Service Inventory Study
Categorization and Verification Phase
Communications Report

Phase Two Project Team

October 26, 2017

Service Inventory – Categorization and Verification Phase Communications Report

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Service Inventory – Categorization and Verification Phase Communications Report

1. Executive Summary

In April of 2017, UW–Madison compiled its first catalog of the IT services provided to customers. To compile the inventory, a "Phase One" team fulfilled its charge to solicit customer-facing IT services from school, college, institute, and division CIOs. The collected data included service name, fulltime equivalent (FTE) to support, ranges of estimated annual cost and users supported, and a description of the functions provided.

Examination of the collected data indicated that similar service instances were not named uniformly and that service instances were summarized at a variety of levels. These conditions made the data difficult to analyze. As a result, a "Phase Two" team was chartered to categorize, clarify and validate the service inventory data. This team realized quickly that a common classification system was needed to make the inventory more accessible during future data analysis.

Developing a common classification system for roughly 1,400 service instances was a challenge. As guidance, we referred to an EDUCAUSE ECAR article[1], "The Higher Education IT Service Catalog: A Working Model for Comparison and Collaboration." From that prototype framework, we developed and defined a set of 90 generic services. With this approach, we found we could map each reported service to one or more well-defined generic services. Doing so allowed us to disaggregate and classify service instances. This generic service classification system thereby became a window into the service inventory data. An analysis team may now identify all of the organizational units reporting an instance of "website hosting" or "access management," for example. Here is the summary of the categorized data:

UW - Madison IT Service Inventory - Service Category Summary

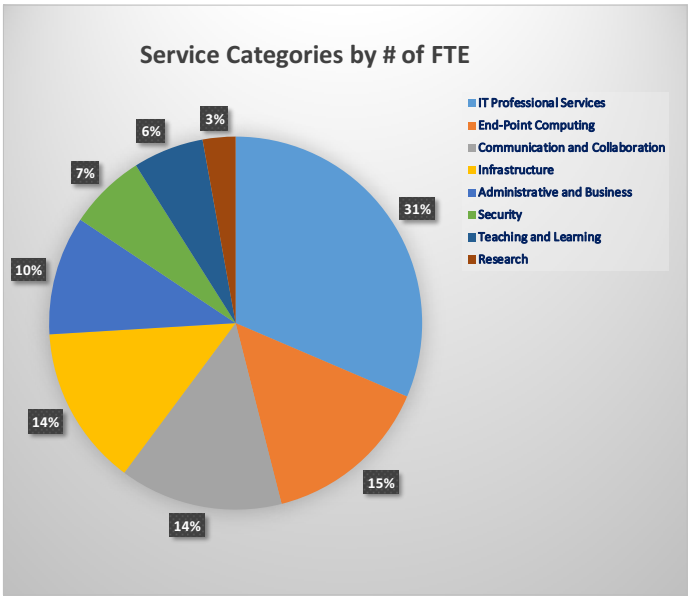
Service Category	# of FTE
IT Professional Services	440
End-Point Computing	204
Communication and Collaboration	198
Infrastructure	194
Administrative and Business	144
Security	93
Teaching and Learning	86
Research	40
Grand Total	**1,398**

IT Professional Services	# of FTE
Application Design/Development	100
Help Desk	84
Consulting and Advising	68

End-Point Computing	# of FTE
Endpoint Mgmt/Device Support	84
Printing Services	50
Application Deployment/Mgmt	44

Communication and Collaboration	# of FTE
Media Production	34
Website Content Develop/Maint	28
Website Design	26

Infrastructure	# of FTE
Network Management	40
Server and Infrastructure Mgmt	29
Website Hosting	22



As of September 21, 2017

[1] https://library.educause.edu/resources/2015/4/the-higher-education-it-service-catalog-a-working-model-for-comparison-and-collaboration

Our work with the data revealed a number of cautions. Many service instances support more than one mission of the University (e.g., both research, as well as teaching and learning). As such, it would be difficult to assign services to a specific TAG for analysis. In addition, the data does not contain an inventory of application software, nor does it include a complete inventory of infrastructure services. Also, service instances vary widely in size (i.e., user counts, FTEs to support, budget, etc.). Further, a high number of service instances for a particular generic service may not necessarily indicate redundant services. Please refer to section, "10. Cautions about the Data," for additional notes.

Taken as a whole, the service inventory offers many dimensions for review – service instance frequency, FTE count, domain of service, cost estimates, etc. Those responsible for analyzing the data will view the service inventory through multiple lenses. Ultimately, however, the data is a gateway to those who provide the service and by inference, those who consume it. Understanding these stakeholders' needs is critical to successful service analysis.

2. Phase Two Objectives, Charge, and Scope

Objective

Using the data collected in Phase One of the Service Inventory Study, clarify, categorize, organize and represent the IT Service Inventory data to enable meaningful analysis of the campus IT service portfolio in the subsequent phase.

Charge and Work Scope

The Team was charged with the following tasks:

1. Categorization: Identify and define meaningful categories of IT services.
2. Mapping: Map service instances as reported in the IT Service Inventory Study to the defined categories.
3. Validation: Validate with stakeholders the assignment (mapping) of service instances to categories.
4. Data reorganization: Re-organize the Service Inventory data and the categorization in a structured format that is accessible and searchable by authorized users in ways that will allow meaningful analysis.
5. Findings and observations: Summarize the main findings and observations from the categorization work, and provide general guidelines for future use of the data to analyze the campus IT service portfolio.

Out of Scope:

The following activities were out of scope in this phase:

A. Analysis and suggestions about the desired state of the campus IT service portfolio, and how to re-organize these services.
B. Developing a taxonomy (namely, "classification into ordered categories") of business processes/functionalities and relating the taxonomy to service instances and categories.
C. Documenting dependencies between services.

3. Background

For a full definition of the terms used in this document, please refer to Appendix A.

The Need

Information Technology (IT) on campus is a complicated and multi-layer landscape. The majority of IT services are owned and internally operated by individual campus units (colleges/schools/departments, etc.). Central IT services including infrastructure are provided centrally by DoIT. Other services are also delivered to various campus units by AIMS (Administrative Information Management Services) and other campus IT organizations. Campus units may develop and operate IT services in-house, or contract with DoIT, AIMS, or third-party providers to do development and/or operational work.

Until recently, we did not have a centralized, campus-wide view of all IT services across campus and their attributes, such as the business processes and functionality they support, their size (number of users supported), their cost (annual budget, FTEs that support them), and the like.

Consequently, the campus lacked the necessary information to examine and evaluate critically its portfolio of IT services.

IT Service Inventory Study

In early 2017, the Service Inventory Phase One Team asked IT unit leaders to provide an inventory of their customer-facing IT services. Their work is the primary deliverable of the Service Inventory project. In May, the Phase One Team completed its observational report and shared it with Mike Lehman, the Interim CIO and project sponsor, along with the technical advisory groups (TAGs).

1. The Phase One team collected information about IT service instances across the entire campus. Basic information collected about services included the following: service provider; description; range of total users; annual budget estimate; FTEs that support the service; scope (provided to one division/department, to multiple divisions/departments, or provided as a campus-wide service); UW missions supported (instruction, research, administration, outreach); business processes supported by the service. This was the first time that a complete mapping of campus IT services was conducted.
2. In Phase One, approximately 188 campus units reported information about 1,400 IT services. Most units reported on customer-facing services only; infrastructure services were generally not reported.
3. This study provided comprehensive view of customer-facing IT services across our complex IT landscape.

4. Phase Two Team Membership

The Phase Two Team included the following members.

Executive Sponsor

Mike Lehman	Interim CIO

Project Sponsor

Dawn McCauley	Center of Excellence Director, CIO Office

Members

Jarrod Bogucki	Law Library IT Coordinator, Law School
Kevin Cherek	Operations and Support Services Manager, AIMS
Steve Devoti	Senior IT/Enterprise Architect, DoIT
Russell Dimond	Associate Director/Statistical Consultant, Social Science Computing Cooperative
Joe Goss	Senior Business Analyst and Project Manager, DoIT; Project Manager
Rafi Lazimy	Executive Director for IT Planning & Strategy, CIO Office
Jim Thompson	Business Performance Manager, Administrative Process Redesign (APR)

Database Work and Support

Mike BonDurant	AIMS

Administrative Support

Kayla Melland	CIO Office

5. Categorization Process

The Phase Two Team faced a challenge in classifying the catalog of 1,400 service instances provided in Phase One. The service titles and descriptions from the Phase One data used a variety of terminology. We realized the importance of a common classification method for understanding the reported service instances. As we worked through the inventory classification process, we discovered that some reported services were aggregates for which multiple lower-level services could be ascribed. We started with a "bottom up" approach – identifying and defining "generic services" that in combination comprised each of the reported service instances. As we worked through the inventory, we iteratively refined this list of generic services. We also found it valuable to look top down, tapping Team members' deep experience in IT services. As a final step, we reviewed the frequency of each generic service and eliminated any that were not mapped to a reported service instance. This three-step approach helped us clarify the boundaries of each generic service and write clear descriptions of each one. Ultimately, these generic services allowed us to disaggregate and classify each of the roughly 1,400 service instances.

A list of definitions for service categories and generic services is available in Appendix B.

6. Validation and Consolidation Process

Information Provided to Stakeholders:

To help those who submitted IT service inventories during Phase One, we provided the following items:

1. Spreadsheet with the reported service instances, along with the Team's classification of these services into generic service categories.
2. The list of generic service categories and associated definitions.
3. Specific instructions to guide the validation work.

Approaches to Validation

We employed several approaches in supporting those tasked with validating the service inventory. We began with face-to-face meetings for a sample of five campus units, each held with the IT unit leader and two or three Team members. We learned valuable lessons from these interactions, which guided of validation work with the remaining campus units. We requested CIOs to assist us in coordinating the validation process for their respective units/departments. Finally, we held a question and answer session, inviting IT unit leaders from several schools and colleges. We received validated spreadsheets from all but a few of the 188 departments.

Major Changes Produced by the Validation Process

This work added significant value to the inventory by validating the generic service classifications and revealing additional services not reported in Phase One. The total number of reported service instances increased from 1,411 (as reported in the Service Inventory Study) to 1,513. The average number of "generic services" per service instance increased from 1.28 (prior to validation) to 1.53 - an increase of 19.4%.

We collected the validated spreadsheets, consolidated the data, and uploaded it into the service inventory database.

7. Structuring, Standardizing, and Reporting Inventory Data

The Team designed and developed a database to hold the validated data. Though meant as a temporary repository for the service inventory, the database helped us standardize the data and move it from the spreadsheets used for Phase One and most of Phase Two. Details about the data model and the extent of use are detailed in Appendix C – Data Model and Extent of Use.

At the time of this writing, the database has a simple, web-based user interface for uploading and extracting data. The interface requires a NetID and authorization for use. We have identified possible enhancements to this interface. This list is included with the project documentation and is available on request.

We used Stata, a statistical analysis tool, to provide the tables and graphs shared in this report.

8. Summary of the Data

Analysis of the Service Inventory data was out of scope for this phase of the project. The following tables and graphs introduce aspects the data.

Statistics:

The total number of reported services (after validation with stakeholders): 1,513.

The number of "generic services:" 90 (84 with service offerings in the inventory).

The average number of "generic services" per service instance: 1.53.

Major Findings, Observations:

The main findings are grouped into three major areas:

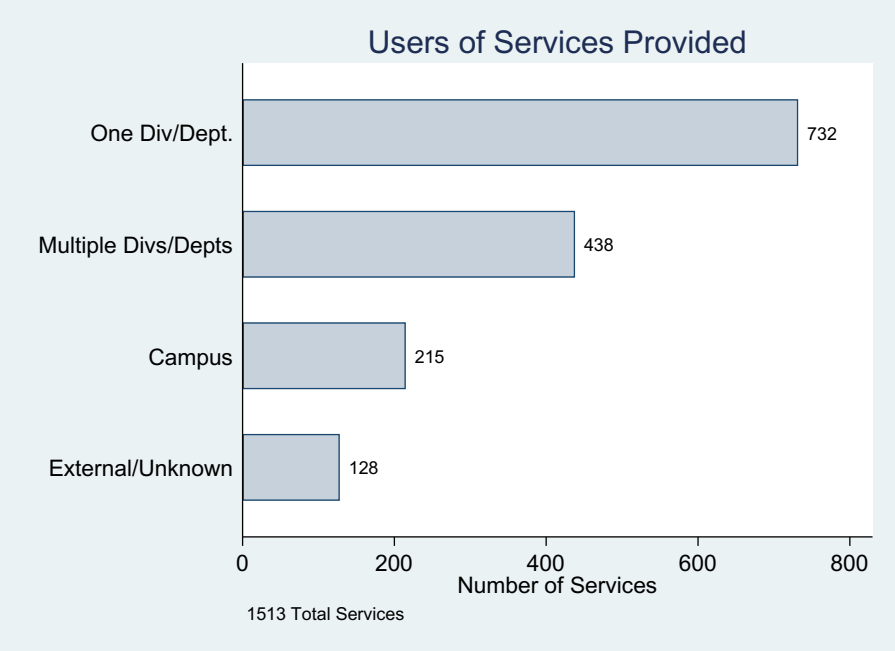
- Distribution of Service Instances across Generic Categories.
- Distribution of Service Instances by Divisional Use (Scope).
- Distribution of Services by Size.
- Distribution by Function:
    - Breakdown of IT FTEs by Function
    - Breakdown of Number of Services by Function

A. Distribution of Service Instances across Generic Services

The distribution of service instances across generic services is not uniform. The number of service instances varies widely among generic services. It should be noted that a service instance may belong to more than one generic service. On the average, a service instance appears in 1.53 generic services.

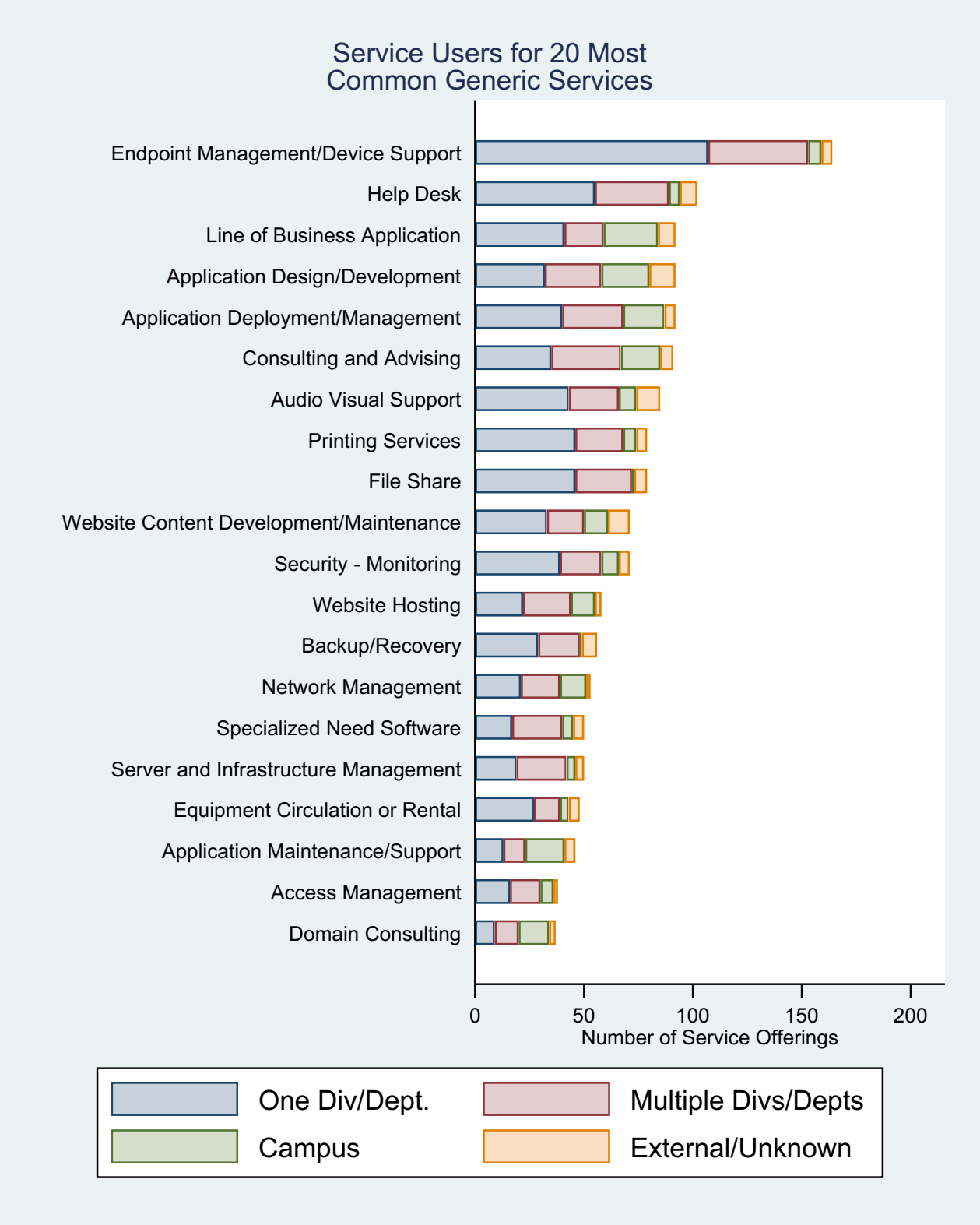
B. Distribution of Usage Profiles

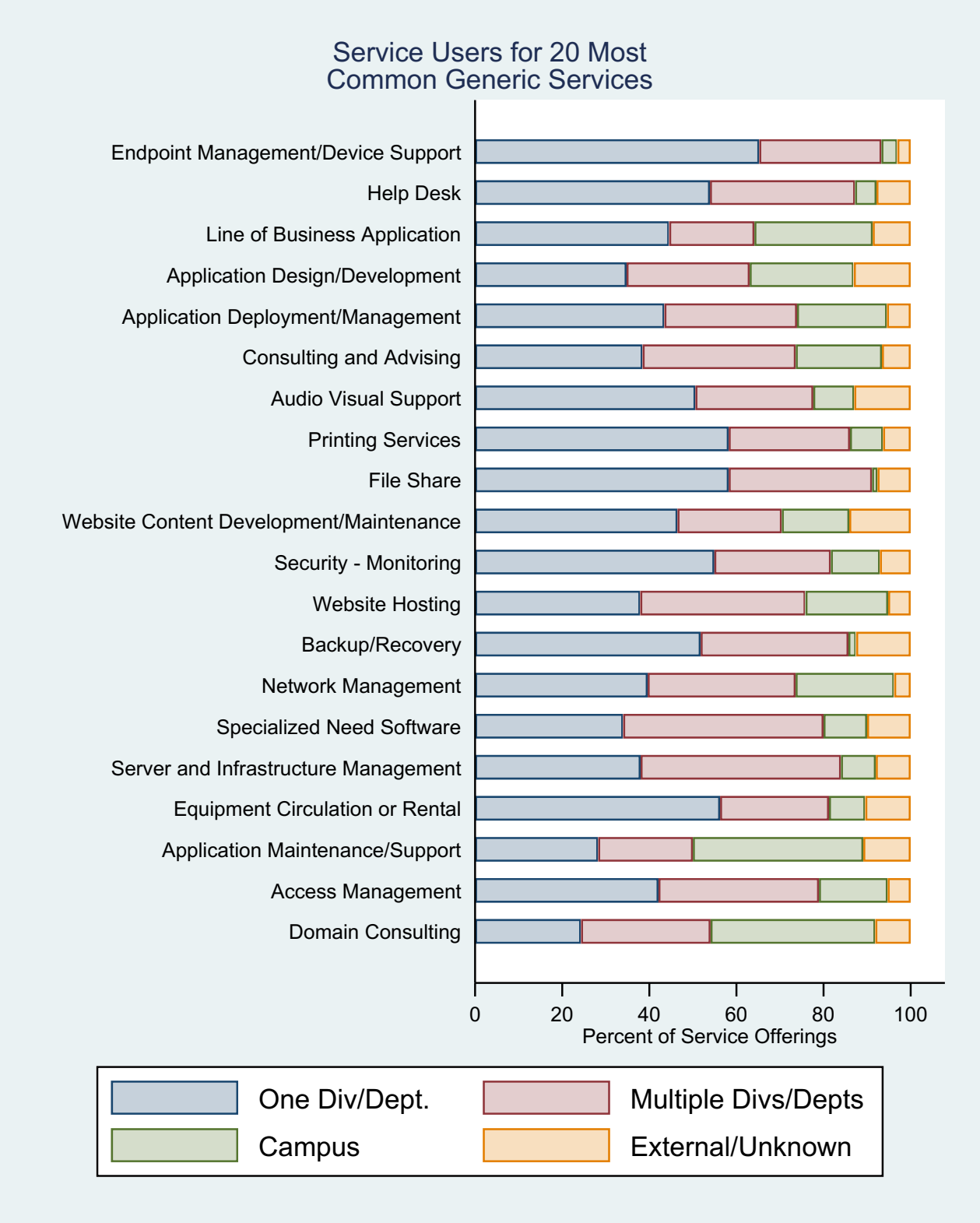
The usage profile specifies whether a service is provided to a single division/department, to multiple divisions/departments (but not campus-wide), to the campus as a whole, and/or to external consumers.



C. Usage Profiles within Generic Services

The distribution of usage profiles for each of the **20 largest generic services** appears below. Note: service instances within the **same generic service** are made available to a variety of usage profiles.

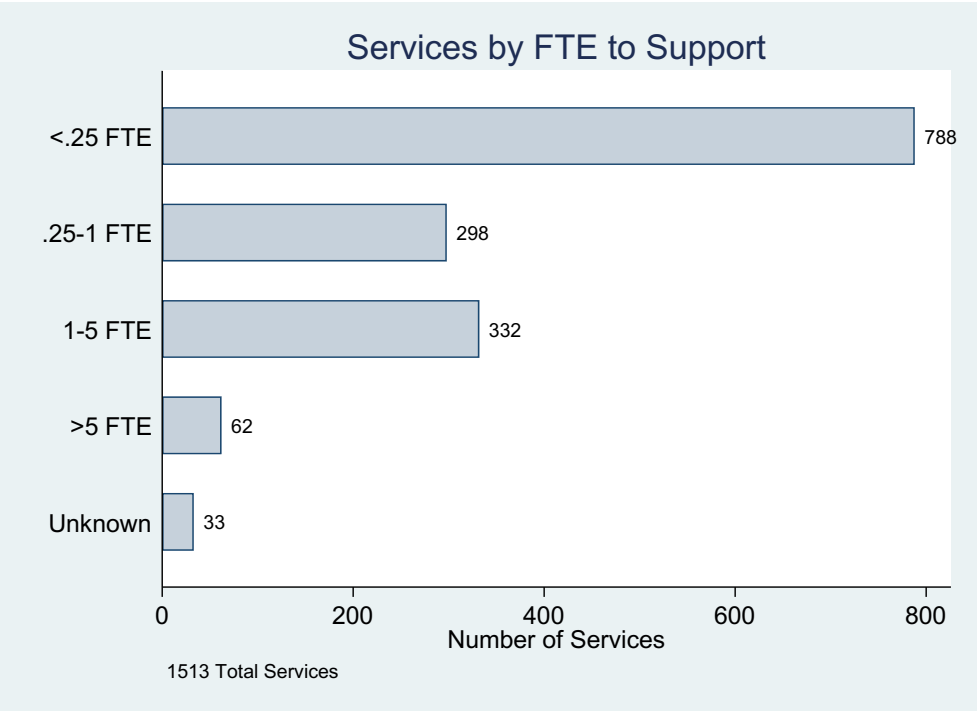



Service Users for 20 Most Common Generic Services
Endpoint Management/Device Support
Help Desk
Line of Business Application
Application Design/Development
Application Deployment/Management
Consulting and Advising
Audio Visual Support
Printing Services
File Share
Website Content Development/Maintenance
Security - Monitoring
Website Hosting
Backup/Recovery
Network Management
Specialized Need Software
Server and Infrastructure Management
Equipment Circulation or Rental
Application Maintenance/Support
Access Management
Domain Consulting
0
20
40
60
80
100
Percent of Service Offerings
One Div/Dept.
Multiple Divs/Depts
Campus
External/Unknown

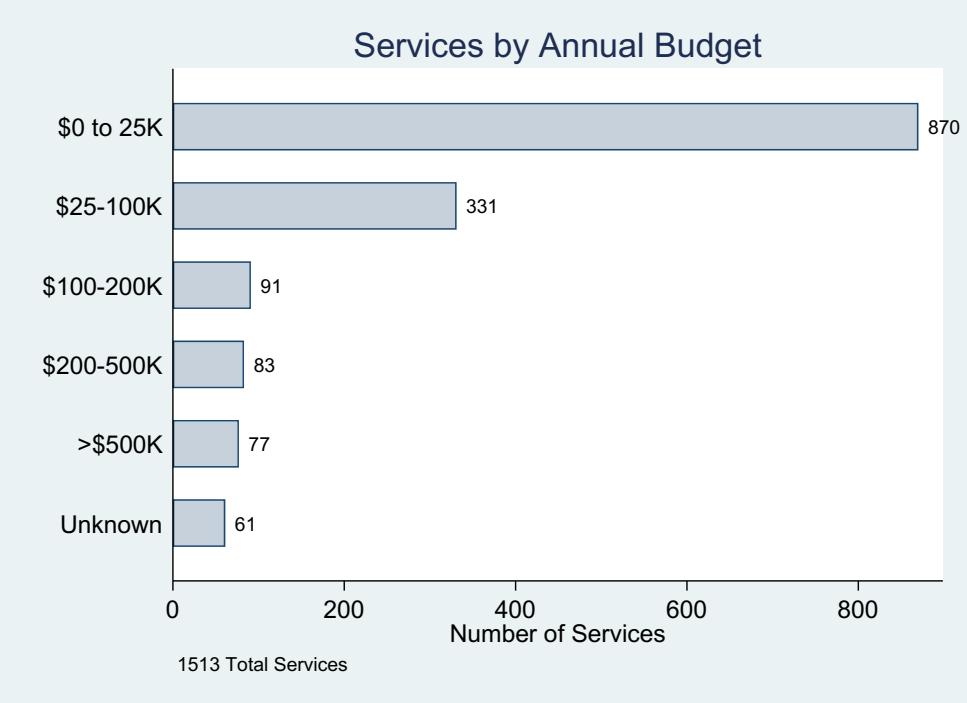
D. Distribution of Services by Size

We present the distribution of service instances by size, as measured by three metrics: (1) FTE to support the services, (2) annual budget, and (3) number of users served by a service.

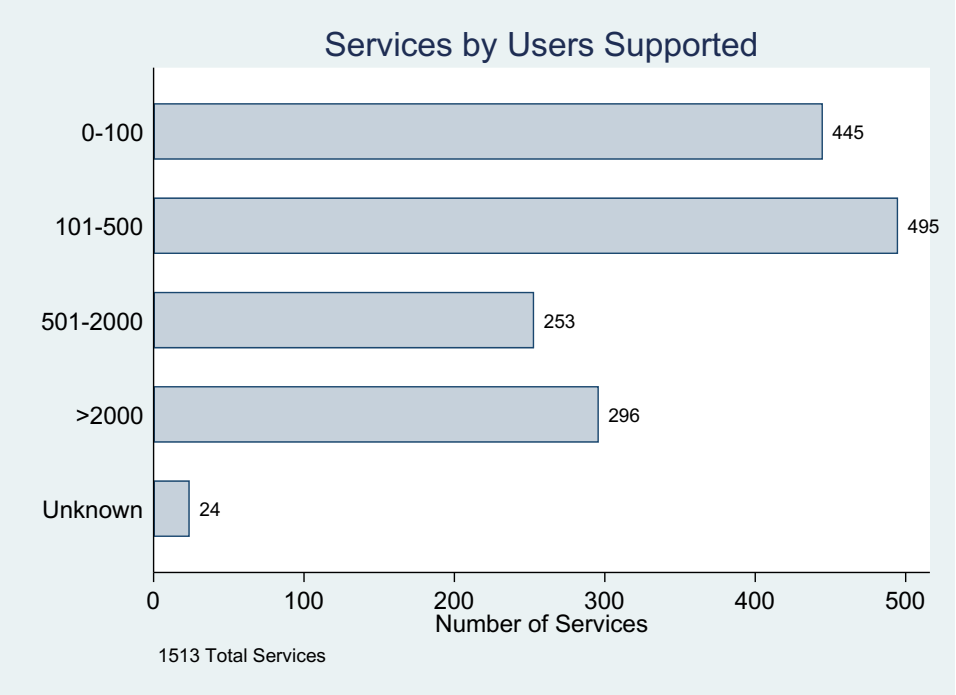
1. Distribution of FTEs across All Service Instances



2. Distribution of Annual Budget across All Service Instances

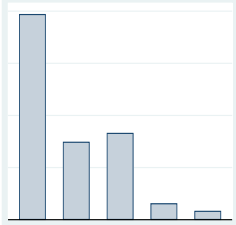
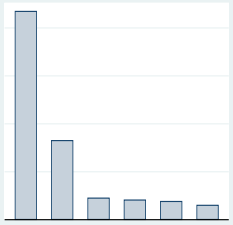
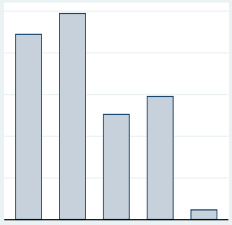
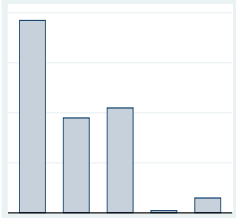
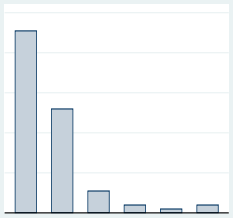
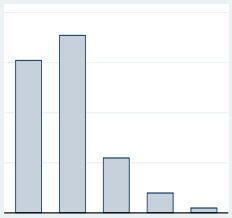
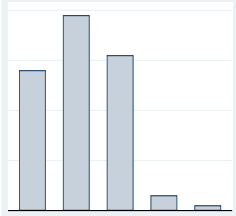
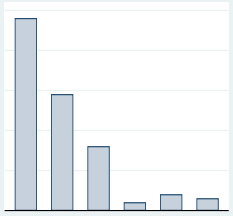
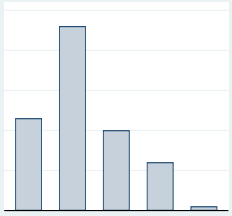
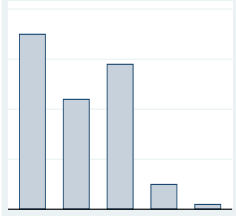
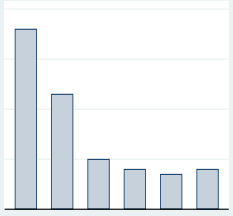
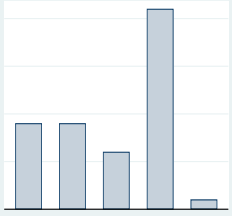
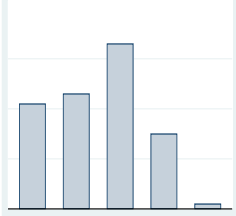
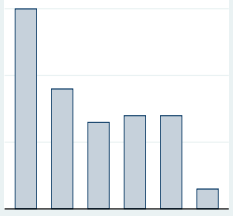
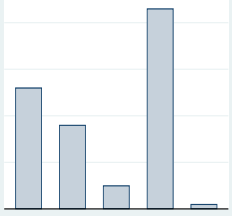


3. Distribution of Number of Users across All Service Instances



E. Distribution of Service Size within Generic Services

The distribution of service size – as measured by FTEs, annual budget, and the number of users – within generic services is shown in the graph below, together with the total number of service instances and the number of campus units providing the generic service.

Generic Service	**Number of Services/Units Providing Service**	**Number of Services by:**		
		FTEs to Support: <.25, .25-1, 1-5, >5, Unknown	**Budget:** <$25k, $25-100k, $100-200k, $200-500k, >$500k, Unknown	**Users:** <100, 101-500, 501-2000, >2000, Unknown
All Services	1513/188			
Endpoint Management / Device Support	164/98			
Help Desk	102/92			
Line of Business Application	92/39			
Application Design / Development	92/77			

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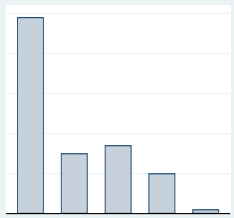
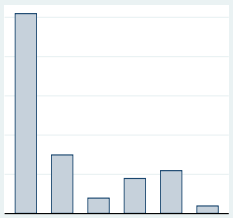
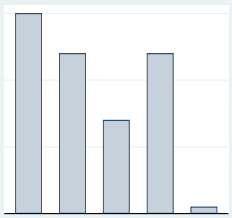
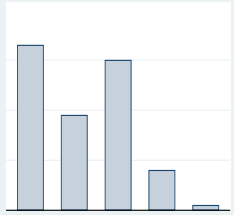
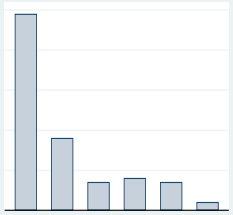
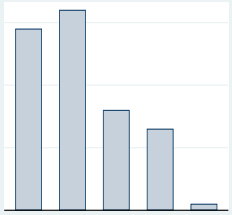
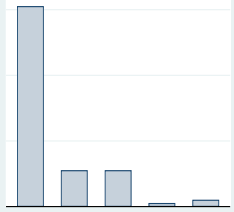
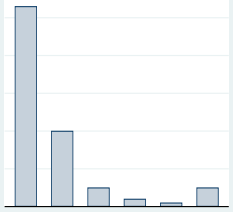
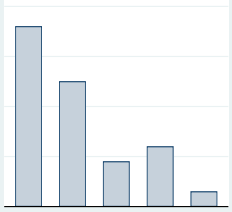
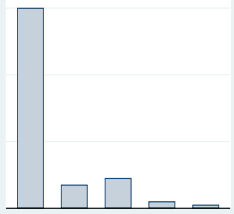
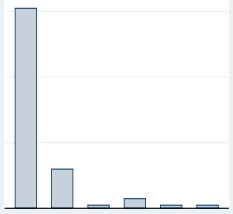
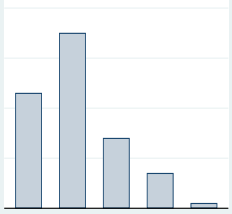
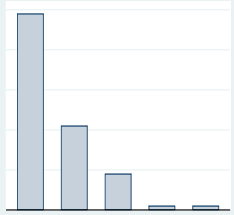
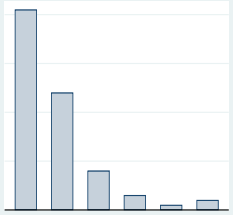
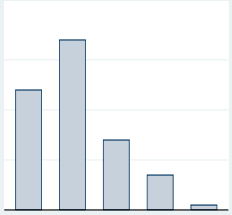
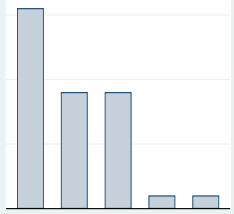
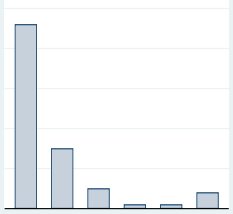
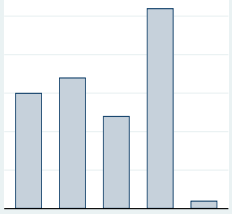
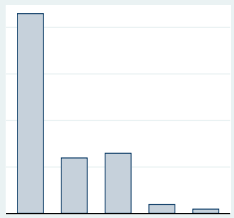
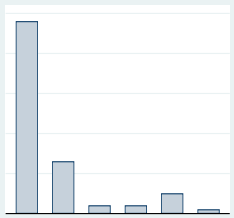
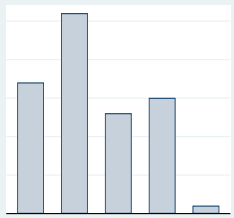
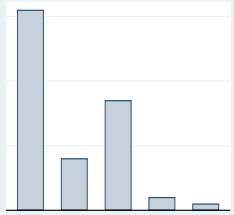
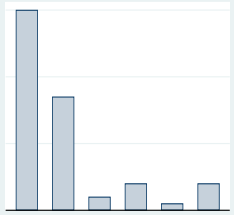
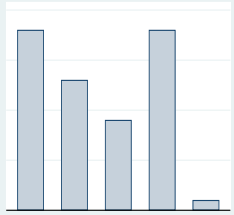
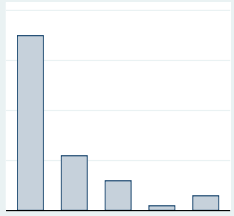
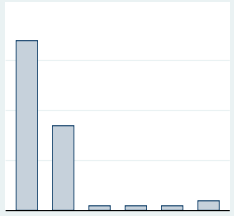
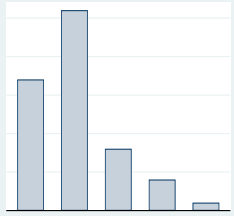
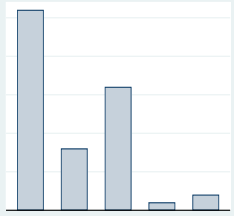
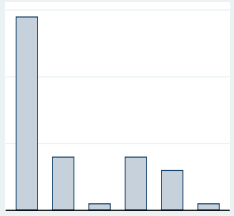
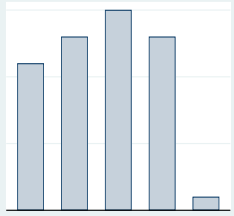
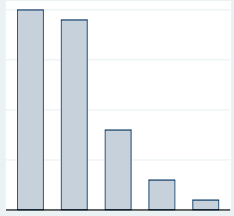
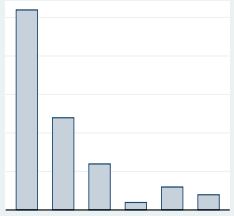
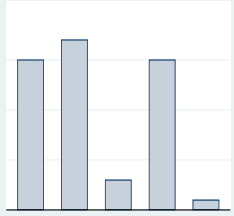
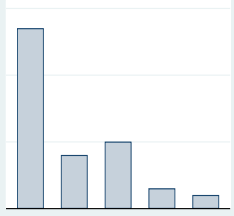
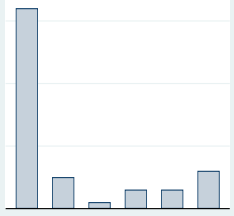
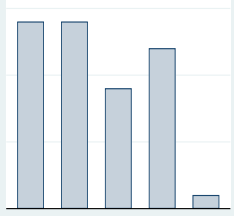
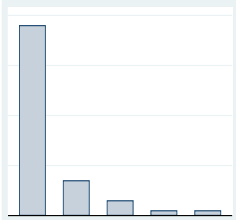
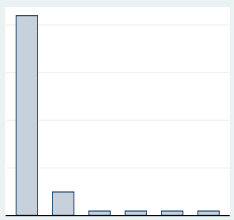
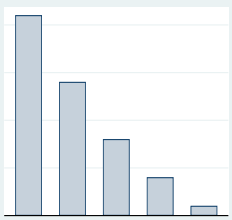
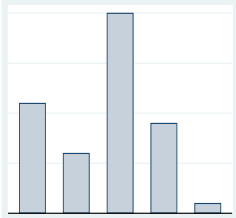
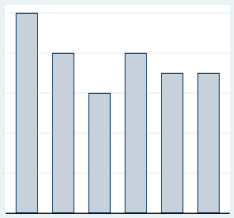
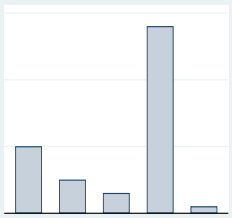
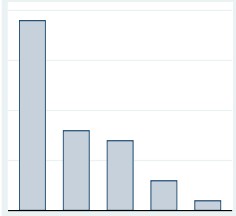
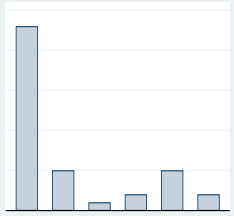
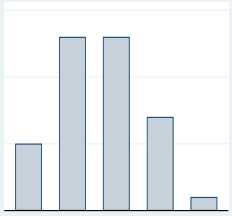
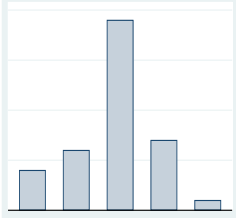
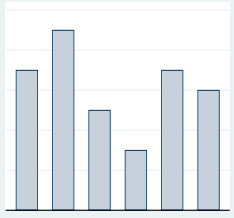
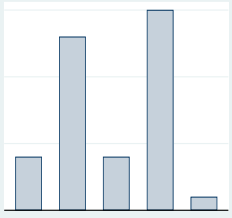
Generic Service	Number of Services/Units Providing Service	Number of Services by:		
		FTEs to Support: <.25, .25-1, 1-5, >5, Unknown	**Budget:** <$25k, $25-100k, $100-200k, $200-500k, >$500k, Unknown	**Users:** <100, 101-500, 501-2000, >2000, Unknown
Application Deployment / Management	92/71			
Consulting and Advising	91/75			
Audio Visual Support	85/62			
Printing Services	79/69			
File Share	79/71			
Website Content Development / Maintenance	71/64			

Service Inventory – Categorization and Verification Phase Communications Report

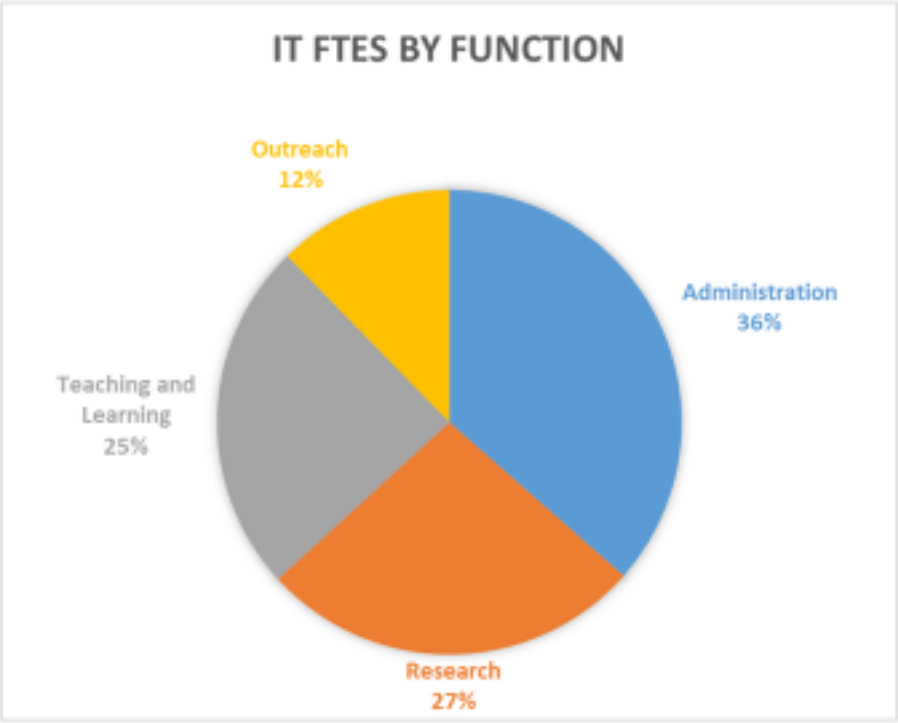
Generic Service	Number of Services/Units Providing Service	Number of Services by:		
		FTEs to Support: <.25, .25-1, 1-5, >5, Unknown	**Budget:** <$25k, $25-100k, $100-200k, $200-500k, >$500k, Unknown	**Users:** <100, 101-500, 501-2000, >2000, Unknown
Security - Monitoring	71/63			
Website Hosting	58/49			
Backup / Recovery	56/53			
Network Management	53/36			
Specialized Need Software	50/35			
Server and Infrastructure Management	50/34			

Service Inventory – Categorization and Verification Phase Communications Report

Generic Service	Number of Services/Units Providing Service	Number of Services by:		
		FTEs to Support: <.25, .25-1, 1-5, >5, Unknown	**Budget:** <$25k, $25-100k, $100-200k, $200-500k, >$500k, Unknown	**Users:** <100, 101-500, 501-2000, >2000, Unknown
Equipment Circulation or Rental	48/45			
Application Maintenance / Support	46/25			
Access Management	38/33			
Domain Consulting	37/29			

F. Breakdown of IT FTEs by Function Across ALL Services

IT FTEs By Function



4

Function	% FTE Count	Number of FTEs
Teaching and Learning	24.5%	331.2
Research	26.7%	360.1
Administration	36.5%	491.9
Outreach	12.3%	166.2
TOTAL	100%	1349.4

Comment: The total number of IT FTE is 1398.39. Services that did not report breakdown by mission account for 49 - the difference between 1398.39 and 1349.4.

G. Breakdown of FTEs by Function within each Generic Service Category

Generic Service	Total FTEs	Research		Teaching and Learning		Admin		Outreach	
		FTE	%	FTE	%	FTE	%	FTE	%
Application Design / Development	100.4	29.6	29.6	10.9	10.9	46.2	46.1	13.5	13.5
Help Desk	84.1	21.9	27.1	19.7	24.3	33.6	41.5	5.7	7.0
Endpoint Management / Device Support	84.0	20.8	25.8	22.7	28.2	30.7	38.2	6.3	7.8
Consulting and Advising	68.4	16.0	23.8	22.6	33.6	14.4	21.3	14.3	21.3
Line of Business Application	55.9	22.3	47.4	3.9	8.2	16.8	35.6	4.1	8.8
Printing Services	49.9	12.5	27.8	11.8	26.3	11.1	24.8	9.4	21.1
Application Deployment / Management	43.7	8.3	19.1	6.7	15.6	25.0	57.7	3.3	7.5
Network Management	40.3	13.0	32.2	9.3	23.0	12.2	30.2	5.9	14.7
Application Maintenance / Support	39.3	4.1	10.9	4.1	10.9	27.1	72.7	2.0	5.4
Domain Consulting	38.0	9.4	24.8	15.0	39.6	6.8	17.9	6.8	17.8
Application Monitoring / Management	37.2	2.2	6.1	8.6	24.1	23.4	65.4	1.6	4.5
Media Production	34.0	3.8	11.3	8.1	24.2	11.3	33.6	10.4	30.9
IT Management	32.9	0.7	2.0	3.0	9.0	28.9	88.4	0.2	0.6
Server and Infrastructure Management	28.7	10.5	36.6	6.8	23.5	8.8	30.6	2.7	9.3
Access Management	28.6	7.7	28.3	7.1	26.3	8.0	29.5	4.3	15.8
Website Content Development / Maintenance	27.9	5.6	22.1	4.4	17.3	7.9	31.2	7.4	29.4
Business Analysis	27.1	2.2	9.0	6.8	28.0	14.6	60.3	0.7	2.7
Training	26.7	1.7	6.3	11.7	44.0	7.3	27.6	5.9	22.1
Website Design	26.5	5.6	21.1	2.4	9.0	8.4	31.7	10.1	38.2
Security - Monitoring	22.0	8.4	40.0	4.8	22.7	6.8	32.7	1.0	4.6
Website Hosting	21.8	8.0	37.1	4.5	21.0	4.1	19.0	5.0	22.9
Audio Visual Support	20.9	4.1	19.6	9.2	44.3	5.1	24.4	2.4	11.7
Project Management	20.7	1.6	8.6	3.5	19.5	12.5	69.1	0.5	2.7
File Share	20.3	12.6	62.4	2.4	11.8	4.3	21.5	0.9	4.3
Business Intelligence	19.7	0.5	2.8	1.5	7.9	15.7	83.1	1.2	6.2
Learning Management System Support	18.7	0.4	2.3	17.3	92.6	0.6	3.5	0.3	1.6
Compliance Support	18.3	6.5	35.7	4.8	26.3	4.9	26.6	2.1	11.5
Ticketing	18.2	5.5	30.2	6.0	32.8	5.0	27.3	1.8	9.7
Database Hosting / Management	16.0	8.3	51.8	2.7	17.0	2.8	17.8	2.2	13.5
Data Analysis	14.6	9.4	64.6	0.3	2.1	3.1	21.2	1.8	12.1
VM Host / Management	14.1	4.8	33.6	3.4	24.0	4.9	34.3	1.1	8.1
Computation Server	13.4	8.5	66.4	0.6	4.3	0.7	5.5	3.0	23.8
Point of Sale	13.2	1.3	9.5	5.3	40.2	5.6	42.7	1.0	7.6
Equipment Repair	12.4	1.9	15.6	5.7	45.5	3.7	29.8	1.1	9.1
Specialized Need Software	12.2	7.6	64.8	3.2	27.0	0.6	4.7	0.4	3.5
Backup / Recovery	12.1	4.6	42.1	2.0	18.8	3.3	29.8	1.0	9.3
Student Data Service	11.6	0.3	2.7	2.4	20.5	8.6	73.6	0.4	3.3

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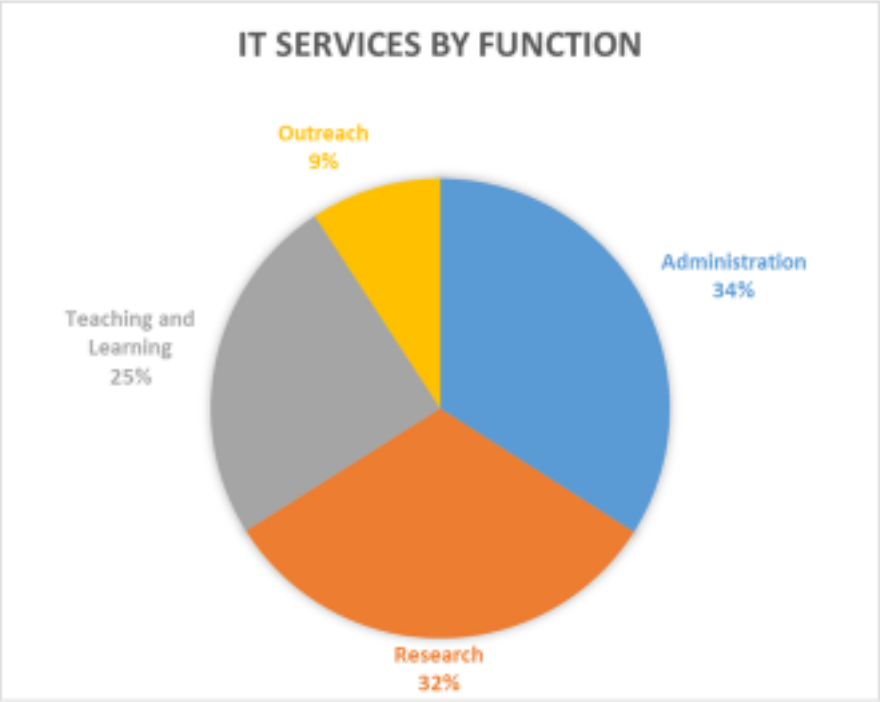
Generic Service	Total FTEs	Research		Teaching and Learning		Admin		Outreach	
		FTE	%	FTE	%	FTE	%	FTE	%
Security Consulting	10.4	3.3	32.6	3.3	32.4	3.3	31.9	0.3	3.0
Portal	10.1	3.8	39.9	1.9	19.9	2.1	22.0	1.8	18.3
Security - Restricted Data Compliance	10.0	3.2	32.1	2.1	21.2	2.7	26.7	2.0	19.9
Cloud Service Brokering	10.0	1.8	18.3	6.4	63.7	1.4	13.6	0.5	4.5
Survey	9.4	6.3	66.9	1.0	10.3	0.8	8.3	1.4	14.5
Restricted Data Environment	9.3	5.1	55.0	1.2	13.0	2.1	22.5	0.9	9.5
Lab Instrument Data Collection & Support	9.3	6.6	80.6	1.4	17.4	0.1	0.9	0.1	1.1
Data Center	9.1	3.8	41.3	2.0	22.5	2.6	28.8	0.7	7.4
Computer Lab	8.7	0.2	2.8	7.2	83.2	1.1	12.7	0.1	1.3
Teleconferencing	8.7	3.5	41.5	1.8	21.9	2.0	23.7	1.1	12.9
Classroom Support	8.3	0.3	4.2	7.1	84.7	0.4	5.3	0.5	5.8
Telephony	7.8	1.6	24.0	1.6	23.0	2.1	30.6	1.5	22.4
Video Capture	7.7	1.4	23.0	2.2	35.6	0.8	12.2	1.8	29.3
Remote Access	7.2	2.6	42.6	1.3	20.8	1.9	30.2	0.4	6.4
Directory Services	6.9	1.6	22.8	1.8	25.4	2.1	29.9	1.5	21.8
Equipment Circulation or Rental	6.8	1.1	19.0	3.1	52.9	1.4	23.8	0.3	4.4
Computer Co-Location	6.8	2.1	31.1	2.0	29.6	2.0	29.5	0.7	9.8
Digital Signage	6.7	0.5	8.0	0.2	3.5	2.1	31.0	3.8	57.5
Learning Management System	6.5	0.1	0.8	6.0	93.1	0.3	4.9	0.1	1.2
Email	5.9	0.8	13.2	0.3	5.7	4.7	80.6	0.0	0.4
Email Lists	5.7	2.4	41.5	0.7	12.6	2.1	35.9	0.6	10.0
Calendar	5.6	0.6	11.5	0.2	3.9	4.7	83.3	0.1	1.3
Incident Response	4.7	1.6	40.1	1.2	29.8	1.1	28.9	0.0	1.2
Parallel Computing Cluster - Tightly Coupled	4.4	4.0	95.0	0.2	4.2	0.0	0.7	0.0	0.0
Television	4.2	1.0	23.8	1.0	23.8	1.2	28.6	1.0	23.8
Resource Scheduling	4.0	0.6	14.8	1.7	41.7	0.3	7.9	1.4	35.7
Knowledge Base	3.9	1.4	36.3	1.1	28.8	1.1	28.7	0.2	6.3
Data Archive	3.7	1.5	39.5	0.7	18.7	0.9	23.0	0.7	18.8
Document Management	3.5	0.0	1.2	0.1	2.2	3.3	96.2	0.0	0.4
Grant Application and Management	3.2	2.0	64.2	0.1	3.2	1.0	32.6	0.0	0.0
Asset Management	2.2	1.2	53.3	0.4	17.8	0.5	21.6	0.2	7.3
Test Administration	2.0	0.0	0.6	1.7	84.8	0.1	3.0	0.2	11.6
Event Scheduling and Management	1.9	0.0	0.0	0.0	1.7	1.5	81.1	0.3	17.2
Communications and Collaboration	1.9	0.3	18.1	0.3	17.5	1.0	58.2	0.1	6.1
Accreditation Support	1.7	0.0	0.0	1.6	96.9	0.1	3.1	0.0	0.0
Identity Management	1.5	0.2	22.4	0.2	17.2	0.5	52.0	0.1	8.4
Emergency Notification	1.3	0.0	0.0	0.0	0.0	1.2	95.6	0.1	4.4
Student Advising	1.1	0.1	12.0	0.6	59.4	0.3	27.4	0.0	1.1
Purchasing Services	0.6	0.4	68.3	0.1	17.5	0.1	14.3	0.0	0.0
Graphic Design	0.5	0.1	25.0	0.1	25.0	0.1	25.0	0.1	25.0
Billing	0.5	0.0	8.6	0.1	34.3	0.2	52.9	0.0	4.3
Version Control	0.5	0.3	52.6	0.1	18.9	0.1	17.9	0.1	10.5

Generic Service	Total FTEs	Research		Teaching and Learning		Admin		Outreach	
		FTE	%	FTE	%	FTE	%	FTE	%
Parallel Computing Cluster – Loosely Coupled	0.4	0.4	93.8	0.0	3.8	0.0	0.0	0.0	2.4
TA Management	0.2	0.0	18.5	0.1	44.4	0.1	37.0	0.0	0.0
Student Admissions	0.1	0.0	25.0	0.0	25.0	0.1	50.0	0.0	0.0
Course Scheduling	0.1	0.0	11.9	0.0	30.0	0.1	48.6	0.0	9.5
URL Shortening	0.1	0.0	25.0	0.0	25.0	0.0	25.0	0.0	25.0

H. Breakdown of Number of Services by Function

IT Services By Function



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Function	% of Services	Number of Services
Teaching and Learning	24.7%	357.1
Research	32%	462.2
Administration	34%	490.9
Outreach	9.2%	132.8
TOTAL	100%	1443

I. An Additional Observation

The total of the FTEs to support all of the services in the IT Service Inventory and the reported total FTEs from the IT Spend Study are similar: 1,398.42 in the former, 1,278.35 in the latter.

9. Considerations from the Analysis Working Group

The Analysis Working Group (comprised of DTAG members and led by Meloney Linder) developed a set of important questions to consider (see Appendix D for a more complete excerpt; Meloney Linder, former chair of DTAG has the full report). The categorization work and the findings raise additional questions – and challenges - about the current organization of the campus IT service portfolio.

1. How might such services be scaled to better support research, teaching, and/or administrative excellence while also maintaining or improving the value to customers and stakeholders?
2. How might the service improve integration and operational coherence to achieve increased value to stakeholders and reduce redundancy with the intent of freeing resources to support innovation in teaching and learning, research, administration, and outreach?

Further analysis must be undertaken to answer these questions and, possibly, produce a more effective organization of campus IT services. Answering these questions requires a good understanding of the "value" of any service instance.

1. What value do consumers and other stakeholders gain from the service instance?
2. What business and stakeholder requirements support that value?

Major themes for such analysis may include:

1. Advance the mission of the University while increasing value to stakeholders.
2. Rationalization: Reduce possible duplication and redundancy; create more effective and efficient models for delivering IT services across campus.
3. Reduce/eliminate opportunity costs: Promote greater service levels, identify potential cost savings, or help a department advance its mission in teaching or research by freeing its IT resources from continuing commodity-level IT services that could be regionalized.
4. Eliminate/reduce inequities. Some of the IT services across campus are based on affordability, which creates inequities in the consumption of IT services (the "haves" and "have nots" problem).
5. Promote greater transparency, collaboration, trust, and accountability in the delivery of IT services.

10. Cautions about the Data

Users of the IT Services Inventory should keep in mind several key characteristics of the data:

1. IT unit leaders were asked to report in Phase One only "customer-facing" services and to exclude infrastructure services. Nevertheless, some IT unit leaders reported infrastructure services and these are included in the service inventory.
2. IT unit leaders' understanding of what constituted an IT Service varied. In Phase One, IT unit leaders were asked to divide their unit's IT activities into discrete services. Some IT unit leaders reported large numbers of "small" (i.e., disaggregated) services, while others reported a small number of "large" (I.e., aggregated) services. Fundamental properties of the data set, like the number of services included, reflect both reality and how the IT unit leaders chose to describe that reality.
3. When a service instance is mapped to multiple generic services, it is not possible to identify a "primary" generic service for that particular service instance. Sometimes, a service instance should have been reported as separate service instances. In other cases, a single service fulfills more than

one function. Analysts who want to generate statistics based on the Inventory should be careful not to over count such service instances.

4. Many service instances support more than one mission of the University (e.g., both teaching and learning, and research). As such, it will be difficult to assign particular service groups for analysis by a specific TAG.
5. A "service" is not a standard unit of measure like a meter or a kilogram, and counts of service instances should be interpreted with caution. Services vary widely in size as well as other important attributes. For example, the largest service instance is supported by 31 FTEs, which is more than the smallest 547 services combined (about 1/3 of all services). The number of service instances UW-Madison has in a given area is not a good measure of the effort UW-Madison puts into that area.
6. "FTEs to Support" and "Annual Budget" are rough estimates by IT unit leaders. At the time they reported their service inventory, unit leaders knew their total FTEs and budget, but were asked to divide them up appropriately among the services they provide. As such, we discourage using these estimates to compare IT units. In addition, an aggregate (e.g., total number of FTEs supporting a given generic service or service category) may be interesting for the purpose of comparison, but as such are simply accumulations of estimates.
7. Service instances that are assigned to the same generic service are not necessarily duplicates, as these service instances can differ in important ways. Some generic services vary more than others. For example, we expect all "Ticketing" systems to be very similar, but "Computation Servers" can be very different, depending on the field they support or the software they run.

Appendix A – Glossary of Terms

Catalog	A catalog is "a list or record of items systematically arranged and often including descriptive material." Such a catalog in the context of this project would include support for the lifecycle of IT services.
Customer	A customer in the context of this project includes UW Madison students, faculty, staff, and partners.
Customer-Facing Service	A Customer-Facing Service delivers value by facilitating outcomes customers want to achieve. They do not include the activities or infrastructure provided by the IT Service provider, such as IT processes, technologies, or platforms. A Customer-Facing Service is a discrete, top-level, business-oriented activity that provides functionality and value to customers. For this project, a Customer-facing Service explicitly excludes activities that do not directly touch a customer. [Adapted from the definition for IT Service from "Service Inventory Study – Definitions, Clarifications, Implementation Plan, Timeline"]
Generic Service	A Generic Service describes an IT service at an elementary level. One or more Generic Services are components of a reported service. A Generic Service is the smallest common component of reported services in the IT service inventory.
Inventory	Given limited resources, an inventory in the context of this project is a "best effort" listing of IT services made at a point in time. Such an inventory does not make provision for the lifecycle of services.
Service Instance	A Service Instance is a customer-facing service reported in the Service Inventory by an IT unit leader. It may include a customer-facing interface ("front end") functions and infrastructure ("back end") functions.
Taxonomy	A taxonomy is the technique of classifying a set of items into ordered categories.

Appendix B – List of Generic Services with Definitions

Generic Services mapped to Service Categories

We defined the following Generic Services in order to uniformly classify the reported service instances. Each Generic Service is mapped to a broad "Service Category," which aligns roughly to those defined in "The Higher Education Service Catalog" by EDUCAUSE ECAR[2]. Note: some Generic Services map to multiple Service Categories, particularly for "Teaching and Learning" and "Research." The definition for each Service Category follows this table of Generic Services. Note: the color coding in Service Category column corresponds to the colors used in the Service Category table at the end of this appendix.

Service Category	Generic Service	Description
Security	Access Management	Ensuring that the right people have access to resources and only the right people.
Teaching and Learning	Accreditation Support	Software and systems used to support the accreditation process.
End-Point Computing	Application Deployment/Management	Processes required to make applications available to users, including procurement, licensing, distribution, and updating.
IT Professional Services	Application Design/Development	Creation of custom-built applications. Includes web apps, standalone apps, etc. Includes software and load testing.
IT Professional Services	Application Maintenance/Support	Ongoing design, maintenance, and technical support for existing custom-built applications. Includes web apps, standalone apps, etc.
IT Professional Services	Application Monitoring/Management	Service to protect software application systems by maintaining performance, uptime, and patches. Includes database administration functions.
Communication and Collaboration	Appointment Scheduling	Automated tools for scheduling appointments (for example, students meeting with advisors), including managing availability schedules.
Infrastructure	Asset Management	Tools for managing assets, including computer hardware.
Communication and Collaboration	Audio Visual Support	Installation, maintenance, repair, and instruction of audio and visual equipment
Communication and Collaboration	Automatic Call Distribution	Systems for automatically distributing telephone calls to the appropriate recipients.
Infrastructure	Backup/Recovery	Tools for backing up data and restoring it when needed.
Administrative and Business	Billing	Tools that support billing and invoicing. Does not include general purpose software like Excel or other office desktop tools
IT Professional Services	Business Analysis	The practice of enabling change in an enterprise by defining needs and recommending solutions that deliver value to stakeholders.

[2] See https://library.educause.edu/resources/2015/4/the-higher-education-it-service-catalog-a-working-model-for-comparison-and-collaboration

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Service Category	Generic Service	Description
Administrative and Business	Business Intelligence	Collection, analysis, and presentation of data for internal use. Does not include data analysis for research purposes.
Communication and Collaboration	Calendar	Administering electronic calendars, including Office 365 calendaring. Does not include routine support of calendaring clients.
Teaching and Learning	Classroom Support	Support for technology in the classroom other than Audio Visual technology. Includes Lecture Capture.
IT Professional Services	Cloud Service Brokering	Supporting the use of Cloud Services by managing relationships and resolving issues with cloud service providers
Communication and Collaboration	Communications and Collaboration	Tools for communication and collaboration between staff, including chat and web services like SharePoint.
Administrative and Business	Compliance Support	Systems to support adherence to established standards and regulations. Includes ADA, NCAA compliance, for example; does not include restricted data compliance (see Security - Restricted Data Compliance). Also Includes systems to certify and track the certifications of individuals.
Research	Computation Server	A server used by customers for computation or to run specialized software. Includes clusters of servers if customers use them one at a time.
Infrastructure	Computer Co-Location	Providing data center space and infrastructure for customers to rack hardware, e.g. servers, SAN, etc.
Teaching and Learning	Computer Lab	Room with multiple computers accessed by a population of users.
IT Professional Services	Consulting and Advising	Providing guidance to customers on subjects relating to IT. Does not include Domain Consulting.
Teaching and Learning	Course Scheduling	Software specific to scheduling courses for students. Includes tools for scheduling of classrooms for classes and student-focused services to facilitate course selection, scheduling, and enrollment.
IT Professional Services	Data Analysis & Visualization	Data analysis performed by IT staff, including specialized software and hardware for data visualization, graphs, molecular modeling, etc... Does not include Business Intelligence.
Infrastructure	Data Archive	Storage for data no longer in active use but which must be preserved; also the process for moving that data into that storage.
Infrastructure	Data Center	Providing a space with the necessary infrastructure for servers and other hardware. The data center are generally control environmental conditions with security access. Center can be classified at a tier level scale from 1 to 4.
Infrastructure	Database Hosting/Management	Underlying hardware and software required to run databases, includes ongoing management and support.
Teaching and Learning	Degree Audit	Degree Audit Applications

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Service Category	Generic Service	Description
Communication and Collaboration	Digital Signage	Any electronic monitor in a public area that displays information for building visitors or residents.
Security	Directory Services	Includes Active Directory, LDAP, and similar services.
Communication and Collaboration	Document Management	System that provide ability to store and retrieve documents and other informational materials. Includes scanning of documents into digital images.
IT Professional Services	Domain Consulting	Consulting on the use of IT in a specific domain, including both research domains and instruction. Normally provided by domain experts embedded in IT units. Responsible for building a bridge between customers and IT. Services provided by DoIT AT, Center for High Throughput Computing are examples.
Research	Electronic Lab Notebooks	Electronic replacement for physical lab notebooks used for documenting experiments, etc. type events. This may include specialized hardware or software to capture the process.
Communication and Collaboration	Email	Administrative support for email, including Office 365 email. Does not include routine support for email clients.
Communication and Collaboration	Email Lists	Management of email lists, including both use of WiscList and providing email list services.
Communication and Collaboration	Emergency Notification	Instant, high-priority communication out to a group. WiscAlerts, for example. Includes tools for collecting emergency contact information from students, staff, and faculty.
End-Point Computing	Endpoint Management/Device Support	Manage the complete lifecycle for a diverse array of endpoint systems and devices, including desktops, laptops, Chromebooks, mobile devices, virtual workspaces and network-connected non-computing devices. This would include remote desktop management tools. Includes software and other tools used to detect or remove malware.
End-Point Computing	Equipment Circulation or Rental	Provide customers with access to a managed set of equipment on a temporary basis. Includes check-in and check-out process for users of the equipment.
End-Point Computing	Equipment Repair	Repair or refurbish IT equipment, excluding instruments or lab equipment
Communication and Collaboration	Event Scheduling and Management	Includes conference and resource scheduling (e.g., Memorial Union, Housing, DoIT, CPED, and OCPD). May including space management, registration, food, logistics, task lists, and billing, for example. Includes tools for managing conferences or events that go beyond scheduling, such as managing registrations, food, etc.
Infrastructure	File Share	Includes network directory share, Box, Google docs, SharePoint, etc. This includes structured disk space and data storage.
Administrative and Business	Grant Application and Management	Applications that support applying for grants and/or managing grants that are received.

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Service Category	Generic Service	Description
Communication and Collaboration	Graphic Design	Creation of graphics, wherever they are used.
IT Professional Services	Help Desk	Point of contact for users to report incidents and request services with regular hours and contact procedures. Includes request intake, resolution and tracking process.
Security	Identity Management	A service in support of setting up identities for users. For example, this service includes creating and managing a login ID for a user such as NetID or network logins.
Security	Incident Response	Mitigating severe security breaches. Note that mitigating low-severity breaches falls under Security Monitoring.
Teaching and Learning	Instructional Design	Systematic design and development of online instructional materials and activities using learning theory to ensure the quality of instruction. It includes determining learner needs, establishing goals and outcomes, and working within the technology infrastructure to meet those needs.
Administrative and Business	IT Management	Administrative activities associated with running IT. Includes budgeting, hiring, staff management, etc.
Communication and Collaboration	Knowledge Base	A substantial collection of informational web pages, regardless of how they are managed. Includes Wiki documentation.
Research	Lab Instrument Data Collection & Support	Supporting computers connected to lab instruments used for data collection.
Teaching and Learning	Learning Management System	Providing a Learning Management System, e.g. Canvas, Moodle.
Teaching and Learning	Learning Management System Support	Supporting instructors' use of Learning Management Systems. Guidance from staff with substantial expertise in instruction should be considered Domain Consulting.
Administrative and Business	LOB Application	Application used to carry out the mission ("Line of Business") of the unit. Used when the application does not fit into another category.
Communication and Collaboration	Media Production	Creation of videos, multimedia presentations, etc. Includes media transfer. Does not include lecture capture, AV support, and streaming.
Infrastructure	Network Management	Includes monitoring, data jack management, router configuration, network infrastructure, and firewall management.
Research	Parallel Computing Cluster - Loosely Coupled	A cluster of servers used for loosely coupled parallel computing, such as an HTCondor flock, for high-throughput computing.
Research	Parallel Computing Cluster - Tightly Coupled	A cluster of servers used for tightly coupled parallel computing for high-performance computing. Such computers are typically installed in the same server rack.
Administrative and Business	Point of Sale	Support for selling merchandise or services, including collecting payments via credit cards.

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Service Category	Generic Service	Description
Communication and Collaboration	Portal	An Information portal, such as My UW-Madison. A portal is a starting site for users when they get connected to the Web or that users tend to visit as an anchor site, which anchors a set of available services.
End-Point Computing	Printing Services	Providing local, or LAN based printing and/or scanning (e.g. to email, file share, etc.) via queue or direct IP.
IT Professional Services	Project Management	Initiating, planning, executing, controlling, and closing the work of a team to achieve specific goals and meet specific success criteria.
Administrative and Business	Purchasing Services	Tools for supporting Purchasing.
End-Point Computing	Remote Access	Tools that allow customers to use resources remotely, such as VPN or Remote Desktop.
Communication and Collaboration	Resource Scheduling	Systems for scheduling resources like equipment or conference rooms. Does not include scheduling of people.
Security	Restricted Data Environment	Hosting service that typically includes data storage, software, and computation that support security measures for users working with restricted data.
Security	Security - Monitoring	Monitoring computing resources for security issues. Includes dealing with incidents.
Security	Security - Restricted Data Compliance	Processes and resources for identifying restricted data, for obtaining approval to work with restricted data, for complying with requirements for doing so, and for identifying and correcting violations. Includes the creation of appropriate computing solutions if they do not rise to the level of a Restricted Data Environment.
Security	Security Consulting	Consulting on security issues, usually with other IT staff rather than end-users, as through the work of the Cybersecurity Office. Does not include Security Monitoring, Incident Response, or Endpoint Management
Infrastructure	Server and Infrastructure Management	Managing the complete lifecycle for servers and related hardware, including storage systems, and monitoring services.
IT Professional Services	Service/Project Portfolio Management	The centralized management of the processes, methods, and technologies used by project managers and project management offices (PMOs) to analyze and collectively manage current or proposed projects based on numerous key characteristics. Includes creating and maintaining a Service Catalog and a Service Portfolio.
Research	Specialized Need Software	Software for a specific purpose that is not broadly available to the public. Includes research software, business software, etc. Examples include Stata and Mplus.
Teaching and Learning	Student Admissions	Tools that support the admission of new students, including undergraduate, graduate, and all other student types.
Teaching and Learning	Student Advising	Tools for support of Student Advising.

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Service Category	Generic Service	Description
Teaching and Learning	Student Data Service	Tools for managing student data, including SIS. Includes tools for managing information about all types of students. Includes service to allow students / alumni to request their transcript.
Communication and Collaboration	Survey	Creation and distribution of surveys. Includes data collection and very basic analysis (such as provided by Qualtrics).
Teaching and Learning	TA Management	Includes any applications related to hiring, managing, and certifying teaching assistants
Communication and Collaboration	Teleconferencing	Support for conferences involving groups or individuals in remote locations.
Communication and Collaboration	Telephony	Support for communication by telephone, including VoIP and cell phones.
Communication and Collaboration	Television	Services and infrastructure for providing support for television and cable services.
Teaching and Learning	Test Administration	Tools and applications for administering student tests, including automated scoring.
Infrastructure	Ticketing	A system for tracking service requests or incidents. Mostly used by help desks but not always.
Teaching and Learning	Training	Training provided by IT staff, including software training. Includes domain-specific training.
Infrastructure	URL Shortening	Shorten lengthy URLs which allows for redirecting web address to another name.
Infrastructure	Version Control	Repositories, check-in/check-out, and versioning of files, including software code.
Communication and Collaboration	Video Capture	Tools for capturing video and disseminating the results.
Infrastructure	VM Host/Management	Hosting and managing virtual machines.
Communication and Collaboration	Website Content Development/Maintenance	Creating or maintaining content for existing web sites. Also includes content for twitter, Facebook, and other social media. Does not include simply providing a Content Management System.
Communication and Collaboration	Website Design	Creating the base design for web sites, including art, structure, and code required to implement them. Does not include creating content for existing designs or web applications. See Application design/development for new software development.
Infrastructure	Website Hosting	Hosting web sites, including the necessary server(s) and storage. Includes hosting web Content Management Systems such as WordPress.

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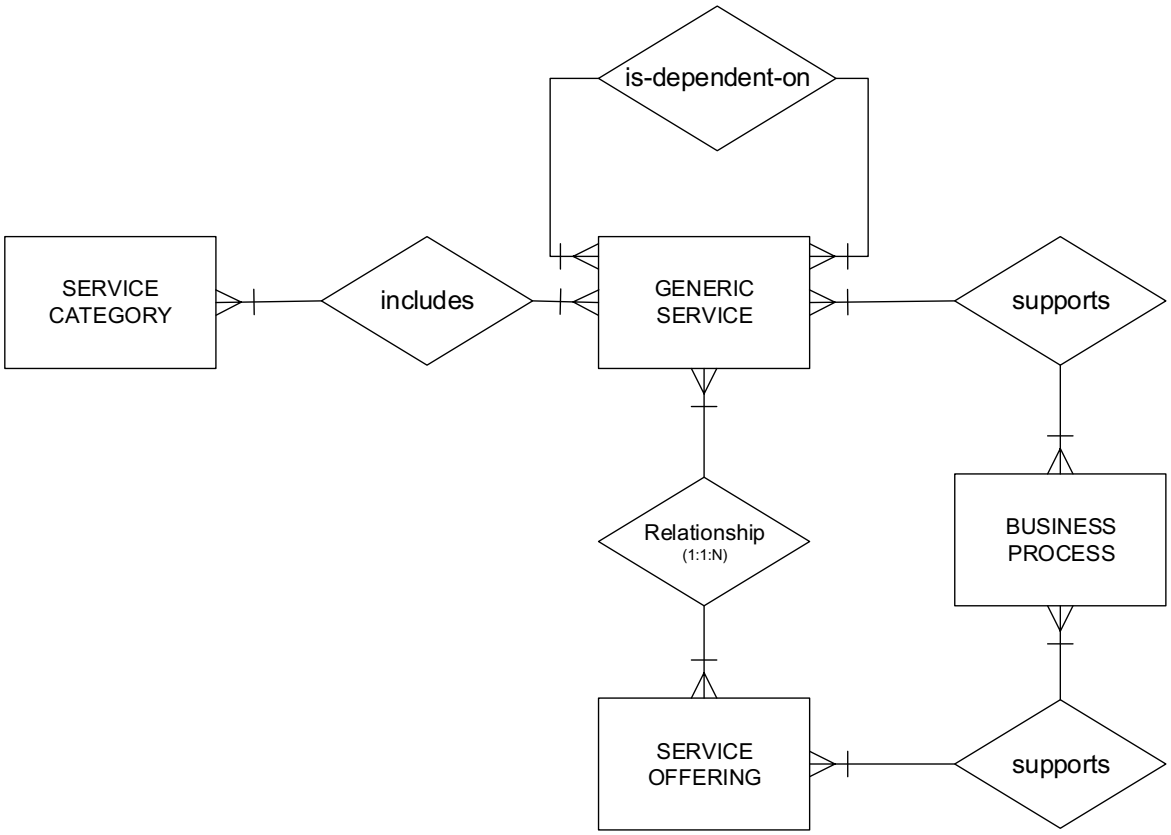
Service Category Definitions

Service Category	Category Description
Administrative and Business	Enterprise and local services that support the administrative and business functions of an institution. Includes analytics, business intelligence, reporting, finance, human resources, student information systems, advancement, research administration, and conference and event management.
Communication and Collaboration	IT services that facilitate institutional communication and collaboration needs. Includes e-mail, calendaring, telephony/VoIP, video/web conferencing, unified communications, web content management system, web application development and hosting, and media development.
End-Point Computing	Services that enable community members to do their day-to-day work, including providing access to enterprise services. Includes network access, user file storage, end-point computing backup solutions, desktop virtualization, computer labs, and printing.
Infrastructure	Enterprise-level hardware, software, systems, and network infrastructure that provide underlying support for institutional activities. Includes data centers, network backbone, wireless, central storage and system backup solutions, server virtualization, and systems management and operations.
IT Professional Services	Services that are consultative in nature, in contrast to the other categories, which tend to be technology-based; these may be a combination of customer-facing and non-customer-facing services. Includes IT training, consulting/advisory services, business continuity/disaster recovery, enterprise architecture, portfolio/project management, and ITSM.
Research	Services supporting the institution's research activities, including specialized storage and computation, high-performance computing (HPC), visualization, and lab-management systems.
Security	Infrastructure and services that provide security, data integrity, and compliance for institutional activities. Includes security services such as virus protection, encryption, privacy impact assessments, information risk management, emergency preparedness, data security, identity management solutions, access controls (i.e., passwords, accounts, and authentication), audit and monitoring systems and services, and data access and stewardship.
Teaching and Learning	Instructional technology, tools, and resources directly supporting teaching and learning. Includes learning management systems, in-class and online course development, learning analytics, course evaluation, lecture capture, webinars, and other academic tools for faculty and students.

Appendix C – Data Model and Extent of Use

The Data Model:

The categorization work was fundamentally based on a data model that we developed early on, and on the definition of major objects and relationships in this data model. Given its critical importance for this work, we show below the conceptual representation of this model in the form of an Entity-Relationship diagram, followed by the definitions of "Generic Service" and "Service Offering" (i.e., service instance)



Extent of Use

The categorization work was limited to the objects "GENERIC SERVICE" and "SERVICE OFFERING" and the relationships between them (as represented conceptually by the relationship "has/belongs-to" in the Entity-Relationship model). The remaining objects and relationships were out-of-scope. We note, however, that these relationships will have to be developed in subsequent phases, as they play an essential role in the analysis of the service inventory data.

Appendix D – Guiding Principles from Analysis Working Group

Meloney Linder, chair of DTAG, formed the Analysis Working Group to identify guiding principles for the analysis and questions the analysis should answer.

The data helps TAG members answer the questions posed by the Analysis Working Group

1. How might such services be scaled to better support research, teaching, and/or administrative excellence while also maintaining or improving the value to customers and stakeholders?
2. How might the service improve integration and operational coherence to achieve increased value to stakeholders and reduce redundancy with the intent of freeing resources to support innovation in teaching and learning, research, administration, and outreach?

A. Support and advance the university mission by…

1. Using analysis and recommendations to advance continuous improvement in teaching and learning, research, administration, and outreach;
2. Writing recommendations that free divisions to focus on their mission by instantiating services appropriately on the spectrum of centralized and localized IT service models; and
3. Identifying and preserving local services that support domain-level innovation and sustain discipline-specific expertise and opportunities for growth.
4. In conducting the Analysis Phase,
    a. Recognize the business, research, and teaching needs of the local organizational unit;
    b. Avoid oversimplifying and aggregating data into high-level summaries that describe diverse services, thereby masking potentially significant variability; and
    c. Understand why variations in services exist, currently, for each service provider and classify these services in like groupings.

B. Understand the value stakeholders' gain from current services.

Before developing an analysis recommendation, understand and consider the value of the current system both to the business, and to the stakeholders. Steps in this assessment include:

1. Asking Deans or School/College/Division leadership to provide perspective on strategic priorities and alignment of IT to ensure value is preserved;
2. Asking customers about their experience with and value of existing IT services; and
3. Validating analysis recommendations with respondents from the Data Collection phase to understand the value of services to customers.

C. Understand stakeholder requirements:

When requirements are undefined, vague, or contradictory, engage all stakeholders to elicit, validate, and document requirements. These steps include:

1. Identifying where further elicitation of business and stakeholder requirements is needed;
2. Engaging stakeholders (e.g., service providers and users) to ensure a full understanding of requirements;
3. Engaging technical staff to understand "current state" solution requirements (e.g., technical and process dependencies, as well as the local service integration and management expertise) for service provision;
4. Including in the "future state" analysis a security risk assessment by Cybersecurity and stakeholders; and
5. Assessing how well these requirements are met during the lifecycle of the "future state" solution.