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# Information Technology (IT) Workforce Capability Assessment Survey (2004)

For the Governmentwide IT Workforce

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Analysis of Survey Results  
December 2004

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## Chapter

# 1 Introduction

## IT Workforce Capability Assessment Survey (2004) Analysis of Survey Results

### 1.1 Purpose of this Analysis Report

This Analysis Report describes the 2004 IT Workforce Capability Assessment Survey (in **Chapter 1**), summarizes and analyzes the key findings from the survey (in **Chapter 2**), and provides a summary of conclusions and recommendations as a result of the analysis (in **Chapter 3**). Listings and definitions of the competencies, skills, and certification areas referenced in the survey are provided in **Appendix A**, changes to the 2003 IT Workforce Capability Assessment Survey<sup>1</sup> are provided in **Appendix B**, and a list of assumptions are provided in **Appendix C**.

It is important to note that while the survey responses came from employees representing a large number of Federal agencies, the analysis of the results and the accompanying recommendations are presented in aggregate at the Governmentwide or Federal level and are not focused on any individual department or agency. Upon conclusion of the survey, each department/agency received its survey data for analysis.

### 1.2 About the IT Workforce Capability Assessment Survey

#### Purpose of the IT Workforce Capability Assessment Survey

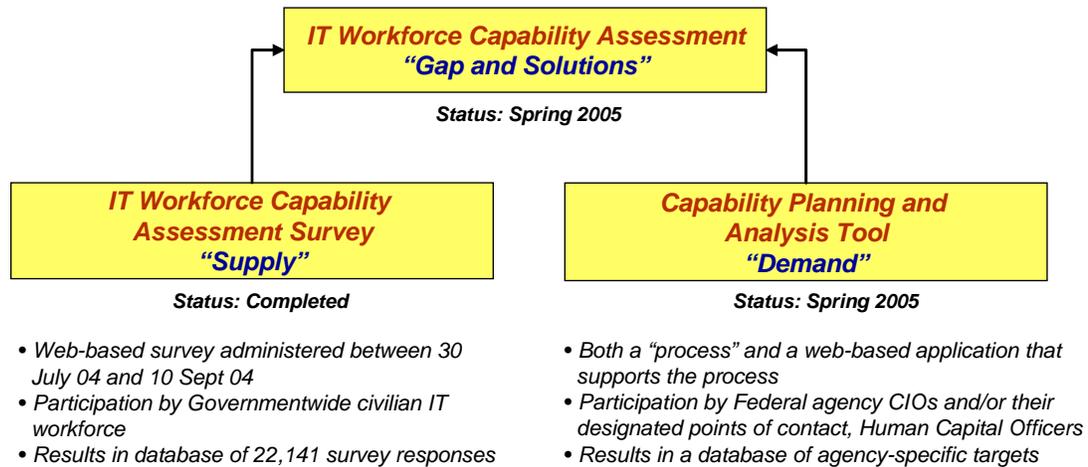
The Federal Chief Information Officers' Council (CIOC), in partnership with the Office of Personnel Management (OPM), is nearing completion of a process to design, develop, implement, and support a capability assessment focused on the Information Technology (IT) workforce. The IT Workforce Capability Assessment, as it is known, is meant to help Federal agencies realize the inherent value of strategic human capital management while satisfying a number of regulatory requirements specific to the IT workforce, including the Clinger-Cohen Act and the E-Gov Act (Section 209). In addition, the IT Workforce Capability Assessment helps Federal agencies address a number of broader guidelines, requirements, and mandates related to the strategic management of human capital, including the President's Management Agenda (PMA), OPM guidelines on human capital management (the Human Capital Assessment and Accountability Framework, or

<sup>1</sup> The analysis for the 2003 IT Workforce Capability Assessment Survey, the first administration of the survey, can be found at <http://www.cio.gov>.



HCAAF), and Government Accountability Office (GAO) guidance and reports on strategic human capital management.

The IT Workforce Capability Assessment has two distinct but complementary parts, as illustrated in Figure 1.1.



• Figure1.1 IT Workforce Capability Assessment

One part is the **IT Workforce Capability Assessment Survey** that captures the "supply" of IT workforce capabilities, including proficiency in a set of IT-related competencies and skills, percentage of the workforce possessing certain IT-related certification areas, amount of time spent on selected specialized job activities (SJAs), and a demographic profile of the IT workforce. The second part is the **Capability Planning and Analysis Tool** that helps Federal agencies identify a "demand" model of capabilities needed to support their IT mission. This demand model consists of a framework for each SJA that outlines the competencies, skills, and certification areas central to that SJA, and that assigns proficiency targets.

This report describes the results of the IT Workforce Capability Assessment Survey, or the "supply" of the IT workforce's capabilities. Results from the survey will be used in the Capability Planning and Analysis Tool to identify capability gaps by comparing capability "supply" with "demand." After gaps are identified, solutions to mitigate the gaps will be explored, developed, and recommended. A follow-on report detailing the "demand" step and the resulting gap analysis will be published in spring 2005.

## Survey Sponsorship

The IT Workforce Capability Assessment is sponsored by the Federal CIOC and OPM. This is the second annual assessment of the Federal IT workforce.

## Survey Timeframe

The IT Workforce Capability Assessment Survey was administered between July 30, 2004 and September 10, 2004. The survey was launched one month earlier than the 2003 survey (i.e., July rather than August) in order to provide a longer timeframe for respondents to complete the survey.



## Survey Coordination

To ensure the survey information gathered would be useful in supporting agencies' human capital planning requirements, close coordination was required. Members of the CIOC IT Workforce Committee formed a survey working group that coordinated with OPM to develop survey content. The working group also coordinated with agency points of contact (POCs), who had specific responsibilities regarding the administration of the survey within their respective organizations. As part of the coordination process, the CIOC survey working group established a team specifically dedicated to liaise with agency POCs, and provided POCs with the background, orientation, and other resources needed to understand the survey process.

### Role of Agency Points of Contact

Agency POCs had specific responsibilities for survey administration, including:

- 1) Identifying their IT workforce population to participate in the survey based on occupational series (see **Chapter 1.3**, below).
- 2) Identifying the organizational structure of their agencies to facilitate data analysis.
- 3) Developing a method for notifying IT workers of the survey.
- 4) Disseminating information about the survey to their IT workforce (most often via email), announcing the commencement of the survey, providing instructions on how to access the survey via the survey web address, sending reminders to complete the survey, and providing "tokens of appreciation" (e.g., computer brushes, coasters, pens) to those who completed the survey. POCs were provided a communications toolkit to facilitate this process.
- 5) Tracking their IT populations' usage of the survey via a separate tracking website to ensure their organizations captured a sufficient sample size.

## Survey Methodology

The 2004 IT Workforce Capability Assessment Survey was based upon the 2003 survey. A number of improvements to the questions and content areas (e.g., demographics, specialized job activities, competencies, skills, and certification areas) were made by the CIOC, OPM, and representatives from several agencies across the Government. Improvements included developing a streamlined list of competencies, skills, and certification areas representing the most important areas of IT and information resources management, as identified by agency subject matter experts. As part of this effort, definitions for skills were developed, and skills and certifications were grouped into more meaningful categories with examples. Other changes included new user-interface functionality that allowed respondents to navigate more easily through the web-based survey, and more options including the capability to print responses. See **Appendix B** for a list of implemented changes.

Participants were notified to take the survey by the designated POC from their respective agency. Once notified that the survey commenced, respondents visited the survey website, selected and submitted the most appropriate answers to questions organized in



five major parts: Demographics, Specialized Job Activities, Competencies, Skills, and Certification Areas.

Only “valid” surveys, defined as those surveys in which the individual responded to all five sections and acknowledged completion by submitting the survey via the ‘Submit’ button, were analyzed in this report. “Valid” survey responses were stored in a centralized database; agency POCs were provided their agencies’ data shortly after the survey closed.

As the survey was voluntary, the sample of responses collected was self-selecting, not random. In addition, the survey was completely confidential.

### 1.3 Survey Scope

#### Intended Audience

The survey was intended for Federal civilian employees occupying IT and IT-related positions. The CIOC recognizes that the IT workforce comprises both civilians as well as contractor support, and, in some cases, uniformed military members. In fact, many Government agencies may outsource or have entire IT functions performed by military members. The CIOC did not intend to devalue the support that contractor or military members perform, but due to time and resource constraints, chose to focus the survey on the civilian members of the IT workforce.

#### Occupational Series

The Federal civilian IT workforce generally falls into more than one occupational series. For purposes of the survey, applicable series in both the General Schedule (GS) and Foreign Service (FS) systems were included. Agency POCs were asked to estimate their IT workforce population based, to a large extent, on traditional IT-related series:

- GS-2210 Information Technology Management
- GS-334 Computer Specialist<sup>2</sup>
- GS-391 Telecommunications
- GS-854 Computer Engineering
- GS-1550 Computer Science
- FS-2880 Information Management
- FS-2882 Information Management Technical
- FS-2884 Information Technology Management

Agency POCs were also asked to include in the estimate of their IT workforce population other occupational series not typically associated with, but nonetheless could be considered part of, the IT workforce based on their job title or function as appropriate. These included:

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<sup>2</sup> The GS-334 Computer Specialist occupational series was cancelled by OPM, but not all agencies have converted their Computer Specialists to other appropriate series. Therefore, this option was included for survey respondents.



- GS-301 Miscellaneous Administration and Program
- GS-340 Program Management
- GS-343 Management and Program Analysis
- GS-855 Electronics Engineering

It was recognized that certain respondents might not fit into a specific occupational series or pay band. Individuals that fell into this category were asked to select the most appropriate response, or select “other” if there were no equivalent match.

### Grade Levels

Table 1.1 lists the GS and FS grade levels that were included in the 2004 survey.

General Schedule (GS)	Foreign Service (FS)
GS-5	FS-1
GS-7	FS-2
GS-9	FS-3
GS-11	FS-4
GS-12	Senior Foreign Service (SFS)
GS-13	
GS-14	
GS-15	
Senior Executive Service (SES)	

• Table 1.1: Grade Levels Included in the IT Workforce Capability Assessment Survey



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## Chapter

# 2 Key Findings

## IT Workforce Capability Assessment Survey (2004) Analysis of Survey Results

### 2.1 Introduction

This chapter presents the key findings from the survey, including the total number of responses at the Governmentwide level, and provides an analysis of the raw survey data. Due to the amount of data collected, only summary information and illustrative data are provided in this chapter.

It is important to note that the data referenced in this report represent a snapshot in time of the Governmentwide IT workforce, based on the portion of the IT workforce that responded to the survey. Due to the relatively high response rate (described further in section 2.2), it may be reasonable to generalize the results of this assessment to the rest of the Governmentwide IT workforce. In addition, no statistical tests of significance have been performed on these data. Where applicable, changes in percentages and rank order from the 2003 to 2004 survey administrations have been highlighted. These findings should not imply that changes in proficiency or frequency have actually occurred in the Governmentwide IT workforce between 2003 and 2004. Rather, the true power of the IT Workforce Capability Assessment Survey lies in its ability to track shifts in competency and skill proficiencies over time. Consequently, subsequent administrations of this survey and the corresponding analysis reports that follow will begin to look at how proficiencies are changing over the years. “Trends” and “changes over time” will begin to emerge, and it is recommended that those findings be the basis for designing interventions and policy changes.



## 2.2 General Quantitative Results

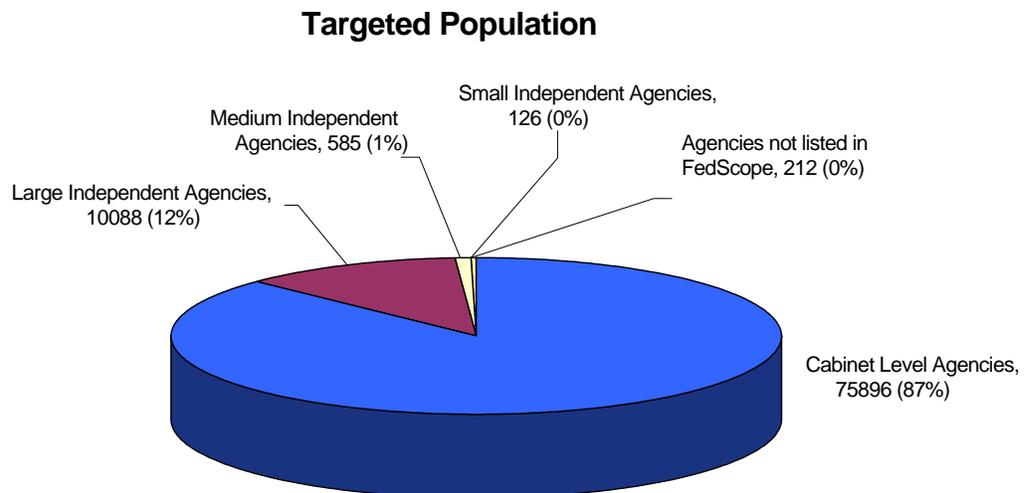
### Survey Responses and Response Rate

The total number of Governmentwide responses, along with the targeted Federal IT workforce population<sup>3</sup> (as described in **Chapter 1.3**) and response rate, are provided in Table 2.1.

Targeted Federal IT Population Size	Number of Responses	Overall Survey Response Rate
78,912	22,104	28%

• Table 2.1: Survey Responses – Governmentwide

Figure 2.1 illustrates the percentage of the targeted IT workforce population across the Government, including cabinet-level agencies; large, medium and small independent agencies; and those agencies not listed in the OPM FedScope database<sup>4</sup>. Figure 2.2 shows the overall percentage of Governmentwide responses (an aggregate of all departments/agencies). As expected, the cabinet-level agencies represent the largest portion of the IT workforce. The overall response rate for 2004 increased by approximately two percentage points compared to the 2003 survey administration. Compared to last year’s survey, the targeted Federal IT population size increased by 2,549 personnel, which may be attributed to improved coordination with agency POCs, resulting in more accurate estimates of their IT workforce.



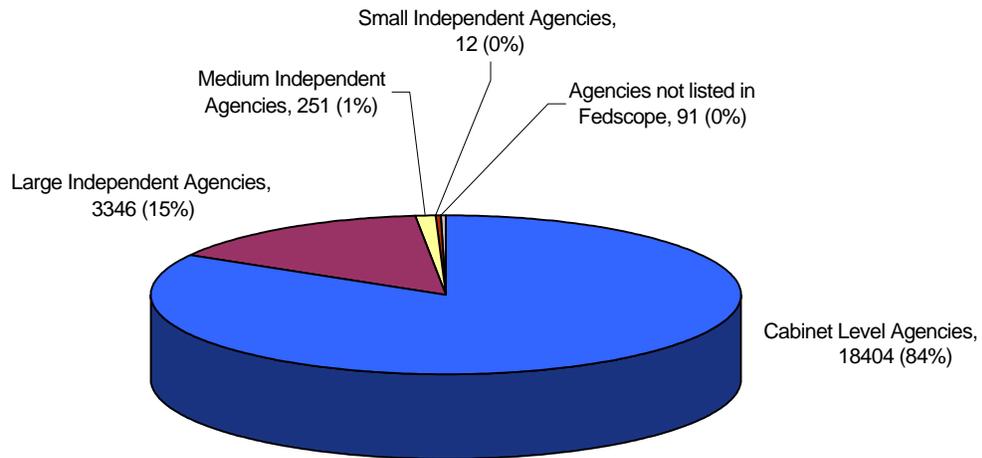
• Figure 2.1 – Targeted Governmentwide IT Workforce Population by Percentage

<sup>3</sup> The targeted Federal IT population is defined as those individuals asked to participate in the survey, and is based on the sum of individual estimates agency POCs provided to the CIOC survey working group.

<sup>4</sup> The OPM FedScope database (<http://www.fedscope.opm.gov>) contains a central personnel data file that supports statistical analysis of Federal personnel programs. Its coverage is limited to Federal civilian employees and does not include all departments or agencies. Therefore, the survey analysis groups those agencies, not part of the FedScope database, in a separate category.



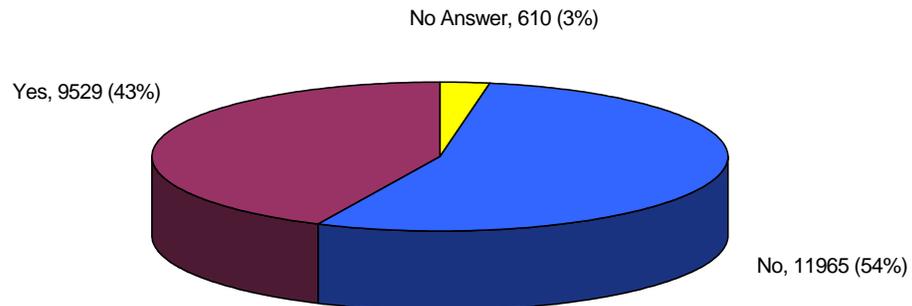
## Respondent Population



• Figure 2. 2 – Governmentwide Total Number of Responses by Percentage

In order to gain an understanding of how many repeat participants there were from the 2003 survey administration, respondents were asked to indicate whether they completed the 2003 IT Workforce Capability Assessment Survey. As Figure 2.3 illustrates, 11,965 individuals (or 54% of all respondents) were new respondents to the 2004 survey. By contrast, only 9,529 individuals (or 43% of all respondents) indicated that they participated in the 2003 survey. Assuming that 2003 respondents were given the same opportunity to participate in the 2004 survey, these data suggest that over 50% of 2003 respondents did not respond in 2004. While the increase in new participants is encouraging and may be attributed to the improved communication campaign, the decline in repeat participation should be monitored for implications to future survey response rates.

## Did You Take the 2003 Survey?

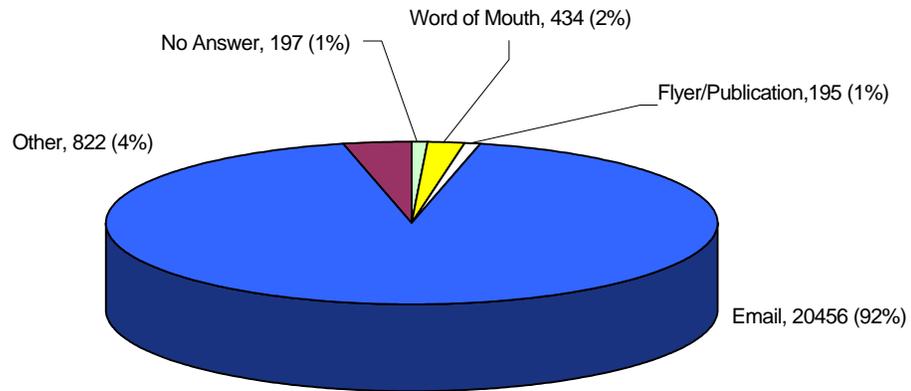


• Figure 2. 3 – Percent of Respondents who Submitted the 2003 IT Workforce Capability Assessment Survey



In addition, respondents were asked to indicate how they heard about the 2004 survey. As shown in Figure 2.4, 92% of respondents heard about the 2004 survey administration through e-mail. As previously noted, agency POCs were provided with a communications toolkit to help increase the 2004 survey response rate. This toolkit facilitated the POCs' execution of their survey coordination and outreach responsibilities, likely increasing the volume of e-mail directed to potential survey respondents.

### How Did You Hear About the Survey?

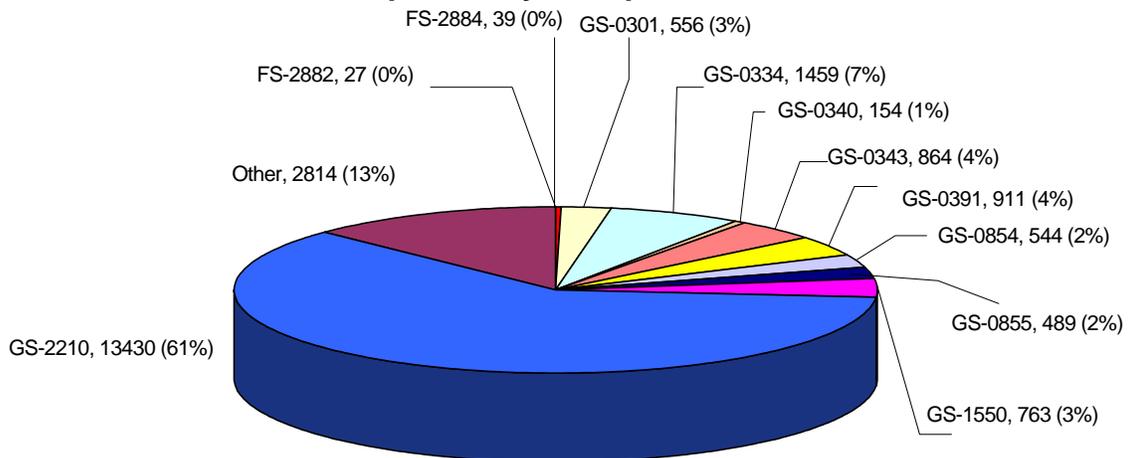


• Figure 2. 4 – How Respondents Heard about the 2004 Survey Administration

### Breakout of Responses by Occupational Series

Figure 2.5 shows the proportion of survey responses by occupational series. Not surprisingly, the GS-2210 IT Management series represented more than half of all survey responses. Interestingly, 1,459 (or 7%) responses represent the GS-0334 Computer Specialist series that was cancelled in May 2001 and reclassified into the GS-2210 occupational series. The 2003 survey administration yielded 1,966 responses in the GS-0334 Computer Specialist series, likely indicating that more respondents have been properly reclassified to the GS-2210 IT Management job series in 2004.

### Responses by Occupational Series

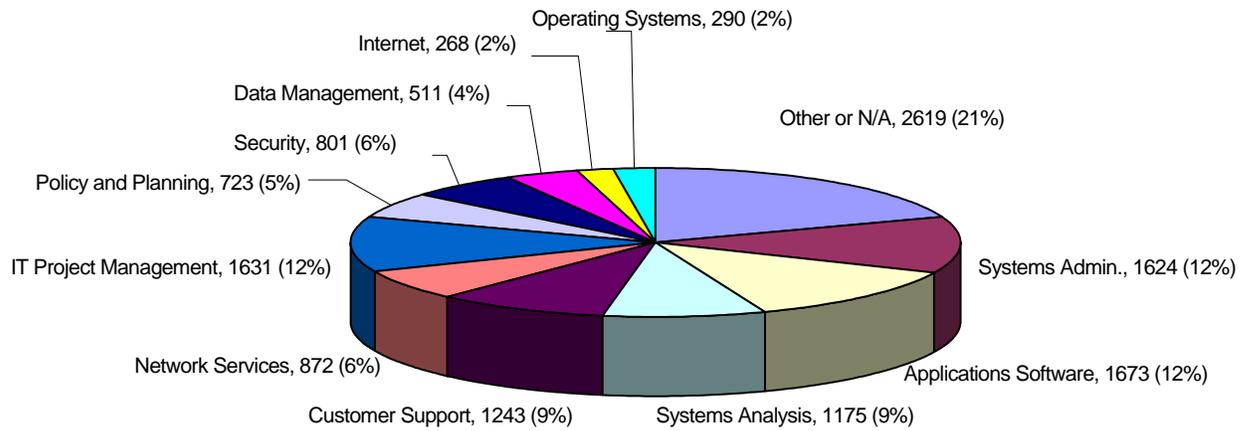




• Figure 2.5 – Responses by Occupational Series

Those respondents who chose GS-2210 as their occupational series were also asked to provide up to two parenthetical (specialty) titles that reflect the type of functions they perform. Aside from the “Other or N/A” category, IT Project Management, Applications Software, and Systems Administration were the most frequently cited responses. Although there were no significant changes in the frequencies of parenthetical title response categories from the 2003 to 2004 survey administration, the addition of IT Project Management as a category in 2004 yielded responses from 12% of the GS-2210 respondents. Figure 2.6 shows the detailed breakout of responses for GS-2210s by parenthetical title.

### Responses by Parenthetical Title



• Figure 2.6 – Responses by GS-2210 Parenthetical Title

## 2.3 Demographic Findings

### Profile of the “Typical” IT Worker

Based on the frequency of responses to the demographic survey questions, a profile of the “typical” IT worker emerges. This profile represents the most frequent number of responses for each pertinent question; summary results are provided in this section.



The "Typical" IT Worker most often...
...is between 46 and 55 years of age
...is male and white (non-Hispanic)
...is a GS-13 (or FS-3 for Foreign Service)
...has over 20 years of Federal Government experience
...has little to no private sector experience
...is likely to retire in the next 11 to 20 years
...may leave their organization in the next 1 - 3 years
...holds a Bachelor's degree

The 2004 profile of the "typical" IT worker is very similar to that of the 2003 profile.

### Age Findings

The most frequently chosen age ranges were between 46 and 50 (21%) and 51 and 55 (21%), representing approximately 42% of the population. Of the remaining population, roughly 17% responded that they were older than 55 and 42% reported that they were younger than 46.

### Grade Level Findings

The most frequently chosen grade level was GS-13 or equivalent (approximately 28% of all responses). However, there were also a substantial percentage of responses in the GS-12 or equivalent range (26%). Combined, GS-12s and GS-13s accounted for over 54% of all responses.

### Education Level Findings

The most frequently chosen education level was a Bachelor's Degree (approximately 41% of all responses). Almost 22% of the respondents reported having a post-Baccalaureate Degree (Masters Degree or Ph.D.).

### Experience (Years of Service) Findings

The survey asked three separate questions to gauge respondents' experience based on years of service in the Federal Government in general, and in IT specifically. The three questions were:

- Please indicate the number of years of Federal service
- Please indicate the number of years of public sector experience in IT
- Please indicate the number of years of private sector experience in IT

The highest percentage of respondents (42%) has "21+ years" of overall Federal service, which generally indicates a very experienced workforce. Also, the highest percentage of respondents (23%) have "11-20 years" of public sector IT experience. However, the respondents indicated a lack of private sector IT experience, in that nearly half (47%) selected "None" (for the number of years of experience). Of those who did indicate some private sector IT experience, the most frequent response (20%) was "1-3 years."



## Retirement and Longevity Findings

The survey included questions on retirement eligibility, as well as retirement estimations. In addition, the survey asked respondents to indicate their plans for remaining in IT-related employment (i.e., their “longevity”) with the Federal Government, in general, and with their respective department/agency specifically. The questions asked were as follows:

- How soon are you eligible for full retirement?
- How soon do you plan on retiring?
- How long do you expect to continue to work for the Federal Government in IT-related work?
- How long do you expect to continue to work for your current agency in IT-related work?

The most frequent response for both retirement-related questions (when respondents are eligible to retire, and when they plan on retiring) was the same, or “11-20 years” (30% for “eligible to retire” and 28% for “plan on retiring”). There is a relatively high level of agreement between when respondents are eligible to retire and when they plan on retiring, except in the short-term (0-3 years), where more respondents are eligible to retire (19%) than plan to (12%).

Respondents in two occupational series (GS-301 and GS-340) had the two highest percentages of individuals indicating they are likely to retire over the next ten years. Interestingly, this reflects a change from 2003 in which respondents in the GS-391, GS-334, and GS-2210 occupational series represented the highest percentage of individuals indicating likely retirement over the next ten years. Among all IT occupational series, and as would be expected, retirement estimates are related to grade level; i.e., the higher the grade level, the higher the possibility for an earlier estimated retirement.

In terms of longevity, 21% of respondents indicated that they are likely to leave their current organization within the next 1 – 3 years. However, there is a significant drop in the percentage of people who indicated they will leave the Federal Government within that same time frame (10%). This suggests that although there is a projected shift in where IT personnel may work in the next 1 – 3 years, it does not necessarily mean that they will leave the Federal Government. Also, 43% of respondents indicated that they expect to remain in their current organization for at least the next 7 years.

## 2.4 Competency Findings

### Background

The survey asked respondents to provide a self-assessment of their current proficiency on a set of general and technical competencies. The competencies were a subset of those developed by OPM for the GS-2210 occupational series. The competencies included 16 general and 53 technical competencies and were chosen by a focus group of Subject Matter Experts (SMEs) based on relative importance in Federal IT work. OPM defines a competency as a measurable pattern of knowledge, skills, abilities, behaviors, and other



characteristics that an individual needs to successfully perform work roles or occupational functions. See **Appendix A** for a listing and definition of all competencies used in the survey. The rating scale used for the self-assessment was:

0. None – do not possess proficiency
1. Basic – capable of handling only the simplest assignments, but will need significant assistance beyond the easiest situations
2. Foundational – capable of handling some assignments, but will need assistance beyond routine situations
3. Intermediate – capable of handling many day-to-day assignments, but may seek assistance in difficult situations
4. Advanced – capable of handling most day-to-day assignments, though may seek expert assistance with particularly difficult situations
5. Expert – capable of handling all assignments and may serve as a role model and/or coach others on this competency

### Technical Competencies Summary

Technical competencies address job-specific IT functions. Tables 2.2 and 2.3 list the ten highest and lowest-ranked technical competencies, respectively, based on the combined percentage of responses in the Intermediate, Advanced and Expert proficiency levels<sup>5</sup>.

There has been some shifting in positions among the top ten ranked technical competencies, though the changes are not considered noteworthy. Between the 2003 and 2004 survey administrations, only two competencies are no longer part of the current top ten list. In 2004, Computer Languages and Knowledge Management were ranked in the 11<sup>th</sup> and 17<sup>th</sup> positions respectively, while Requirements Analysis and Systems Life Cycle were new to the top ten list.

<b>Technical Competency</b>	<b>% Intermediate or Greater Proficiency</b>	<b>Rank</b>
Hardware	58.3%	1
Operating Systems	56.0%	2
Project Management	52.7%	3
Technology Awareness	52.1%	4
Configuration Management	51.4%	5
Technical Documentation	51.2%	6
Standards	49.0%	7
Requirements Analysis	48.7%	8
Systems Life Cycle	48.6%	9
Data Management	45.9%	10

<sup>5</sup> Throughout this report, various tables will provide a column for “% Intermediate or Greater Proficiency.” This column represents the combined percentage of responses in the Intermediate, Advanced, and Expert levels (which represent the minimal capability needed to successfully perform the competency or skill), compared to the total number of responses for that competency or skill. The reader can calculate the numerical equivalents by multiplying the percentages by the total number of respondents referenced by the table, as appropriate; either all respondents (22,104 total) or respondents retiring within the next three years (4186 total).



• Table 2.2 – Ten Highest-Ranked Technical Competencies

Similarly, there has been some shifting in positions among the bottom ten ranked technical competencies. Between the 2003 and 2004 survey administrations, only two competencies are no longer part of the current bottom ten list. In 2004, Telecommunications and Human Factors were ranked in the 33<sup>rd</sup> and 43<sup>rd</sup> positions respectively, while Business Process Reengineering and e-Commerce were new to the bottom ten list.



<b>Technical Competency</b>	<b>% Intermediate or Greater Proficiency</b>	<b>Rank</b>
Logical Systems Design	27.6%	44
Business Process Reengineering	27.5%	45
Electronic Commerce (e-Commerce)	26.7%	46
Encryption	25.9%	47
Object Technology	25.4%	48
Capital Planning and Investment Assessment	24.1%	49
Computer Forensics	20.9%	50
Modeling and Simulation	20.2%	51
Artificial Intelligence	13.0%	52
Embedded Computers	11.0%	53

• Table 2.3 – Ten Lowest-Ranked Technical Competencies

### General Competencies Summary

General competencies are cross-functional in nature and are needed by most members of the workforce regardless of the function they perform. Table 2.4 orders all general competencies, based on the combined percentage of responses in the Intermediate, Advanced, and Expert proficiency levels. As only 16 general competencies were included in the survey, all are described in the table.

<b>General Competency</b>	<b>% Intermediate or Greater Proficiency</b>	<b>Rank</b>
Interpersonal Skills	87.3%	1
Problem Solving	85.9%	2
Oral Communication	80.4%	3
Customer Service	79.4%	4
Decision Making	78.0%	5
Leadership	76.2%	6
Organizational Awareness	73.2%	7
Planning and Evaluation	72.8%	8
Influencing/Negotiating	61.9%	9
Administration and Management	53.6%	10
Strategic Thinking	53.2%	11
Managing Human Resources	50.3%	12
Public Safety and Security	41.6%	13
Financial Management	40.9%	14
Legal, Government and Jurisprudence	37.8%	15
Contracting/Procurement	37.6%	16

• Table 2.4 – Ranked General Competencies

Compared to the 2003 survey, the ranking of the general competencies remains relatively unchanged.



## Competencies Subject to Impact by Retirement

Tables 2.5 and 2.6 list the highest ranked technical and general competencies, respectively, based on the combined percentage of responses in the Intermediate, Advanced, and Expert proficiency levels for those who plan on retiring within the next three years. Although the Quality Assurance competency does appear on Table 2.5, the exclusion of this competency among the top ten rankings in the population at large (Table 2.2) is simply due to its proficiency percentage being .72% lower than the tenth ranked competency. There is little to no difference in the rankings of the general competencies. Consequently, there are no substantial differences in the competency distribution among the retiring IT workforce.

Technical Competency	% Intermediate or Greater Proficiency	Rank
Project Management	52.4%	1
Hardware	49.8%	2
Requirements Analysis	49.3%	3
Technology Awareness	46.6%	4
Operating Systems	46.5%	5
Systems Life Cycle	46.3%	6
Technical Documentation	46.3%	7
Configuration Management	45.8%	8
Standards	45.0%	9
Quality Assurance	42.7%	10

• Table 2.5 – Ten Highest-Ranked Technical Competencies Subject to Impact by Retirement

General Competency	% Intermediate or Greater Proficiency	Rank
Interpersonal Skills	85.8%	1
Problem Solving	84.7%	2
Oral Communication	80.1%	3
Customer Service	78.5%	4
Decision Making	78.3%	5
Leadership	76.9%	6
Organizational Awareness	76.6%	7
Planning and Evaluation	74.7%	8
Influencing/Negotiating	64.0%	9
Administration and Management	56.3%	10
Managing Human Resources	55.6%	11
Strategic Thinking	51.4%	12
Financial Management	43.7%	13
Contracting/Procurement	42.6%	14
Legal, Government and Jurisprudence	40.7%	15
Public Safety and Security	40.1%	16

• Table 2.6 – General Competencies Subject to Impact by Retirement



## Training Summary

Respondents were asked to identify up to five competencies where additional training would help them improve their job performance. Table 2.7 ranks the competencies and the percentage of the IT workforce who selected the competency.

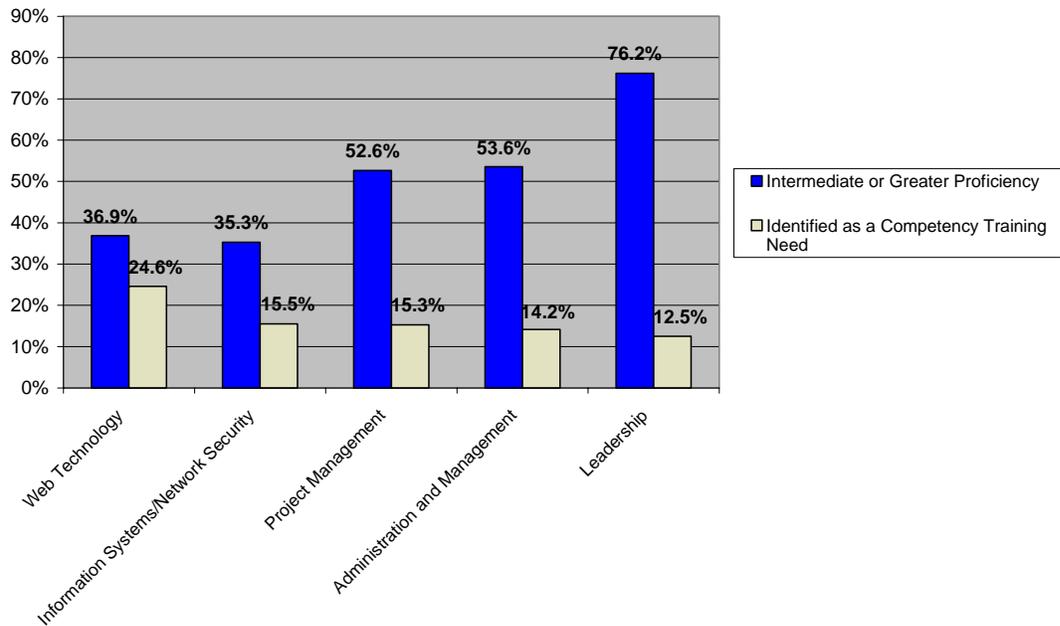
<b>Competency</b>	<b>% Responses</b>	<b>Rank</b>
Web Technology	24.6%	1
Information Systems/Network Security	15.5%	2
Project Management	15.3%	3
Administration and Management	14.2%	4
Leadership	12.5%	5
Computer Languages	12.4%	6
Network Management	12.2%	7
Computer Forensics	11.1%	8
Database Administration	11.0%	9
Cost-Benefit Analysis	10.9%	10

• Table 2.7 – Top Ten Most Frequently Identified Competency Training Needs

Figure 2.7 shows the top five most frequently identified competencies for training along with the corresponding Intermediate or greater level of proficiency in the IT workforce. Based on these data, Web Technology and Information Systems/Network Security show not only a high level of indicated need, but relatively lower levels of indicated proficiency. In the forthcoming gap analysis, these competencies will be probed for specific gaps to determine if training interventions are needed.



### Top Five Competencies Identified for Training versus Proficiency



• Figure 2.7 – Top Five Most Frequently Identified Competency Training Needs versus Proficiency

## 2.5 Skill Findings

### Background

The survey asked respondents to provide a self-assessment of their current proficiency in a set of IT-related skills. A skill is a part of a competency that describes an individual's ability to use knowledge effectively in execution or performance of specific tasks. The skills were chosen by subject matter expert focus groups, based on relevance to Federal IT work. Care was taken to identify "vendor-neutral" skills, to the greatest extent possible. A total of 55 skills were identified. The rating scale used for the self-assessment was:

0. None – do not possess proficiency
1. Basic – capable of handling only the simplest assignments, but will need significant assistance beyond the easiest situations
2. Foundational – capable of handling some assignments, but will need assistance beyond routine situations
3. Intermediate – capable of handling many day-to-day assignments, but may seek assistance in difficult situations
4. Advanced – capable of handling most day-to-day assignments, though may seek expert assistance with particularly difficult situations



5. Expert – capable of handling all assignments and may serve as a role model and/or coach others on this competency

The scale listed above is identical to the one used for the respondent's competency self assessment. See **Appendix A** for a listing of all skills used in the survey.

### Skills Summary

Tables 2.8 and 2.9 list the ten highest and lowest ranked IT skills, respectively, based on the combined percentage of responses in the Intermediate, Advanced, and Expert proficiency levels.

Skill	% Intermediate or Greater Proficiency	Rank
Desktop Applications	77.6%	1
Windows Operating System	60.8%	2
Document Management	50.1%	3
Client-Server	46.5%	4
Testing	44.9%	5
Systems Maintenance and Helpdesk	41.0%	6
System Analysis and Design	37.4%	7
Project Management Software	35.1%	8
Systems Security Applications	33.2%	9
Continuity of Operations Planning	32.8%	10

• Table 2.8 – Ten Highest-Ranked IT Skills

Skill	% Intermediate or Greater Proficiency	Rank
SEI Capability Maturity Models	13.6%	46
Linux Operating System	13.6%	47
Cellular Network Technology	13.5%	48
Extensible Markup Language (XML)	13.2%	49
Federal/OMB Enterprise Architecture	12.6%	50
Geographic Information Systems (GIS)	12.2%	51
Satellite Communications	10.7%	52
Unified Modeling Language (UML)	8.7%	53
MacOS/MacOSX Operating System	8.1%	54
Biometrics	8.1%	55

• Table 2.9 – Ten Lowest-Ranked IT Skills

It is important to note that the list of 55 skills included in the 2004 survey administration represents a more narrowly focused set of skills when compared to the 2003 list of 80 individual skills. Accordingly, comparisons between 2003 and 2004 data are limited. Nevertheless, the baseline analysis of the IT workforce skill set does yield some interesting points.



First, the intermediate or greater proficiency ratings drop more than 40 percentage points from the highest ranked skill to the tenth ranked skill (from 78% down to 33%; see Table 2.8). Such a rapid decrease in skill proficiency among the rankings of the 55 separate skills suggests the rather specialized nature of many of the IT skills assessed. Secondly, the rapid decrease in percentages of proficiency among the top ten skills as compared to the technical or general competencies may suggest that the top few skills are broad enough to be generalized across job activities. Further analysis will appear in the IT Workforce Capability Assessment Gap Analysis Report to be issued in spring 2005.

### Skills Subject to Impact by Retirement

Table 2.10 describes the ten highest ranked skills based on the combined percentage of responses in the Intermediate, Advanced, and Expert proficiency levels for those who plan on retiring within the next three years. This analysis indicates which skills might be impacted once this segment of the population retires. Mainframes was the only skill that appears in Table 2.10 that is not in Table 2.8, indicating that although this skill is not among the top ten most frequent high-proficient skills found in the population at large, it is among the top ten of those who plan on retiring within the next three years.

Skill	% Intermediate or Greater Proficiency	Rank
Desktop Applications	69.5%	1
Windows Operating System	50.1%	2
Document Management	44.0%	3
Testing	41.8%	4
System Analysis and Design	37.5%	5
Client-Server	36.4%	6
Systems Maintenance and Helpdesk	35.3%	7
Continuity of Operations Planning	33.7%	8
Mainframes	32.6%	9
Project Management Software	32.3%	10

• Table 2.10 – Ten Highest-Ranked Skills Subject to Impact by Retirement

## 2.6 Certification Area Findings

### Background

The survey asked respondents to indicate broad certification areas in which they currently possess a recent (within the past 3 years) certification or certificate. The survey avoided asking for specific certifications and instead focused on certification areas (for example, “Information Systems” as an area versus “Microsoft Certified Systems Engineer” as a discrete certification). This approach was chosen because of the difficulty in compiling a current, comprehensive and reliable list of certifications. In 2003, 44 separate certification areas were identified and assessed; in 2004, these certification areas were narrowed and focused to 19. See **Appendix A** for a listing of the certification areas and examples of certifications or certificates within each area.



## Certification Area Summary

Table 2.11 lists the 19 certification areas, the total number of individuals who indicated they were certified, and the resulting percentage of the total IT workforce. Compared to 2003, the total number certified and corresponding percentage is higher in the 2004 survey administration. This is likely due to a consolidation of certification areas.

Certification Area	# Certified	%	Rank
Network Support	1624	7.4%	1
Project Management	1554	7.0%	2
Operating Systems	1547	7.0%	3
Computing	1461	6.6%	4
Information Systems	1013	4.6%	5
Information Systems Security	982	4.4%	6
Network Security	587	2.7%	7
Database	563	2.6%	8
Business Applications	545	2.5%	9
Software Development	346	1.6%	10
Training	323	1.5%	11
Web	306	1.4%	12
Engineering	264	1.2%	13
CIO	259	1.2%	14
Quality	214	.97%	15
GSA 1000 by 2000 Certification	125	.57%	16
Healthcare	78	.35%	17
Evidence Collection	32	.14%	18
Mechanical	26	.12%	19

• Table 2.11 – Certification Areas, Number Certified and Percentage

## 2.7 Specialized Job Activity Findings

### Background

The survey asked respondents to estimate the amount of time they spend on a daily basis (as part of their normal duties and responsibilities) on 19 different “specialized job activities.” The rating scale used was:

- Extensive – I spend most of my time on this job activity in a given day
- Moderate – I spend a moderate amount of time on this job activity in a given day
- Minimal – I spend very little time on this job activity in a given day
- None – I do not spend any time on this job activity in a given day



The 2004 survey administration included nine GS-2210 parenthetical (or “specialty”) titles that were not represented in 2003. These parenthetical titles were included as activities to ensure the representation of Governmentwide IT functions was as inclusive as possible. Each activity is identified and defined alphabetically below:

- **Applications Software** - This activity involves the design, documentation, development, modification, testing, installation, implementation, and support of new or existing applications software.
- **Capital Planning and Investment** - This activity involves using a systematic approach to designing or selecting, implementing, managing, and evaluating information technology investments for maximizing the value and assessing the risks of the information technology acquisitions for your particular agency.
- **Customer Support** - This activity involves the planning and delivery of customer support services, including installation, configuration, troubleshooting, customer assistance, and/or training, in response to customer requirements.
- **Data Management** - This activity involves the planning, development, implementation, and administration of systems for the acquisition, storage, and retrieval of data.
- **E-Government** - This activity involves all Federal initiatives that play an integral role in streamlining and improving procedures for moving Federal employees through the employment lifecycle. E-Government initiatives should seek to remove redundancies, reduce response times, eliminate paperwork, and improve coordination among Federal agencies.
- **Enterprise Architecture (EA)** - This activity links the business mission, strategy, and processes of an organization to its IT strategy. It is documented using multiple architectural models or views that show how the current and future needs of an organization will be met. By focusing on strategic differentiators and working across the enterprise, there is a unique opportunity to create leverage and synergies and avoid duplication and inconsistencies across the enterprise.
- **Internet** - This activity involves the technical planning, design, development, testing, implementation, and management of Internet, intranet, and extranet activities, including systems/applications development, and technical management of Web sites.
- **IT Project Management** - This activity typically involves exercising centralized authority and responsibility for planning, organizing, staffing, and controlling efforts of participating personnel and organizations for management of one or more specific IT project(s) throughout the life cycle (from initiation to deployment and closeout) of the system. IT project management includes responsibilities such as definition of requirements, development of project plans, acquisition, risk mitigation, deployment and maintenance, and ensuring the project is on schedule and within budget.
- **IT Security/Information Assurance** - This area ensures the integrity, availability, and confidentiality of information systems through the planning, analysis, development, implementation, maintenance, and enhancement of systems, programs, policies, procedures, and tools.
- **IT Workforce Management/ Development** - This activity involves identifying and addressing IT workforce planning and management issues; creating and promoting human resources management systems to recruit and retain a



productive IT workforce; and providing training and developmental opportunities to ensure that future workforce needs are met.

- **Knowledge Management** - This is the process through which organizations generate value from their intellectual and knowledge-based assets. Most often, generating value from such assets involves sharing them among employees, departments and even with other companies in an effort to devise best practices.
- **Network Services** - This activity involves the planning, analysis, design, development, testing, quality assurance, configuration, installation, implementation, integration, maintenance, and/or management of networked systems used for the transmission of information in voice, data, and/or video formats.
- **Operating Systems** - This activity involves the planning, installation, configuration, testing, implementation, and management of the systems environment in support of the organization's IT architecture and business needs.
- **Policy and Planning** - This activity involves a wide range of IT management activities that typically extend and apply to an entire organization or major components of an organization. This includes strategic planning, capital planning and investment control, workforce planning, policy and standards development, resource management, knowledge management, architecture and infrastructure planning and management, auditing, and information security management.
- **Privacy** - This activity helps to ensure that sound data management practices are maintained by monitoring and controlling how personal data are collected, used, stored, transferred, and destroyed. This activity includes evaluating IT systems for privacy risks and compliance, conducting Privacy Impact Assessments, reviewing public Web sites, and assessing back-office practices pertaining to personal data handling.
- **Records Management** - This includes the creation, retention and scheduled destruction of an agency's paper and film documents. Records management can include document imaging and document scanning, indexing and online document hosting. Completing document conversions from paper, microfilm scanning and large microfiche are also part of records management.
- **Solutions Architecture** - This activity is generally concerned primarily with studying and defining solutions for a single system, department, or solution area within an agency. The Solutions Architect is primarily concerned with issues including fundamental business and technology issues: alignment with core agency business strategies, business process simplification, and the implementation of information technology that enables the realization of key business objectives but on a small scale and within the scope of a single project or system.
- **Systems Administration** - This activity involves the planning and coordinating the installation, testing, operation, troubleshooting, and maintenance of hardware and software systems.
- **Systems Analysis** - This activity involves applying analytical processes to the planning, design and implementation of new and improved information systems to meet the business requirements of customer organizations.



The survey asked respondents to rate the amount of time they spend on each specialized job activity. Table 2.12 ranks the specialized job activities based on the proportion of responses for each time variable (the sum of the percentages for the Extensive and Moderate time variables).

<b>Specialized Job Activity</b>	<b>% Moderate or Greater</b>	<b>Rank</b>
Customer Support	60.6%	1
IT Project Management	47.4%	2
Applications Software	46.2%	3
IT Security/Information Assurance	42.1%	4
Systems Analysis	39.5%	5
Data Management	39.0%	6
Systems Administration	38.6%	7
Policy and Planning	32.0%	8
Operating Systems	31.5%	9
Knowledge Management	29.4%	10
Network Services	29.0%	11
Internet	28.0%	12
Solutions Architecture	26.6%	13
Privacy	24.0%	14
Capital Planning and Investment	22.1%	15
Enterprise Architecture (EA)	21.4%	16
IT Workforce Management Development	18.8%	17
E-Government	17.6%	18
Records Management	15.7%	19

• Table 2.12 – Specialized Job Activity Responses

Based on survey responses, Customer Support was the most frequently performed job activity, with 61% of the population spending a moderate or greater amount of time on the activity. This is a 14 percentage point difference from the second ranked activity, IT Project Management. The large percentage of responses to the Customer Support activity may indicate the inherent customer-focused nature of Federal IT work; it should be noted that the definition of Customer Support was intended to include broader activities than traditional help desk functions.

As stated earlier, the 2004 administration of the IT Workforce Capability Assessment Survey included an additional nine specialized job activities. Therefore, comparisons between the two years are limited. However, these data do provide baseline information for subsequent survey administrations and trend analyses.



Chapter

3

Conclusions and Recommendations

IT Workforce Capability Assessment Survey (2004)

Conclusions and Recommendations

3.1 Introduction

This Chapter summarizes high-level conclusions based on the key survey findings and presents a set of recommendations.

3.2 Conclusions

Demographic Conclusions

With no significant changes from the 2003 survey administration, once again, the overall demographic analysis depicts a mature Federal IT workforce. Specifically, 76% of the workforce is over the age of 40 and more than one third of the workforce is over the age of 50. However, **it is important to note that although the IT workforce remains relatively older, only 13% estimate that they plan on retiring in the next three years with an additional 16% estimating their retirement will be within four to six years.**

As in 2003, respondents indicate that they have very little private sector experience. The majority of respondents (68%) have less than three years of private sector experience.

The grade level profile appropriately reflects the management-oriented nature of Government IT work. In fact, over 75% of respondents indicate they are GS-12s or higher. While it cannot be assumed that all of these respondents have supervisory responsibilities, **it remains clear that Government IT work delegation remains skewed towards the higher GS levels.**

As would be anticipated, more so in the Senior Executive Service relative to other grade levels, expected retirements will have a more profound effect in terms of the percentage planning to retire. Specifically, slightly fewer than one third of executives expect to retire in the next three years with a total of 54% retiring within the next six years.



## Competency and Skill Conclusions

In general, there were a minimal number of changes from 2003 to 2004 in the self assessed proficiency ratings of both the technical and general competencies. Only two of the 2003 top ten ranked technical competencies were replaced with other competencies during the 2004 survey administration. This suggests that **there has not been any significant acquisition or loss of any particular technical competency in the one year between analyses**. Likewise, there were very little discrepancies in the rankings of the general competencies.

Comparisons of skill proficiency between 2003 and 2004 are limited, as the list of 55 skills included in the 2004 survey administration represents a more narrowly focused set than the 2003 list of 80 skills. Nevertheless, the rapid decrease in skill proficiency among the rankings of the 55 separate skills suggests the rather specialized nature of many of the IT skills assessed. In addition, the rapid decrease in percentages of proficiency among the top 10 skills as compared to the technical or general competencies may suggest that the top few skills are broad enough to be generalized across job activities.

There were no significant differences in the skill or competency proficiencies between the retiring population and the IT workforce population in general. As such, **no particular competency or skill is “at risk” of vacating the Federal workforce due to retirement**. However, the competency Project Management was the highest-ranked competency, based on the combined percentage of responses in the Intermediate, Advanced, and Expert proficiency levels, for those who plan on retiring within the next three years. Due to its importance to the Federal Government and individual agencies, it is recommended that a trend analysis be performed to ascertain if, over time, these retirements affect the overall proficiency level of the Project Management competency.

In terms of training, nearly a quarter (24.6%) of respondents indicated that they would benefit from training for the Web Technology competency. Of this group, 46% are grades GS-13 and above, suggesting the relative importance this skill set may have in some of the more advanced or managerial IT activities.

## Certification Area Conclusions

Just as in the 2003 survey administration, **the 2004 survey found that very few respondents were certified in any given area**. However, the total number certified and corresponding percentage is higher in the 2004 survey administration. This is likely due to a consolidation of certification areas.

## Specialized Job Activity Conclusions

The majority of respondents indicated that they spend a moderate or greater amount of time performing the Customer Support specialized job activity. This may suggest a dominant customer service-oriented culture that is inherent in a broad array of activities of the Federal IT workforce.

Comparing the ranked list of specialized job activities to the data gathered on identified competency training needs shows that the second and third most identified competencies (Information Systems/Network Security and Project Management) are highly similar to the second and fourth ranked job activities (IT Project Management and IT



Security/Information Assurance). These two activities have both a relatively high percentage of workers who spend a moderate or greater amount of time performing the activity and a relatively high perceived need for training. These competencies may be excellent candidates for more extensive professional development (e.g., training, rotational assignment) programs.

### 3.3 Recommendations

#### IT Workforce Human Capital Planning Recommendations

This *IT Workforce Capability Assessment Survey (2004): Analysis of Survey Results Report* describes the results of the IT Workforce Capability Assessment Survey, or the “supply” of the IT workforce’s capabilities. Survey results will be used in the forthcoming Capability Planning and Analysis Tool to identify capability gaps by comparing capability “supply” with “demand.” After gaps are identified, specific human capital solutions to mitigate the gaps will be explored, developed, and recommended. A follow-on *IT Workforce Capability Assessment (2004): Gap Analysis Report* detailing the “demand” step, resulting gap analyses, and subsequent recommendations will be published in spring 2005.

#### Survey Administration Methodology Recommendations

As additional years of survey data begin to accumulate, standardizing and updating the IT Workforce Capability Assessment Survey and its accompanying methodology will be critical to successful trend analysis. Based on the 2004 survey administration, methodology and assessment recommendations for subsequent survey administrations include:

- a) Survey respondents were asked to identify competencies in which they perceive a need for training. It is recommended that, in subsequent survey administrations, respondents be asked to identify skills in which they perceive a need for training as well.
- b) Incorporating other assessment methodologies will help ease the burden on the surveyed population while allowing for further explanation and validation of results. As would be expected, every assessment methodology has its limitations. Additional assessment methodologies, such as interviews and focus groups, could be used by participating agencies to develop a more in-depth follow-on analysis. These assessment methodologies have been shown to further substantiate and explain the results of the survey, to develop solutions or interventions to identified issues, and to increase survey participant “buy-in” to the assessment process.
- c) Updating and revising the IT Workforce Capability Assessment Survey is critical to the applicability of the survey results to future IT populations. Optimally, the addition, deletion, and amending of survey items should be completed as early as possible to ensure that trend analysis data can begin to accrue. However, items should also be modified and updated to reflect changes in or additions to job tasks, certification availabilities, and/or less relevant competencies and skills. Careful attention should always be paid to the cost/benefit balance of



updating/revising the survey and maintaining the standardization necessary to establish trend data over time.

- d) As a 2005 administration of the IT Workforce Capability Assessment Survey would mark the third circulation of the instrument, additional analyses can be added. Specifically, it is recommended that the next analysis of assessment data include descriptive and analytical text surrounding changes over time, or trends. Typically, these analyses can be done with at least three years of successive data. Certain aspects of the survey content lend themselves particularly well to trend analyses, such as general competencies. General competencies are by definition applicable across occupations, tasks, and agencies, and as such one would not expect to find much fluctuation in self-appraisal ratings on the mastery of general competencies over time. For example, it may be difficult to find any significant portion of the population stating that they have not achieved at least a minimal mastery of the Interpersonal Skills general competency. Therefore, a trend analysis of the general competencies would be useful to identify any large jumps in rankings from year to year. Similarly, trend analyses would also help to identify significant discrepancies in rankings between the population at large and the retiring population in any given year.
- e) Asking respondents to identify at what time they intend to leave the Federal IT workforce provides useful data, but does not adequately distinguish between retirement and other types of attrition. It is recommended that additional questions be designed so that the proficiency and demographic composition of those workers who are leaving the workforce, but not retiring, may be better understood.



## Appendix

# A Survey Content

## IT Workforce Capability Assessment Survey (2004) Survey Content

### A.1 List of General Competencies and Definitions

1. **Administration and Management** - Knowledge of planning, coordination, and execution of business functions, resource allocation, and production.
2. **Contracting/Procurement** - Knowledge of various types of contracts, techniques for contracting or procurement, and contract negotiation and administration.
3. **Customer Service** - Works with clients and customers (that is, any individuals who use or receive the services or products that your work unit produces, including the general public, individuals who work in the agency, other agencies, or organizations outside the Government) to assess their needs, provide information or assistance, resolve their problems, or satisfy their expectations; knows about available products and services; is committed to providing quality products and services.
4. **Decision Making** - Makes sound, well-informed, and objective decisions; perceives the impact and implications of decisions; commits to action, even in uncertain situations, to accomplish organizational goals; causes change.
5. **Financial Management** - Prepares, justifies, and/or administers the budget for program areas; plans, administers, and monitors expenditures to ensure cost-effective support of programs and policies; assesses financial condition of an organization.
6. **Influencing/Negotiating** - Persuades others to accept recommendations, cooperate, or change their behavior; works with others towards an agreement; negotiates to find mutually acceptable solutions.
7. **Interpersonal Skills** - Shows understanding, friendliness, courtesy, tact, empathy, concern, and politeness to others; develops and maintains effective relationships with others; may include effectively dealing with individuals who are difficult, hostile, or distressed; relates well to people from varied backgrounds and different situations; is sensitive to cultural diversity, race, gender, disabilities, and other individual differences.
8. **Leadership** - Influences, motivates, and challenges others; adapts leadership styles to a variety of situations.



9. **Legal, Government and Jurisprudence** - Knowledge of laws, legal codes, court procedures, precedents, legal practices and documents, Government regulations, executive orders, agency rules, Government organization and functions, and the democratic political process.
10. **Managing Human Resources** - Plans, distributes, coordinates, and monitors work assignments of others; evaluates work performance and provides feedback to others on their performance; ensures that staff are appropriately selected, utilized, and developed, and that they are treated in a fair and equitable manner.
11. **Oral Communication** - Expresses information (for example, ideas or facts) to individuals or groups effectively, taking into account the audience and nature of the information (for example, technical, sensitive, controversial); makes clear and convincing oral presentations; listens to others; attends to nonverbal cues; and responds appropriately.
12. **Organizational Awareness** - Knows the organization's mission and functions, and how its social, political, and technological systems work and operates effectively within them; this includes the programs, policies, procedures, rules, and regulations of the organization.
13. **Planning and Evaluation** - Organizes work, sets priorities, and determines resource requirements; determines short- or long-term goals and strategies to achieve them; coordinates with other organizations or parts of the organization to accomplish goals; monitors progress and evaluates outcomes.
14. **Problem Solving** - Identifies problems; determines accuracy and relevance of information; uses sound judgment to generate and evaluate alternatives, and to make recommendations.
15. **Public Safety and Security** - Knowledge of the military, weaponry, and intelligence operations; public safety and security operations; occupational health and safety; investigation and inspection techniques; or rules, regulations, precautions, and prevention techniques for the protection of people, data, and property.
16. **Strategic Thinking** - Formulates effective strategies consistent with the business and competitive strategy of the organization in a global economy. Examines policy issues and strategic planning with a long-term perspective. Determines objectives and sets priorities; anticipates potential threats or opportunities.

## A.2 List of Technical Competencies and Definitions

1. **Accessibility** - Knowledge of tools, equipment, and technologies used to help individuals with disabilities use computer equipment and software.
2. **Artificial Intelligence** - Knowledge of the principles, methods, and tools used to design systems that perform human intelligence functions.
3. **Business Process Reengineering** - Knowledge of methods, metrics, tools, and techniques of Business Process Reengineering.
4. **Capacity Management** - Knowledge of the principles and methods for monitoring, estimating, or reporting actual performance or the performance capability of information systems or components.



5. **Capital Planning and Investment Assessment** - Knowledge of the principles and methods of capital investment analysis or business case analysis, including return on investment analysis.
6. **Computer Forensics** - Knowledge of tools and techniques used in data recovery and preservation of electronic evidence.
7. **Computer Languages** - Knowledge of computer languages and their applications to enable a system to perform specific functions.
8. **Configuration Management** - Knowledge of the principles and methods for planning or managing the implementation, update, or integration of information systems components.
9. **Cost-Benefit Analysis** - Knowledge of the principles and methods of cost-benefit analysis, including the time value of money, present value concepts, and quantifying tangible and intangible benefits.
10. **Data Management** - Knowledge of the principles, procedures, and tools of data management, such as modeling techniques, data backup, data recovery, data dictionaries, data warehousing, data mining, data disposal, and data standardization processes.
11. **Database Administration** - Knowledge of the principles, methods, and tools for automating, developing, implementing, or administering database systems.
12. **Database Management Systems** - Knowledge of the uses of database management systems and software to control the organization, storage, retrieval, security, and integrity of data.
13. **Distributed Systems** - Knowledge of the principles, theoretical concepts, and tools underlying distributed computing systems, including their associated components and communication standards.
14. **Electronic Commerce (e-Commerce)** - Knowledge of the principles, methods, and tools for conducting business online, including electronic data interchange.
15. **Embedded Computers** - Knowledge of specifications and uses of specialized computer systems used to control devices (for example, automobiles, helicopters), including the appropriate programming languages.
16. **Encryption** - Knowledge of procedures, tools, and applications used to keep data or information secure, including public key infrastructure, point-to-point encryption, and smart cards.
17. **Hardware** - Knowledge of specifications, uses, and types of computer or computer-related equipment.
18. **Hardware Engineering** - Knowledge of the principles, methods, and tools for designing, developing, and testing computer or computer-related equipment.



19. **Human Factors** - Knowledge of the principles, methods, and tools used to identify and apply information about human behavior, abilities, limitations, and other characteristics to the design of tools, machines, systems, tasks, jobs, and environments for effective human use.
20. **Information Assurance** - Knowledge of methods and procedures to protect information systems and data by ensuring their availability, authentication, confidentiality, and integrity.
21. **Information Resources Strategy and Planning** - Knowledge of the principles, methods, and techniques of information technology (IT) assessment, planning, management, monitoring, and evaluation, such as IT baseline assessment, interagency functional analysis, contingency planning, and disaster recovery.
22. **Information Systems Security Certification** - Knowledge of the principles, methods, and tools for evaluating information systems security features against a set of specified security requirements.
23. **Information Systems/Network Security** - Knowledge of methods, tools, and procedures, including development of information security plans, to prevent information systems vulnerabilities, and provide or restore security of information systems and network services.
24. **Information Technology Architecture** - Knowledge of architectural methodologies used in the design and development of information systems, including the physical structure of a system's internal operations and interactions with other systems.
25. **Information Technology Performance Assessment** - Knowledge of the principles, methods, and tools (for example, surveys, system performance measures) to assess the effectiveness and practicality of information technology systems.
26. **Information Technology Research & Development** - Knowledge of scientific principles, methods, and tools of basic and applied research used to conduct a systematic inquiry into a subject matter area.
27. **Infrastructure Design** - Knowledge of the architecture and typology of software, hardware, and networks, including LANS, WANS, and telecommunications systems, their components and associated protocols and standards, and how they operate and integrate with one another and with associated controlling software.
28. **Knowledge Management** - Knowledge of the value of collected information and the methods of sharing that information throughout an organization.
29. **Logical Systems Design** - Knowledge of the principles and methods for designing business logic components, system processes and outputs, user interfaces, data inputs, and productivity tools (for example, CASE).
30. **Modeling and Simulation** - Knowledge of mathematical modeling and simulation tools and techniques to plan and conduct test and evaluation programs, characterize systems support decisions involving requirements, evaluate design alternatives, or support operational preparation.
31. **Multimedia Technologies** - Knowledge of the principles, methods, tools, and techniques of developing or applying technology using text, audio, graphics, or other media.



32. **Network Management** - Knowledge of the operation, management, and maintenance of network and telecommunication systems and linked systems and peripherals.
33. **Object Technology** - Knowledge of the principles, methods, tools, and techniques that use object-oriented languages, analysis, and design methodologies.
34. **Operating Systems** - Knowledge of computer network, desktop, and mainframe operating systems and their applications.
35. **Operations Support** - Knowledge of procedures to ensure production or delivery of products and services, including tools and mechanisms for distributing new or enhanced software.
36. **Organizational Development** - Knowledge of the principles of organizational development and change management theories and their applications.
37. **Process Control** - Knowledge of the principles, methods, and procedures used for the automated control of a process, including the design, development, and maintenance of associated software, hardware, and systems.
38. **Product Evaluation** - Knowledge of methods for researching and analyzing external products to determine their potential for meeting organizational standards and business needs.
39. **Project Management** - Knowledge of the principles, methods, or tools for developing, scheduling, coordinating, and managing projects and resources, including monitoring and inspecting costs, work, and contractor performance.
40. **Quality Assurance** - Knowledge of the principles, methods, and tools of quality assurance and quality control used to ensure a product fulfills functional requirements and standards.
41. **Requirements Analysis** - Knowledge of the principles and methods to identify, analyze, specify, design, and manage functional and infrastructure requirements; includes translating functional requirements into technical requirements used for logical design or presenting alternative technologies or approaches.
42. **Risk Management** - Knowledge of methods and tools used for risk assessment and mitigation of risk.
43. **Software Development** - Knowledge of the principles, methods, and tools for designing, developing, and testing software in a given environment.
44. **Software Engineering** - Knowledge of software engineering design and development methodologies, paradigms, and tools; the software life cycle; software reusability; and software reliability metrics.
45. **Software Testing and Evaluation** - Knowledge of the principles, methods, and tools for analyzing and developing software test and evaluation procedures.
46. **Standards** - Knowledge of standards that either are compliant with or derived from established standards or guidelines.



47. **System Testing and Evaluation** - Knowledge of the principles, methods, and tools for analyzing and developing systems test and evaluation procedures and technical characteristics of IT systems, including identifying critical operational issues.
48. **Systems Integration** - Knowledge of the principles, methods, and procedures for installing, integrating, and optimizing information systems components.
49. **Systems Life Cycle** - Knowledge of systems life cycle management concepts used to plan, develop, implement, operate, and maintain information systems.
50. **Technical Documentation** - Knowledge of procedures for developing technical and operational support documentation.
51. **Technology Awareness** - Knowledge of developments and new applications of information technology (hardware, software, telecommunications), emerging technologies and their applications to business processes, and applications and implementation of information systems to meet organizational requirements.
52. **Telecommunications** - Knowledge of transmissions, broadcasting, switching, control, and operation of telecommunications systems.
53. **Web Technology** - Knowledge of the principles and methods of web technologies, tools, and delivery systems, including web security, privacy policy practices, and user interface issues.

### A.3 List of Skills and Definitions

1. **Biometrics** - Activities related to technological methods of identifying individuals via biological traits, such as retinal or iris scanning, fingerprints, or face recognition.
2. **Broadband Media** - Activities related to telecommunication in which a wide band of frequencies is available to transmit information. This allows information to be multiplexed and sent on many different frequencies or channels within the band concurrently, allowing more information to be transmitted in a given amount of time.
3. **Cellular Network Technology** - Activities related to wireless communications network architecture. These employ "cells" or modular coverage areas typically serviced by a cell site or base station and usually provide capability between cells for roaming devices.
4. **Client-Server** - Activities related to software programs that are used to contact and obtain data from a server software program on another computer, often across a great distance. Each client program is designed to work with one or more specific kinds of server programs, and each server typically requires a specific kind of client.
5. **Collaboration Software** - Activities related to software or tools that integrate work on a single project by several concurrent users at separated workstations (also known as groupware).
6. **Continuity of Operations Planning** - Building contingencies and strategies for minimizing financial and operational losses following service interruptions caused by natural, technological, and attack-related emergencies. Such planning includes the safety of employees, information, and services.



7. **Cryptology** - The methods of transforming data for secure storage and transmission purposes. Such activities make it difficult or impossible for unauthorized individuals to access confidential or sensitive data.
8. **Data Analysis and Reporting** - Activities related to the analysis of data in a database using tools that look for trends or anomalies, establish relationships, and predict future patterns among events. Includes using statistical software (such as SAS and SPSS) to generate reports.
9. **Data Modeling** - Activities related to the analysis of data objects that are used in a business or other context and the identification of the relationships among these data objects. Creating graphical representations of the entities, and the relationships among entities, within an information system. Diagramming assists in planning the database model and communicating its design to an end user.
10. **Data Warehousing** - Population and maintenance of a central repository for all, or significant parts of, data that an enterprise's various business systems collect. Also includes the migration of data from legacy databases into a data warehouse.
11. **Desktop Applications** - Ability to productively use or employ a variety of widely-used end-user applications such as Microsoft Office, Visio, etc..
12. **Development Languages** - Ability to write or author code in a variety of programming languages (e.g., html, c++, java, java script, xml, asp) to develop applications. Encompasses 4<sup>th</sup> Generation, Low-level and Mid-level Languages.
13. **Document Management** - Activities related to the computerized management of electronic and paper-based files.
14. **Earned Value Management** - Ability to manage projects/programs by integrating technical performance requirements, resource planning, scheduling and risk management to ensure the use of effective cost and schedule management controls by the contractor.
15. **Enterprise Directory Services (EDS)** - Activities related to an Enterprise Directory Service (EDS), which identifies all resources (e.g., email addresses, computers, printers, databases) on a network and makes them accessible to users and applications. An EDS offers a unique way of naming, describing, and locating resources on a network.
16. **Enterprise Portal Development** - The creation and maintenance of a web-based framework for agency resources (e.g., email, news, search engine, policies). A portal is a single point of access for all employees in an enterprise, providing access to specific information and services.
17. **Enterprise Resource Planning (ERP)** - Activities related to the integration of all departments and functions across a company onto a single computer system that can serve all those different departments' particular needs. Integration can include databases, tools, interfaces and applications.
18. **Extensible Markup Language (XML)** - Activities related to Extensible Markup Language (XML), a widely used system for defining data formats. XML provides a rich system to define complex documents and data structures. As long as a programmer has the XML definition for a collection of data (often called a "schema") then they can create a program to reliably process any data formatted according to those rules.



19. **Federal/OMB Enterprise Architecture** - Activities related to the business-based framework developed by the Office of Management and Budget (OMB) for Governmentwide improvement. The architecture is being constructed through a collection of interrelated "reference models" designed to facilitate cross-agency analysis and the identification of duplicative investments, gaps, and opportunities for collaboration within and across Federal Agencies.
20. **Firewalls** - Activities related to the combination of hardware and software that separates a network into two or more parts for security purposes.
21. **Geographic Information Systems (GIS)** - Activities related to computer software capable of capturing, storing, analyzing, and displaying geographically referenced information. Layers of information about cities, countries, or other locations may include bodies of water, roadways, agriculture, natural resources, and commerce.
22. **Joint Application Development/Rapid Application Development (JAD/RAD)** - Utilization of JAD, a methodology that involves the client or end user in the design and development of an application, through a succession of collaborative workshops called JAD sessions. A variation on JAD, Rapid Application Development (RAD) creates an application more quickly through such strategies as using fewer formal methodologies and reusing software components.
23. **Linux Operating System** - Activities related to the widely used open source UNIX-like operating system Linux. Operating systems perform basic tasks, such as recognizing input from the keyboard, sending output to the display screen, keeping track of files and directories on the disk, and controlling peripheral devices such as disk drives and printers.
24. **MacOS/MacOSX Operating System** - Activities related to the operating system behind many Macintosh computers. Operating systems perform basic tasks, such as recognizing input from the keyboard, sending output to the display screen, keeping track of files and directories on the disk, and controlling peripheral devices such as disk drives and printers.
25. **Mainframe Operating Systems** - Activities related to mainframe operating systems that perform basic tasks, such as recognizing input from the keyboard, sending output to the display screen, keeping track of files and directories on the disk, and controlling peripheral devices such as disk drives and printers.
26. **Mainframes** - Activities related to mainframes, which are computers for large-scale computing purposes. Historically, a mainframe is associated with centralized rather than distributed computing, and is able to handle hundreds, or even thousands, of users simultaneously.
27. **Network Architecture and Design** - Ability to ensure that networks are structured and designed to support the success of an organization. They are responsible for making the right connections for the Internet, intranets, and extranets, including designing and maintaining local area networks and wide area networks.
28. **Network Configuration and Implementation** - Programming of the layout and settings of the computers and equipment on an enterprise's local area network (LAN) or intranet. This includes devices like routers and gateways that interconnect the LAN with other LANs or the Internet.



29. **Network Voice/Data Integration** - Activities related to packetizing and carrying normal telephony-style voice over a network circuit or channel, similar to, and often interspersed with, data packets.
30. **Object-Oriented Languages** - Ability to write or author code using object-oriented languages, which are organized around "objects" rather than "actions" and data rather than logic. Programmers define not only the data type of a data structure, but also the types of operations (functions) that can be applied to the data structure. Also, programmers can create relationships between objects. Examples of object-oriented languages include C++ and Java.
31. **OS/2 Operating System** - Activities related to the OS/2 operating system for PCs developed originally by Microsoft Corporation and IBM. Operating systems perform basic tasks, such as recognizing input from the keyboard, sending output to the display screen, keeping track of files and directories on the disk, and controlling peripheral devices such as disk drives and printers.
32. **Personal Digital Assistants** - Activities related to Personal Digital Assistants (PDAs), or handheld devices that were originally designed as personal organizers, but became much more versatile over the years. A basic PDA usually includes a clock, date book, address book, task list, memo pad and a simple calculator. One major advantage of using PDAs is their ability to synchronize data with desktop, notebook and desknote computers.
33. **Portfolio Management for IT** - Activities related to the management of IT resources, as one would manage investments in a real estate or stock portfolio. The IT portfolio facilitates the alignment of technology investments with agency business needs and the analysis and proper mitigation of IT investment risks.
34. **Process Design** - Activities related to the strategic establishment of the flow of information, control or materials from one activity to another. Examples of graphical representations of process design include the Business Process Modeling Notation (BPMN) and the Integrated Computer Aided Manufacturing Definition (IDEF).
35. **Project Management Software** - The use of software in order to manage resources and scheduling for a given project.
36. **Public Key Infrastructure (PKI)** - Activities related to Public Key Infrastructure (PKI), or the use of an unsecured public network, such as the Internet, to securely and privately exchange data and money through the use of a public and a private cryptographic key pair that is obtained and shared through a trusted authority.
37. **Records Management** - Activities related to the physical or digital maintenance of public records, from creation through destruction.
38. **Relational Database Management Systems (RDBMS)** - Activities related to relational database management systems, or programs that let you create, update, and administer a relational database. Examples include Oracle, IBM's DB2 and Microsoft's SQL Server.
39. **Reusable Modules** - Activities employing reusable modules in programming, when repeating the same function multiple times. The module includes files and is inserted into the code to reduce the code's complexity and redundancy.



40. **Satellite Communications** - Activities related to the utilization of geostationary orbiting satellites to relay the transmission received from one earth station to one or more earth stations. They are the outcome of research in the area of communications whose objective is to achieve ever-increasing ranges and capacities with the lowest possible costs.
41. **Scripting/Metadata** - The use of metadata, or describing how, when and by whom a particular set of data was collected, and how the data is formatted. Metadata is essential for understanding information stored in data warehouses.
42. **SEI Capability Maturity Models** - Working knowledge of the Carnegie Mellon Software Engineering Institute's (SEI) 5-stage model of how software organizations improve, over time, in their ability to develop software. Knowledge of the model provides a basis for assessment, comparison, and process improvement.
43. **Structured Query Language (SQL)** - Activities related to SQL, a standardized query language for requesting information from a database.
44. **System Analysis and Design** - Activities related to the design, specification, feasibility, cost, and implementation of a computer system for business. Knowledge of the development and implementation process, metrics and tools for analysis, design and project management, quality factors and post evaluation techniques.
45. **Systems Maintenance and Helpdesk** - Activities related to an enterprise's physical or online resource center for just-in-time assistance with desktop, network, hardware, and software questions and issues.
46. **Systems Security Applications** - Activities related to the applications and tools that administrators use to manage various users, roles and groups to implement access and privilege controls for certain applications or against operating system resources.
47. **Telephony/PBX** - Activities related to a telephone network used within an enterprise. Users of the PBX share a certain number of outside lines for making telephone calls external to the PBX. It allows a small number of outside lines to be shared among all of the people of the organization.
48. **Testing** - Activities related to determining whether objectives are being met during hardware/software development. Testing can take place at a variety of levels such as the module, component, or system levels. Testing is also related to the various types of verification, validation and evaluation of whether or not a system satisfies its acceptance criteria. This process enables the customer to determine whether or not to accept the system.
49. **Unified Modeling Language (UML)** - Activities related to the industry-standard Unified Modeling Language (UML) for specifying, visualizing, constructing, and documenting the artifacts of software systems. It simplifies the complex process of software design, making a "blueprint" for construction.
50. **UNIX Operating System** - Activities related to the UNIX operating system. Operating systems perform basic tasks, such as recognizing input from the keyboard, sending output to the display screen, keeping track of files and directories on the disk, and controlling peripheral devices such as disk drives and printers. UNIX is designed for use by many people at the same time (it is multi-user) and has TCP/IP built-in. It is the most common operating system for servers on the Internet.



51. **Video Imaging** - Ability to use software tools to capture, store, manipulate, and display graphic images.
52. **Web-enabled Application Design and Development** - Ability to design and develop web-enabled applications that provide certain functionality, automate certain processes or provide access to or interface with legacy applications. Includes designing the look and feel of the application and ensuring accessibility to site content for individuals with disabilities.
53. **Web Site Management** - Activities that involve the management and maintenance of an enterprise's web site or portal. Activities include developing web pages, performing backups and ensuring user access to the site, monitoring site traffic and helping scale site capacity meet traffic demands.
54. **Windows Operating System** - Activities related to the operating system behind all Microsoft Windows-configured computers. Operating systems perform basic tasks, such as recognizing input from the keyboard, sending output to the display screen, keeping track of files and directories on the disk, and controlling peripheral devices such as disk drives and printers.
55. **Wireless Technologies** - Activities related to any technology that transmits information signals via radio waves rather than cables or wires, where individual units are connected to a network, such as cellular phones, networked laptops, and PDAs.

#### A.4 List of Certification Areas and Examples

1. **Business Applications** - PeopleSoft, SAP, Oracle, Lotus, Citrix
2. **CIO** - Chief Information Officer Certificate, GSA CIO University Program
3. **Computing** - Computer Service, Repair, Data Processing, Document Imaging, CompTIA A+, Certified Computing Professional (Institute for Certification of Computing Professionals)
4. **Database** - Microsoft MCDBA, Oracle Certified Database Administrator, IBM DB2 Database Administrator
5. **Engineering** - Licensed Engineer
6. **Evidence Collection** - Certified Electronic Evidence Collection Specialist
7. **GSA 1000 by 2000 Certification** - n/a
8. **Healthcare** - Certified Professional in Healthcare Information and Management Systems
9. **Information Systems** - CISA (Certified Information Systems Auditor), Certified System Professional, Certified Administrator, Certified Systems Engineer, Certified Solutions Architect, Microsoft MCSD, Dell DCSE, Certified Java Developer, Certified Information System Auditor Certificate



10. **Information Systems Security** - Information Systems Security Professional (CISSP), Information Systems Security Associate (ISSA), Systems Security Certified Practitioner (SSCP), Systems Security Professional NSTISSI No. 4011 Certificate (NDU / IRMC), Checkpoint
11. **Mechanical** - Certified Mechanical Inspector
12. **Network Security** - Security Certified Network Architect, Security Certified Network Professional, Certified Network Support/Administration, Certified Firewall Analyst, Certified Intrusion Analyst, Certified Incident Handler, Certified Windows Security Administrator, Certified UNIX Security Administrator
13. **Network Support** - Certified Professional, Certified Call Center Manager, Certified Help Desk Director, Certified Help Desk Manager, Certified Help Desk Professional, Certified Network Administrator, Novell (various), Netware, Cisco (various), Microsoft MCSE
14. **Operating Systems** - Microsoft MCSE, IBM AIX, Sun Solaris, HP-UX, Linux, Red Hat Certified Engineer, SCO Certification
15. **Project Management** - Project Management Institute (PMI), Defense Acquisition University (DAU), other equivalent Project Management Certification, Advanced Management Program (NDU / IRMC), eGovernment Leadership Certificate Program (eGOV) (NDU / IRMC)
16. **Quality** - Certified Quality Auditor, Certified Quality Auditor - Hazard Analysis Critical Control Point, Certified Quality Engineer, Certified Quality Improvement Associate, Certified Quality Technician, Certified Reliability Engineer, Certified Software Quality Engineer, Strategic & Tactical Advocates for Results
17. **Software Development** - Certified Software Development Professional, Microsoft MCSD, Certified Java Developer
18. **Training** - Certified Technology Trainer, Microsoft Certified Trainer
19. **Web** - HyCurve Web Design Specialist, Prosoft CIW (Certified Internet Webmaster), Master Certified Webmaster, USDA Graduate School Webmaster Certification



Appendix  
**B** Survey Changes from 2003 to 2004

IT Workforce Capability Assessment Survey (2004)  
Survey Changes from 2003 to 2004

**B.1 List of Changes**

The table below lists the changes implemented to the 2004 survey’s content and questions based on lessons learned, as documented in the 2003 report.

2003 Lessons Learned	2004 Implemented Changes
Improve method through which Departments/Agencies are identified to participate in the survey	Outreach to Agency POCs was increased. OPM Human Capital Officers and Small Agencies CIOs were briefed.
Consider adding race and gender to the set of demographic questions	Race and gender were added to the demographic questions as well as additional levels of reporting within agencies. Adding such demographic questions may help to provide a different perspective of analysis of survey results, and could help in determining intervention strategies based on such factors.
Define and refine the skills	The list of skills decreased from 80 to 55 and definitions were added for each skill based upon feedback from the 2003 survey administration. This was done to narrow and focus the list to only those skills that are critical to Governmentwide IT work.
Limit the list of competencies and skills	The list of skills decreased but the list of competencies was considered appropriate and so was not modified.
Provide definitions for the proficiency level rating scale used, as was done for the competencies	Definitions were provided for each proficiency level rating scale.
Include the wording “or equivalent” to cover unspecified certification examples	The number of certifications decreased from 44 to 19. Certifications were grouped into categories or areas of certification with example certification programs as a point of reference for respondents.
Include DoD-specific certifications as examples that relate to certification areas	DoD certifications were included where appropriate in the description/examples of the certification areas (for example, DAU certifications).
Define the relationships of competencies, skills and certifications to specialized job activities as part of survey design	The survey working group is currently defining these relationships with agency subject matter experts. The results will be reported in the IT Workforce Capability Assessment Gap Analysis Report, to be issued in early CY 2005.



Additional improvements made to the 2004 survey administration included:

Expanding communications and outreach via a formal marketing plan. A marketing plan and communications kit were developed that outlined the audience, message, and media to be used to ensure maximum participation and understanding of the survey's relevance among various stakeholders.

Better enabling individual Departments/Agencies to work with raw survey data. Individual Department/Agency points of contact were provided raw survey data that could be downloaded in a variety of formats. Additionally, the Microsoft Access database that included a large set of preformatted queries similar to last year was included. Provisions were made to ensure points of contact were supported through training, assistance or other help desk-type activities.

Timing the survey earlier in the year to avoid the end of the Government fiscal year. The survey was administered at the end of July, two months prior to the end of the fiscal year.

Allowing the user to print out a copy of their survey responses. This capability was provided in the 2004 survey administration. In addition, users were informed of the IT Workforce Development Roadmap website where they could track their individual skill and competency progression and develop personal career plans.

Conducting a pilot test of the survey prior to administration. The pilot test focused on time to complete the survey, ease of use, and relevancy to Federal IT workforce. Based upon the results of the pilot, survey instructions were improved.



## Appendix

# C Survey Assumptions

## IT Workforce Capability Assessment Survey (2004) Survey Assumptions

### C.1 List of Assumptions

#### Assumptions

The following is a list of basic assumptions that the CIOC documented as part of the design and administration of the IT Workforce Capability Assessment Survey:

- The survey would be web-based.
- The survey would be based on the 2003 administration of the Clinger-Cohen Survey (retitled to the IT Workforce Capability Assessment Survey in 2004).
- The survey would require a relational database to store responses.
- There could be a potential for a large number of participants (i.e., tens of thousands). Such a large number of voluntary responses would be reasonably representative of the workforce as a whole.
- The survey website would be compliant with Section 508 of the Rehabilitation Act. This law ensures that reasonable accommodations are provided to those individuals with disabilities.
- Any participant should be able to complete the survey in 30 minutes or less.
- A commercial service provider with a .gov domain would host the survey.
- Only Federal Government civilian employees should participate in the survey.
- Frequently asked questions would be developed to assist in answering participants' questions about the survey.
- There would be no requirement for OMB clearance because the survey does not present a burden to the public.