

Digital Backbone

The Sustained Need for
Enterprise Computing Jobs

April 2021

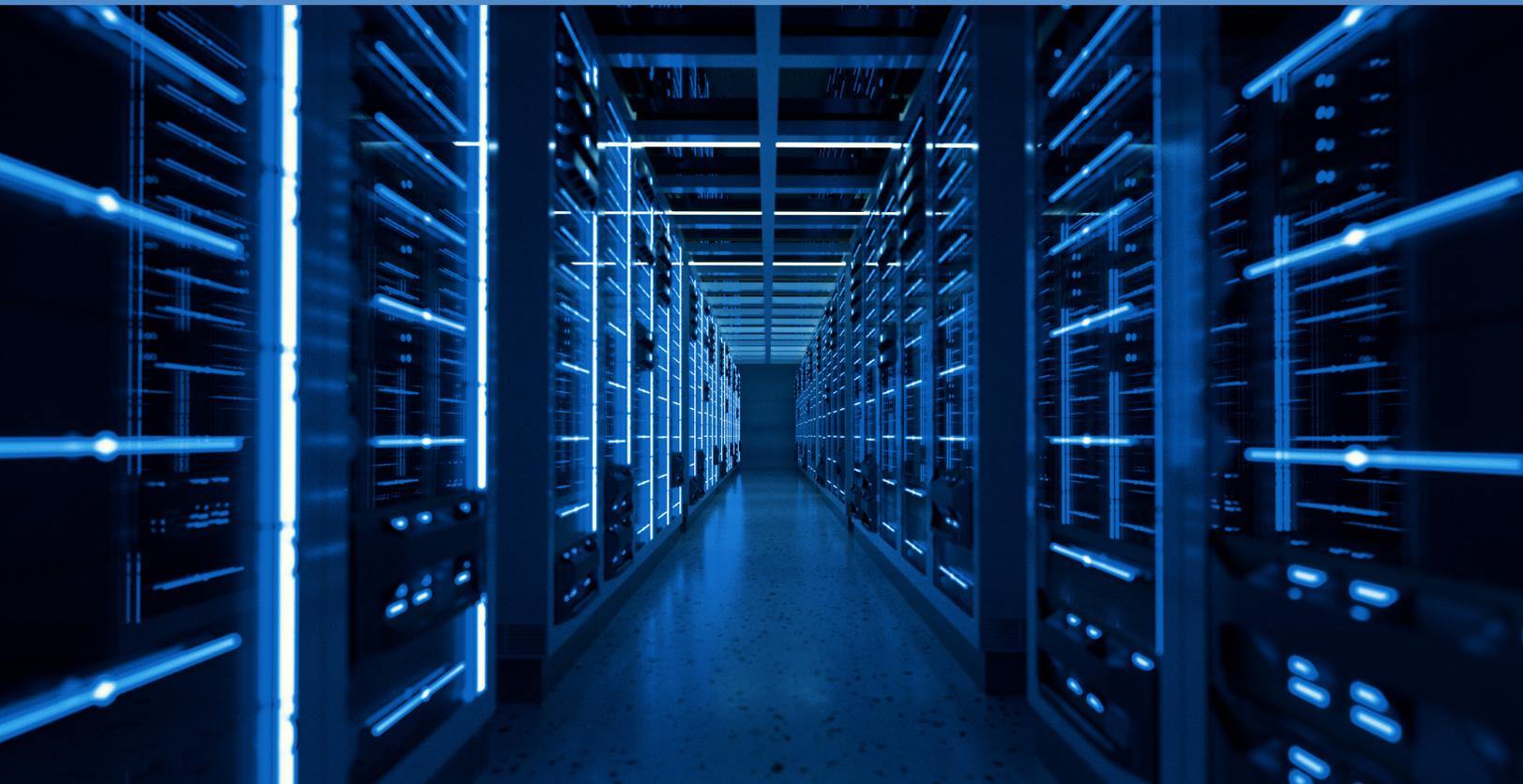




Table of Contents

1.	Executive Summary	pg 4
2.	Introduction	pg 7
3.	Findings	pg 9
4.	Conclusion	pg 21
5.	Methodology	pg 23
6.	Appendix	pg 26
7.	Acknowledgments	pg 31

1.

Executive Summary

Information technology is rapidly evolving, with key innovations aiming to disrupt how modern business is done. During this era of digital transformation, firms rely on well-established enterprise computing technologies to power their most important business processes. Enterprise computing technologies ensure that financial transactions, health information processing, and other critical high-volume data tasks are performed reliably and securely. This essential, but often overlooked, role of enterprise computing offers valuable opportunities for professionals seeking long-term career prospects in information technology.

Enterprise computing is here to stay:

Whether reflecting on current conditions or future plans, business leaders' needs for speed and flexibility have been amplified dramatically. Given firms' reliance on infrastructure for critical, high-volume data capabilities, enterprise computing roles hold essential and ongoing value for employers. The critical function of enterprise computing for financial and technical services firms creates robust job opportunities for technical professionals.

Java is a key crossover skill for information technology professionals looking to enter the enterprise space.

Core enterprise computing skills are

widely applicable: Competencies in core technologies – mainframe architecture, COBOL, Job Control Language, Java, and Customer Information Control System – constitute a foundational skillset for enterprise computing roles. As a general-purpose language, Java is a key crossover skill for information technology professionals looking to enter the enterprise space. Together, this skillset provides a common platform to high-demand occupations with diverse functions in enterprise computing, including Software Developers, Database Administrators, and Computer Systems Engineers.¹

Technical specialization unlocks job

opportunities: Career pathways in this space track with business-critical applications of enterprise technologies, namely mainframe architecture software development and systems engineering. Two specialist roles – Application Developers on Z and System Administrators for Z – offer promising opportunities in these respective areas, with consistent demand for their distinct competencies.

¹ In this paragraph and the two that follow, United States data serves as a model for global trends.

Enterprise skills offer entry-level salary premiums: Enterprise computing roles offer early-career professionals a salary premium over comparable non-enterprise positions. For roles requiring less than two years of experience, Application Developers on Z and System Administrators for Z earn \$3,000 and \$4,000 more annually, on average, than comparable non-enterprise roles.

Key proficiencies hold long-term career value: Enterprise computing skills hold or increase in market value throughout the course of one's career. COBOL, Java, and JCL proficiencies are requested at consistent rates for both early-career and senior roles, while CICS and Virtual Storage Access Method competencies see increasing demand as experience increases. Taken together, enterprise computing specializations are low-risk, high-reward investments that pay dividends over the course of one's career.



2.

Introduction

Information technology is widely recognized as a dominant force in today's job market. While demand for computing professionals has grown substantially in recent years, the information technology labor market remains incredibly competitive. Securing a job in information technology continues to be a difficult task, particularly for early-career professionals and those without a degree in computer science.²

In this challenging labor market, the enterprise computing field is quite well-positioned for technical professionals seeking new opportunities. Enterprise computing technologies provide businesses with infrastructure for critical high-volume data capabilities: Each day, enterprise technologies process over 30 billion transactions.³ Given firms' reliance on these technologies, enterprise computing roles hold essential and ongoing value for employers.

The vast majority of modern enterprise computing architecture is powered by the IBM Z platform, with Hitachi, Unisys, and Fujitsu serving niche market segments.⁴

As a key player in the development of modern enterprise technologies, IBM also actively works to meet firms' critical labor needs for enterprise computing professionals. Workforce development initiatives, such as the IBM Z Apprenticeship Program being piloted in the United States, establish a clear pathway into enterprise computing by connecting rigorous, specialized skills training with industry placements.

Enterprise computing offers viable, long-term career opportunities for those seeking information technology roles. This report places these opportunities into the global labor market context, including the identification of specific career pathways in enterprise computing, based on findings from the following representative countries: Australia, Brazil, Canada, Germany, India, the Netherlands, the United Kingdom, and the United States.

2 "Beyond Tech: The Rising Demand for IT Skills in Non-Tech Industries," Burning Glass Technologies and Oracle Academy, 2019.

3 "Why Staying Current is Important to IBM Z Marketing and its Clients," Evelyn Hoover, IBM Systems Magazine, May 2019.

4 "IBM Mainframe," HG Insights, accessed August 9, 2020, <https://discovery.hgdata.com/product/ibm-mainframe>.

3.

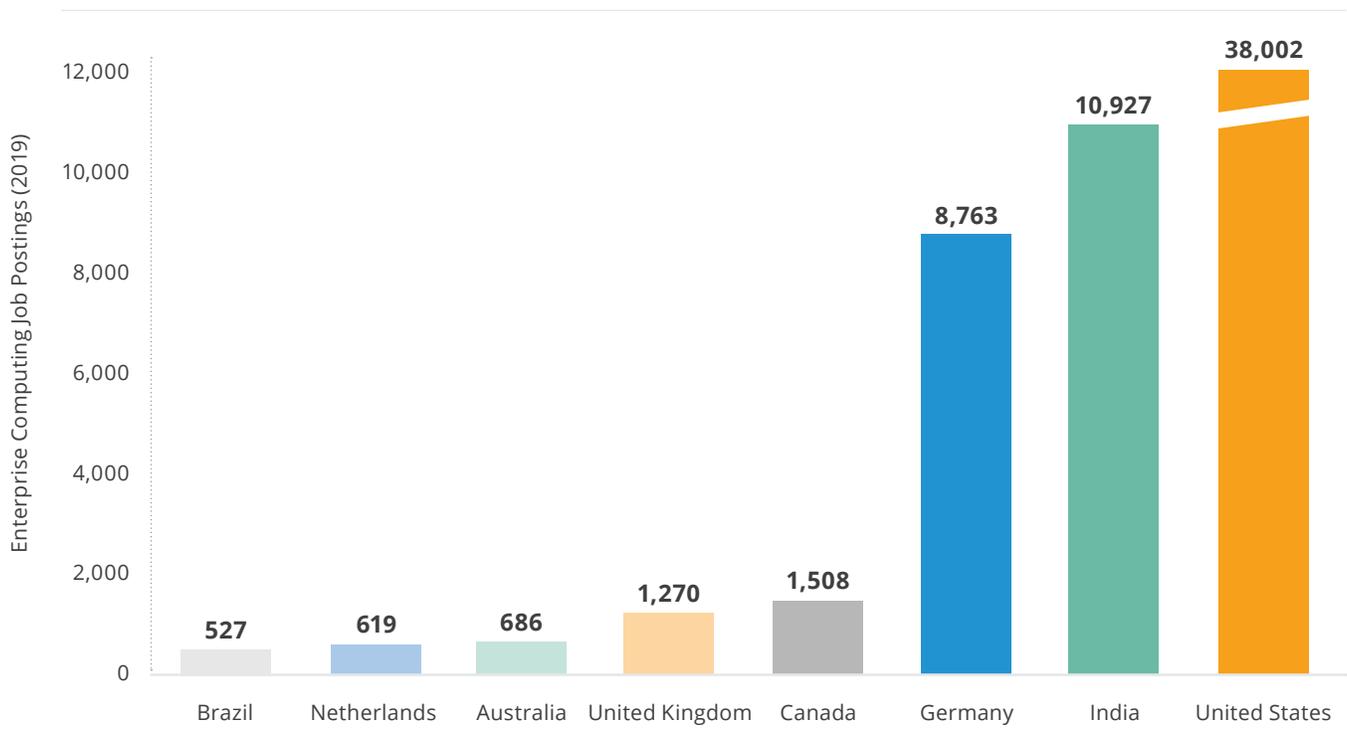
Findings

Dynamics of the enterprise computing global labor market

ADVANTAGES IN THE GLOBAL LABOR MARKET

In 2019, employers posted over 62,000 job openings for enterprise computing roles across Australia, Brazil, Canada, Germany, India, the Netherlands, the United Kingdom, and the United States. And while the study did not include other key markets such as the Czech Republic, South Africa, Japan, and more, the study confirms that with companies' continued reliance on mainframe architecture for transaction, trade, and claims processing, significant job opportunities in enterprise computing exist across the globe.

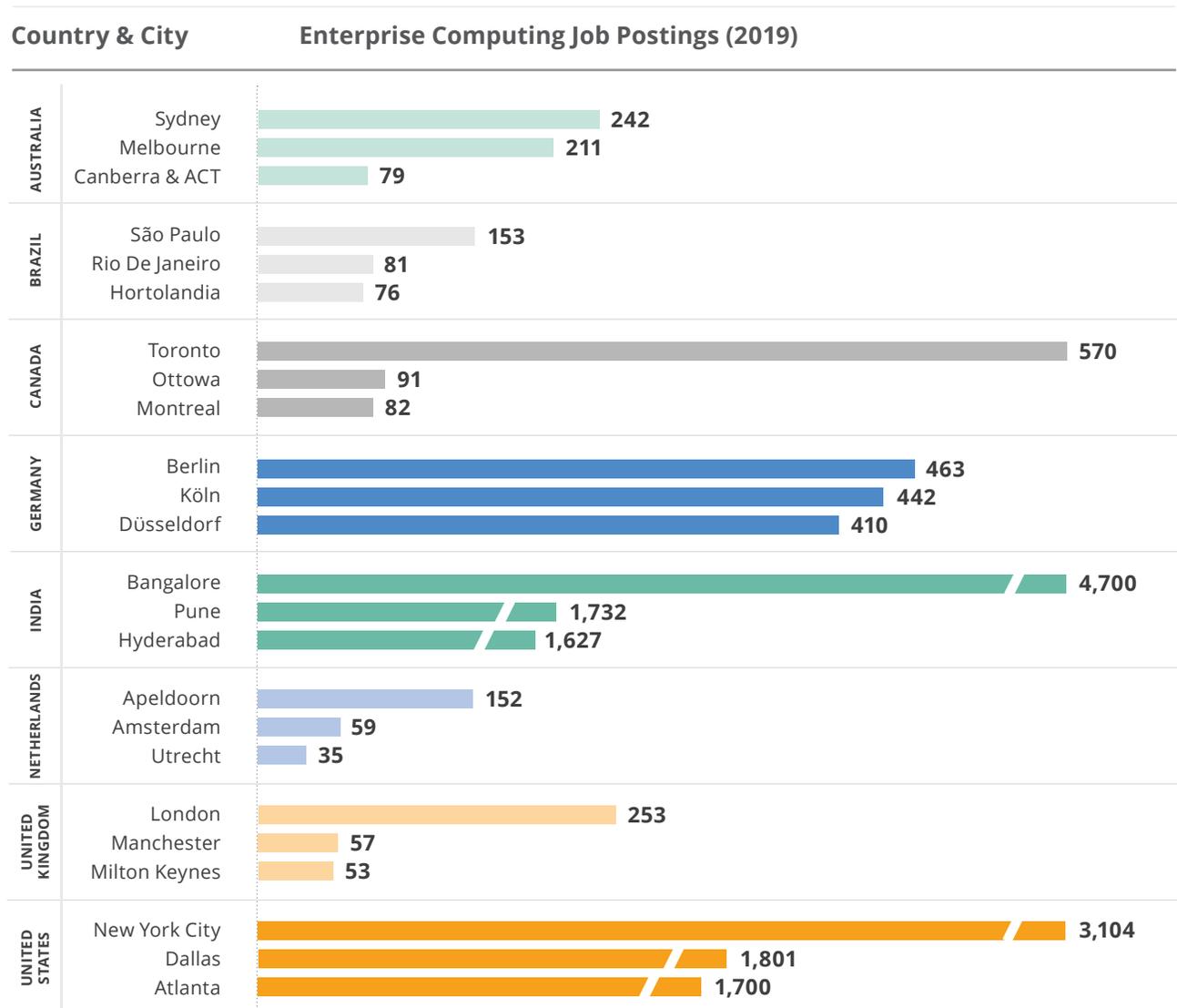
Figure 1: Enterprise Computing Demand by Country



Among countries, demand for enterprise computing roles is most pronounced in the United States, Germany, and India, which account for 61%, 18%, and 14% of global enterprise computing job opportunities, respectively.

In the United States, key opportunities are found in New York City (mostly in depository banks), Los Angeles (centered in the insurance sector), and Dallas (driven by a fast-rising presence of major data centers and technical banking), though substantial demand exists throughout the country. (For more detailed insights on the geographic dynamics of demand in the United States, please see the Appendix of this report.) Berlin, Köln, and Düsseldorf are key urban centers of demand in Germany, while opportunities within India are concentrated in the cities of Bangalore, Pune, and Hyderabad. Canada and the United Kingdom are host to robust, but smaller, opportunity segments, with Toronto and London accounting for a plurality of demand in each respective country. Australia, the Netherlands, and Brazil account for the remaining 10% of global demand, featuring robust opportunities with leading firms in technology, banking, and professional services.

Figure 2: Demand by Country and City



Note 1: Job postings in the United States and India are rescaled to the maximum value in Canada (Toronto, 570) for ease of relative comparison. Raw job posting values are listed in bold for key cities in these two countries."

THE RESILIENCE OF ENTERPRISE COMPUTING JOBS

The United States labor market, which has the majority of enterprise job postings, exemplifies the stability of global demand for enterprise computing. From 2014 to 2019, the United States saw stable demand for enterprise computing, with an annual average of just over 38,000 job openings.

This puts enterprise computing on an extremely short list of roles in which hiring actually grew during the steepest economic decline in modern history.

The United States job market also demonstrates the resilience of the enterprise computing labor market in the face of COVID-19. While U.S. information technology demand saw a 29% decrease from February to April 2020, enterprise computing job postings increased 15% over the same period. This puts enterprise computing on an extremely short list of roles in which hiring actually grew during the steepest economic decline in modern history (job postings overall fell 47% in this period, and unemployment claims rose by 30 million). Enterprise computing, and the massive transaction volume it supports, is a critical function in a socially distanced economy.⁵ That's why there continues to be job opportunities for these roles.

Core enterprise computing skills are widely applicable

CORE AND EXTENDED SKILLS FOR ENTERPRISE COMPUTING

A core set of proficiencies in well-established technologies provide a common platform to all roles in the enterprise computing space. Competency with mainframe architecture is perhaps the defining skill in the enterprise computing space, receiving the highest demand rate of all information technology skills considered in this study.⁶

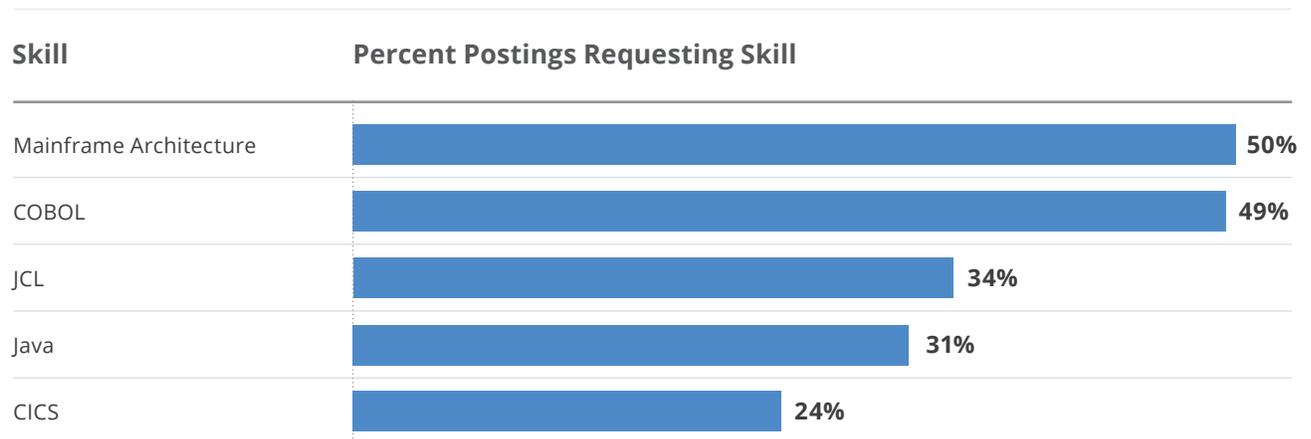
⁵ "IBM and Open Mainframe Project Mobilize to Connect States with COBOL Skills," Stowell, Meredith, last modified April 9, 2020, <https://newsroom.ibm.com/2020-04-09-IBM-and-Open-Mainframe-Project-Mobilize-to-Connect-States-with-COBOL-Skills>.

⁶ In this section and in the "Career Pathways" and the "Enterprise Computing" sections of this report, United States data serves as a model for global trends.

Enterprise-specific software competencies are defining skills for professionals in this space. COBOL is the most-demanded programming language for enterprise professionals, serving as a necessary complement to mainframe architecture knowledge. Job Control Language (JCL) and Customer Information Control System (CICS) are situated as programming- and middleware-focused requirements for transaction processing.

Though not strictly an enterprise language, Java rounds out the core skillset for enterprise computing professionals. A generalist language, Java allows for robust extensions of enterprise capabilities for end-user application development. As the fifth most commonly used programming language,⁷ Java is strongly positioned as a crossover skill for technical professionals who wish to break into the enterprise space.

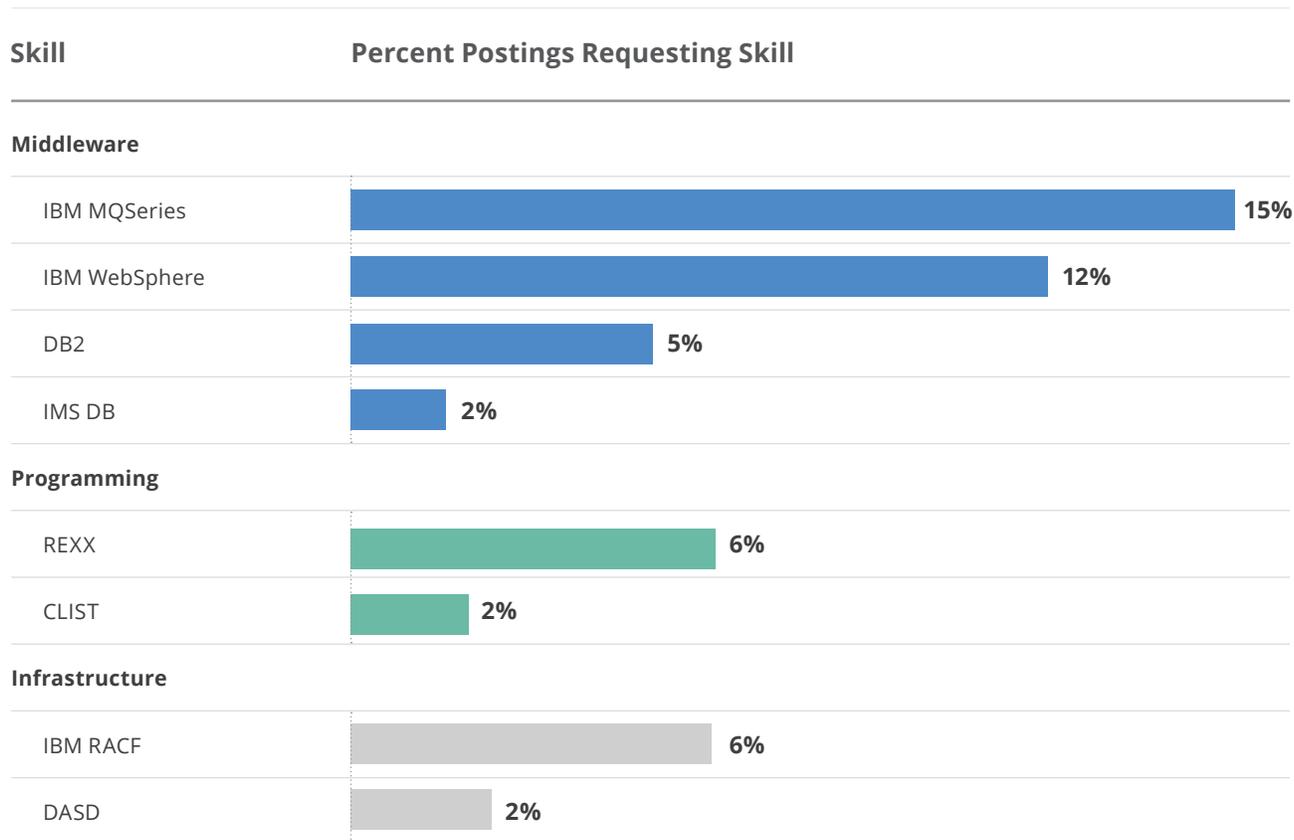
Figure 3: Core Enterprise Computing Skills



An extended set of competencies in middleware, infrastructure, and procedural languages add value beyond the core enterprise computing toolkit. Middleware capabilities (IBM's MQSeries, WebSphere, DB2, and IMS DB software) are relatively common requirements for application development. Infrastructure skills address architecture-related needs, particularly for data management (Direct Access Storage Device) and systems administration (Resource Access Control Facility). Extended proficiencies in procedural programming (REXX and CLIST languages) afford greater flexibility for a range of enterprise computing tasks, adding general value.

⁷ Stack Overflow Developer Survey 2020," Stack Overflow, accessed August 12, 2020, <https://insights.stackoverflow.com/survey/2020#technology-programming-scripting-and-markup-languages>.

Figure 4: Extended Enterprise Computing Skills



ENTERPRISE COMPUTING SPANS MULTIPLE ROLES

Enterprise computing occupations span a variety of information technology roles, with demand concentrated among software development and systems engineering positions. Software Developer roles, with responsibilities for both the design and programming of applications, account for the majority of job postings. In contrast, Computer Programmer roles – more narrowly focused on code production – see less demand. The gap in demand between these roles has widened over time, suggesting that firms are increasingly seeking roles that can handle the entire application development process over those with limited software engineering skills.

Systems engineering roles account for a lesser share of enterprise computing demand compared to development-oriented positions. Systems Analysts and Computer Systems Engineers see comparable extents of demand, though demand for Systems Analysts has decreased considerably since 2014 while demand for Systems Engineers has increased modestly. Database Administration roles stand as an increasingly distinct demand segment, with substantial demand growth in this same period. Parallel with software development trends, engineering roles with greater skill latitude – a well-rounded range of competencies for systems development, design, and administration – have become an increasing priority in enterprise computing.

Table 2: Key Enterprise Computing Occupation Categories

Burning Glass Technologies Specialized Occupations	Postings 2019	Demand Growth 2014–2019
Software Developer / Engineer	13,569	+12%
Computer Programmer	3,417	-10%
Database Administrator	2,782	+16%
Systems Analyst	1,974	-23%
Computer Systems Engineer / Architect	1,736	+6%

Career pathways via technical specialization

OPPORTUNITY TRACKS IN ENTERPRISE SOFTWARE AND INFRASTRUCTURE

Developing skills in software development and systems engineering provide meaningful avenues for career development in the enterprise computing space. Two specialist roles – Application Developers on Z and System Administrators for Z – are uniquely positioned to provide ongoing support for these key enterprise computing use cases through distinctive skillsets.

Table 3: Summary of Enterprise Computing Specialist Roles

Specialist Role	Defining Characteristics	Postings 2019	Percent Demand	Demand Growth 2014-2019
Application Developer on Z	Expertise in enterprise programming integrated with middleware competencies for distributed application development.	15,626	74%	+1%
System Administrator for Z	Expertise in technical infrastructure combined with core programming competencies to support critical enterprise processes.	5,491	26%	-1%

Application Developers on Z account for just under three-quarters of demand among the two specialist roles, while System Administrators for Z comprise the remaining 26% of specialist job openings. Demand for both specialist roles has been quite stable from 2014 to 2019, with negligible changes in the number of job openings over this period. Together, these findings suggest that both software development and infrastructure engineering are sustained areas of need in enterprise computing, although the scale of opportunities is larger in software development.

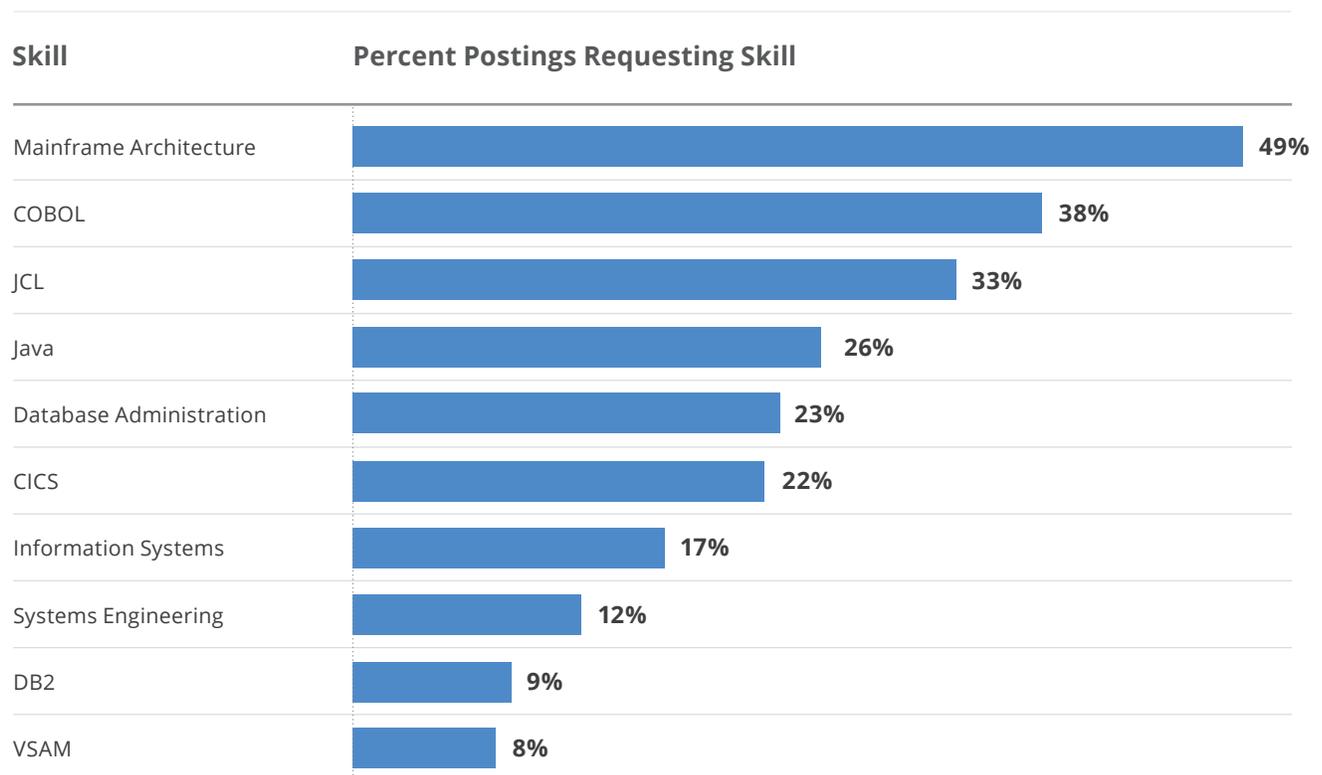
Application Developers on Z are primarily distinguished by expert proficiencies in core enterprise languages and middleware products, along with robust operating processes for software engineering. Taken together, this skillset enables Application Developers on Z to both build scalable enterprise software and extend such programs for operation by end users.

Compared to the average enterprise computing role, Application Developer on Z roles see considerably higher demand for COBOL, JCL, and Java proficiencies; these abilities are key for software development and optimization on mainframe architecture. Middleware skills – specifically, proficiency with IBM’s MQSeries, WebSphere, and CICS software – highlight this role’s focus on distributed application development, extending high-performance functionality to end-users. Knowledge of best practices in software development and application design round out the Application Developer on Z skillset with a strong theoretical orientation for efficient software engineering.

System Administrators for Z share many core skill requirements with their specialist counterparts but are best distinguished by proficiency with data management technologies and expertise in enterprise infrastructure. This well-rounded skillset allows System Administrators for Z to optimize system performance, provide critical support to ensure uptime, and facilitate others' use of key enterprise technologies.

Core enterprise computing competencies – mainframe architecture, COBOL, JCL, Java, and CICS – are required, but not defining, skills for System Administrators for Z. Being requested at similar rates as the average enterprise computing role, these skills enable System Administrators for Z to support and improve enterprise systems, rather than develop native applications. In contrast, expertise with enterprise frameworks – in database administration, information systems, and systems engineering – is a distinguishing characteristic of this role, underpinning key responsibilities in systems maintenance and optimization. Proficiency with related technologies, including DB2 and Virtual Storage Access Method (VSAM), follows directly from this knowledge base.

Figure 5: System Administrator for Z Key Skills

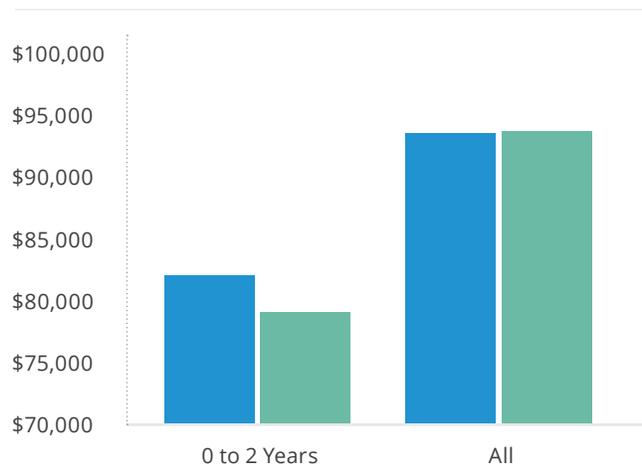


Enterprise computing skills offer entry-level gains

SPECIALIST ROLES OFFER EARLY-CAREER SALARY PREMIUMS

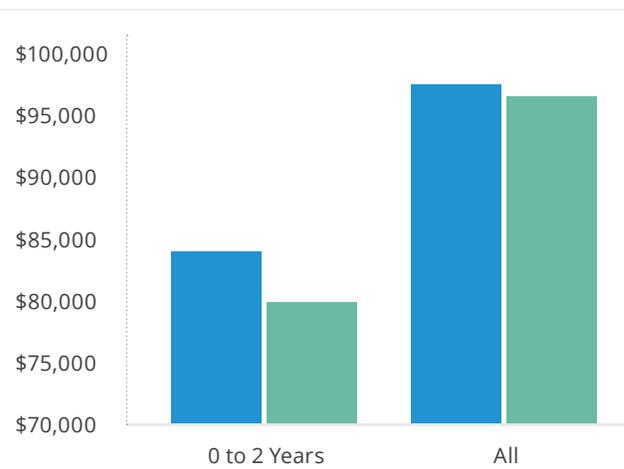
The value offered by this pair of enterprise specialist roles is most clearly reflected in what employers are willing to pay for them. Application Developers on Z and System Administrators for Z receive average market salaries of \$93,000 and \$97,000, respectively, on par with non-enterprise software development and systems engineering roles. Indeed, these competitive levels of compensation position enterprise computing specialist roles as lucrative alternatives to generalist computing occupations.

Figure 6: Application Developer on Z Salary



Role
 ■ Application Developer on Z
 ■ Non-Enterprise Software Developer

Figure 7: System Administrator for Z Salary



Role
 ■ System Administrator for Z
 ■ Non-Enterprise Systems Engineer

Importantly, enterprise specializations do not merely offer impressive salaries: Rather, these areas of focus can provide substantial salary premiums for early-career professionals. Entry-level job postings – requiring less than two years of employment experience in the enterprise space – for Application Developers on Z hold a market salary of \$82,000 annually, nearly \$3,000 more than entry-level software development roles. Similarly, entry-level System Administrator for Z positions receive a market salary of \$84,000, with a premium of about \$4,000 over comparable systems engineering jobs. Taken together, these trends suggest that an enterprise computing specialization is likely to accelerate one’s salary trajectory relative to similar roles, offering substantial benefits for early-career professionals.

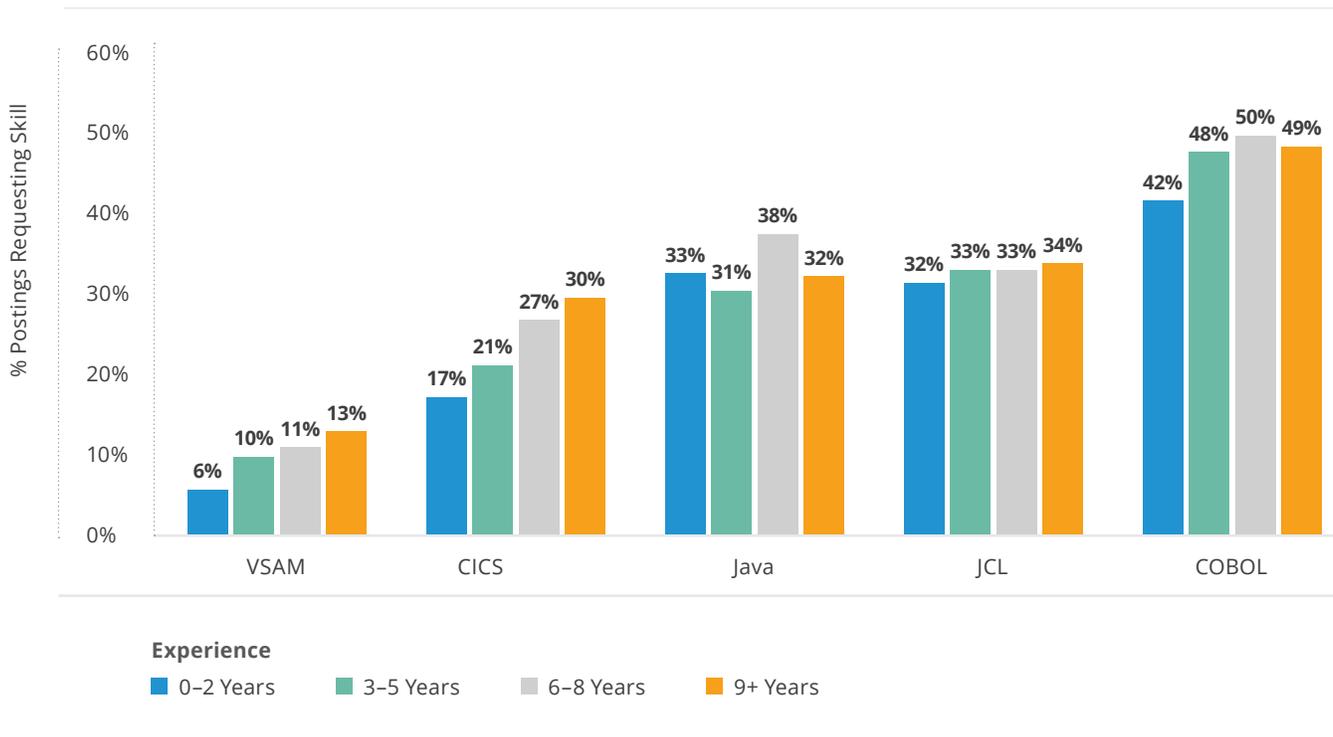
Enterprise computing skills offer long-term career value

CORE COMPETENCIES HOLD SUSTAINED MARKET VALUE

Enterprise computing competencies are uniquely positioned to hold or increase in market value over time. JCL proficiency is consistently in demand over a decade of seniority, requested by at least 30% of enterprise job listings along this experience trajectory. The case for Java and COBOL is quite similar: While there are minor fluctuations over levels of experience, both skills display stable value vis-à-vis their labor market demand.

Other core skills provide increasing returns for enterprise computing professionals. Notably, CICS gains substantial value as seniority increases: There is a 13% increase in demand for CICS competency from entry-level to senior roles, with steady intermediate increases along the way. Familiarity with VSAM follows a similar trend, although at a smaller absolute scale.

Figure 8: Skill Market Value by Experience



Competencies with sustained career value are broadly applicable, crosscutting both Application Developer on Z and System Administrator for Z roles. While these core skills provide a practical foundation for either specialization pathway in the enterprise space, they also add critical value that will hold over the course of a career. Training in these skills is a low-risk investment for early-career professionals looking to fortify a competitive long-term labor market position.

4.

Conclusion

Firms' continued reliance on enterprise technologies has created a remarkably stable labor market for enterprise computing professionals. Training in a core skillset – mainframe architecture, COBOL, JCL, Java, and CICS – provides a common foundation to enterprise application development and systems administration roles. Further technical specialization translates these discrete opportunities into valuable career pathways: The specialist roles of Application Developer on Z and System Administrator for Z address companies' critical and ongoing enterprise computing needs, affording professionals with long-term value in the technical labor market. Training initiatives offered by IBM Z establish a clear pipeline for this career progression, providing a robust and viable pathway for professionals in a competitive labor market.



5.

Methodology

To provide the information contained in this report, Burning Glass mined its comprehensive database of more than 1 billion online job postings. Burning Glass's spidering technology extracts information from close to 40,000 online job boards, newspapers, and employer sites on a daily basis and de-duplicates postings for the same job, whether it is posted multiple times on the same site or across multiple sites. Burning Glass's proprietary data is supplemented and contextualized by additional indicators from the Bureau of Labor Statistics and other published sources. The data analyzed in this report reflect job postings in Australia, Brazil, Canada, Germany, India, the Netherlands, the United Kingdom, and the United States for the calendar year 2019.

Job postings data in Australia, Canada, the United States, and the United Kingdom were sourced from Nova™, Burning Glass's real-time, standardized jobs information feed. Data in Germany and the Netherlands were sourced from Tabulaex, a Milan-based firm acquired by Burning Glass in 2018. Data in India and Brazil were sourced from Burning Glass's Global Fortune 500 dataset. Burning Glass standardized and validated data across these three sources to ensure findings were comparable across all countries referenced.

Unless stated otherwise, the United States data reflect United States job postings over the period of January 1, 2014 to December 31, 2019. To account for the impact of COVID-19 on the enterprise computing labor market, the section entitled "The Resilience of Enterprise Computing Jobs" reflects research drawn from job postings in the United States from the period of January 1, 2020 to April 30, 2020. Additional analyses in Australia, Canada, and the United Kingdom were conducted, but were not referenced in this report.

To define enterprise computing roles, Burning Glass and IBM Z compiled a list of 23 skills related to enterprise computing in Burning Glass's skill taxonomy. Enterprise computing job postings were then identified as all information technology job listings that requested one or more enterprise computing skills within the posting text. The superset of information technology roles – regardless of skill requirement – were used as a benchmark point of comparison.

The “Application Developer on Z” and “System Administrator for Z” specialist roles are bespoke occupation categories created in collaboration with IBM Z for this report. These categories were defined by grouping together Specialized Occupations from Burning Glass’s occupation taxonomy whose definitions strongly align with established areas of concentration in enterprise computing. Metrics for these roles reflect two mutually exclusive subsets of enterprise computing roles that correspond with each grouping.



6.

Appendix

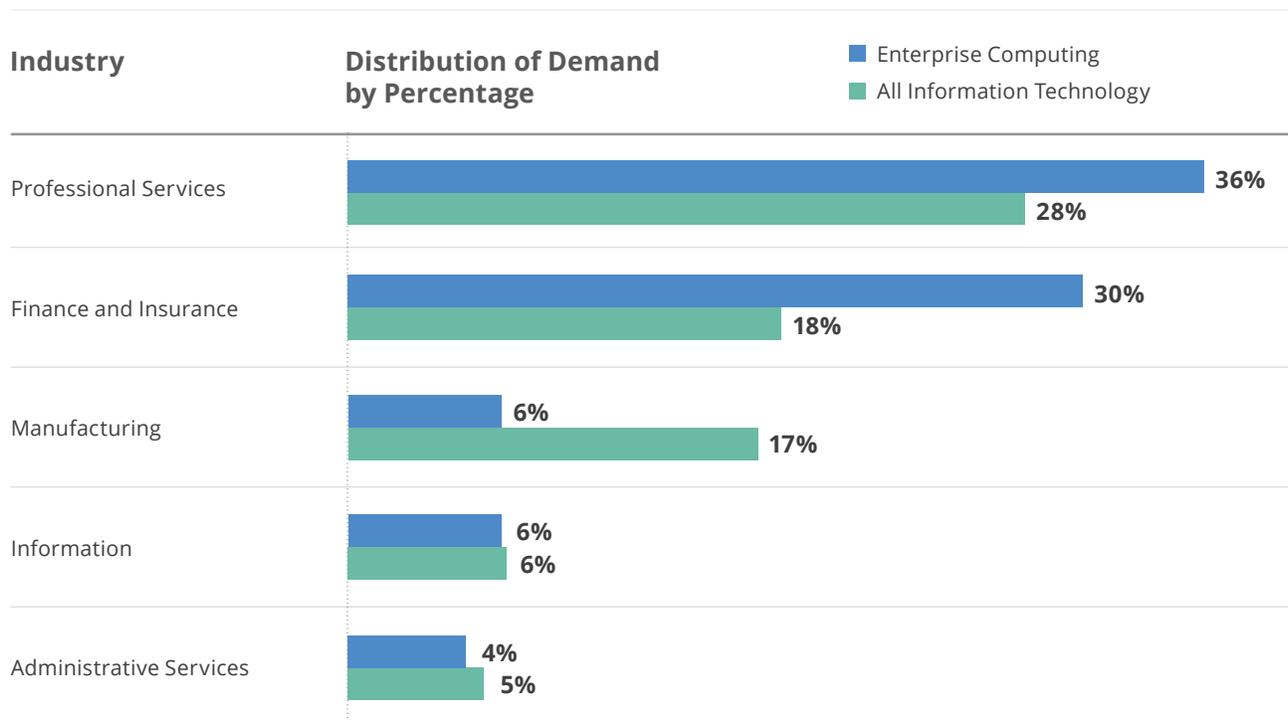
Additional United States Findings by Industry and Location

U.S. enterprise computing job openings tend to offer different opportunities in different industries, depending on local economic needs. This appendix provides more detailed analysis on U.S. enterprise job openings by industry and region.

INDUSTRY DRIVERS OF ENTERPRISE COMPUTING DEMAND

The U.S. financial and professional services industries have an outsized need for enterprise computing professionals, accounting for over two-thirds of demand in this space. Financial industry demand is largely split between the depository banking and insurance sectors, while professional services industry demand is concentrated in the computer systems design sector.

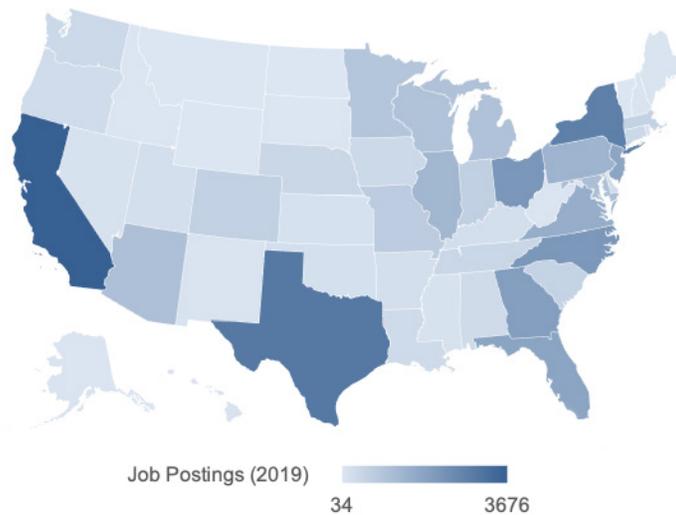
Figure 9: Enterprise Computing Demand by U.S. Industry (Top Five)



REGIONAL OPPORTUNITIES FOR ENTERPRISE COMPUTING

Due to a widespread reliance on enterprise technologies, job opportunities in this space are relatively well-distributed throughout the United States. The labor market for enterprise computing is centered in California, New York, and Texas. These top three states have seen consistent demand growth since 2014, accounting for 25% of all enterprise computing demand as of 2019. Beyond these key states, the East Coast and, to a lesser extent, the Midwest are substantial areas of opportunity for enterprise computing professionals: Ohio, North Carolina, Georgia, Florida, New Jersey, Virginia, Pennsylvania, and Illinois each represent robust segments of demand in this space.

Figure 10: Enterprise Computing Demand by State



Major enterprise computing hubs in key states – New York, California, and Texas – offer distinctly valuable opportunities based on local industries. In New York State, enterprise computing demand remains highly concentrated in the New York City metropolitan area over the period of study. Statewide demand is most marked in the financial industry, driven primarily by large savings banks. Together, these patterns suggest that depository banks – given a persistent need for transaction processing – are the key driver of demand in the New York enterprise computing market.

Opportunities in California are primarily distributed across the Los Angeles, San Francisco, and Sacramento metropolitan areas, in order of magnitude. Los Angeles has seen enterprise demand growth of 57% over the period of 2014 to 2019, now accounting for the plurality of demand in the state. San Francisco and Sacramento account for smaller segments, with the former experiencing a decrease and the latter an increase in openings since 2014. Industry demand is most pronounced in California’s insurance sector, although the technical services and computer systems design sectors account for substantial opportunities, as well. In these ways, the Californian enterprise computing market is quite diverse, with robust opportunities existing across regions and sectors.

Texas is host to perhaps the highest-value metropolitan area for enterprise computing. The Dallas-Fort Worth region holds the highest concentration of demand in the state and has experienced a 64% increase in postings since 2014. This trend is largely driven by a growing presence of major data centers and technical banking operations in Dallas. Other major metropolitan areas – Austin, San Antonio, and Houston – are smaller segments of this labor market, with software services firms consistently demanding enterprise computing professionals. Indeed, growth trends and a distinctive industry focus position Texas strongly for enterprise computing roles.

Table 4: Enterprise Computing Demand by Key States and Metropolitan Areas

State	Postings State, 2019	Demand Growth State, 2019	Top Metropolitan Statistical Area MSA	Percent Demand in MSA	Demand Growth MSA, 2014–2019
California	3,676	+29%	Los Angeles	41%	+57%
Texas	2,984	+6%	Dallas-Forth Worth	60%	+12%
New York	2,814	+9%	New York City	64%	+1%

Figure 11: Financial Sector Demand by State

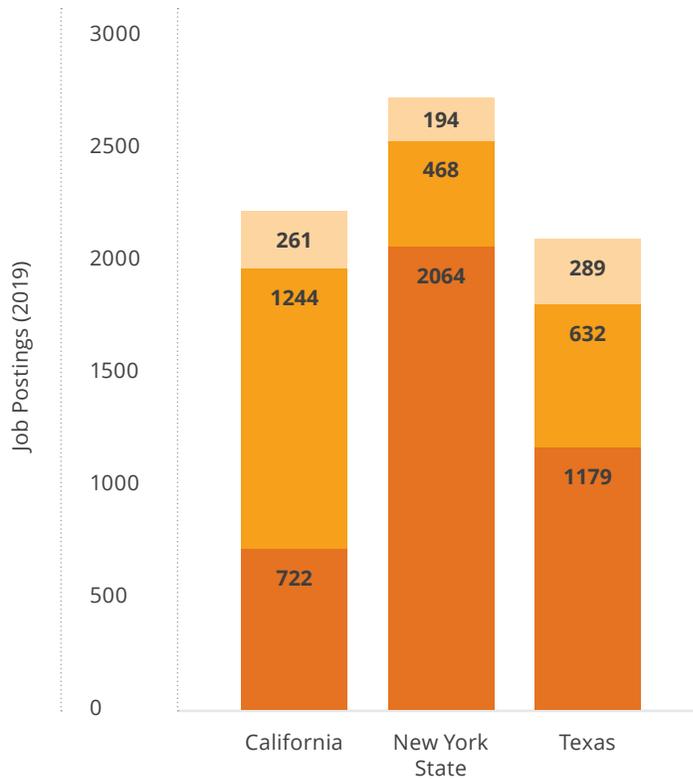
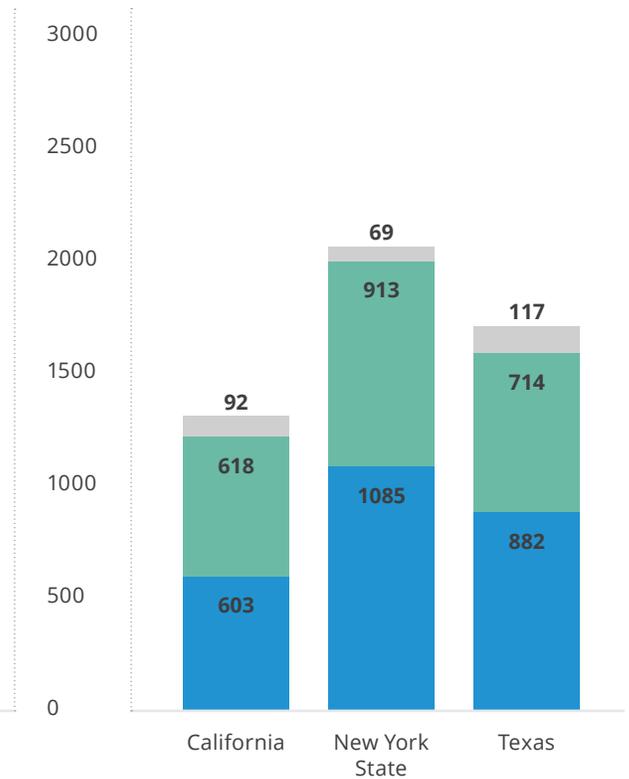


Figure 12: Professional Services Sector Demand by State



Financial Industry Postings (2019)

- Nondepository Credit Intermediation
- Insurance Carriers
- Depository Credit Intermediation

Professional Services Postings (2019)

- Engineering Services
- Technical Consulting Services
- Computer Systems Design Services

Note 1: Enterprise computing job postings reported in Figures 3 and 4 are limited to the three highest demand sectors within the Financial and Professional Services industries, respectively.

7.

Acknowledgments

Authors

Written by David Barney, Will Markow and Caroline Effinger of Burning Glass Technologies.

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About Burning Glass

Burning Glass Technologies delivers job market analytics that empower employers, workers, and educators to make data-driven decisions. The company's artificial intelligence technology analyzes hundreds of millions of job postings and real-life career transitions to provide insight into labor market patterns. This real-time strategic intelligence offers crucial insights, such as which jobs are most in demand, the specific skills employers need, and the career directions that offer the highest potential for workers. For more information, visit burning-glass.com.

About IBM Z

IBM Z is the industry's most robust, resilient, secure, dynamically scalable and technologically advanced enterprise computing platforms. Co-developed with hundreds of customers and deployed by Fortune 100 clients as well as innovative startups, they are designed for running mission-critical workloads in a hybrid multicloud environment with industry-leading data protection to reduce risk and ensure compliance, while enabling modernization of application investments and agile development of new cloud native services.

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