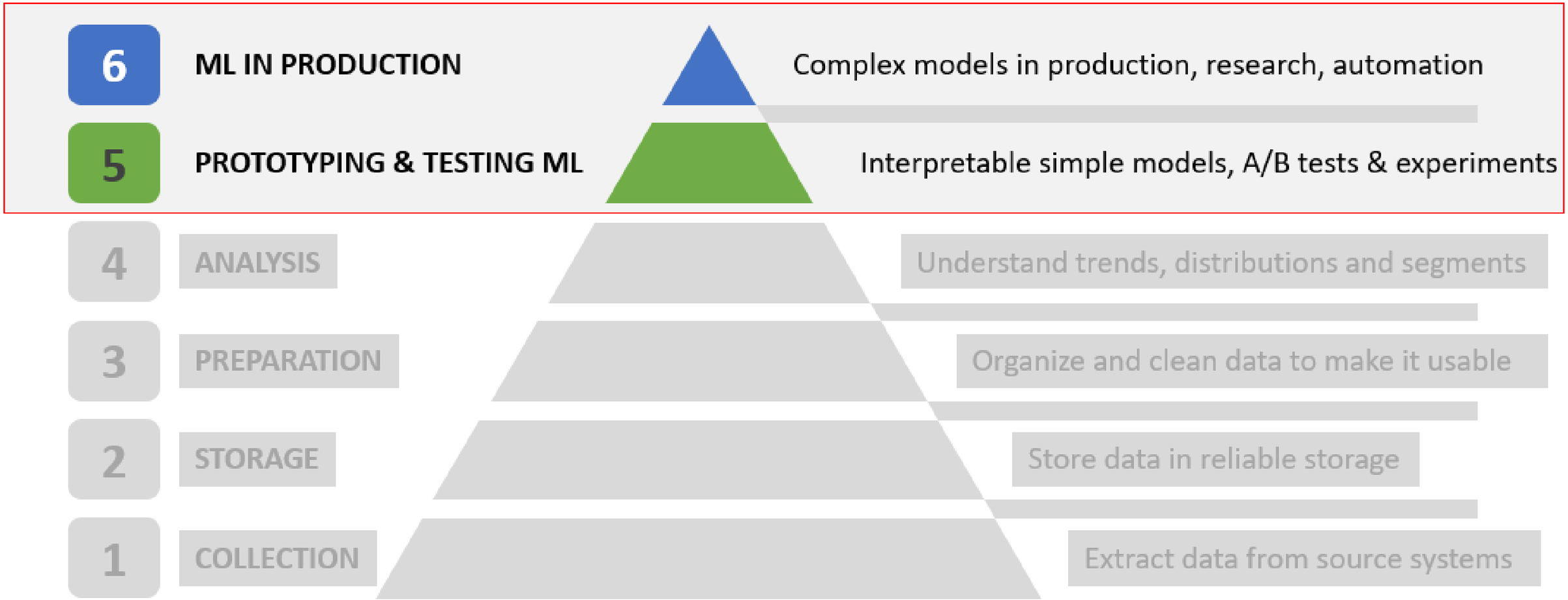
Model prototyping and testing



ML in production



Focus


6
ML IN PRODUCTION
Complex models in production, research, automation
5
PROTOTYPING & TESTING ML
Interpretable simple models, A/B tests & experiments
4
ANALYSIS
Understand trends, distributions and segments
3
PREPARATION
Organize and clean data to make it usable
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STORAGE
Store data in reliable storage
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Let's practice!

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Machine learning principles

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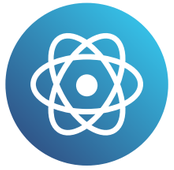

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Machine learning types

Machine learning - applying statistical or computer science methods on data to:

1. Draw causal insights

   > *"**What is causing** our customers to cancel their subscription to our services?"*

2. Predict future events

   > *"**Which customers** are likely to cancel their subscription next month?"*

3. Understand patterns in data

   > *"**Are there groups of customers** who are similar and use our services in a similar way?"*

Supervised vs. unsupervised ML

Machine learning - applying statistical or computer science methods on data to:

1. Draw causal insights

   SUPERVISED Machine Learning

2. Predict future events

   SUPERVISED Machine Learning

3. Understand patterns in data

   UNSUPERVISED Machine Learning

Supervised ML data structure

	Transaction data A	Transaction data B	Transaction data C	Transaction data D
Transaction 1				
Transaction 2				
Transaction 3				
Transaction ...				
Transaction N				

Fraud probability

Target variable

	Transaction data A	Transaction data B	Transaction data C	Transaction data D
Transaction 1				
Transaction 2				
Transaction 3				
Transaction ...				
Transaction N				

Target variable

Fraud probability

Input features

Data about transactions that the business collected (input features)

Target variable

	Transaction data A	Transaction data B	Transaction data C	Transaction data D	Fraud probability
Transaction 1					
Transaction 2					
Transaction 3					
Transaction ...					
Transaction N					

Example input features

	Past fraud count	Time of transaction	Declined in T-30 days	Amount	Fraud
Transaction 1	20	3 am	Yes	5.25 USD	Yes
Transaction 2	1	9 pm	Yes	19.5 USD	Yes
Transaction 3	0	9.30 am	No	500 USD	No
Transaction ...					
Transaction N					

Using input features

Use these data points

	Past fraud count	Time of transaction	Declined in T-30 days	Amount	Fraud
Transaction 1	20	3 am	Yes	5.25 USD	Yes
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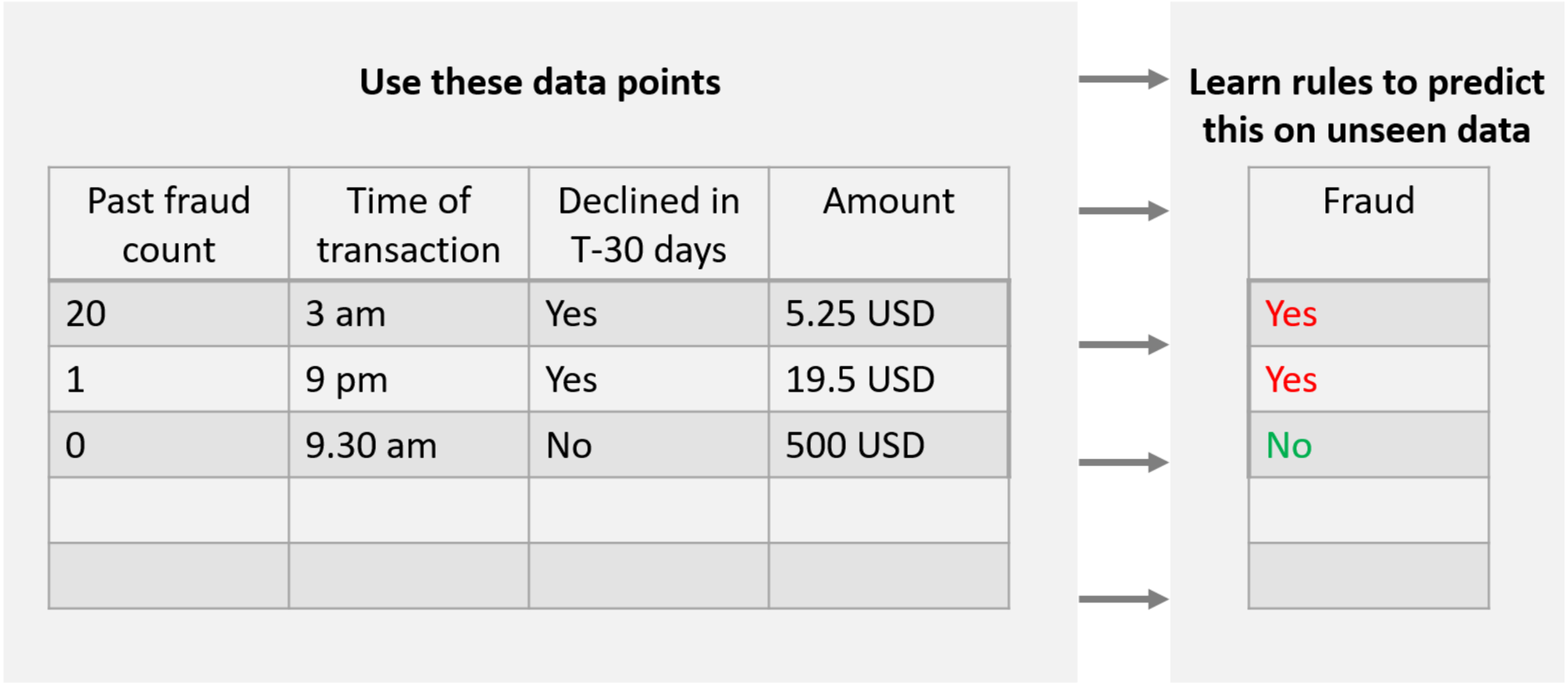
Transaction ...					
Transaction N					

Predicting target variable



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Transaction ...					
Transaction N					

Unsupervised ML data structure

	Transaction data A	Transaction data B	Transaction data C	Transaction data D
Transaction 1				
Transaction 2				
Transaction 3				
Transaction ...				
Transaction N				

Unsupervised input features

Use these data points

	Transaction data A	Transaction data B	Transaction data C	Transaction data D
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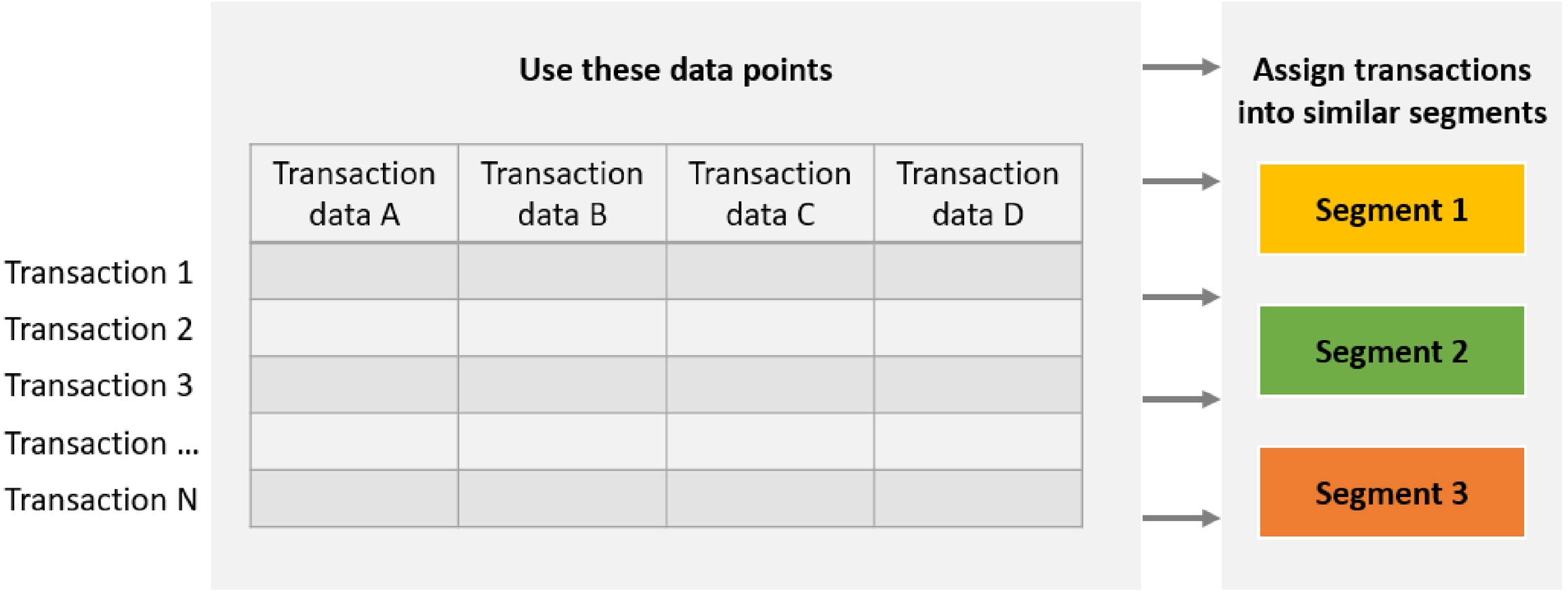
Unsupervised ML results



ML examples - Marketing

SUPERVISED Machine Learning:

- Predict which customers are likely to purchase next month
- Predict each customer's expected lifetime value

UNSUPERVISED Machine Learning:

- Group customers into segments based on their past purchases

ML examples - Finance

SUPERVISED Machine Learning:

- Identify key transaction attributes that indicate a potential fraud
- Predict which customers will default on their mortgage payments

UNSUPERVISED Machine Learning:

- Group transactions into segments based on their attributes to understand which segments are the most profitable

ML examples - Manufacturing

SUPERVISED Machine Learning:

- Predict which items in production are likely faulty and should be manually inspected
- Predict which machines are likely to break and need maintenance

UNSUPERVISED Machine Learning:

- Group readings from machine sensors and identify anomalies for potential manufacturing malfunctions

ML examples - Transportation

SUPERVISED Machine Learning:

- Predict the expected delivery of the parcel
- Identify the fastest route for driving
- Predict product demand to prepare enough stock, rent/buy vehicles and hire workers

Let's practice!

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Job roles, tools and technologies

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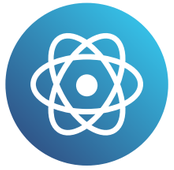

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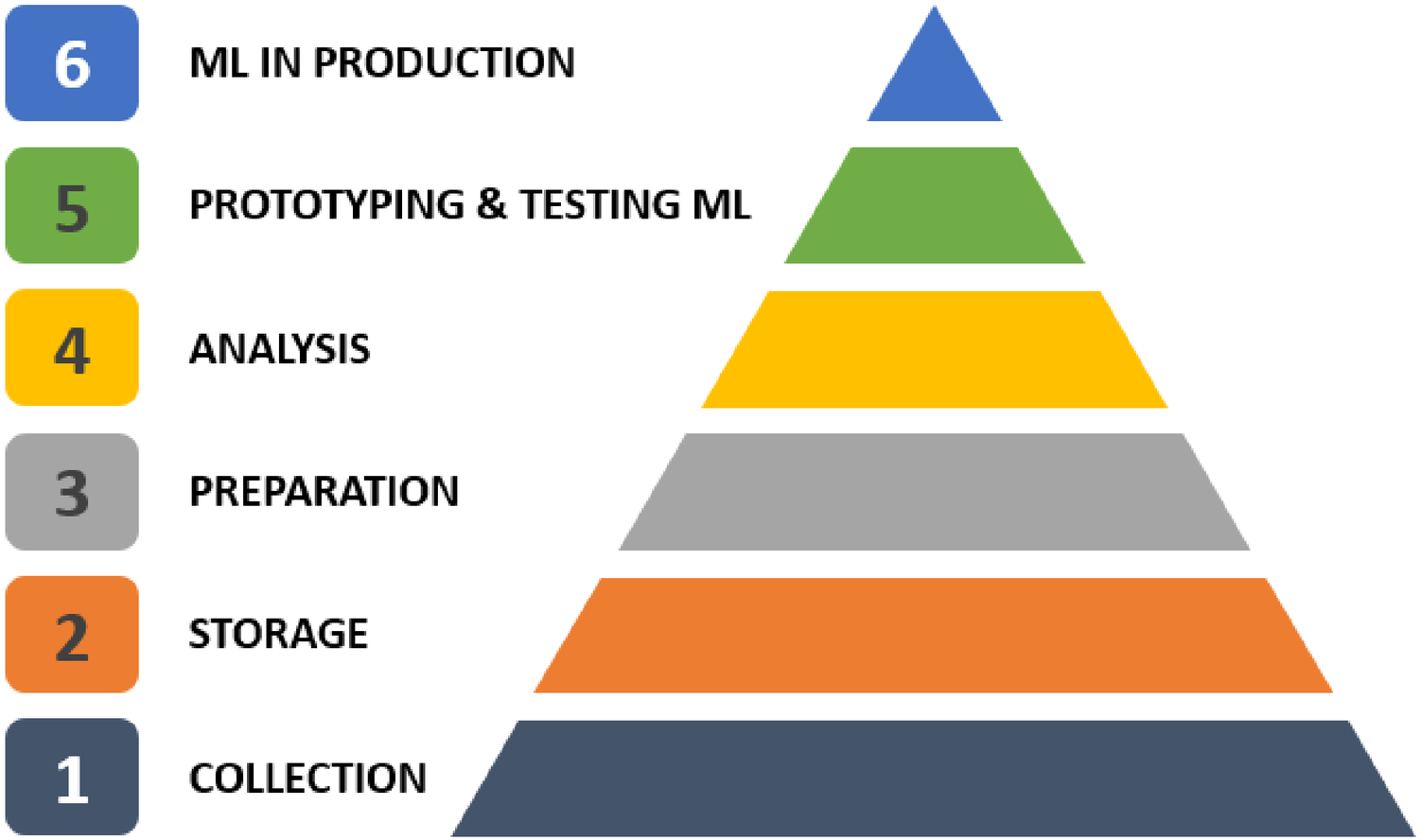
Data pyramid and roles

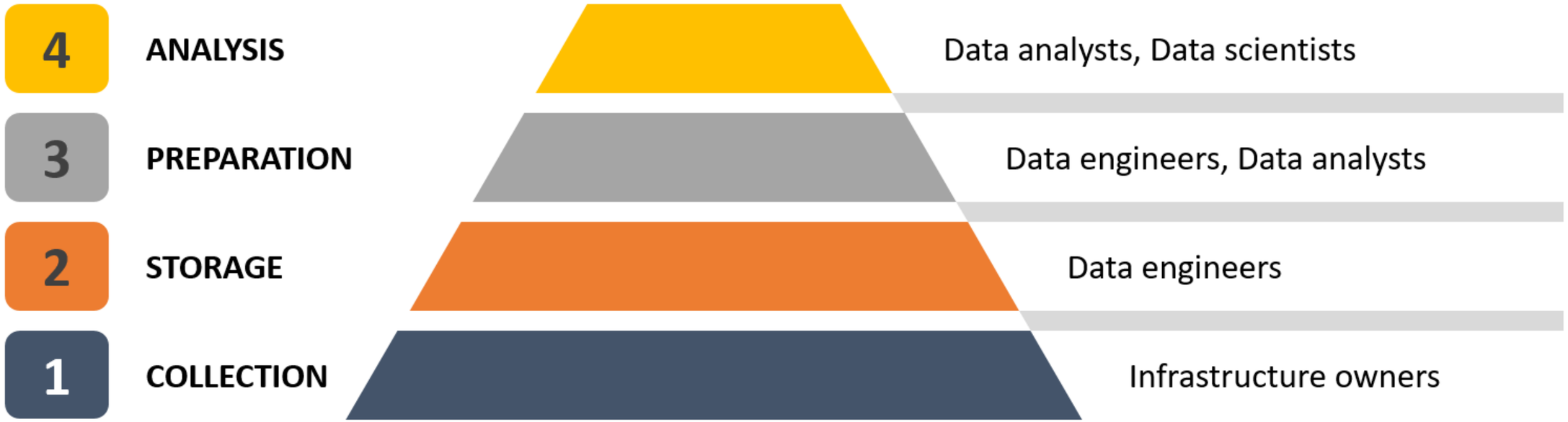


Infrastructure owner

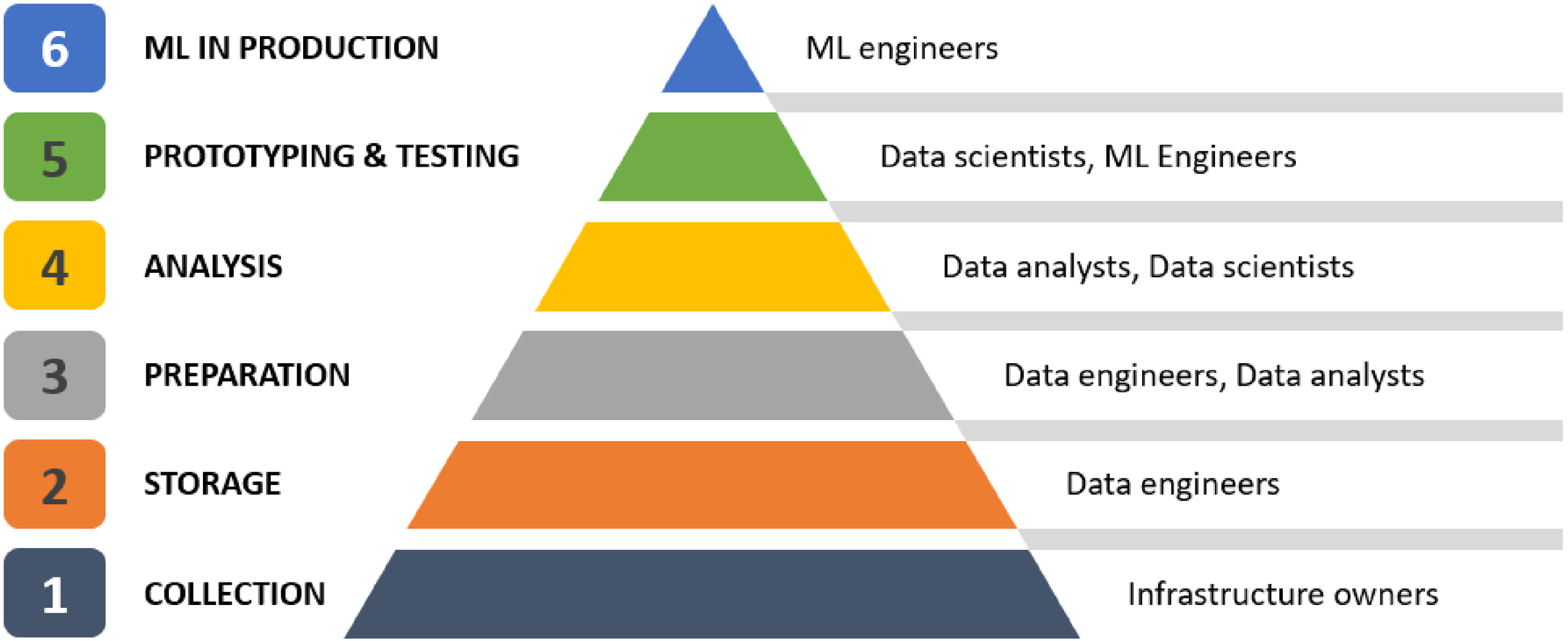
Data Engineer

Data Analyst

Data Scientist



Machine Learning Engineer



Team structure

1. **Centralized**
2. **Decentralized** (or **embedded**)
3. **Hybrid**

Team structure comparison

1. **Centralized** - all data functions in one central team. Works well for small companies, startups, new organizations. Gets slow once business matures and requires focus
2. **Decentralized** - each business unit, geography or department have their own data functions. Works well for larger companies. Introduces issues with data governance, differences in definitions, redundancies, and added complexity
3. **Hybrid** - infrastructure, definitions, methods and tooling are **centralized**, while application and prototyping **decentralized**

Let's practice!

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