
AWS
re:Invent

ENT301

Executing a large-scale migration to AWS

Jonathan Allen

Director, Enterprise Strategy

AWS

AWS re:Invent

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Agenda

1. Business drivers to migrate and modernize
2. Phases of migration
3. Technical deep dive on the Rs
4. Migration Acceleration Program



AWS re:Invent

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Industry leaders migrate to AWS

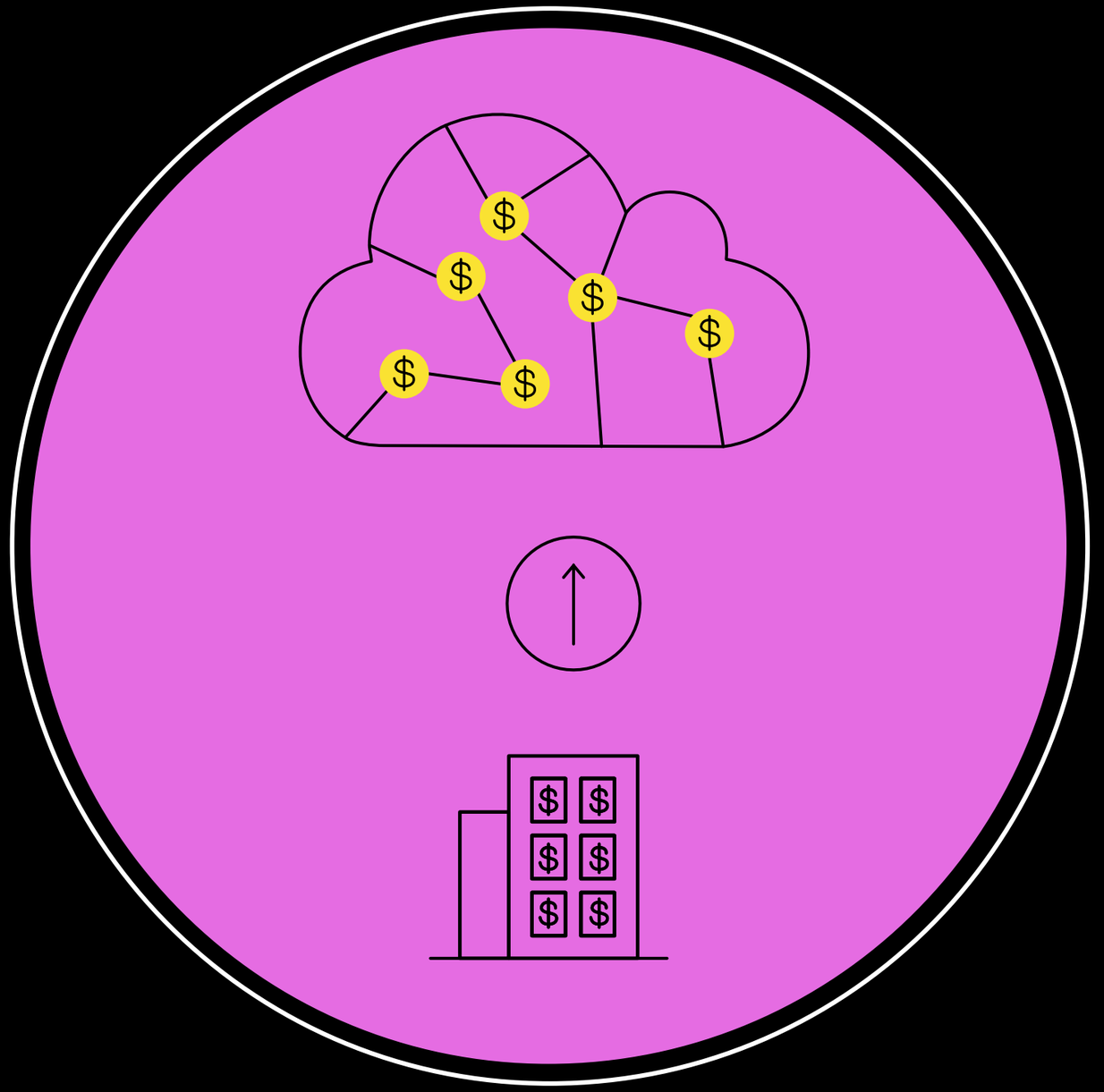


There are many different business drivers



Migrate

Unlock savings and position for modernization



Game-changing 17-month journey

LIVE NATION

58%

total cost savings: 18% immediate and another 40% after optimizations

50%

reduction in traditional IT operations tasks

99.999%

application availability – up from 99.9%

10x

increase in innovation pipeline

"**Go faster** than what is comfortable."

Michael Rapino
CEO, Live Nation

"…when you know you have the ability to quickly deprovision, **it makes you bolder to say yes and try new things.**"

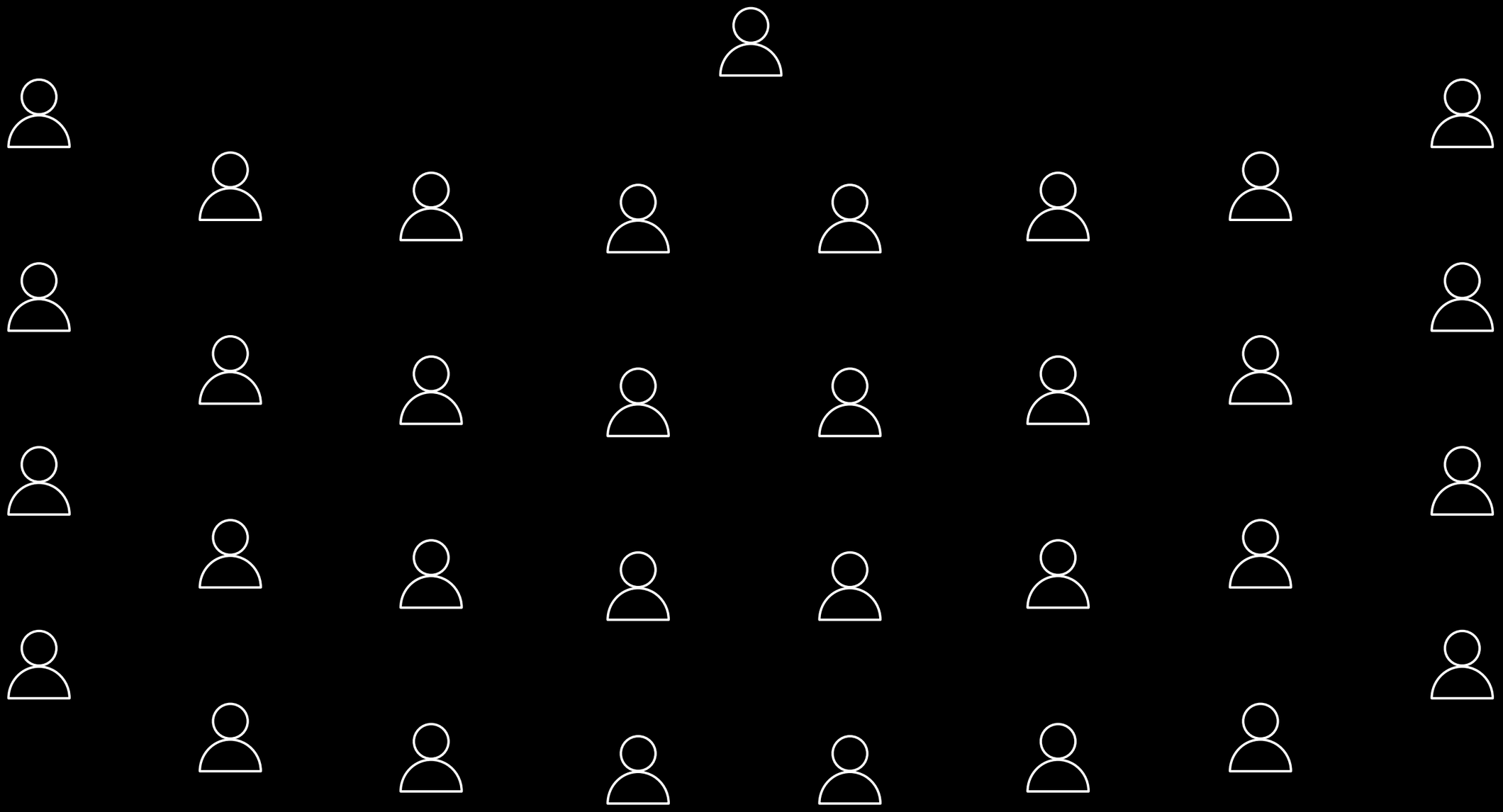
Jake Burns
(former) VP of Cloud Services, Live Nation

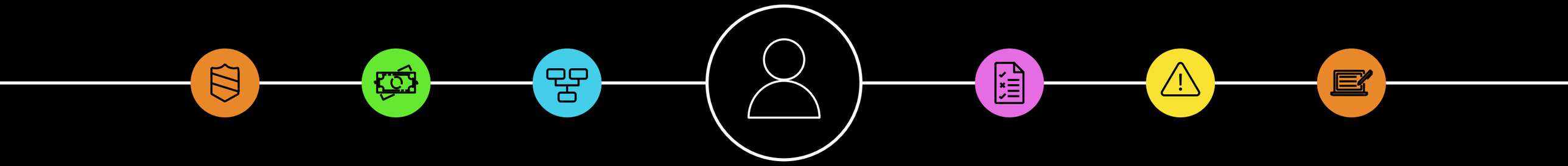
“So with the benefit of your hindsight, how can we go really fast but safely?”

Nearly every EBC conversation



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“Declare a bold business migration objective”

Enel


FABIO VERONESE
HEAD OF INFRASTRUCTURE & TECHNOLOGICAL SERVICES, ENE
enel

Enel

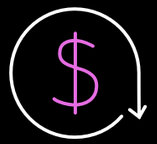
ENEL improved IT infrastructure, reduced provisioning time, and saved costs



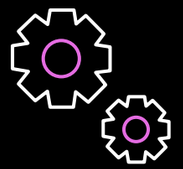
Improved IT infrastructure availability, security, and disaster recovery



Reduced provisioning time from **4 weeks to 2 days**

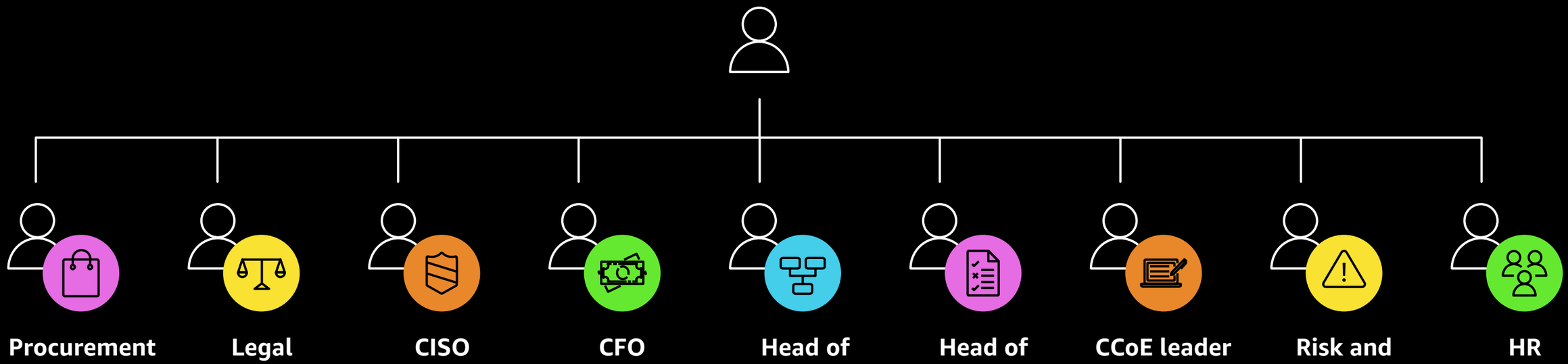


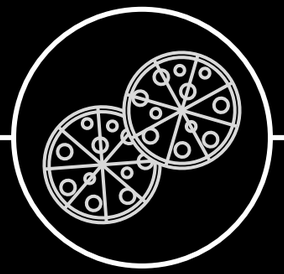
Saved **21%** on compute costs and **60%** on storage costs

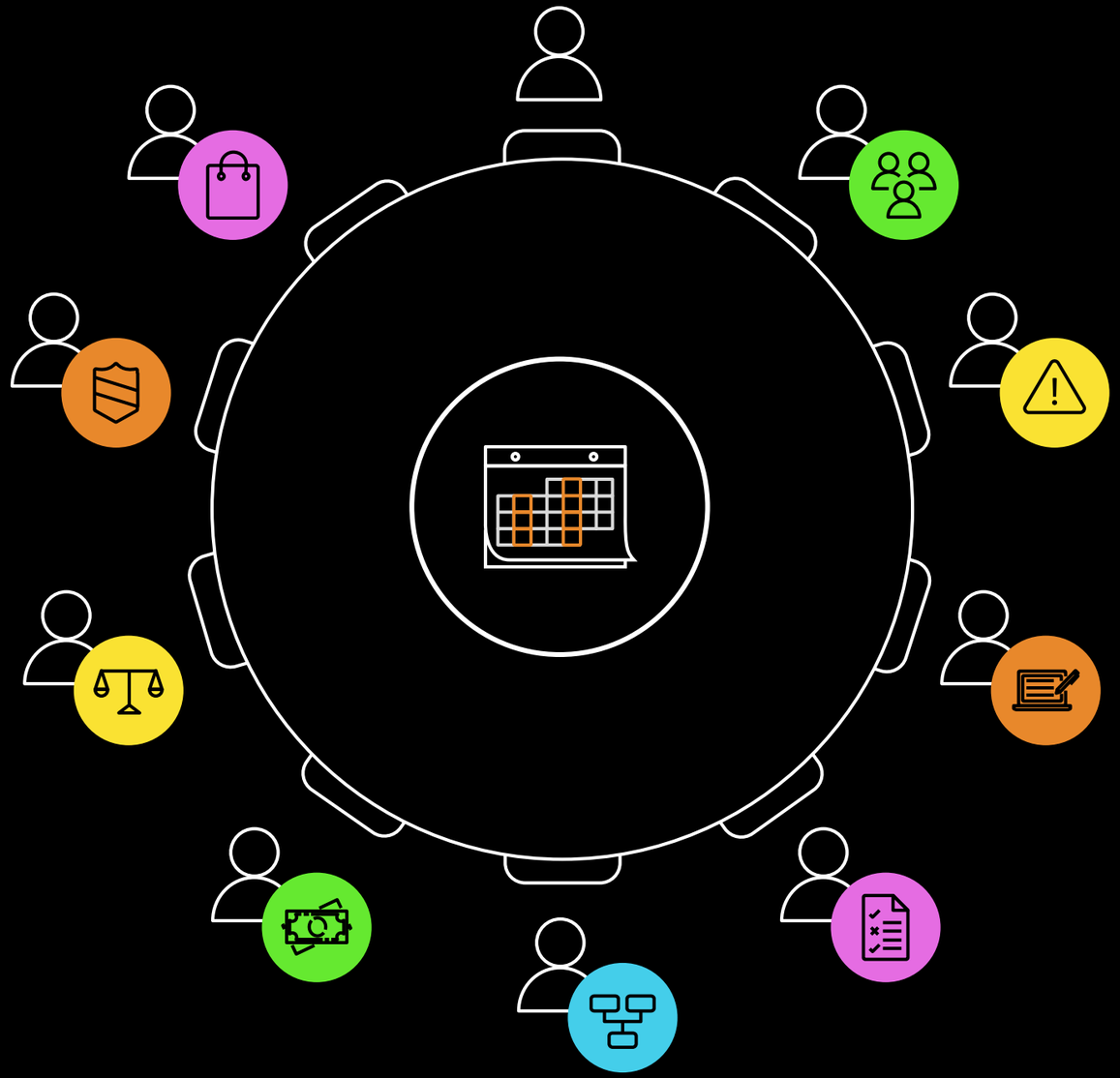


Automated over **60%** of service requests

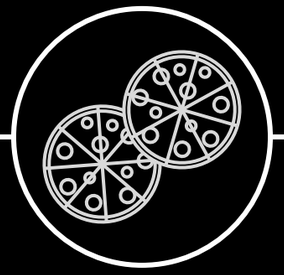
Cloud leadership team







Cloud Center of Excellence (CCoE)



AWS infrastructure engineers

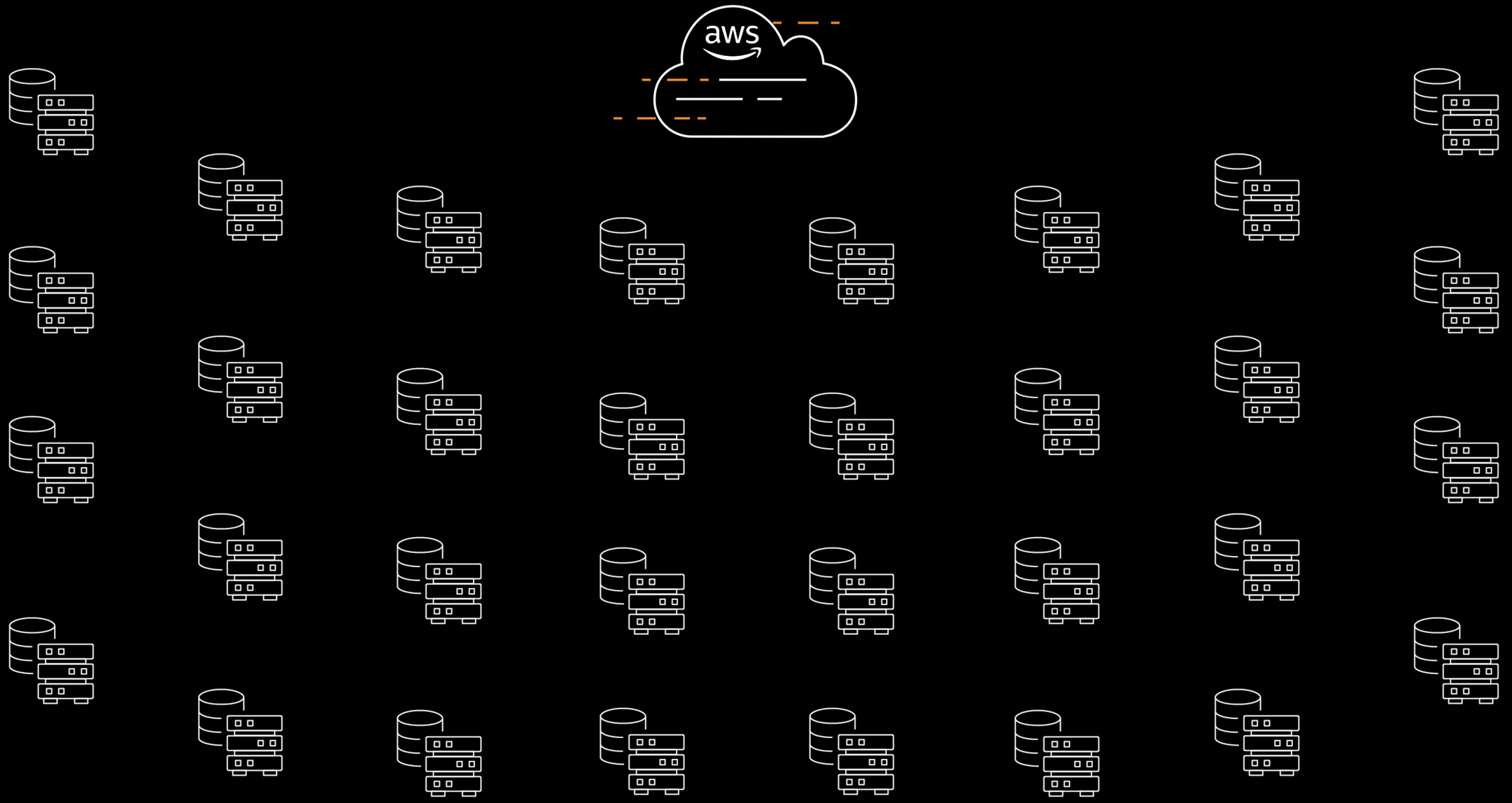
Security engineers

Application engineers

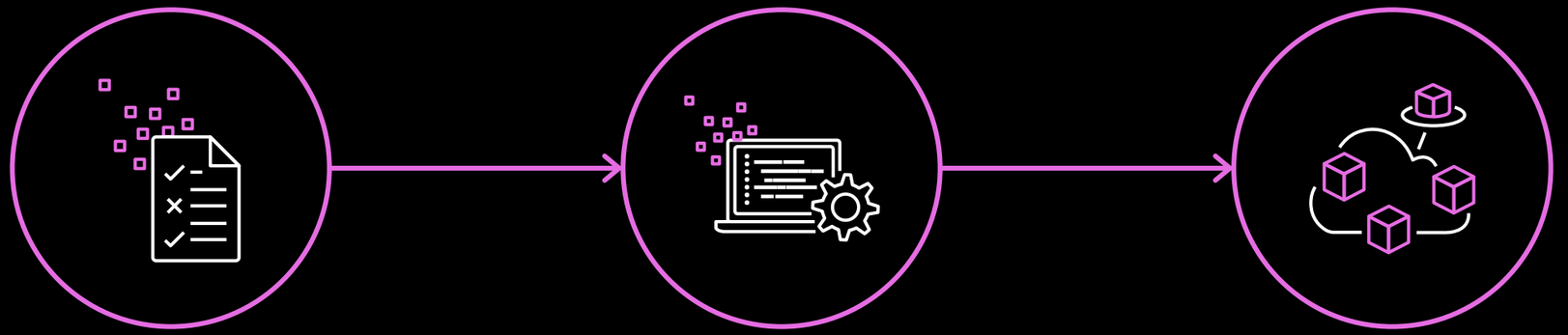
Operations engineers

Lead architect

Don’t overthink it



Don’t overthink it



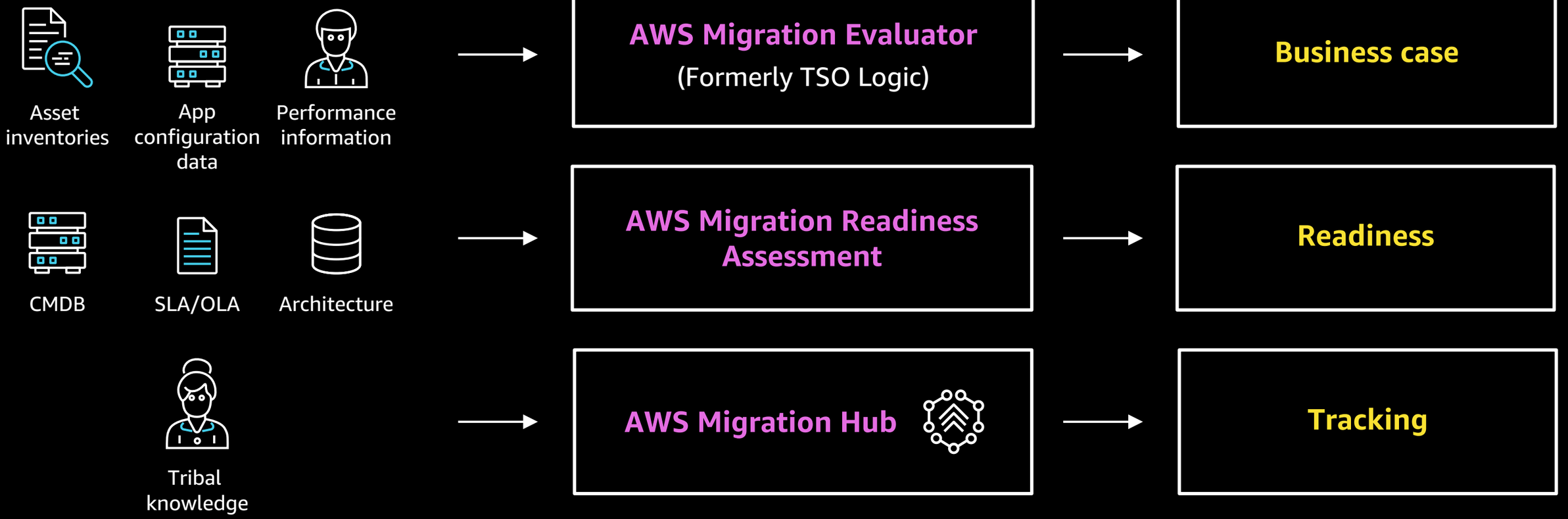
Assess

Mobilize

Migrate
and modernize

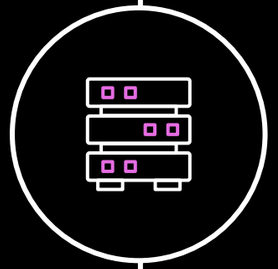
Assess

Current IT snapshot



AWS Migration Evaluator: Inventory discovery

AGENTLESS COLLECTOR



- Needs dedicated Windows Server 2012 R2 or greater with local admin rights
- Supports automatic upload of daily inventory and utilization
- Supports data redaction through manual Excel export and upload via Management Console

VMWARE

Communicates with each vSphere virtual appliance

Via the vSphere SOAP API over HTTPS (TCP 443)

Provisioning is persisted along with their relationships (VM/Host) and time series usage

HYPER-V

Communicates with each Hyper-V host

Via WMI over TCP port 135 + ephemeral TCP port range (49152–65535)

Provisioning is persisted along with their relationships (VM/Host) and time series usage

BARE METALS

Communicates with each server directly through WMI, SNMP v2c, or SNMP v3

SNMP is done over UDP port 161, WMI over TCP port 135 + ephemeral TCP port range (49152–65535)

Provisioning is persisted for Windows machines and time series usage

SQL SERVER

Communicates with each server directly through T-SQL

Connectivity via TCP port 1433

SQL Server version and edition is persisted against each VMware virtual machine, Hyper-V virtual machine, and bare metal

AWS Migration Evaluator: Deliverables

Data Insights

Overview of the percentage of time servers were used, environment insights & licensing details.

OS INSTANCE CLASSIFICATION



In Use	48.9%
Idle	9.6%
Unclassified	7.5%
Zombie	15.3%
Expected Idle	18.6%

Environment & Licensing	
Zombies	15% (305 Servers removed from future state modeling)
SQL Enterprise	59
SQL Standard	21
Windows Servers	647
Linux Servers	573

- **In Use** – Estimated percentage of time the servers delivered business value by being on and having their CPU utilization above 5% or above 300 MHz for VMWare VMs.
- **Idle** – Estimated percentage of time the servers were on but did not deliver business value by having their CPU utilization below 5% or below 300 MHz for VMWare VMs.
- **Unclassified** – Percentage of time servers were on but had no metrics available to determine if they were idle or in use.
- **Zombie** – Percentage of servers that were expected to deliver business value, but did not. These are candidates for retiring and not migrating to AWS.
- **Expected Idle** – Percentage of servers expected to not be in use but deliver business value in different ways. Examples include templates or disaster recovery.

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aws migration evaluator
Formerly TSO Logic

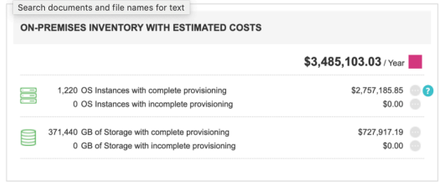
On-Premises Annual Cost Estimation

Included in On-Premises Cost Estimation

- Server hardware based on AWS benchmarks
- Attached storage
- Power
- Software licensing: OS (if applicable)
- MS SQL Server licensing (if applicable)

Excluded in On-Premises Cost Estimation

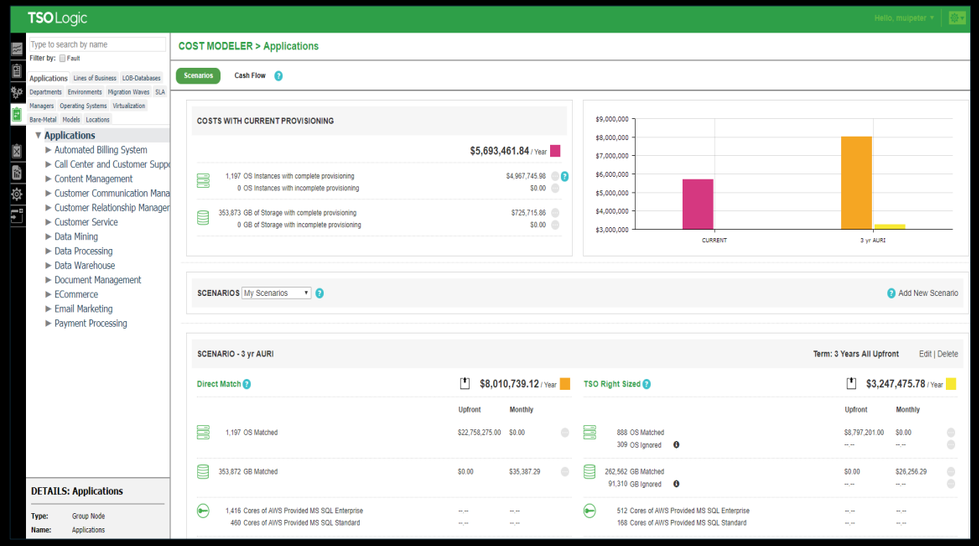
- Employee costs
- Migration tools
- Professional services
- Shared storage
- Software outside of OS and SQL
- Networking



Currency is in USD, annually. TSO Logic benchmark costs were used for calculating on-premises estimations. OS and SQL licensing can be configured to customer actuals. On-premises licensed SQL cores are counted at the operating system level verses host @ $3,300 per core; operating system @ $300 per OS.

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aws migration evaluator
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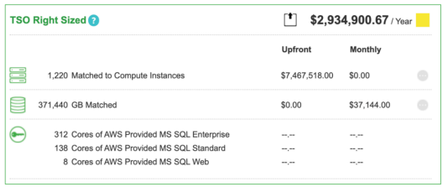


3 YR Standard RI/Instance Savings Plan

(Windows Server & SQL Server Included)

AWS Modeling Parameters

Location:	US East (N. Virginia)
Instances:	• 3 Year • Standard Reserved • All Upfront payment
Modeling:	• TSO Right Sizing
Licensing:	• Windows licenses included • SQL licenses included
Currency:	• USD annually
Savings Plan Rate Estimate:	• $248.15 Commit / Hour



While this doesn't take into account the cost of change, migration tools, and services, the intent of our software is to provide a directional business case based on your actual data.

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Migration Readiness Assessment (MRA) to build the case for change

- Diagnose migration readiness and build a case for change
- 1-day workshop to identify readiness and gaps for a large-scale migration
- Followed by an action plan proposal to close the gaps (e.g., Accelerators, a Mobilize project plan by ProServe / partner)

Business capability-focused

Technical capability-focused

Business
Value realization

People
Roles and readiness

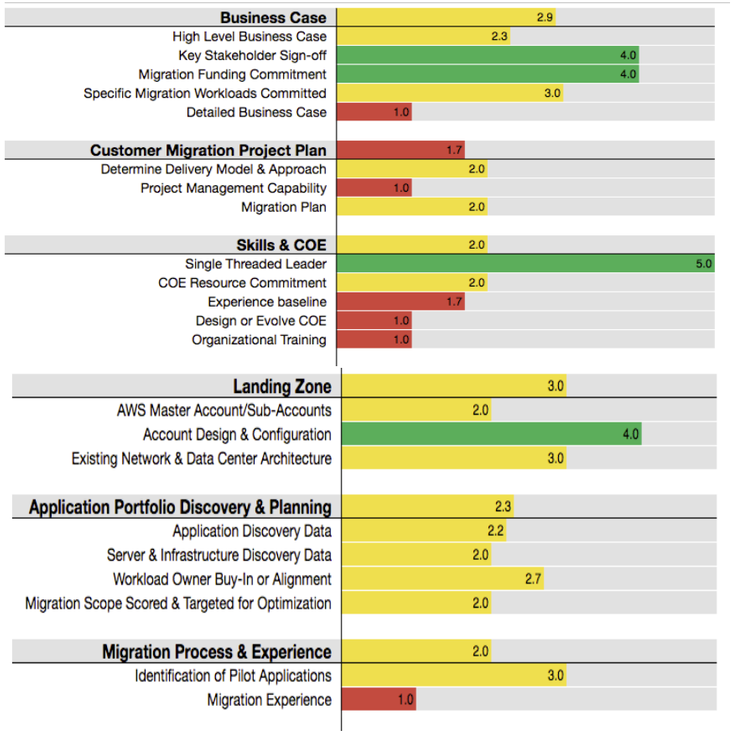
Governance
Prioritization and control

Platform
Applications and infrastructure

Security
Risk and compliance

Operations
Hybrid and dynamic

https://aws.amazon.com/professional-services/CAF/



Mobilize

Current IT snapshot

Asset inventories

App configuration data

Performance information

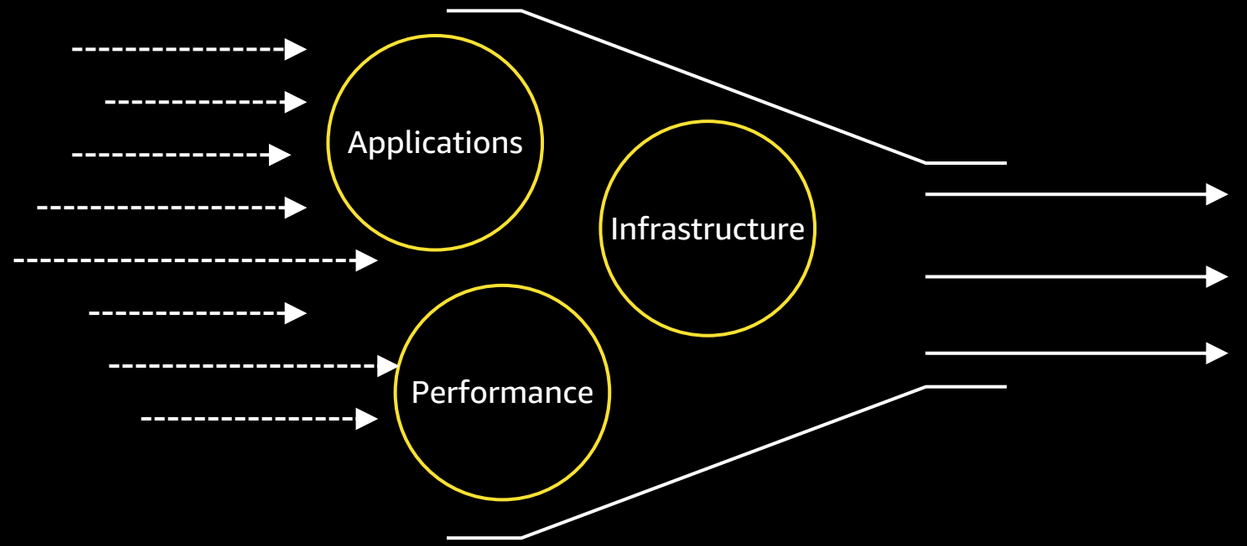
CMDB

SLA/OLA

Architecture

Tribal knowledge

Discover and organize data



Migration strategies for each workload (i.e., 7 Rs)

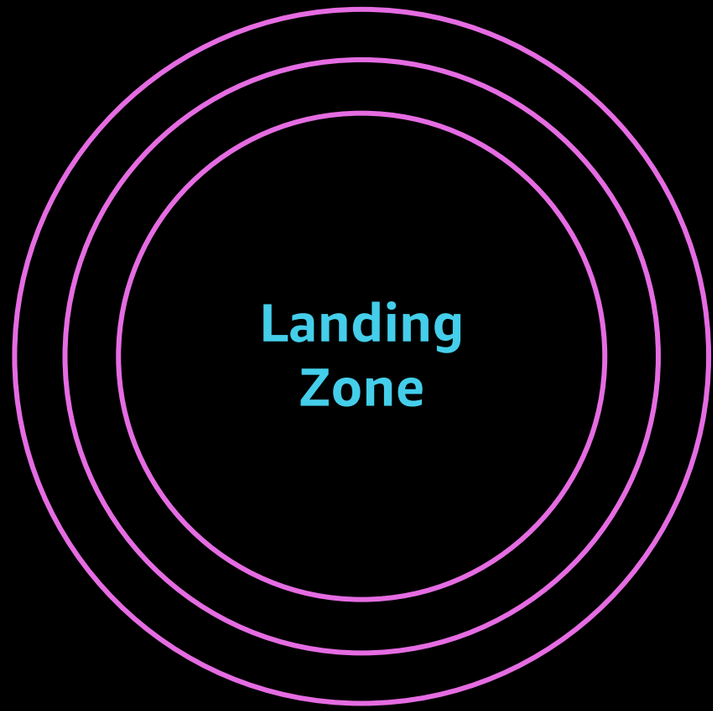
- Refactor
- Replatform
- Repurchase
- Rehost
- Relocate
- Retain
- Retire

Level of effort

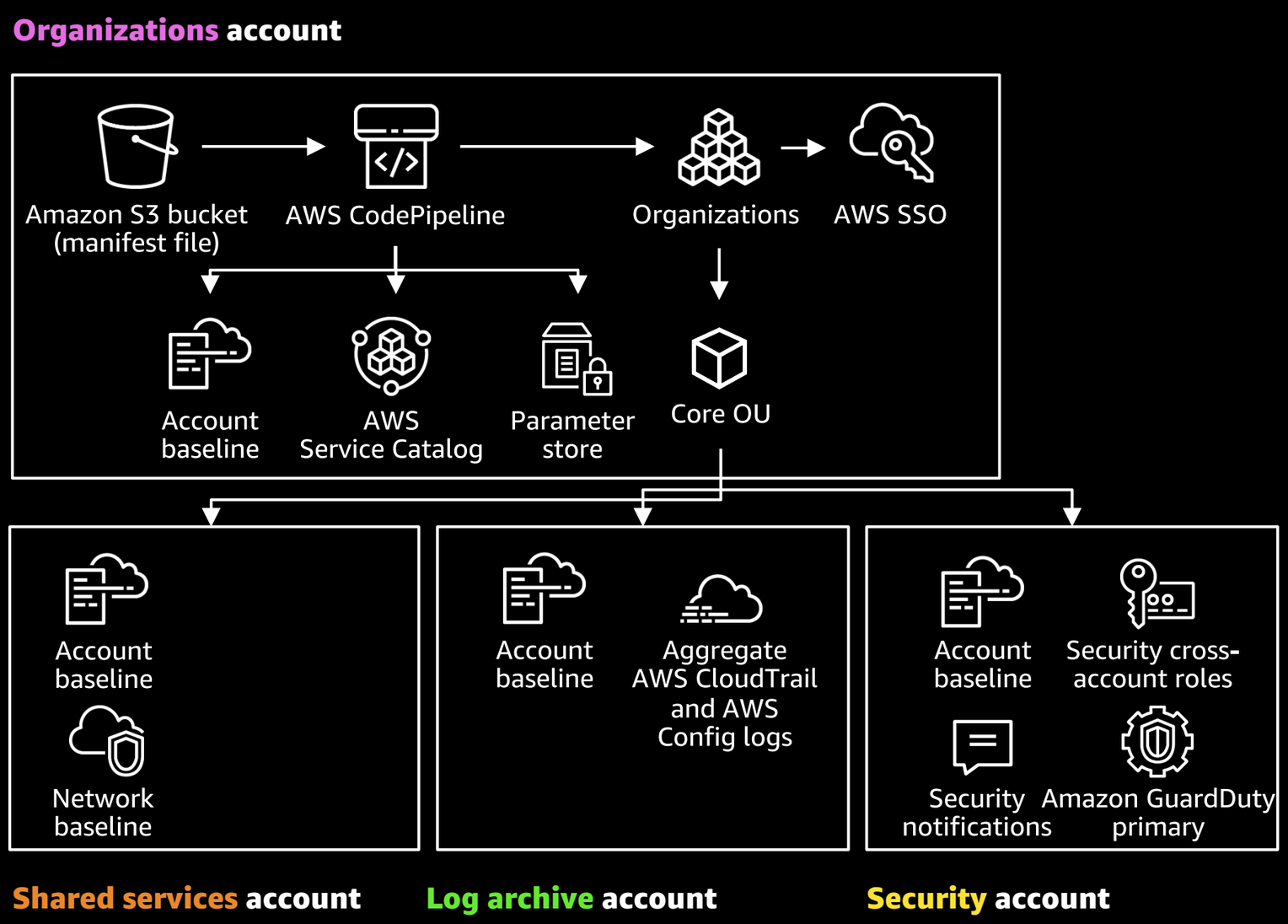
Migration strategy decision criteria should be based on both business and technical needs

You need a “landing zone”

- A configured, secure, scalable, and multi-account AWS environment based on AWS best practices
- A starting point for net new development and experimentation
- A starting point for migrating applications
- An environment that allows for iteration and extension over time



AWS Landing Zone structure: Basic



Organizations account

- Account provisioning
- Account access (SSO)

Shared services account

- Active directory
- Log analytics

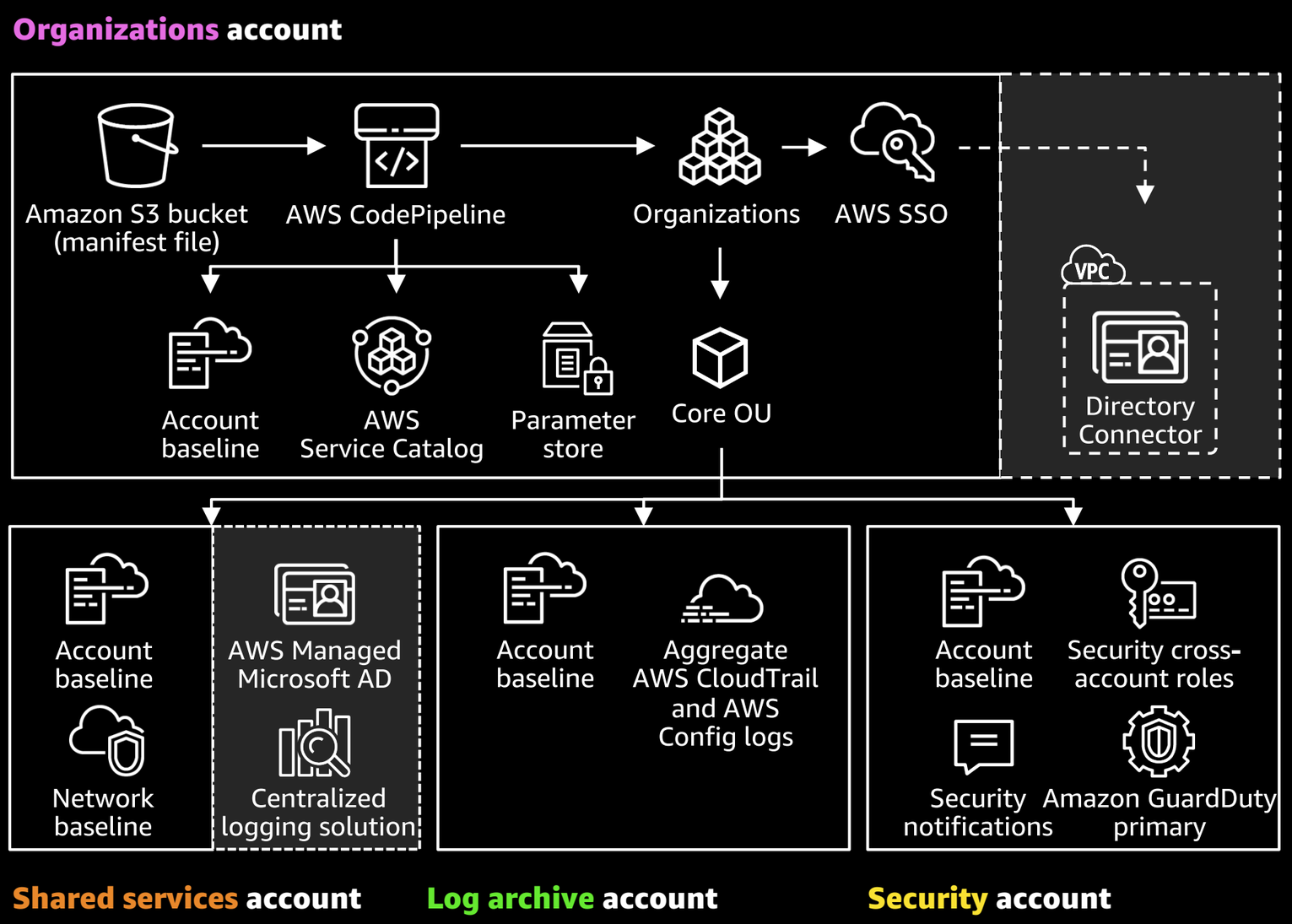
Log archive account

- Security logs

Security account

- Audit / break-glass

AWS Landing Zone structure



Organizations account

- Account provisioning
- Account access (SSO)

Shared services account

- Active directory
- Log analytics

Log archive account

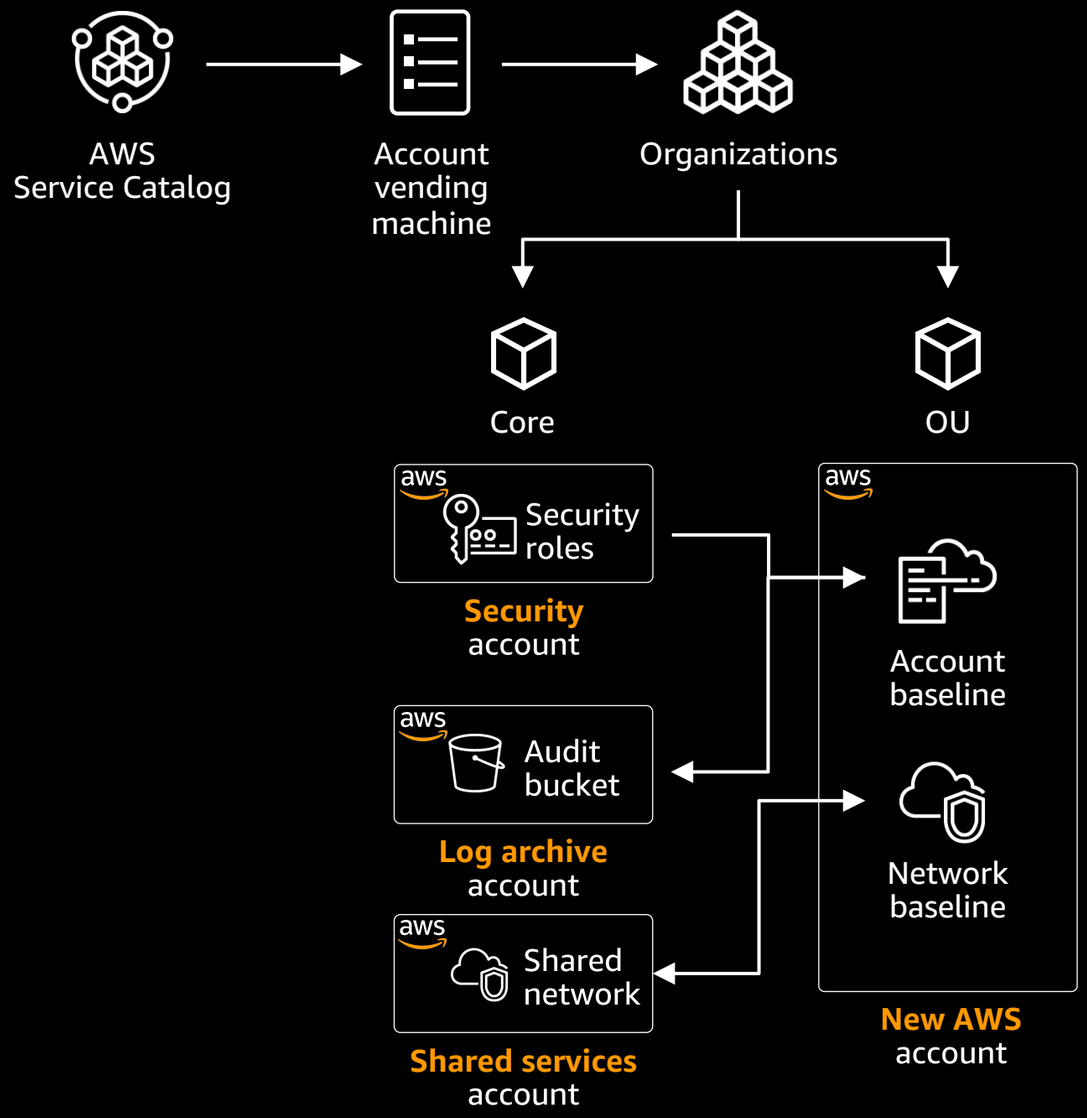
- Security logs

Security account

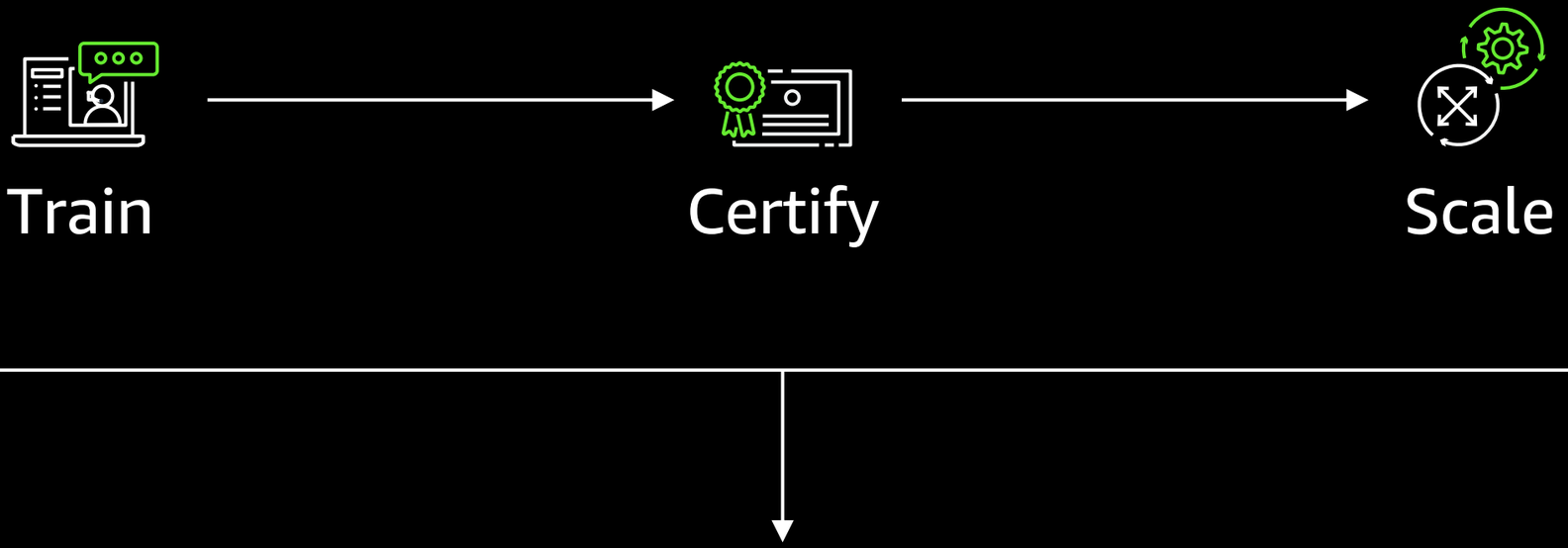
- Audit / break-glass

Account vending machine

- **Account vending machine (AWS Service Catalog)**
  - Account creation UI
  - Account baseline versioning
  - Launch constraints
- **Creates / updates AWS account**
- **Apply account baseline stack sets**
- **Create network baseline**
- **Apply account security control policy**



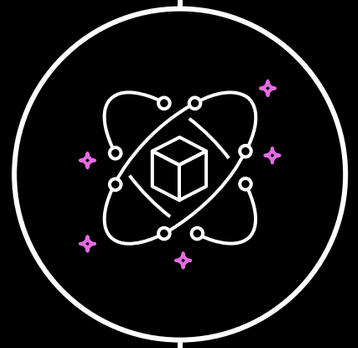
Scale the “know-how” across the business



Watch: re:Invent talk
https://www.youtube.com/watch?v=yHzJw007oO8

Read: AWS blog post
https://amzn.to/36syEg0

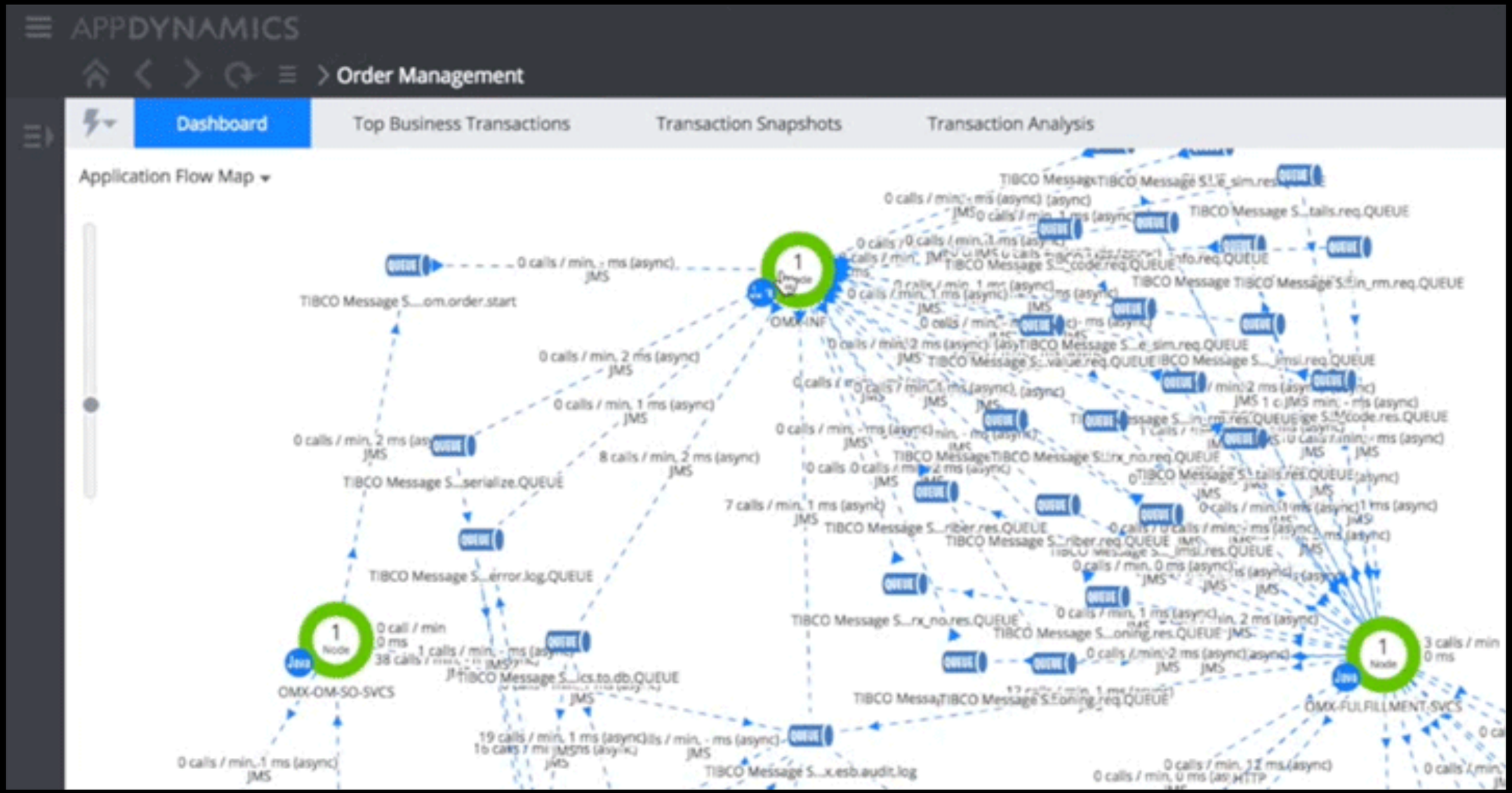
Lessons learned: Assess and mobilize phase



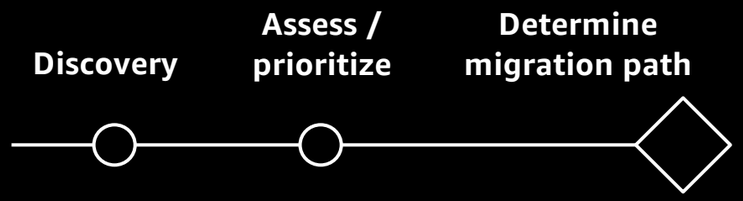
- Firewalls, firewalls, firewalls!
- Teams that can own the outcome
- Remember that data has gravity
- Establish people-centric mechanism scale reskilling
- Shortlist migration partners
- Shortlist tooling

Biggest lesson learned: Dependency mapping matters

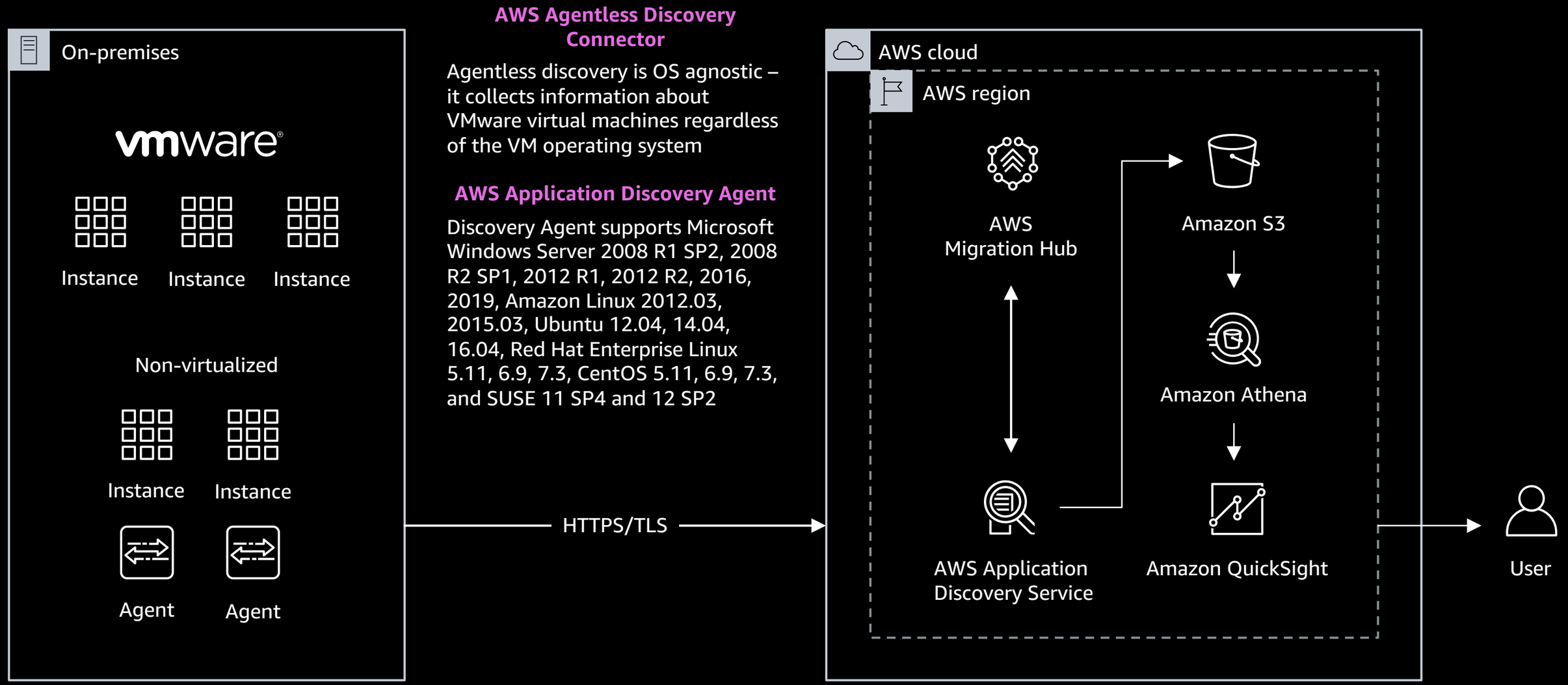
How do I untangle?



7 R application migration strategies



AWS Application Discovery Service



AWS Agentless Discovery Connector

Agentless discovery is OS agnostic – it collects information about VMware virtual machines regardless of the VM operating system

AWS Application Discovery Agent

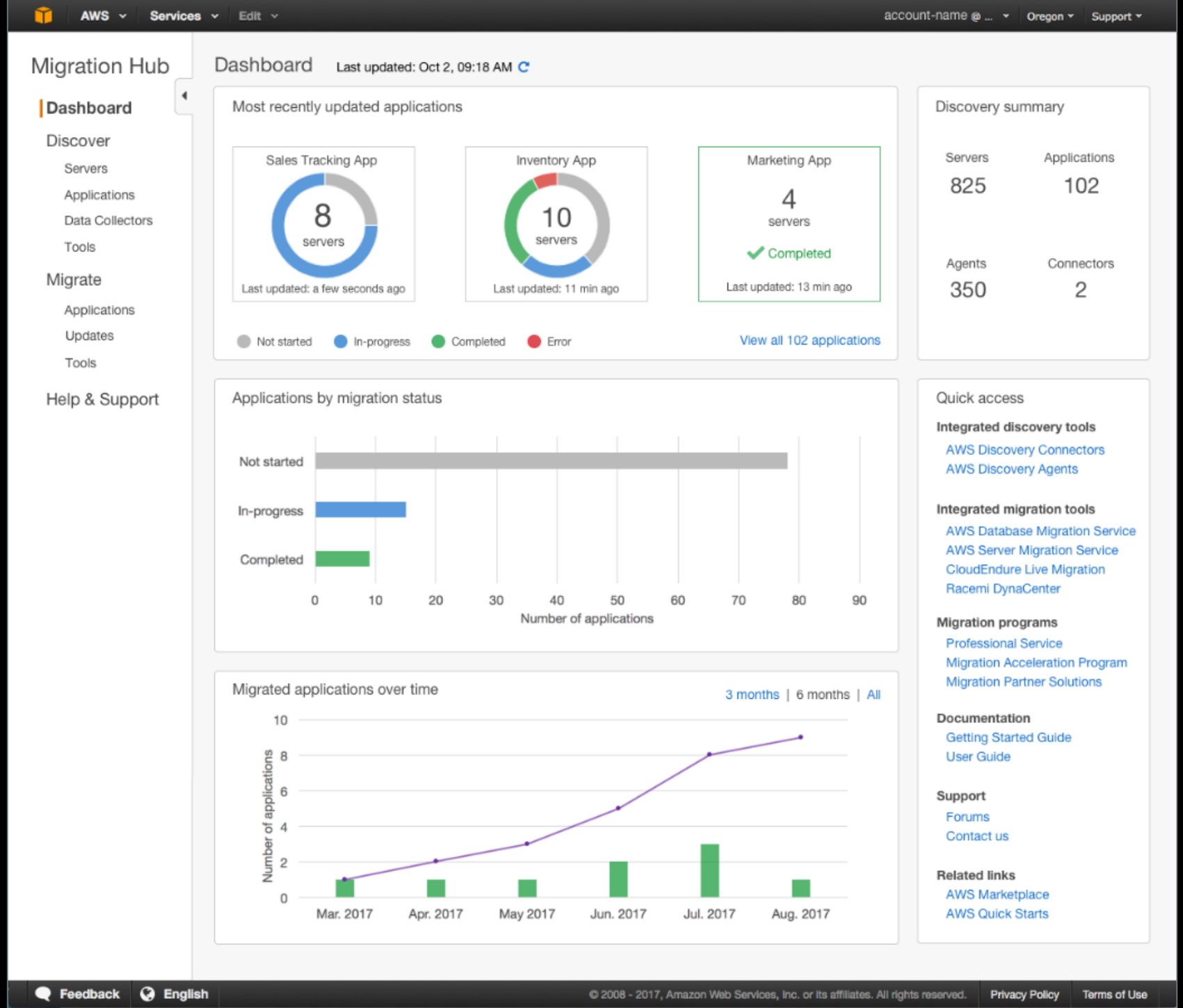
Discovery Agent supports Microsoft Windows Server 2008 R1 SP2, 2008 R2 SP1, 2012 R1, 2012 R2, 2016, 2019, Amazon Linux 2012.03, 2015.03, Ubuntu 12.04, 14.04, 16.04, Red Hat Enterprise Linux 5.11, 6.9, 7.3, CentOS 5.11, 6.9, 7.3, and SUSE 11 SP4 and 12 SP2

AWS Migration Hub

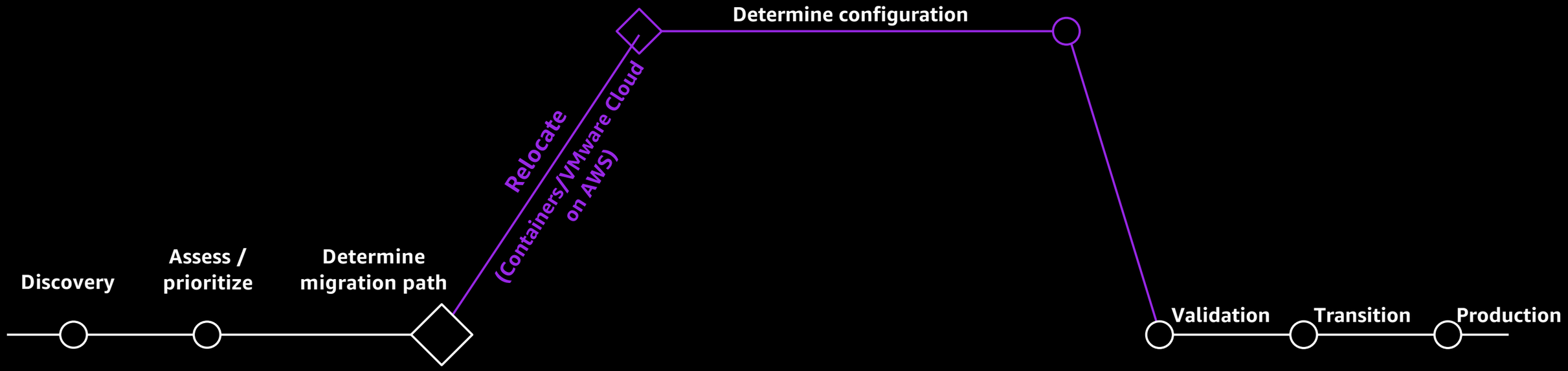


AWS Migration Hub

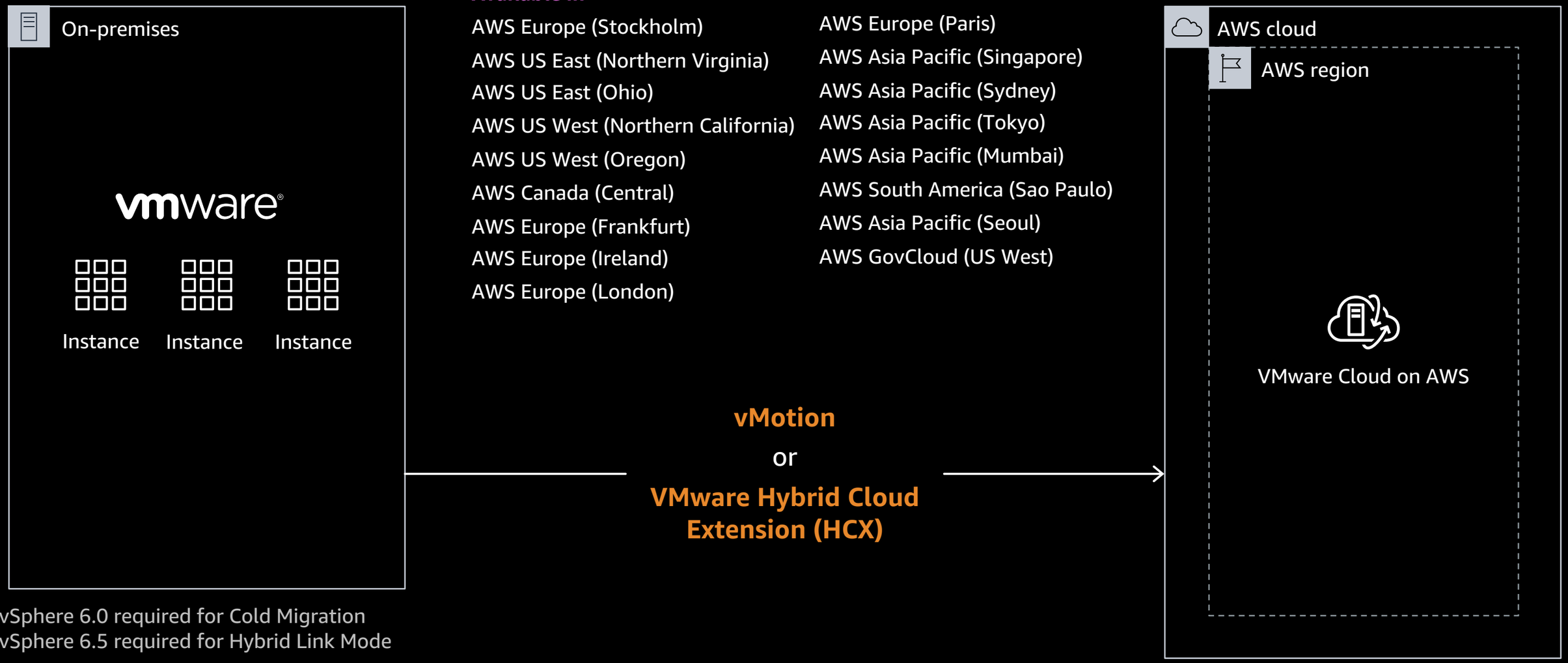




Application migration strategies

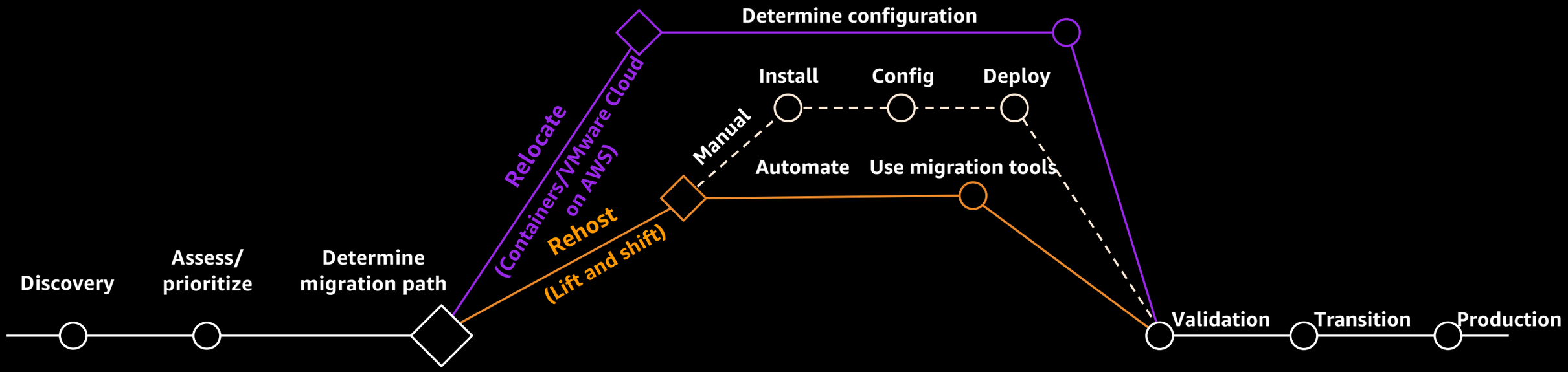


Relocate with VMware Cloud on AWS

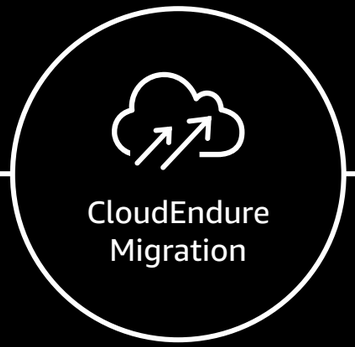


vSphere 6.0 required for Cold Migration
vSphere 6.5 required for Hybrid Link Mode

Application migration strategies



Rehost applications



CloudEndure Migration

- Agent-based
- Block-level replication
- Any source infrastructure as long as it runs x86 operating systems supported by Amazon EC2—this includes physical servers, P2V (virtual servers converted from physical), VMware, Hyper-V, and other cloud providers*
- Sub-second latency: Enables cutover time between 5–20 minutes (depending on OS and network latency)

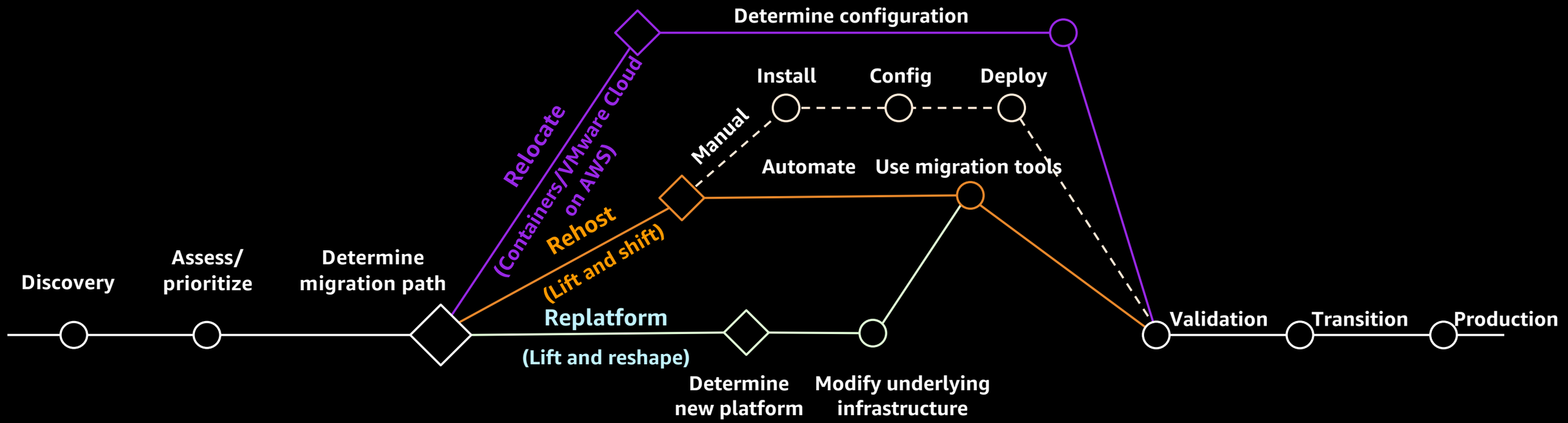


AWS Server Migration Service

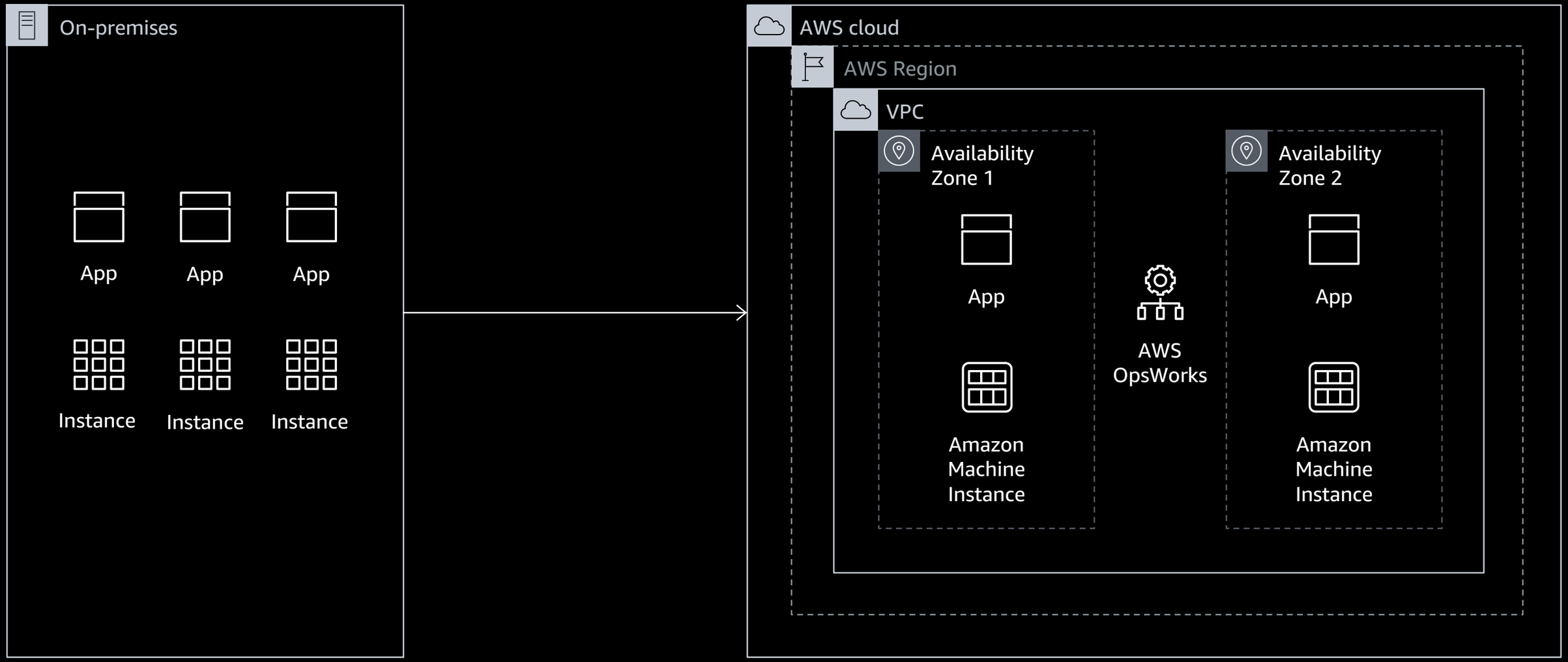
- Agentless
- Virtual machines from VMware, Hyper-V, or Microsoft Azure—doesn't support physical infrastructure or other public cloud providers beyond MS Azure
- Minimum time between replication in SMS is one hour

* Be aware of some limits that are specific to some the operating systems. For example, dynamic-type Windows disks that have GPT partitions are not supported

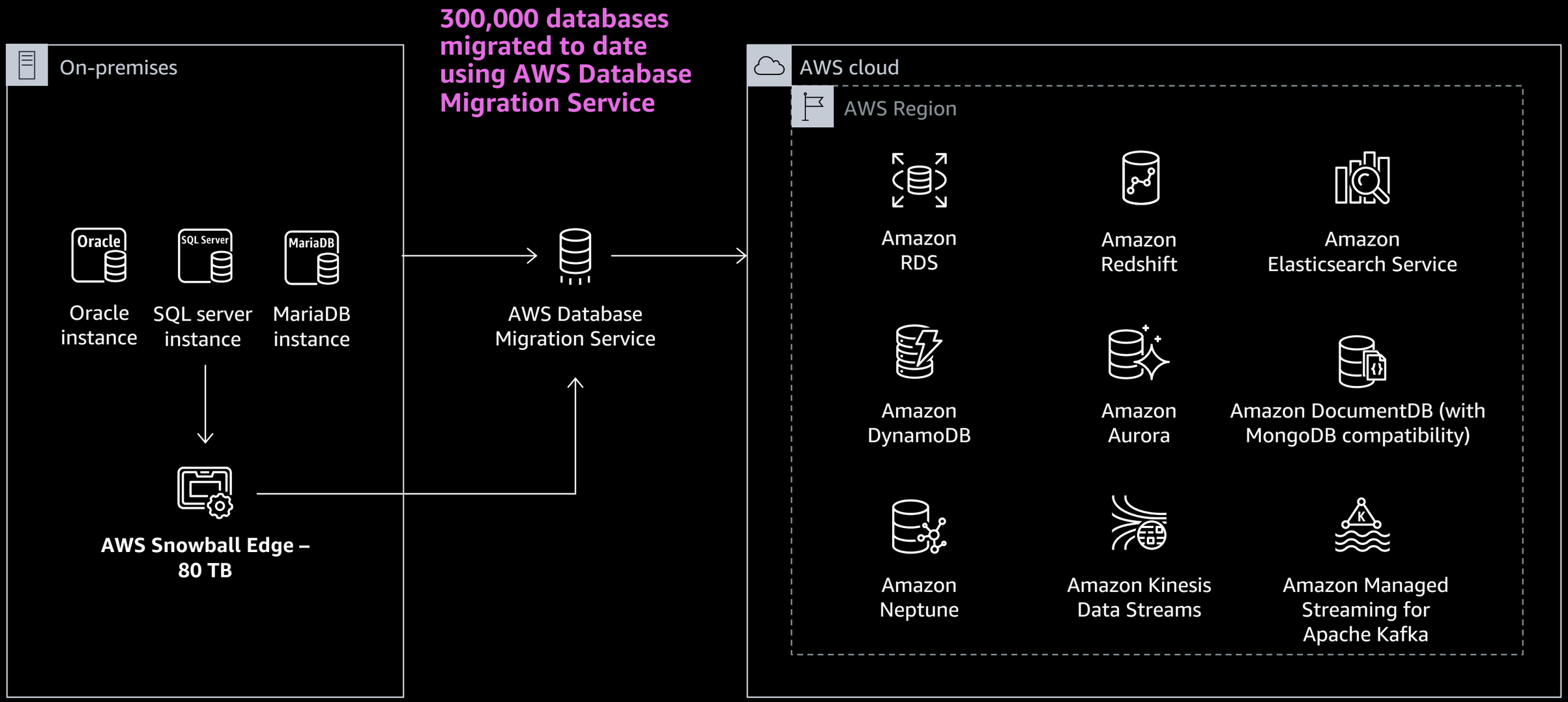
Application migration strategies



Re-platform applications



Re-platform databases



Sources for the AWS Database Migration Service



AWS Database Migration Service

On-premises and Amazon EC2 instance databases

- Oracle versions 10.2 and later (for versions 10.x), 11g and up to 12.2, 18c, and 19c for the Enterprise, Standard, Standard One, and Standard Two editions
- Microsoft SQL Server versions 2005, 2008, 2008R2, 2012, 2014, 2016, 2017, and 2019 for the Enterprise, Standard, Workgroup, and Developer editions; the Web and Express editions are not supported
- MySQL versions 5.5, 5.6, 5.7, and 8.0
- MariaDB (supported as a MySQL-compatible data source) versions 10.0.24 to 10.0.28, 10.1, 10.2, and 10.3 to 10.3.13
- PostgreSQL version 9.4 and later (for versions 9.x), 10.x, 11.x, and 12.x
- MongoDB versions 3.x and 4.0
- SAP Adaptive Server Enterprise (ASE) versions 12.5, 15, 15.5, 15.7, 16, and later
- IBM Db2 for Linux, UNIX, and Windows (Db2 LUW) versions:
    - Version 9.7, all fix packs are supported
    - Version 10.1, all fix packs are supported
    - Version 10.5, all fix packs except for Fix Pack 5 are supported

Microsoft Azure

- Azure SQL Database

Amazon RDS instance databases and Amazon Simple Storage Service (Amazon S3)

- Oracle versions 11g (versions 11.2.0.4 and later) and up to 12.2, 18c, and 19c for the Enterprise, Standard, Standard One, and Standard Two editions
- Microsoft SQL Server versions 2008R2, 2012, 2014, 2016, 2017, and 2019 for the Enterprise, Standard, Workgroup, and Developer editions; the Web and Express editions are not supported
- MySQL versions 5.5, 5.6, 5.7, and 8.0 (for version 8.0 except when the transaction payload is compressed)
- MariaDB (supported as a MySQL-compatible data source) versions 10.0.24 to 10.0.28, 10.1, 10.2, and 10.3 to 10.3.13
- PostgreSQL version 9.4 and later (for versions 9.x), 10.x, 11.x, and 12.x. Change data capture (CDC) is only supported for versions 9.4.9 and later, 9.5.4 and later, 10.x, 11.x, and 12.x; the rds.logical_replication parameter, which is required for CDC, is supported only in these versions and later
- Amazon Aurora with MySQL compatibility (supported as a MySQL-compatible data source)
- Amazon Aurora with PostgreSQL compatibility (supported as a PostgreSQL-compatible data source)
- Amazon DocumentDB (with MongoDB compatibility) version 3.6
- Amazon S3

Some sources will require AWS DMS version 3.4.0 and later

Targets for the AWS Database Migration Service



AWS Database Migration Service

On-premises and Amazon EC2 instance databases

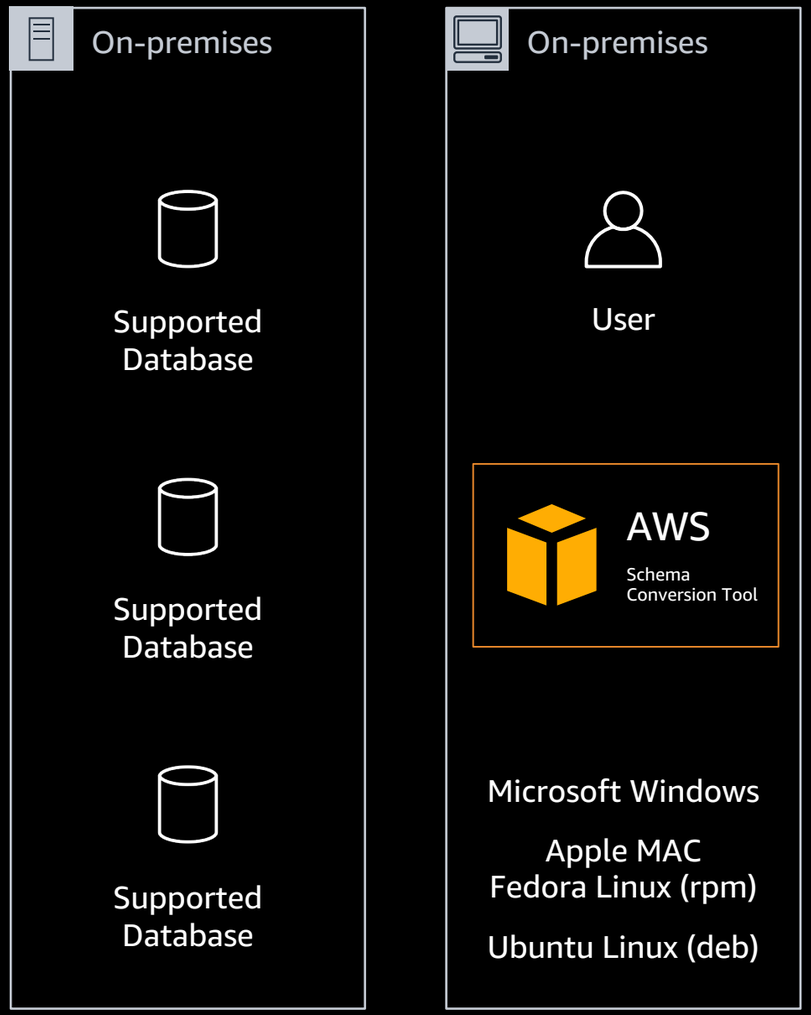
- Oracle versions 10g, 11g, 12c, 18c, and 19c for the Enterprise, Standard, Standard One, and Standard Two editions
- Microsoft SQL Server versions 2005, 2008, 2008R2, 2012, 2014, 2016, 2017, and 2019 for the Enterprise, Standard, Workgroup, and Developer editions; the Web and Express editions are not supported
- MySQL versions 5.5, 5.6, 5.7, and 8.0
- MariaDB (supported as a MySQL-compatible data target) versions 10.0.24 to 10.0.28, 10.1, 10.2, and 10.3
- PostgreSQL version 9.4 and later (for versions 9.x), 10.x, 11.x, and 12.x
- SAP Adaptive Server Enterprise (ASE) versions 15, 15.5, 15.7, 16, and later

Amazon RDS instance databases, Amazon Redshift, Amazon DynamoDB, Amazon S3, Amazon ES, Amazon Kinesis Data Streams, Amazon DocumentDB, Amazon Neptune, and Apache Kafka

- Oracle versions 11g (versions 11.2.0.3.v1 and later), 12c, 18c, and 19c for the Enterprise, Standard, Standard One, and Standard Two editions
- Microsoft SQL Server versions 2008R2, 2012, 2014, 2016, 2017, and 2019 for the Enterprise, Standard, Workgroup, and Developer editions; the Web and Express editions are not supported
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- PostgreSQL version 9.4 and later (for versions 9.x), 10.x, 11.x, and 12.x
- Amazon Aurora with MySQL compatibility
- Amazon Aurora with PostgreSQL compatibility
- Amazon Aurora serverless
- Amazon Redshift
- Amazon S3
- Amazon DynamoDB
- Amazon ES
- Amazon Kinesis Data Streams
- Amazon DocumentDB (with MongoDB compatibility)
- Amazon Neptune
- Apache Kafka – Amazon Managed Streaming for Apache Kafka (Amazon MSK) and self-managed Apache Kafka

Some sources will require AWS DMS version 3.4.0 and later

Databases: AWS Schema Conversion Tool (SCT)



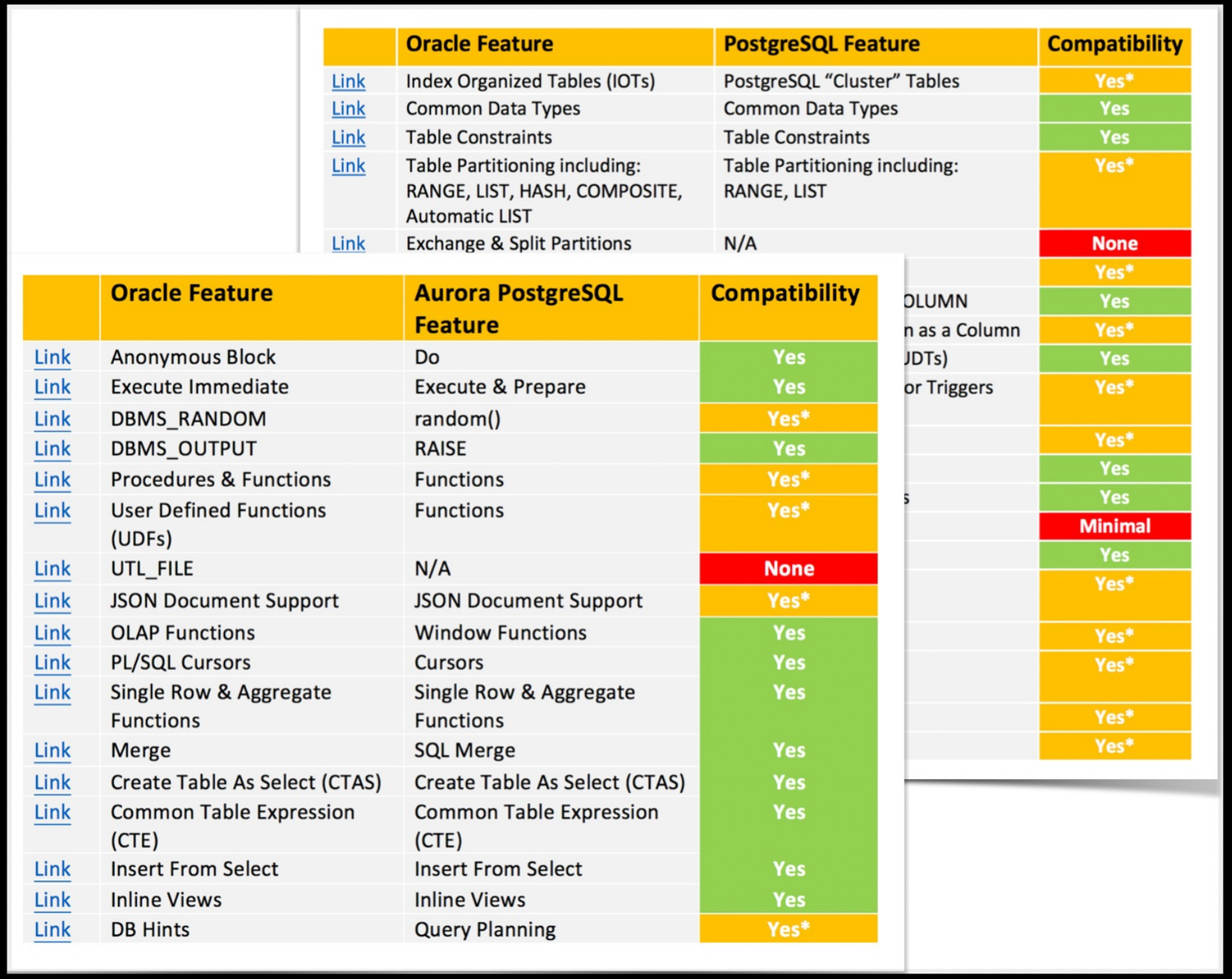
Source Database	Target Database on Amazon RDS
Oracle Database	Amazon Aurora, MySQL, PostgreSQL, Oracle
Oracle Data Warehouse	Amazon Redshift
Azure SQL	Amazon Aurora, MySQL, PostgreSQL
Microsoft SQL Server	Amazon Aurora, Amazon Redshift, MySQL, PostgreSQL
Teradata	Amazon Redshift
IBM Netezza	Amazon Redshift
Greenplum	Amazon Redshift
HPE Vertica	Amazon Redshift
MySQL and MariaDB	PostgreSQL
PostgreSQL	Amazon Aurora, MySQL
Amazon Aurora	PostgreSQL
IBM DB2 LUW	Amazon Aurora, MySQL, PostgreSQL
Apache Cassandra	Amazon DynamoDB
SAP ASE	RDS for MySQL, Aurora MySQL, RDS for PostgreSQL, and Aurora PostgreSQL

Database Migration Playbooks



- Migrate from Microsoft SQL Server to Amazon Aurora MySQL
- Migrate from Microsoft SQL Server to Amazon Aurora PostgreSQL
- Migrate from Oracle to Amazon Aurora PostgreSQL
- Migrate from Oracle to Amazon Aurora MySQL
- Migrate from Oracle to Amazon Redshift

Database migration reference guide



	Oracle Feature	PostgreSQL Feature	Compatibility
Link	Index Organized Tables (IOTs)	PostgreSQL "Cluster" Tables	Yes*
Link	Common Data Types	Common Data Types	Yes
Link	Table Constraints	Table Constraints	Yes
Link	Table Partitioning including: RANGE, LIST, HASH, COMPOSITE, Automatic LIST	Table Partitioning including: RANGE, LIST	Yes*
Link	Exchange & Split Partitions	N/A	None
			Yes*
		OLUMN	Yes
		n as a Column	Yes*
		JDTs)	Yes
		or Triggers	Yes*
			Yes*
			Yes
		s	Yes
			Minimal
			Yes
			Yes*
			Yes*
			Yes*
			Yes*
			Yes*

	Oracle Feature	Aurora PostgreSQL Feature	Compatibility
Link	Anonymous Block	Do	Yes
Link	Execute Immediate	Execute & Prepare	Yes
Link	DBMS_RANDOM	random()	Yes*
Link	DBMS_OUTPUT	RAISE	Yes
Link	Procedures & Functions	Functions	Yes*
Link	User Defined Functions (UDFs)	Functions	Yes*
Link	UTL_FILE	N/A	None
Link	JSON Document Support	JSON Document Support	Yes*
Link	OLAP Functions	Window Functions	Yes
Link	PL/SQL Cursors	Cursors	Yes
Link	Single Row & Aggregate Functions	Single Row & Aggregate Functions	Yes
Link	Merge	SQL Merge	Yes
Link	Create Table As Select (CTAS)	Create Table As Select (CTAS)	Yes
Link	Common Table Expression (CTE)	Common Table Expression (CTE)	Yes
Link	Insert From Select	Insert From Select	Yes
Link	Inline Views	Inline Views	Yes
Link	DB Hints	Query Planning	Yes*

Samsung migrates 1.1 billion users across three continents from Oracle to Amazon Aurora with AWS Database Migration Service

SAMSUNG

60 ms latency

or less for 90% of the time

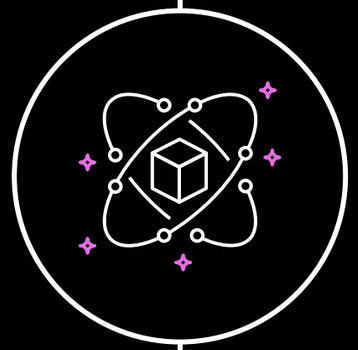
44%

reduced monthly database costs

“The scalability of Amazon Aurora is the best benefit – especially if we focus on the cost.“

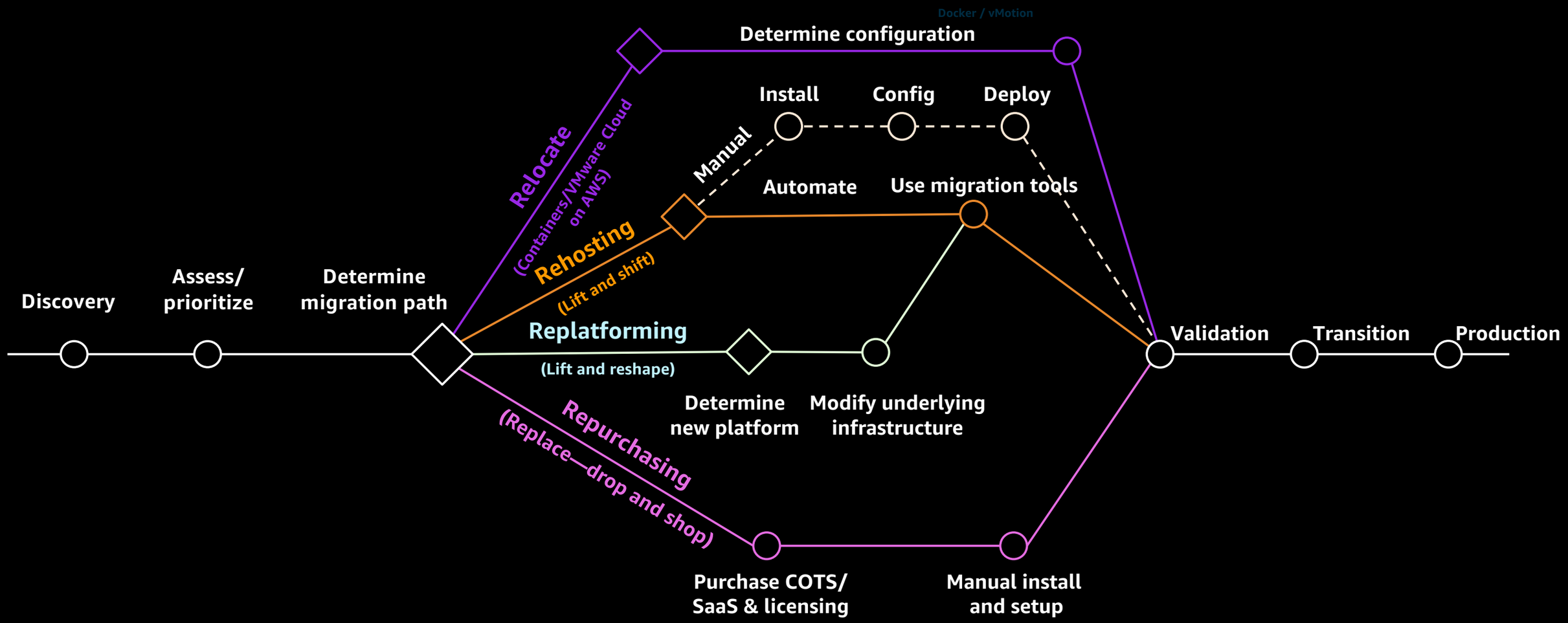
Salva Jung
Principal architect and engineering manager

Lessons learned: Database migration



- Get the code out of the database!
- One size does not fit all
- Conduct dry runs
- Measure performance
- Find the right partner

Application migration strategies

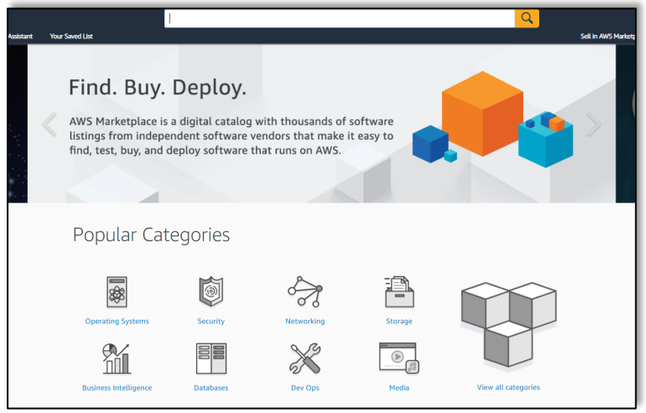


A growing digital software catalog

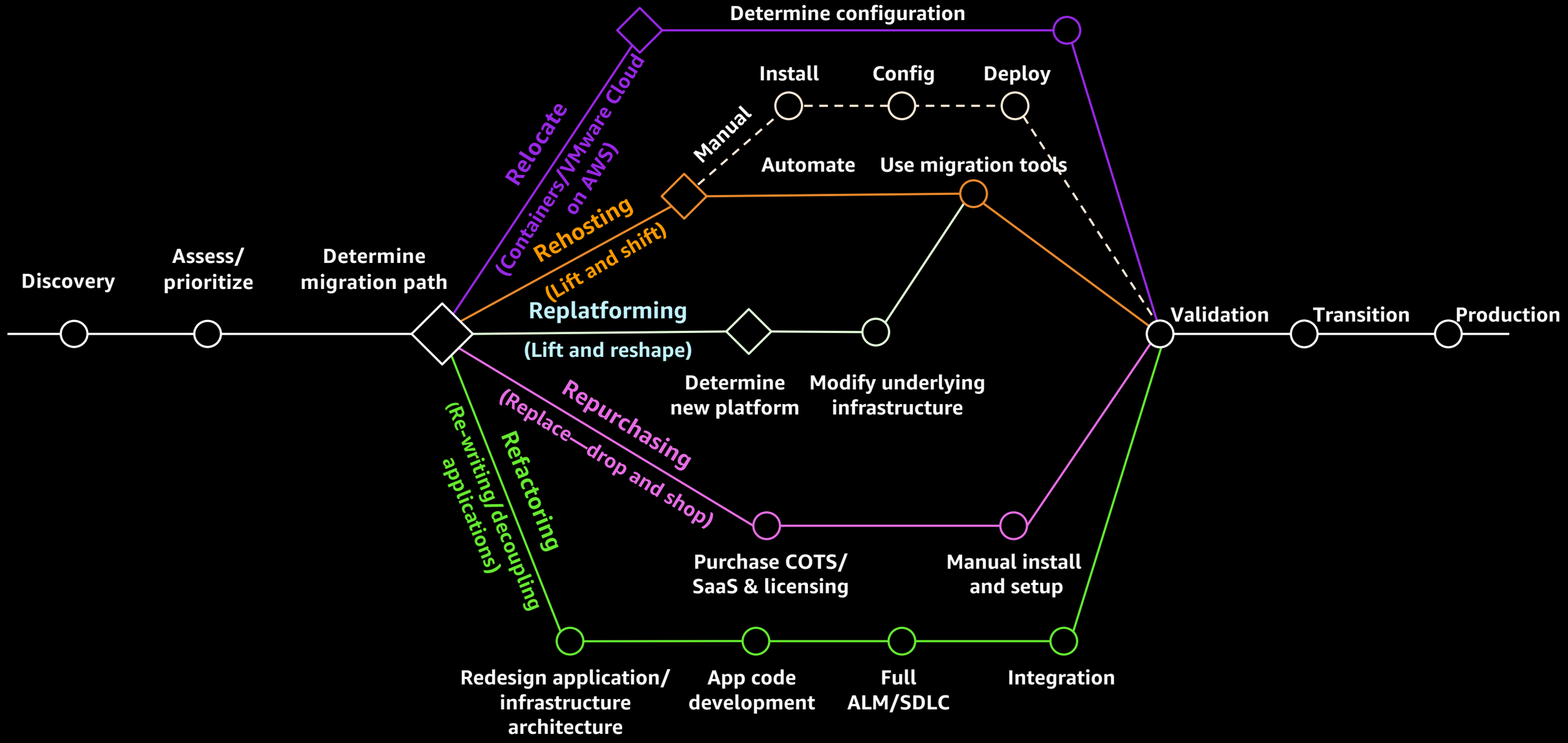
aws marketplace

- Deploy software on demand
- **1,400+** ISVs
- Over **4,500** product listings
- **200,000** active customers
- Over **650 million** hours of Amazon EC2 deployed monthly
- Deployed in **17 regions**
- Offers **35 categories**

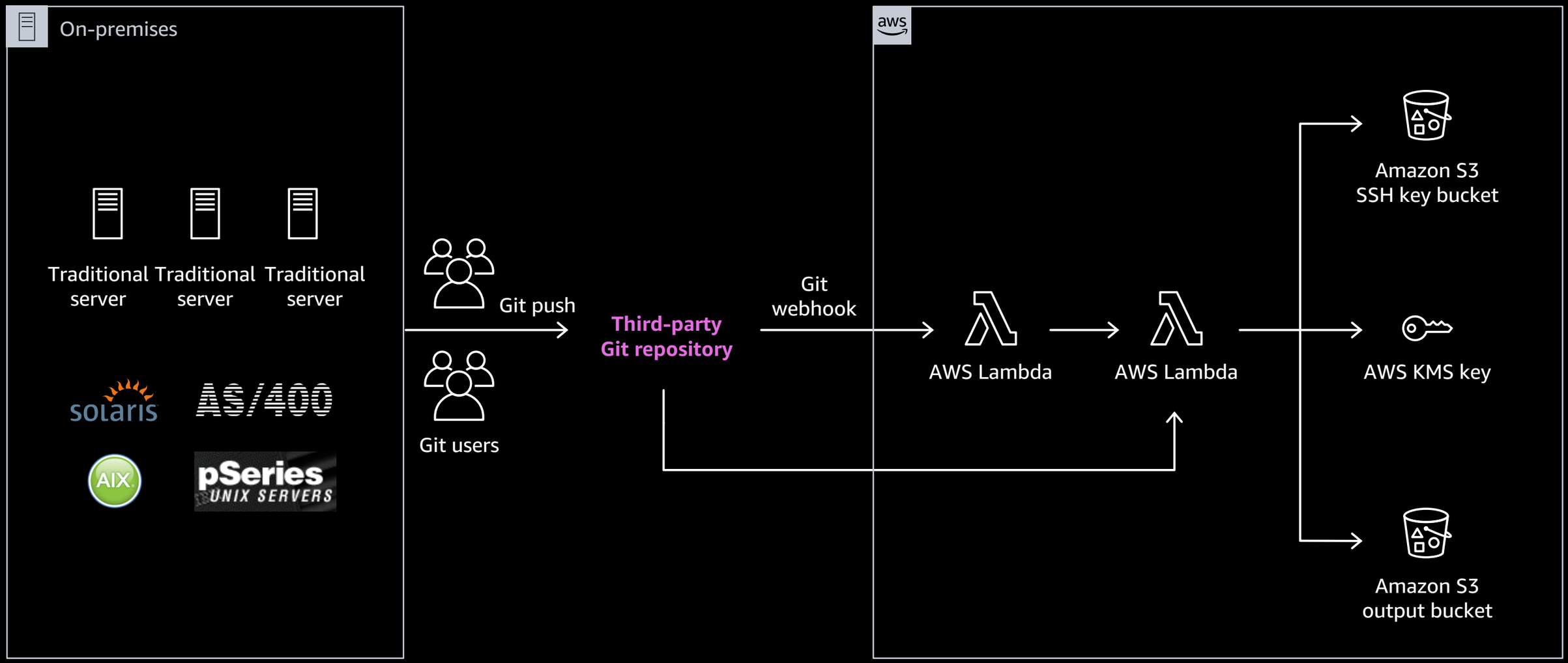
- Flexible consumption and contract models
- Easy and secure deployment, almost instantly
- One consolidated bill
- Always evolving



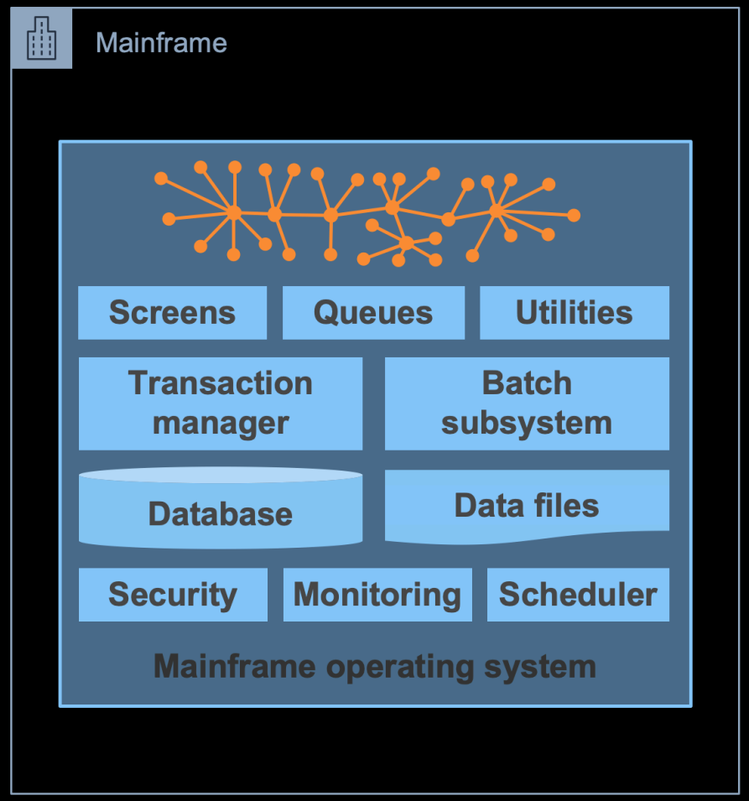
Application migration strategies



Refactoring



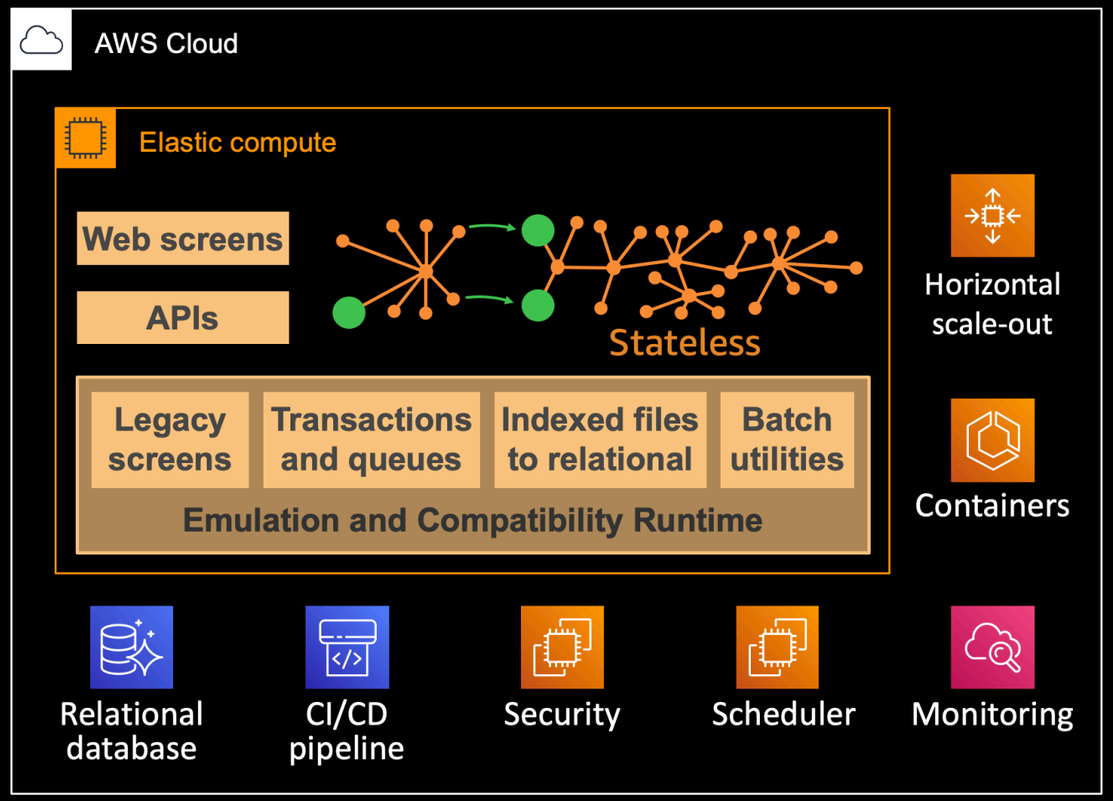
Refactoring Mainframes



Short-term migration

Code ported or converted and then recompiled

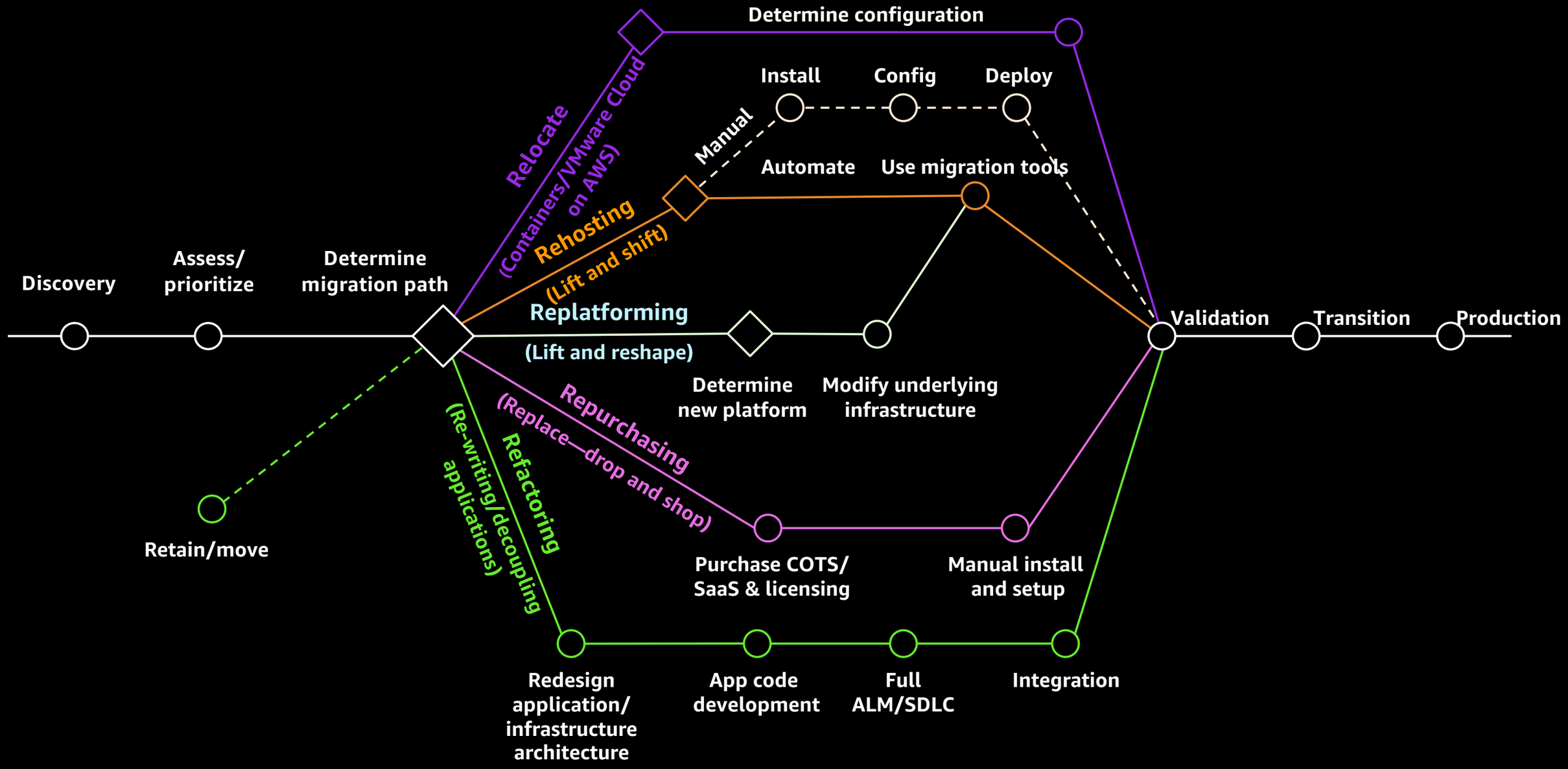
Data converted and migrated



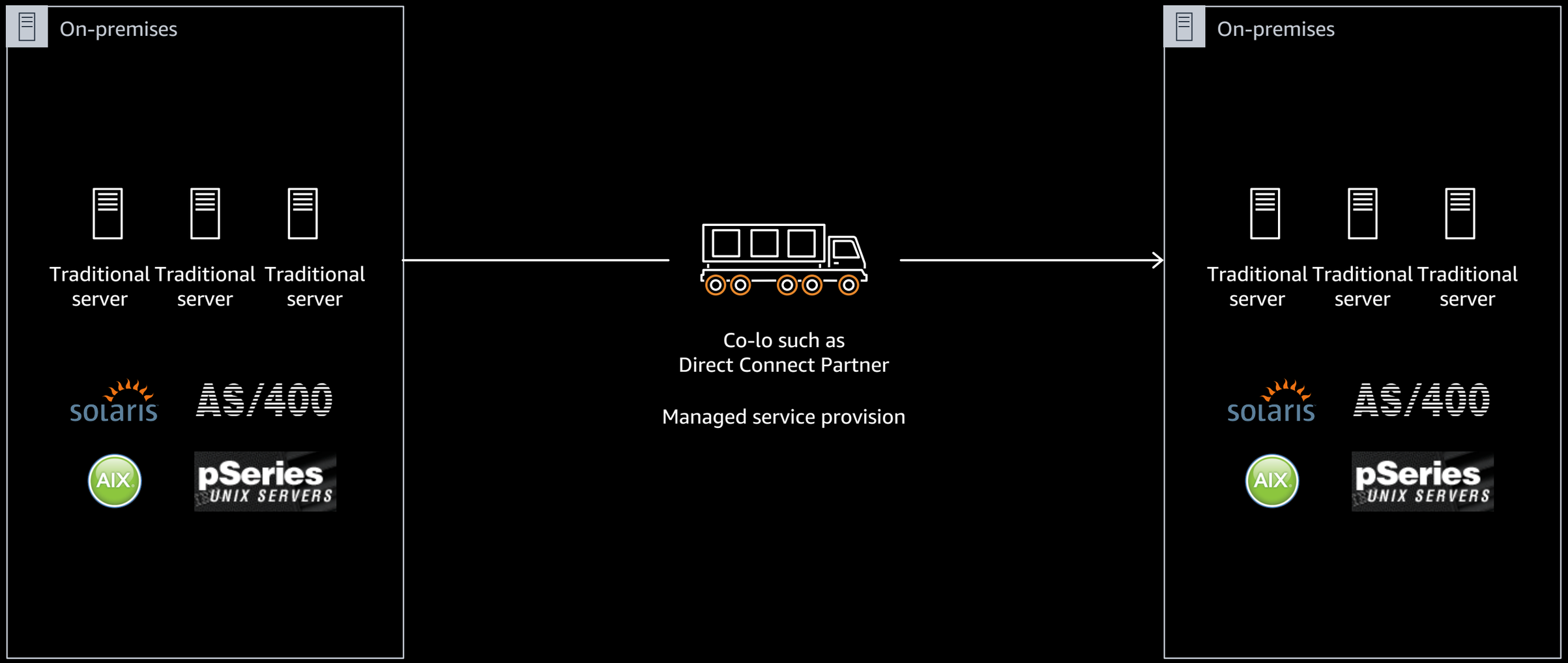
Migration accelerators – **emulation** and **automated refactoring**

ENT307 Mainframe workloads: The fast track to agility - 12TH December 2020 - 11:15 am to 11:45 am

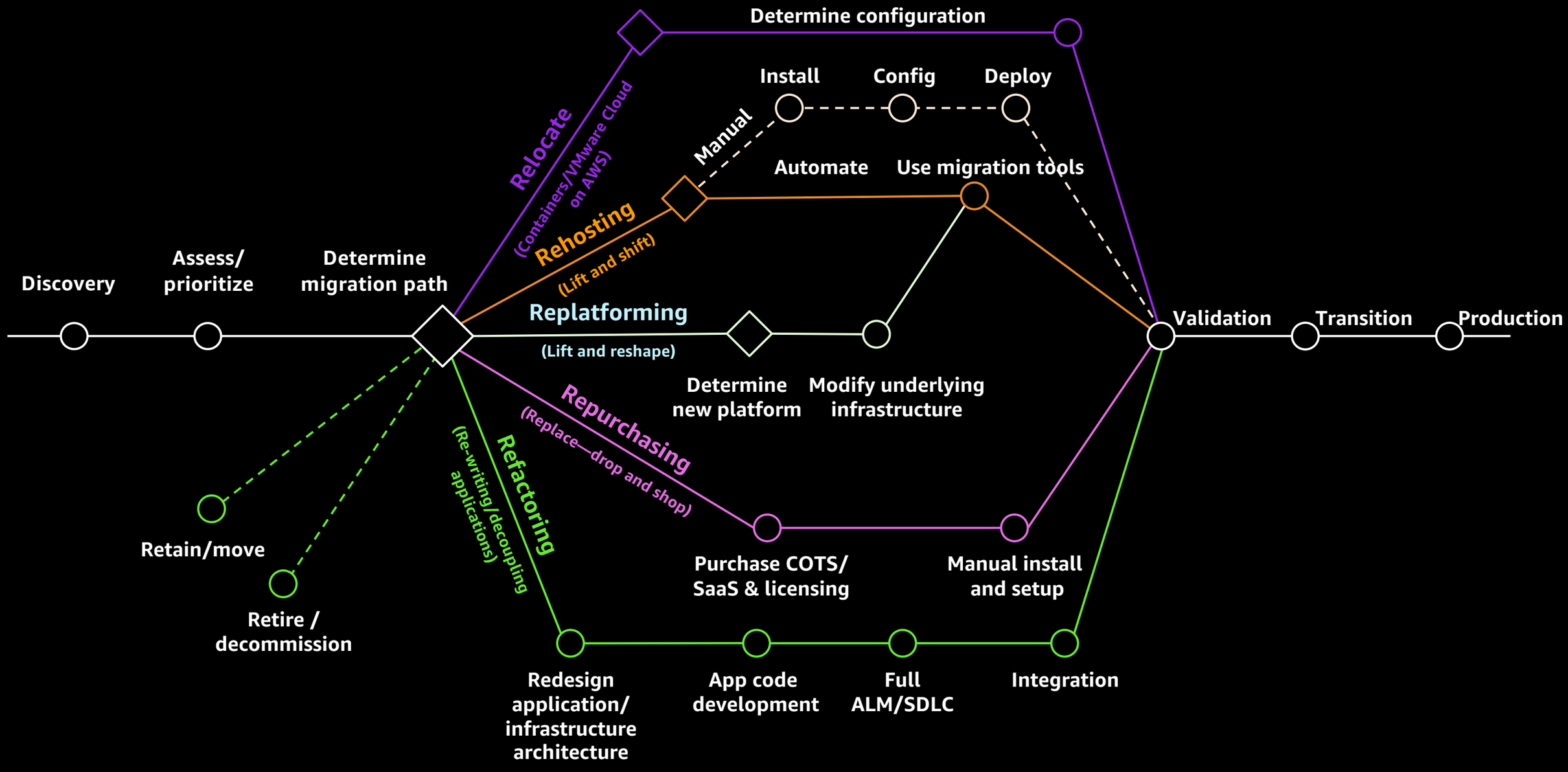
Application migration strategies



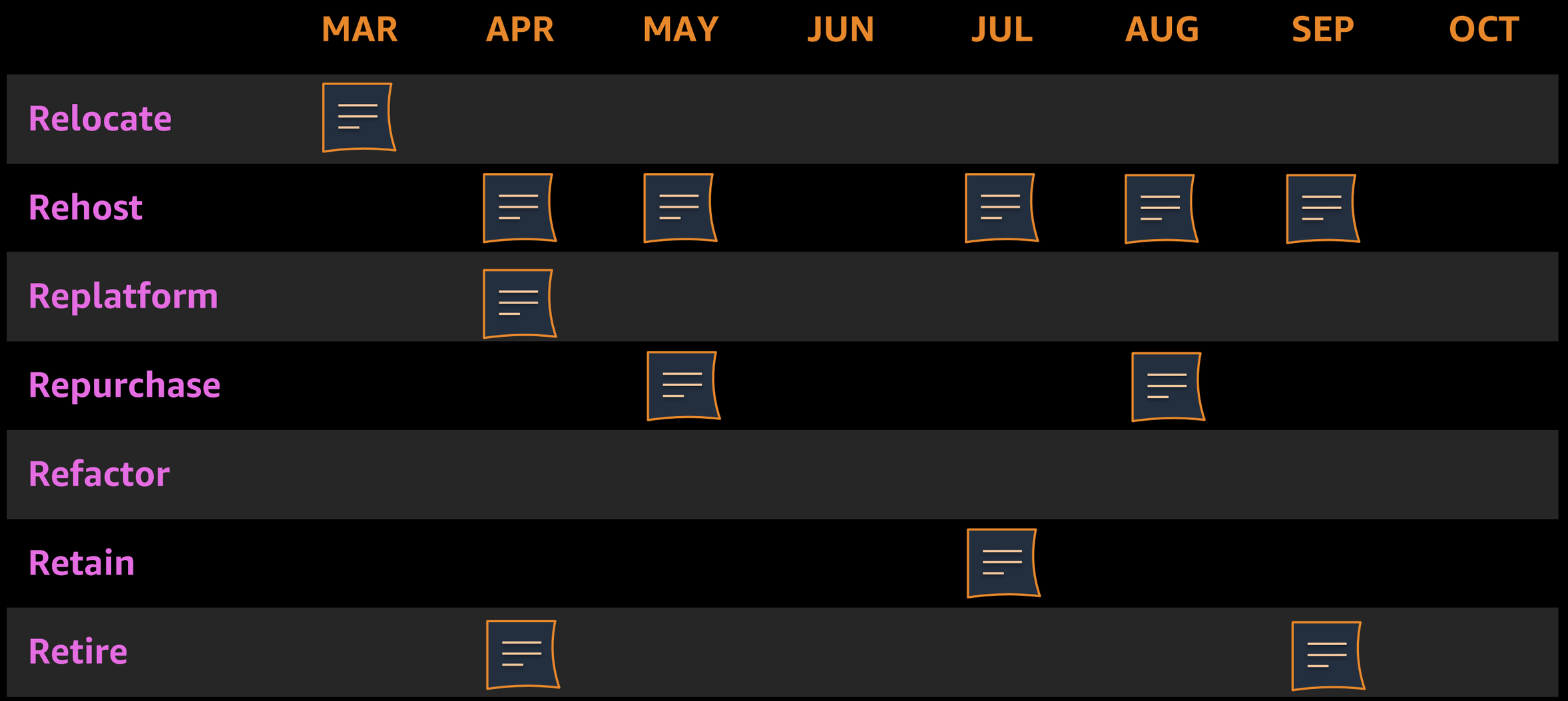
Retain


On-premises
Traditional server
Traditional server
Traditional server
solaris
AS/400
AIX
pSeries UNIX SERVERS
Co-lo such as
Direct Connect Partner
Managed service provision
On-premises
Traditional server
Traditional server
Traditional server
solaris
AS/400
AIX
pSeries UNIX SERVERS

Application migration strategies



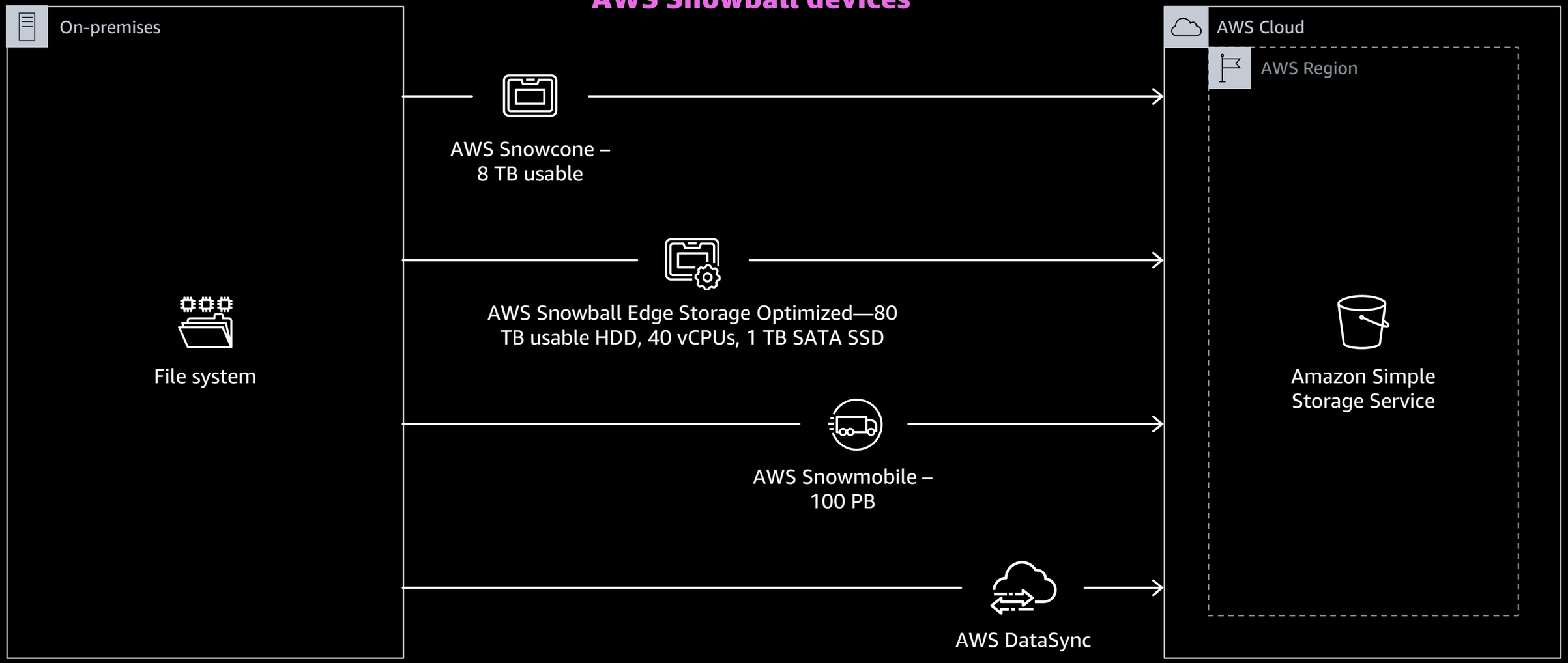
7 R swim lanes



	Pattern description	Percentage	
Relocate	As appropriate	TBD	
Rehost	Like-for-like application migration to target cloud	40%	**70%**
Replatform	Up-version of the OS and/or database	30%	
Repurchase	Appropriately leveraging SaaS & Marketplace	5%	
Refactor	Application architecture changes to cloud native	10%	
Retain	Customer will keep application or move to secure shared facility	5%	
Retire	Application and host decommission on source	10%	

Moving vast amounts of data

Thousands of customers have used AWS Snowball devices



Migration Acceleration Program

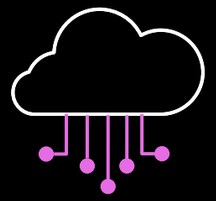


Skyscanner

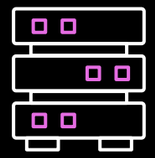
"Using a traditional data center it used to take us 6 to 7 weeks to launch a service; on AWS it can take us 15 minutes. We have thousands of services running in AWS versus a few hundred in our previous data center and that means more products and new features for travelers. Migrating to AWS has enabled Skyscanner to focus on innovating for the traveler rather than managing IT infrastructure."

Ashley Sole
Senior engineering manager

Skyscanner leveraged MAP to accelerate the migration of their entire infrastructure operation into the cloud



Increased agility and scalability



Migrated thousands of VMs and thousands of microservices and closed 5 data centers in 3 years



Reduced costs up to 70% due to platform optimization

Migration customer journey

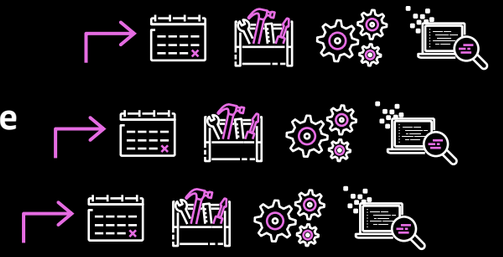
Assess

- Rapid discovery
- TCO calculation
- Briefings and workshops
- Immersion day

Mobilize

- Discovery and planning
- Landing zone
- Skills/center of excellence
- Migration experience
- Business case
- Migration plan
- Operating model
- Security and compliance

Migrate and modernize



- Migrate
- Operate
- Modernize

Create a case for change

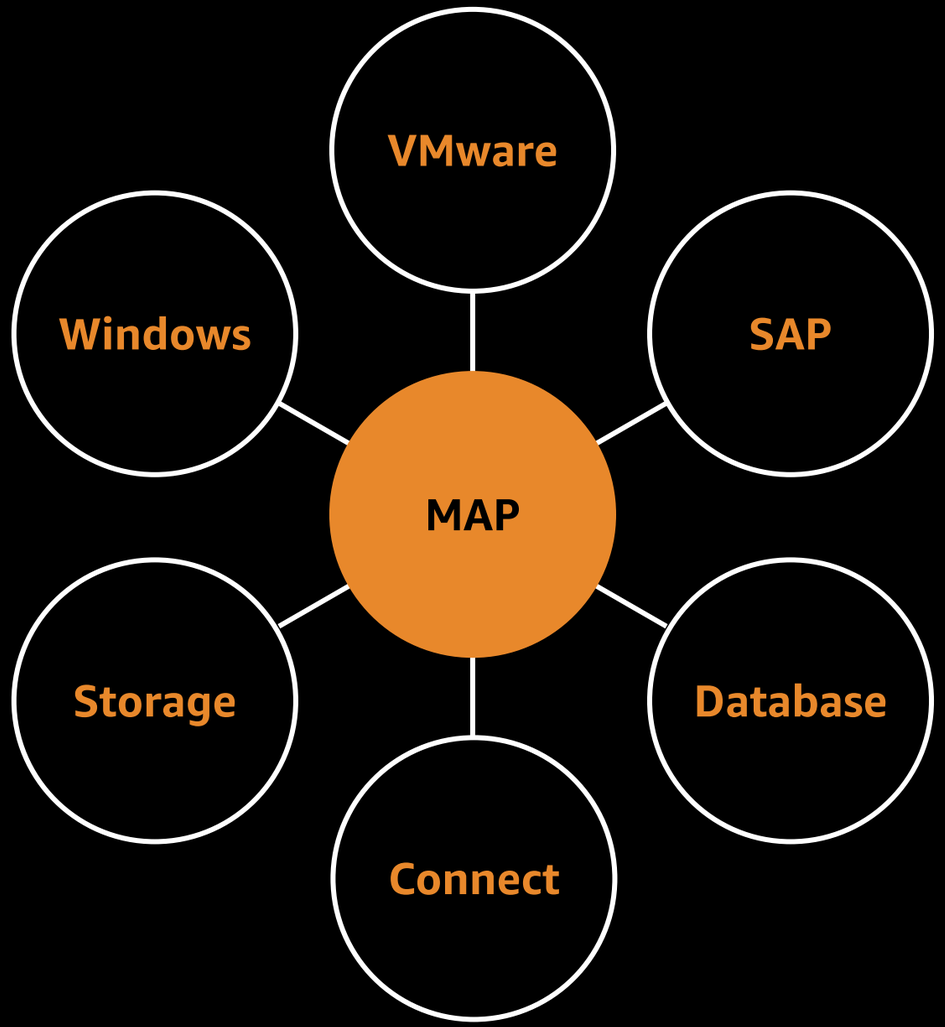
Mobilization through experiences

Accelerate migration at scale

Specialized workloads overview

AWS supports you with one or more of the following:

- Additional incentives
- Specialized services and tools
- Proof-of-concept investments
- Advisory and technical guidance
- Training



Tools to accelerate the journey



AWS
Migration Hub



CloudEndure
Migration



AWS Application
Discovery Service



AWS Database
Migration Service



AWS Server
Migration Service



AWS
DataSync



AWS
Direct Connect



AWS
Kinesis



Amazon
Connect



AWS
Snowball Edge



AWS
Snowmobile



AWS
Snowcone



VMware Cloud
on AWS

INVENTORY

RISC Networks

Cloudamize

ATADATA

TSO Logic

CloudHealth TECHNOLOGIES

turbonomic

BUSINESS CASE

Cloudamize

DEEP DISCOVERY AND PLANNING

RISC Networks

Cloudamize

ATADATA

turbonomic

APP DEPENDENCY MAPPING

RISC Networks

Cloudamize

New Relic

dynatrace

APPDYNAMICS
part of Cisco

WORKLOAD AND DATA MIGRATION

ATADATA

ATTUNITY

rivermeadow
CLOUD MIGRATION

CLOUDVELOX

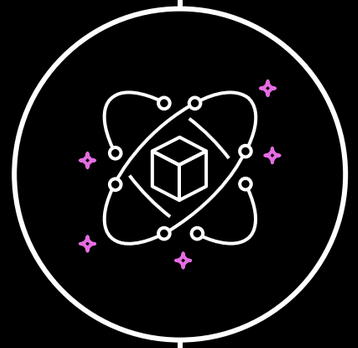
VALIDATION

New Relic

dynatrace

APPDYNAMICS
part of Cisco

Lessons learned: Migrate and Modernize phase



- Minimum Viable Replatforming
- Special Migration Squads
- Leverage partner expertise in tooling
- MAP credits can smooth the way
- Minimalize organization chart changes
- Visualize the waves of migrations for everyone
- Momentum and blockage removal is key!

Biggest lesson learned: Post migration cost optimization!



“Don’t let perfect be the enemy of good enough.”

Voltaire

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