
AWS
re:Invent
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Geisinger's full-scale migration to AWS via self-funding

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About Geisinger Health System

Geisinger Health System (GHS) is a ~$7B ($3.8B NPSR, $3.1B premium revenue), Pennsylvania-based integrated delivery network that provides healthcare services across administration, payer, and providers to incentivize the entire patient experience

4 organizational pillars



Patient care



Health plan



Academics



Research

Highlights

- **13** hospital campuses, **261** clinic sites
- **3,200** employed providers; **56,000** contracted providers
- **552,000** member health plan

Teaching and innovation

- **2 research centers**
  - 1,000+ active research projects
- **1 college of medicine – Geisinger Commonwealth School of Medicine**
  - 526 MD and MBS students
  - 2,300 nursing students
  - 635 physician resident and fellows

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Geisinger transformation: why now?

In an ever-changing world, we must take decisive action to transform so we can continue to deliver on our promise to make **better health easier for everyone we serve**. Geisinger will focus its efforts to achieve **significant performance improvement and growth.**

Prepare for the Future

It is imperative that we improve operational and financial performance so we can continue to deliver on our promise to make better health easier for everyone we serve

Achieve 4% Margin

We will focus on increasing our margin and improving performance through optimizing operations and identifying opportunities to drive efficiency

Better Serve Our Community

This transformation will position us for the future of serving our patients, members, students, and communities by becoming more competitive, more consumer-focused, and more adaptable to change

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What do we stand to gain?

The Geisinger transformation will enable the organization to improve its performance, provide better care, and create an adaptable business model that will ultimately create a stronger organization that is more equipped for the future



Better Care

- Geisinger's differentiating strategies and capabilities
- Better health for patients
- More affordable health coverage for members
- Innovative and technologically advanced treatment options



Performance Improvement

- Become more efficient and effective
- Achieve sustainable performance improvement
- COVID-19 crisis has catalyzed the need for healthcare transformation



Adaptable Business Model

- Optimize operational and financial performance
- Forward-focused business model
- Maximize growth potential
- Drive efficiency

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Geisinger's journey

Overview

SOLUTION

An extensive review of the application environment in order to identify cloud suitability and target state disposition

- **1500 applications**
- **7500 servers**
- **3 data centers**

Detailed review of overall operating environment resulting in best in class, agile IT operations

- Business capability mapping for application future state
- Robust application governance structure
- Cloud-native, leading-edge security constructs
- Product-based, cloud-first operating model
- Cloud service delivery model

IMPACT

Quantitative

- Condensed application portfolio from **1,500+ to 1,100**
- Reduced on-premises footprint by **40%**
- Cloud adoption from roughly **10% to 90%+**
- Optimize staffing by **12%**

Qualitative

- Strong platform for **innovation** and **analytics**
- Highly inoperable **data strategy** and architecture
- Industry leading **security** constructs
- Strong ongoing application and infrastructure **governance**
- Significantly improved **time to market**
- **Digital front door** capabilities for members

Efficiencies gained

25%
Application reduction

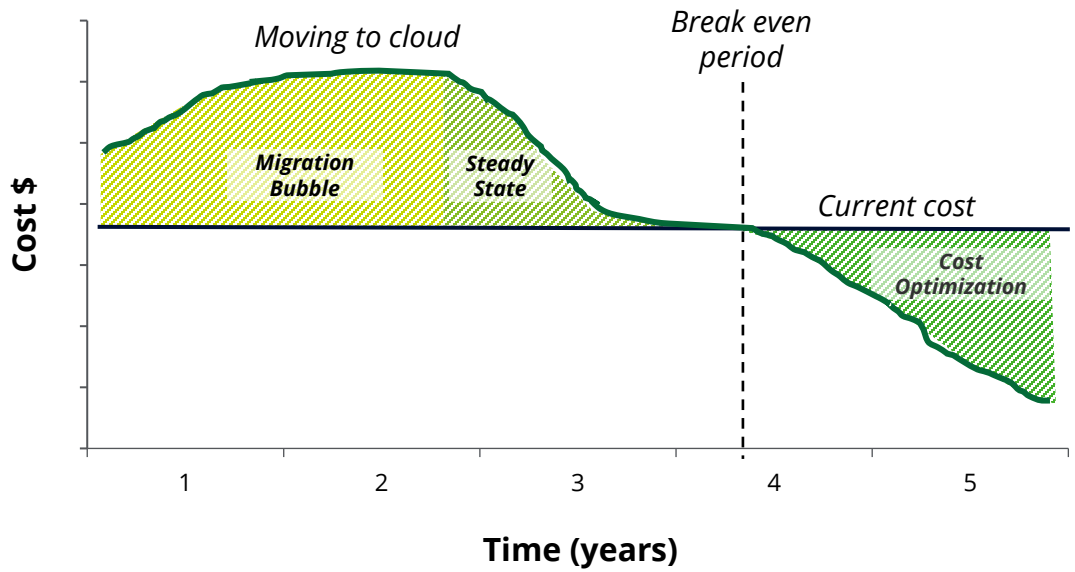
10–15%
Operational ongoing savings

From 10%–90%
Target state to future state cloud adoption

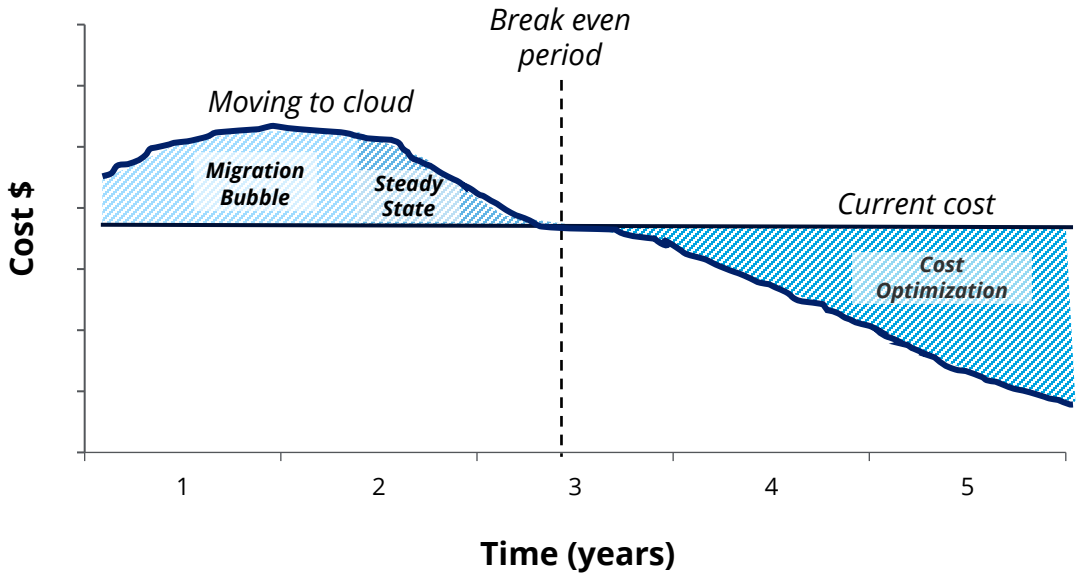
Self-funded approach

A high-level business case will consider multiple phases in cloud transformation, comprised of various cost and benefit components that could either be one-time occurrences or recurring costs/benefits

Typical cost profile



Geisinger cost profile

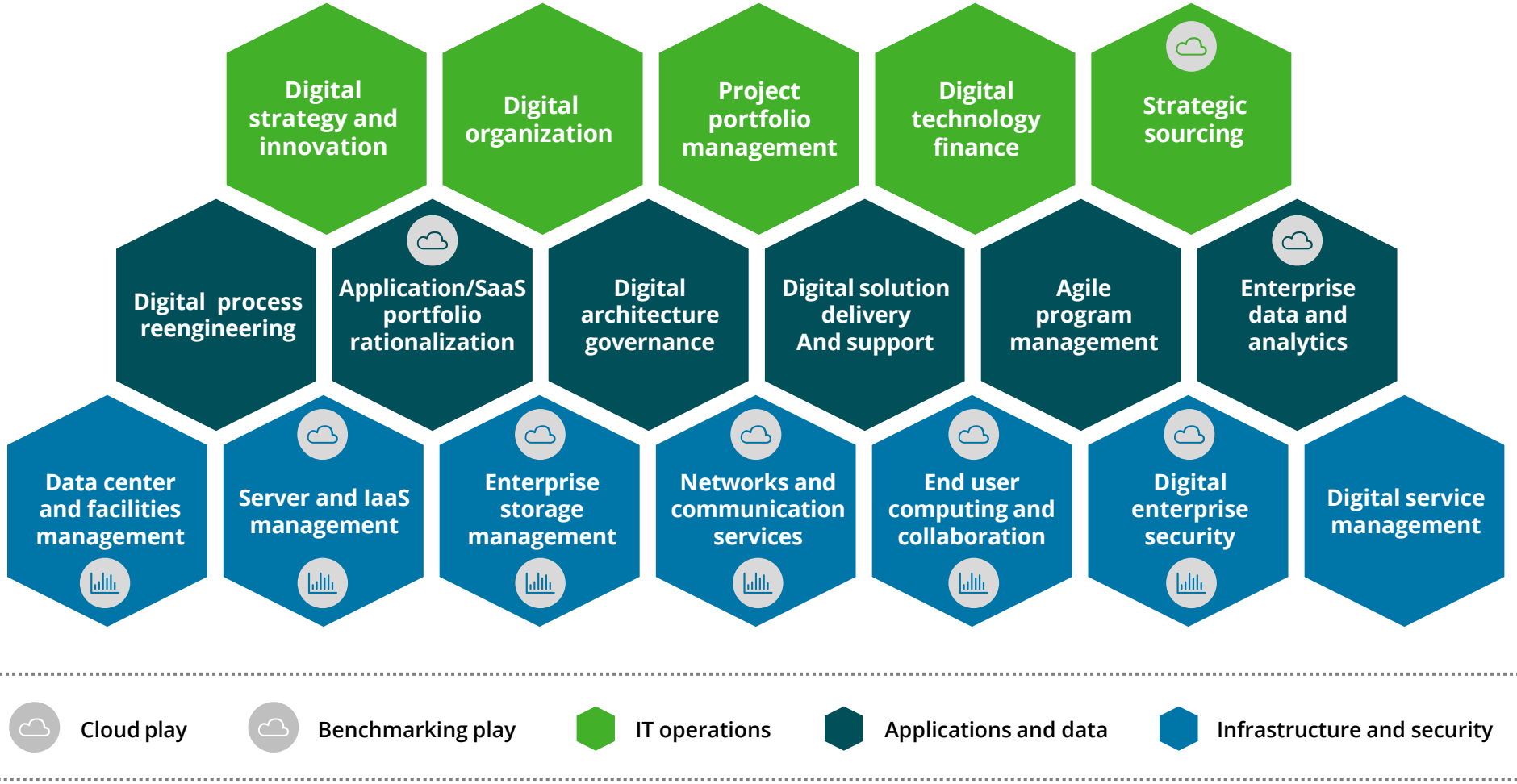


Margin-improvement initiatives such as **application rationalization** and a **refreshed operating model** can **self-fund** major cloud transformations, expediting the time to steady state and cost optimization.

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Self-funding cost optimization framework

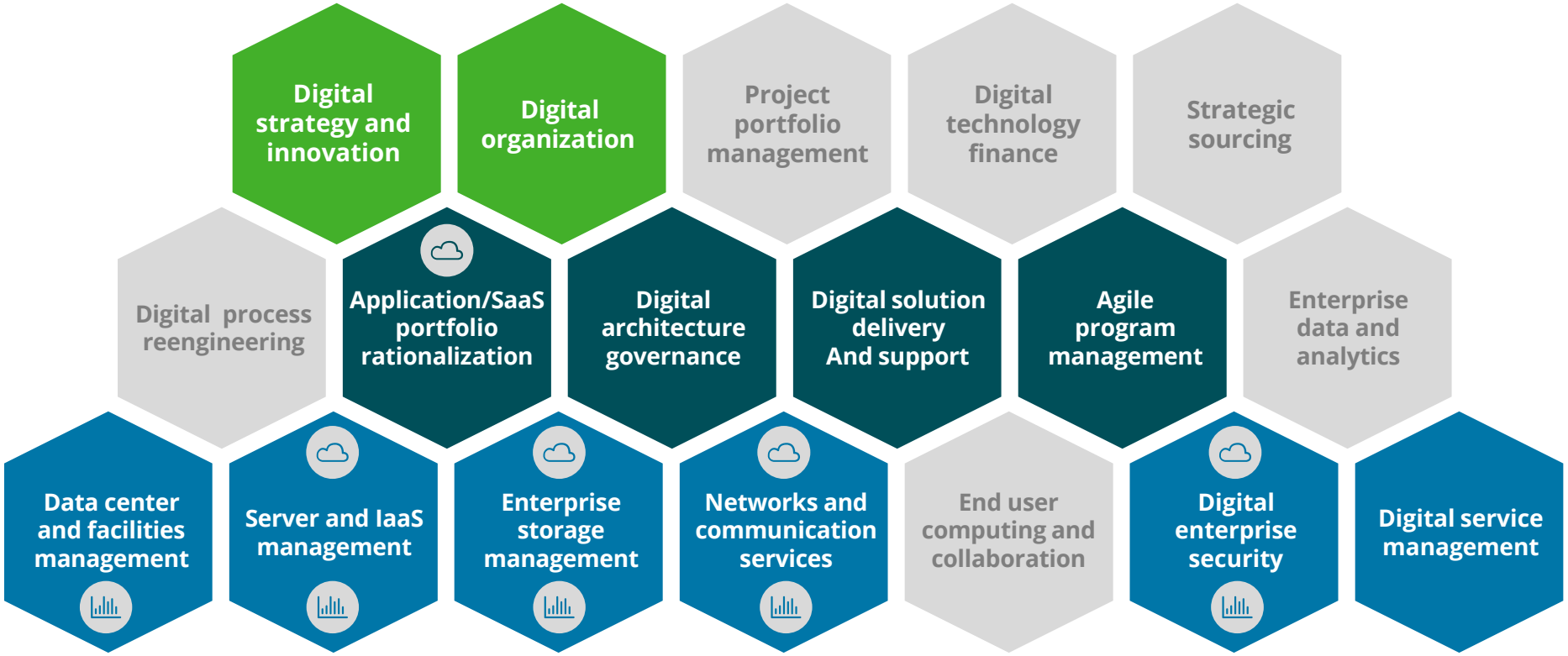
The framework offers a holistic approach for a business that has a varying mix of traditional and as-a-service models, with plays segregated in three categories within the enterprise – **digital IT operations, applications and data, infrastructure and security –** with the goal of identifying cost optimization levers that can help to self-fund a **transformation.**



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Geisinger's journey

Organizations should decide their migration strategy after conducting an assessment on their current state to evaluate how mature they are

PHASE 1

An organization-wide **cloud vision and strategy** has been defined and signed off with business units which include the top-down qualitative and quantitative business case analysis for the following:

- **Operational model transformation**
- **Application modernization**
- **Infrastructure and security modernization**

PHASE 2

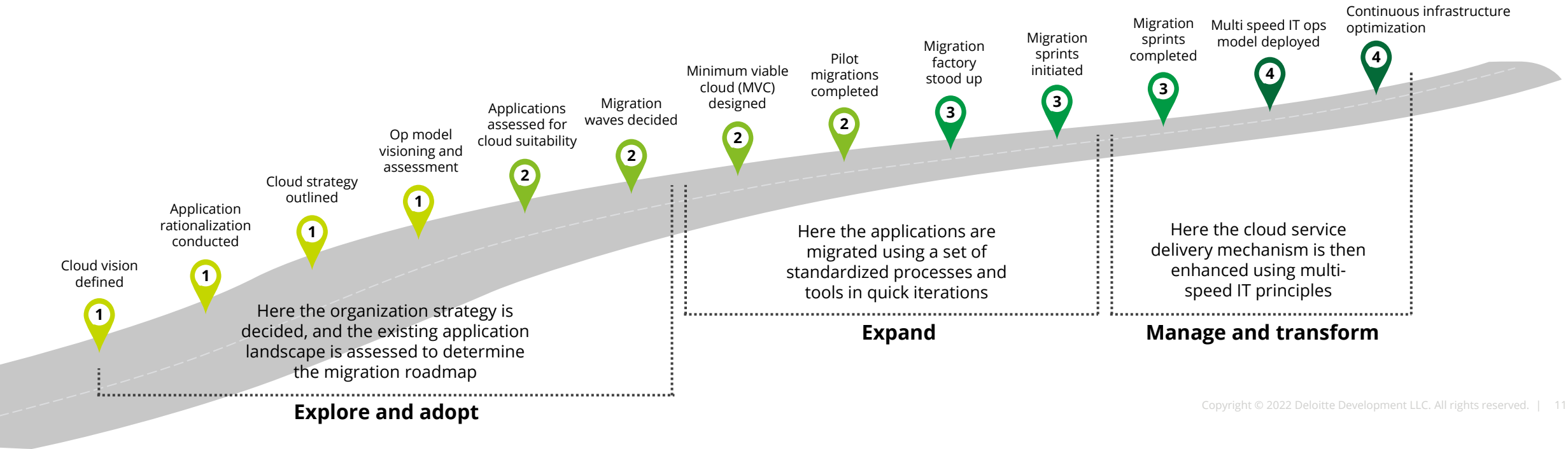
Application rationalization is conducted to streamline the application portfolio and enable enterprisee standardization**.** **Business capability mapping** is leveraged to identify cost savings opportunities and ensure that each application meets a unique business function.

PHASE 3

Cloud-suitable applications Are identified, and **wave planning** is completed. **Migration factory** has been stood up and identified applications have been migrated to cloud.

PHASE 4

A **multi-speed IT operating model** has been deployed to deliver services as per business demands. Efforts to **optimize and fine-tune** the AWS infrastructure governance structure implemented.



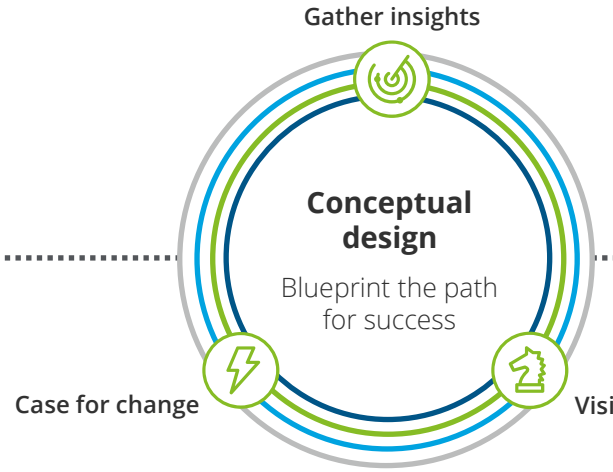
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Technology operating model delivery approach

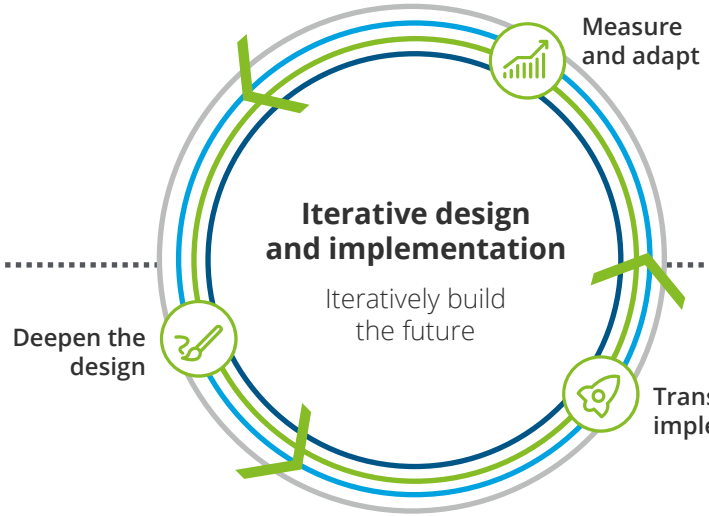
Implementing a new operating model is a multi-phase transition journey. Typically this journey starts with a conceptual design that provides the mandate and direction on which to base the transformation.



Rapid review of current operations, and intensive co-design sessions to agree vision, objectives and roadmap for the future operating model.



Definition of a "fit for purpose" operating model that drives business value within specific industry context and balances high-torque enterprise operations and high-speed innovation.



Incrementally design and implement the operating model by technology domain, region, function or capability; continuously learning and improving. Optimize the IT operational model based on the cloud service delivery model structure.

Ways of working | Culture and capability | Workforce | Tooling

Deepen the design

- Product and value stream design
- Detailed process and ways of working design
- Service catalogue and SLA definition
- Metrics, KPIs, and scorecard design
- Governance model and charters
- Location strategy and planning
- Skills and capability assessment
- Learning and capability development planning
- Detailed org. design (sizing, job canvases, and costing)
- Talent strategy
- Workforce transition and acquisition planning
- Technology and tooling design and selection

Transition and implement

- Pilot products and value streams
- Coach process and ways of working implementation
- Establish metrics and governance
- Manage service transition (e.g., TSA mgmt.)
- Tooling implementation
- Leadership coaching
- Training and development
- Change and communications
- Recruitment and onboarding
- Individual workforce transition

Key considerations for application rationalization

Improving application strategy is key to achieving business effectiveness while minimizing costs, aligning the right skill sets, and establishing more optimized IT processes. It delivers a target application portfolio that integrates business involvement for a greater business value

Application rationalization comprises

- Data element gathering
- Business capability mapping
- Business and IT alignment
- Validation workshops
- Application retention justification
- Identifying SaaS opportunities
- Current state spend analysis
- Identifying savings

To help you

- Reduce software costs
- Eliminate redundancies
- Enable enterprise standardization
- Improve IT portfolio management
- Generate insights

Resulting in potential of

15–20% decrease
in application licensing costs

30–35% reduction
in application portfolio size

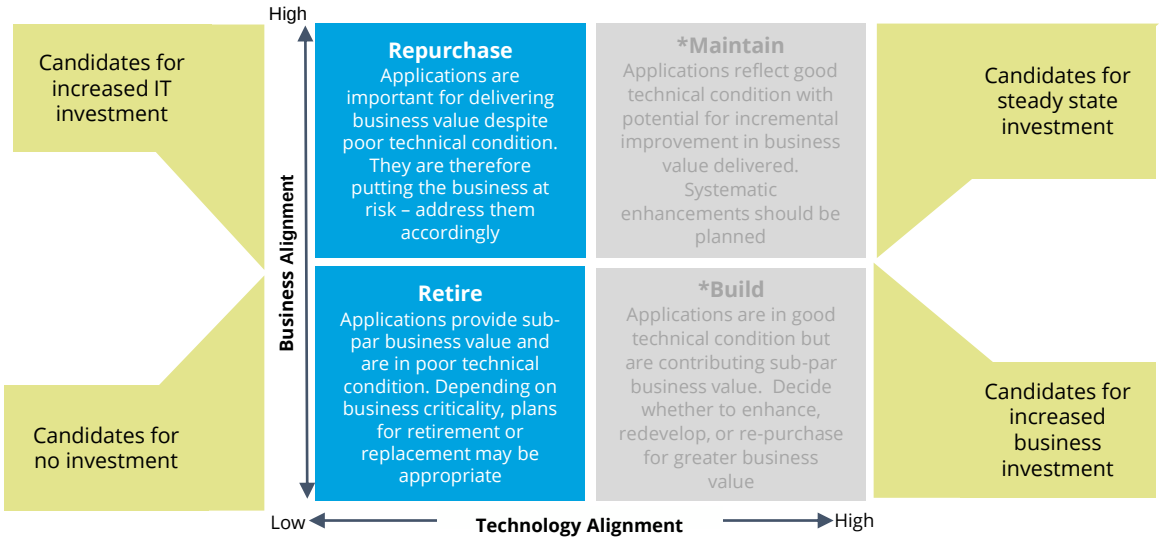
5–10% decrease
in annual run rate spend

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Application execution path framework

Application rationalization

Question answered: *How well is the application aligned to business and technology strategy/operations?*



Application target state path

Question answered: *Can and do we move the application to the cloud?*

By evaluating application infrastructure, operating system, platform, and technology stack, we can determine if an application is . . .

Hosted in cloud

Application is currently hosted on cloud at this time

Cloud compatible

Technology stack is supported in the cloud and can be migrated as-is

Cloud upgrade required

Technology stack component(s) require minor config upgrade(s) to be made cloud compatible

Cloud re-arch required

Technology stack is not supported in the cloud and requires to rearchitect to be hosted to on cloud

Additionally, by assessing associated business and technology costs and constraints, we can determine . . .

- What and how an application/family of applications can migrate to the cloud (cloud migration plan)
- Associated savings for moving to the cloud (migration business case)

Cloud Migration Path (6R's) Decisions

Quick wins

Retire

Application to be retired

Re-purchase

Re-purchase within the cloud

Retain	Re-host	Re-architect	Re-platform
Leave application where it is	Migrate and optimize to cloud	Re-architect to the cloud	Re-platform application to cloud

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Application rationalization: analysis overview

1,868 applications in the master inventory may be reduced to **1,091 applications.**

Quick wins

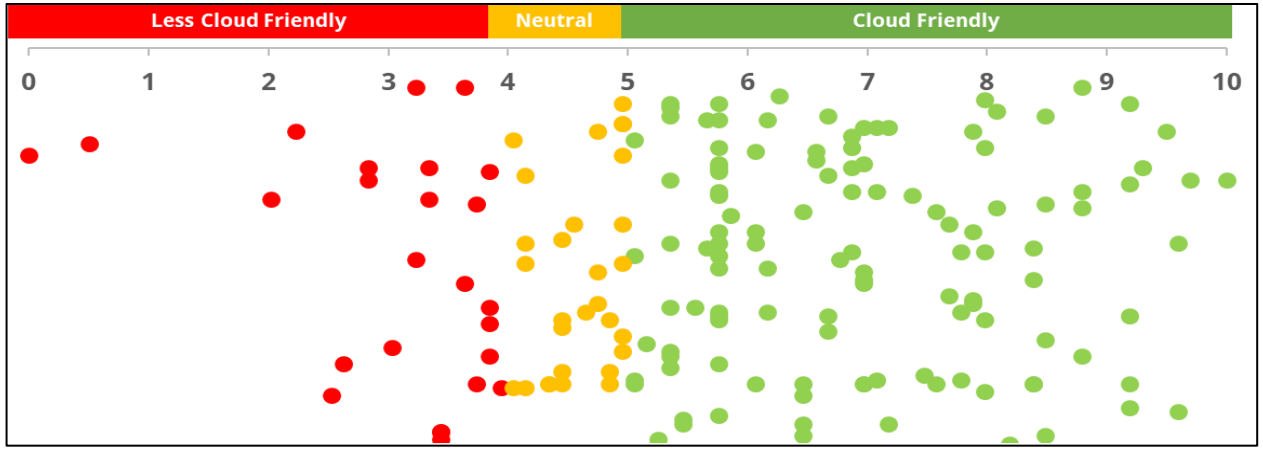
Starting master inventory – 1,868 applications[1]	# of applications Identified[2]	Running app count	
1 Retired applications – identified by Geisinger	365	1,503	↓
2 End of life applications – identified by Deloitte and Geisinger	341	1,162	↓
3 Redundant and duplicate applications	• 31 – Redundant • 3 – Duplicates	1,128	↓
4 Applications with SaaS replacement options	22	1,128	–
5 Enterprise standardization	5	1,123	↓
6 Priority-based applications	32	1,091	↓

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Cloud suitability analysis

Dashboard view of overall cloud suitability and placement analysis in scope applications

Cloud Suitability Scatterplot



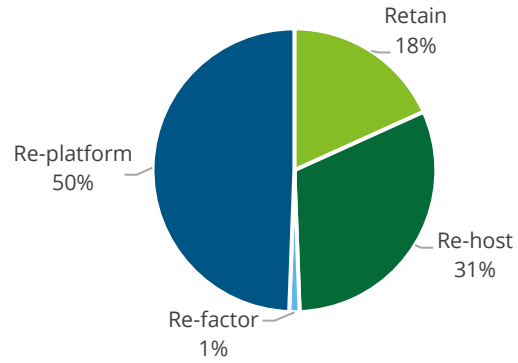
Cloud suitability indicates the compatibility of an application or an IT workload to run in a cloud environment. An evaluation of an application's cloud suitability determines its **cloud maturity**, **placement,** and **migration methodology**.

This output then informs **infrastructure/server migration strategy**.

After undergoing suitability assessment, applications are placed in one of 4 buckets:

Retain	Re-host	Re-architect	Re-platform
Leave application where it is	Migrate and optimize to cloud	Re-architect to the cloud	Re-platform application to cloud

% of applications per migration pathway



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Key considerations for cloud optimization

Our financial analysis has modeled many cloud best practices for optimizing cloud costs

Optimization lever	Increase in cloud cost due to non-optimization[1]	Qualitative benefits
Right sizing	**60–70%**	Greater opportunity for consolidation and flexibility of **scaling up and down** based on performance needs and seasonal trends
Uptime optimization	**40–50%**	Enables better integrations between operational and technology teams for **centralized governance** when operating application workloads on the cloud
Instance types and pricing model	**20–30%**	**Optimized application performance** (i.e., enables Geisinger with a variety of performance options that can be well suited for meeting the application delivery, offering flexibility when heavy workloads are not required)
Vendor discounts	**15%**	**Commitment from vendor** (i.e., training, support, etc.) towards Geisinger cloud transformation goal and further savings opportunities when considering future workloads

[1]*The increase in cloud cost due to non-optimization has been estimated by removing an optimization level and evaluating its impact. The effect of non-optimization can magnify, in case multiple optimization levers are not implemented simultaneously.*

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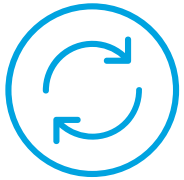
Guiding principles for grouping and sequencing

As the schedule is being prepared for the migration, several key aspects need to be kept in mind to avoid common pitfalls and adopt best practices



Business criticality

For re-host, low and medium criticality applications should be migrated first; highly critical and complex applications will be scheduled for later migration events.



Prod–non-prod environments

For re-host applications, non-production environments are part of different migration move groups and are scheduled for migration in a move group prior to production environments.



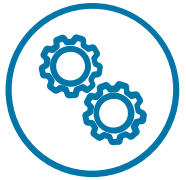
Resourcing considerations

Resource count within a pod will be optimized based on the current workload. In the first month, we will have fewer resources and will then gradually ramp up the number in the consecutive months.



Migration waves

In a move group, cut off for migration will be scheduled when the application taking the highest effort is completely migrated.



Application dependency

Standalone applications have been given priority over interdependent applications and will be migrated in the initial move groups to validate cloud capabilities.



Line of business (LOB) considerations

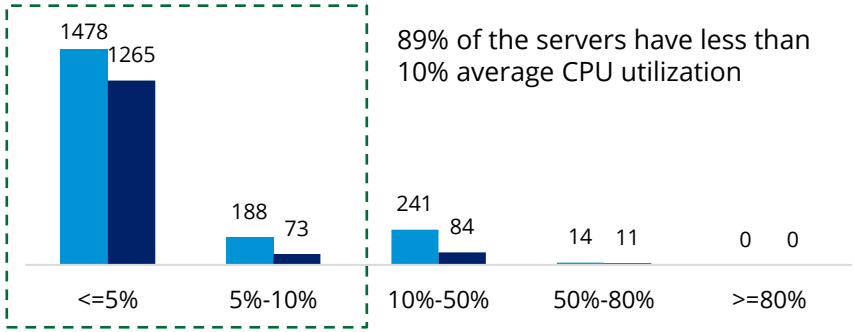
Clinical applications will be grouped and migrated together accordingly. Similarly, non-clinical applications will be grouped and migrated together. Non-clinical applications are prioritized over clinical applications.

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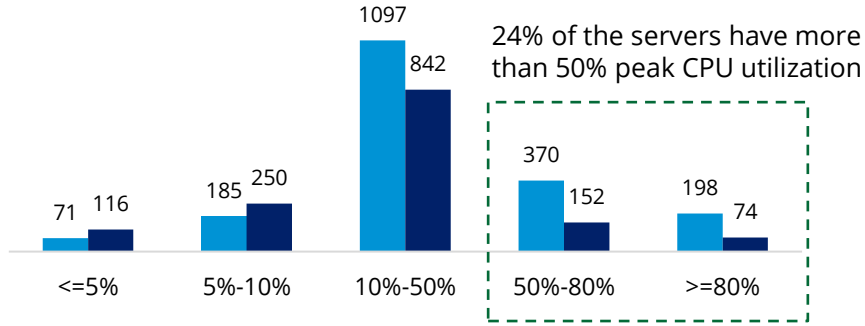
Current landscape analysis – server utilization metrics

Key insights could be drawn from the CPU and memory utilization reports

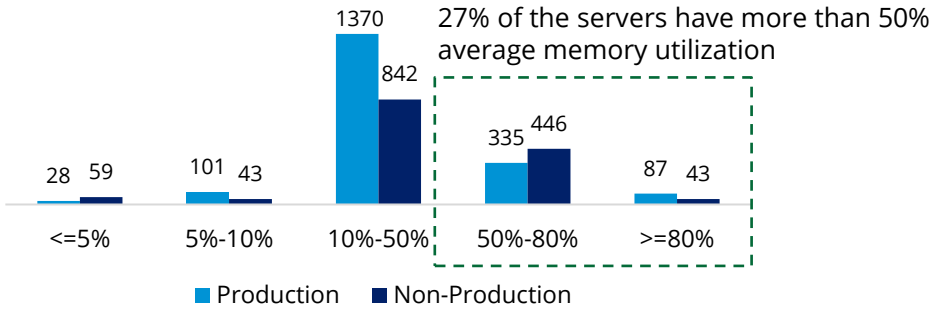
Server distribution by average CPU utilization



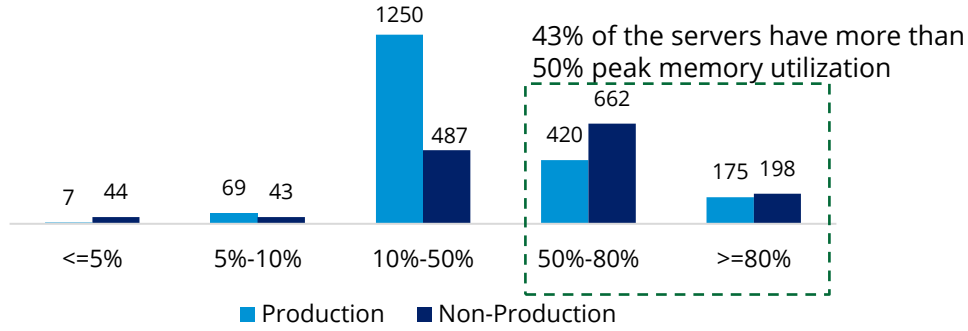
Server distribution by peak CPU utilization



Server distribution by average Memory utilization



Server distribution by peak memory utilization



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EHR on AWS: a case for change

Oversized static compute capacity
>3x spend

Expensive data growth
12x spend

Geo-redundant disaster recovery is expensive
Secondary data center facility



Citrix is oversized to accommodate for peaks
Refreshes approximately every three years

Epic release cycle is accelerating quarterly release cycles

Access to cost-effective resources is challenging

Reduce operating costs | Sustain through automation | Optimize workforce

Resulting in potential of

30%–60% savings
compared to legacy hosting or on premises by using AWS **cloud hosting**

90% reduction
in deployment time

Reduce human error
through automation of builds and cloud managed services automation

60% reduction
in IT spend for the EHR DR environment

Functional and performance testing showed improved performance post migration of EHR on AWS

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Cyber risk profile vision

Geisinger's cyber risk profile increases as it looks to embark and operate on cloud

Current state risk profile

Accelerated digital transformation has **amplified** both the **attack surface and likelihood**

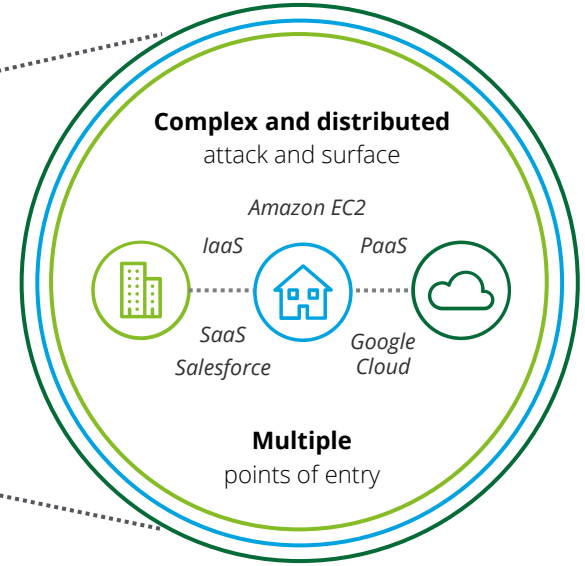
Traditional attack surface

PCIDSS
CIS
FISMA
NIST
CCA
FedRAMP

Limited points of entry

Cloud controls framework

Future state risk profile



Future state security considerations

- **Increased attack surface** due to heterogenous ecosystem (hybrid environment) and involvement of multiple parties and cloud services (IaaS, PaaS, SaaS)
- **Concentration and security** of data stored in cloud
- **Sophisticated and evolving** threat vectors
- **Regulatory focus** and ever-evolving compliance landscape
- **Right-sizing the operating model** for hybrid environment to address day-to-day activities

The combination of Geisinger and AWS security capabilities and technologies will position the organization to protect its assets both on premises and in the cloud

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AWS services used

Cloud Compute Services



Amazon EC2

Application Integration Services



Amazon SNS



Amazon SQS

Databases



Amazon RDS

Developer Tools



AWS CLI



AWS tools and SDKs

Management and Governance



Amazon CloudWatch



AWS Systems Manager



AWS CloudTrail



AWS Control Tower



AWS CloudFormation



AWS Config

Migration and Transfer



AWS Application Migration Service

Network and Content Delivery



Amazon CloudFront



Amazon Route 53



Amazon VPC



AWS Direct Connect



Elastic Load Balancing



AWS Transit Gateway

Security, Identity, and Compliance



AWS Firewall Manager



AWS Shield



AWS Identity and Access Management (IAM)



AWS WAF



AWS KMS



AWS Secrets Manager

Storage



Amazon EBS



Amazon S3



Amazon FSx



AWS Elastic Disaster Recovery

Lessons learned and key takeaways

Ops model, governance, and partnering

- Leverage data as a starting point to identify potential opportunity in achieving cost optimization targets
- Identify and execute quick wins to continue deployment of governance committees and hiring of tech partners
- Promote automation and self-service to increase productivity and speed of delivery
- Organize around a business-centric mindset to engage IT customers and allow for targeted prioritization

Application rationalization

- Drive enterprise standardization by consolidating redundant applications as opposed to encouraging application-specific knowledge
- Communicate importance of an application's capability versus the application itself to prevent application passion from inhibiting decommissioning
- Align on a t-shirt sizing methodology in the case of an outdated accounts payable system
- Establish an intake process and governance structure to ensure that additional sprawl of the application portfolio does not erode completed rationalization effort

Infrastructure

- Ensure successful organizational change management through cloud education at the onset
- Identify opportunities to take advantage of cloud native capabilities
- Spend the time to architect network and landing zones to ensure maximal risk mitigation
- Align on an overarching data strategy to address multiple disparate data stores and lack of data governance
- Establish a coordinated enterprise approach to adopt vendor tools and processes
- Develop and socialize an enterprise migration plan to align timelines and goals across different business units
- Establish a cloud center of excellence (CCOE) to serve as overarching governance on investments and cloud spend

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