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This paper describes the design of a data management system for the Carolina Computing Initiative (CCI) Administration, a division of Information Technology Services at the University of North Carolina at Chapel Hill. An analysis of the current data management systems, procedures and needs of the CCI Administration leads to the design of a new, integrated data management system. The information gathering procedures and findings are described in detail and documentation for creating the new data management system is provided.

### **Headings:**

Information Systems – Merging Information Systems

Systems Analysis

Data Management

System Design – Data Management System Design

**CAROLINA COMPUTING INITIATIVE  
DATA MANAGEMENT SYSTEM DESIGN**

by  
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## **TABLE OF CONTENTS**

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<b>Introduction</b>	<b>3</b>
<b>CCI Processes</b>	<b>4</b>
<b>CCI Administration Structure &amp; Responsibilities</b>	<b>10</b>
<b>Problem Definition</b>	<b>12</b>
<b>Project Objective</b>	<b>14</b>
<b>Information Gathering</b>	<b>15</b>
<b>Project Environment</b>	<b>17</b>
Project Limitations	17
System Requirements	18
Available Assets	21
<b>Data Collection</b>	<b>22</b>
<b>Solution Alternatives</b>	<b>28</b>
<b>System Design Recommendations</b>	<b>33</b>
Technologies and Services	33
Data Storage Schema	36
Reporting	42
<b>Lessons Learned</b>	<b>42</b>
<b>Bibliography</b>	<b>46</b>
<b>Appendices</b>	
<b>A. Entity-Relationship Diagrams</b>	<b>47</b>
<b>B. Data Dictionary</b>	<b>49</b>
<b>C. Web Reports</b>	<b>67</b>
<b>D. Remedy Action Request System Reports</b>	<b>72</b>

## **Introduction**

The University of North Carolina at Chapel Hill (UNC) committed to the increased integration of technology into its educational and instructional mission in 1998 with the creation of the Carolina Computing Initiative (CCI). The CCI is a program at UNC that “aims to ensure that Carolina (UNC) students, faculty, and staff have easy access to high-quality and affordable technology and can use it effectively (ITS, 2004).” Information Technology Services (ITS), the primary information technology organization at UNC, was charged with achieving this goal. The foundation for doing so was established when the Vice Chancellor for Information Technology and chief administrator of ITS signed a contract with IBM to provide regularly updated models of desktop and laptop computers at a significantly discounted rate.

In evidence of this commitment UNC instituted a laptop requirement for all undergraduate students beginning with the incoming class of 2000. The intent was to raise the minimum level of technology that was readily available to educators and students at UNC, guarantee equal access to this technology and leverage the flexibility of mobile technology in learning, both inside and outside the classroom. ITS created a small working group, the CCI Administration, to facilitate the achievement of these objectives. This group originally consisted of seven full-time employees who worked exclusively on the processes that made up the CCI. Today, the CCI Administration consists of three full-time personnel, the Assistant Vice-Chancellor for Academic Computing (AVC-AC) and a project management professional from IBM. These five

people are responsible for managing the three CCI processes that constitute the bulk of the work and responsibilities of the CCI Administration – CCI Model Selection and Customization, Department Deployments, and the Student Laptop Distribution.

### **CCI Processes**

Chronologically and logically, the first process that became part of the CCI in May of 1998 was the CCI Computer Model Selection and Customization. This process is currently completed every six months when several CCI Administration members collaborate with IBM personnel to choose two IBM desktop model computers and two IBM laptop model computers to be customized and called CCI model computers. This begins by selecting a standard IBM model that is closest to the set of features that the CCI Administration has deemed beneficial or necessary through solicited feedback from UNC faculty, staff, students and administrators. Any customizations of this standard IBM model computer necessary to completely match this set of features are then incorporated into the CCI model specification. The CCI Software Load Committee, a committee of ITS and other information technology professionals at UNC that is chaired by CCI Administration personnel, identifies an appropriate set of software that is included in the CCI model specification and installed by IBM before delivery of the computer to UNC. Finally, given the stipulations of the contract between IBM and UNC, the CCI Administration personnel and IBM representatives negotiate a final price for each model computer. This process results in four custom CCI model computers that are available to UNC affiliates for purchase for six months and completes an iteration of the CCI Computer Model Selection and Customization process.

Continuing chronologically, the second CCI process of Department Deployments was created by ITS and CCI Administration Personnel in December of 1998. This process involves providing one CCI model desktop free of charge to every “participant” – every faculty member, teaching graduate student, and academic support staff person in the College of Arts & Sciences at UNC. Each Department Deployment cycle takes three years to distribute approximately two thousand computers, at a rate of six to seven hundred per year. A completed Department Deployment cycle is made up of many individual department cycles, which in turn are comprised of a set of migration procedures performed by CCI Administration personnel for all the eligible participants in a department.

To begin a department’s cycle, the College of Arts & Sciences Administration provides the CCI Administration with a list of the eligible participants for each department. The department is then assigned a corresponding number of computers, known as a department’s allocation. The CCI Administration works with a department contact person to gather the necessary information to complete the delivery and installation of the new computer, migration of files from the old computer to the new computer and removal of the trade-in computer. This set of steps is known as the migration procedure and takes between two and six hours to complete for each participant. It is executed by CCI Administration personnel, in cooperation with departmental computer support personnel, at a rate of eight migrations per day, depending on the availability of the people involved. Thus, the size of a particular department’s allocation determines the length of time it takes to complete the individual department’s cycle.

The final step of the department's cycle once the migration procedures are complete is to determine the cost the department must pay for any upgrades chosen. The department must reimburse the CCI Administration for the cost of any upgrades beyond the CCI standard desktop model computer. Some examples of the more commonly chosen upgrades include choosing a laptop instead of the free desktop model, adding additional memory, adding a larger monitor to the free desktop model, and adding zip drives. Once this reimbursement is made, the individual department's cycle is completed until the next Department Deployment cycle, approximately three years later. Once all of the departments in the College of Arts & Sciences have completed their individual cycles, the overall Department Deployment cycle has been completed and will begin again.

Outside of the Department Deployment cycle is a separate, parallel deployment procedure called the New Faculty Deployments. These deployments are part of the Department Deployment process and are managed by the same CCI Administration personnel. However, unlike the Department Deployment process, the New Faculty Deployments are not regularly scheduled events. Any eligible department may receive computers through the New Faculty Deployments regardless of when the department is scheduled to receive their Department Deployment allocation. New computers are purchased by the CCI Administration when new faculty members are hired, then delivered to the departments that hired the new faculty members. The same migration procedures used for all other participants are executed, excluding the trade-in computer requirement. Any reimbursements for upgrades are processed and a New Faculty Deployment is completed. Approximately fifty new faculty members are hired in the

College of Arts & Sciences each year, primarily at the beginning of the academic and fiscal years, August and June respectively.

The final CCI process that the CCI Administration is responsible for is the Student Laptop Distribution. The CCI Administration works closely with several other UNC entities outside ITS during this process. These include the RAM Shop at UNC's Student Stores, the Scholarships & Financial Aid department (SFA) and the Office of New Student Programs (ONSP). Each of these departments plays an integral role in the successful completion of the Student Laptop Distribution. The RAM Shop assists in developing promotional materials and processes the laptop purchase by the students. SFA evaluates the financial need of incoming undergraduate students and awards CCI Laptop Grants, a grant that can be used to purchase a CCI model laptop package from the RAM Shop, to those who meet the established criteria. The ONSP is responsible for overseeing the Carolina Testing & Orientation Program (CTOPs), the UNC undergraduate student orientation program. In this role, the ONSP provides a physical space and time to distribute the laptops to the students. The CCI Administration is responsible for coordinating all of these efforts and the efforts of other ITS divisions in order to successfully distribute over three thousand laptops and relevant computing information to undergraduate students entering UNC every summer.

To begin the Student Laptop Distribution, the CCI Administration personnel collaborate with the Communications division of ITS and the RAM Shop to produce promotional materials and publish the laptop distribution information that students need on the World Wide Web (WWW). The primary piece of promotional material that this collaboration produces is the CCI Laptop Brochure. This publication is mailed to all



undergraduate students offered admission to UNC. It provides information on the laptop requirement, the CCI model laptops being offered, the service and support that ITS offers for students who purchase CCI laptops, how to place an order for a CCI laptop and payment options for purchasing a CCI laptop. This brochure is reproduced and published electronically on the CCI website (<http://www.unc.edu/cci/>) with an additional collection of web pages that offer much of the same information as offered in the brochure.

With this information successfully published and distributed, the primary responsibility of the CCI Administration in completing the Student Laptop Distribution process is to construct a distribution procedure that can accommodate over three thousand laptop distributions in eleven weeks. This means procuring through the ONSP an appropriately equipped facility and a timeslot in the CTOPs schedule that matches the time needed to distribute and configure each student's laptop. The CCI Administration staff must then complete a number of coordination tasks, including confirming that the SFA department and the RAM Shop are communicating effectively in reference to the CCI Laptop Grants, coordinating the student laptop orders taken by the RAM Shop with the delivery of enough CCI model laptops from IBM to distribute at each CTOPs session while not overwhelming the available storage space, and ensure appropriate staffing resources are available for the laptop distribution sessions through the summer. In addition, the CCI Administration staff must participate in the ITS efforts to choose and construct an appropriate delivery medium for important computing information the incoming students will receive when receiving their laptops.

The largest remaining part of the Student Laptop Distribution is to execute the plan devised for the laptop distribution procedure. The CCI Administration schedules an

appropriate number of student employees, continues to work with IBM and the RAM Shop through the summer to ensure the continued delivery of appropriate numbers of CCI model laptops and takes responsibility for addressing issues as they arise. During the summer, the CCI Administration personnel, the student employees hired to execute the laptop distribution plan and the RAM Shop staff work together two days per week for eleven weeks to distribute and configure more than three thousand CCI model laptops. At the end of the summer, when the CTOPs sessions are finished, the Student Laptop Distribution process is complete for another year.

The final piece of the Student Laptop Distribution process is the Laptop Grant Reclamations. The CCI Laptop Grant Agreement, a document that all grant recipients are required to sign in order to redeem their laptop grant, stipulates that the grant recipient “must graduate from or be enrolled in classes at UNC-Chapel Hill in order to keep (their) CCI laptop grant. If (they) transfer or withdraw prior to graduation, the amount of the grant must be repaid or the laptop must be returned (CCI, 2004).” The CCI Administration is responsible for ensuring that all grant recipients that have left UNC before graduating are notified of their responsibility to repay the laptop grant or return the laptop. The CCI Administration sends two such notices to each of these grant recipients that has left UNC and then refers them to the UNC collections agency. In addition to these notifications, the CCI Administration accepts repayments and returned laptops. The repayments are deposited into the laptop grant account and the returned laptops are placed in the pool of laptops that are loaned to students who are having their laptops repaired.

The Laptop Grant Reclamations are conducted year round, with a periodic increase in activity at the beginning and end of each fall and spring semesters. The notifications to the appropriate grant recipients are mailed out by the CCI Administration staff at the start of each of these semesters. There are typically 60 such letters that must be sent to appropriate grant recipients per semester. Additionally, students who decide to leave UNC before graduating generally do so during the first few weeks of classes or near the end of a semester. This increases the number of grant repayments and temporary semester-long exceptions, which can be granted by the CCI Administration if the circumstances warrant, that the CCI Administration must process during this time.

While the beginning and end of each semester are the busiest times for laptop grant administration and repayments, grant recipients repay their grants all year long and the CCI Administration is responsible for giving them proper credit. When notifications are complete, a cash repayment or returned laptop has been processed, or a temporary exception has been granted by the CCI Administration, then the Laptop Grant Reclamation portion of the CCI Laptop Distribution process is complete.

### **CCI Administration Structure and Responsibilities**

To successfully complete these three CCI processes, the CCI Administration divided responsibilities for their management and execution among the full-time CCI Administration personnel. The CCI Operations Manager, the author of this paper, is responsible for coordinating all the efforts of the CCI Administration and for collaborating with ITS and UNC personnel to ensure the success of the CCI. This includes assisting in the selection of IBM computers to become CCI model computers,

coordinating the Department Deployment efforts and resources and directing the Student Laptop Distribution efforts. The CCI Logistics Manager is responsible for coordinating the ordering, receiving and delivery of over six thousand CCI computers per year for all of UNC, including all the computers for the Department Deployment and Student Laptop Distributions. The CCI Deployment Specialist is primarily responsible for the daily operation of the Department Deployment process during the academic year and for executing the Student Laptop Distribution plan during the summer. However, each of these people assists with all three of the CCI processes and other CCI related activities as needed.

In addition to the three full-time personnel, the AVC-AC and IBM project management professional contribute significantly to the successful completion of the CCI processes. The AVC-AC is the ITS administrator with overall responsibility for the activities and success of the CCI. His CCI responsibilities consist primarily of long-term planning and budgeting for the CCI processes, as well as representing the needs of the CCI Administration personnel and program to ITS and UNC chief administrators. He regularly participates in the CCI Computer Model Selection and Customization process but generally does not have any responsibilities related to the other two CCI processes. Finally, the IBM project management professional works to ensure the success of the CCI from both UNC and IBM's perspectives. This includes coordinating the service and equipment deliveries from IBM, ensuring that both UNC and IBM personnel have matching expectations in their collaborative efforts and that these expectations are met by both parties, as well as a host of other duties as needed.

## **Problem Definition**

The success of the CCI Administration in managing these three processes dictates that detailed and accurate records be kept. To date, this has been accomplished using a range of technologies and ITS resources to execute a number of disjointed data collection procedures. For example, the coordination of the daily activities associated with the Department Deployments is done using an online system known as the CCI Participant Information Worksheet (CCIPIW). This system was created in 1998 as a collection of web pages written in Perl and html that store and retrieve data from a MySQL database. The schedule of departments and allocation information is recorded and accessed when needed in a completely separate collection of spreadsheets stored on a shared network drive. In yet another data management system, the information generated by the Student Laptop Distribution and the selection of CCI model computers is captured and disseminated using custom built forms in the Remedy Actions Request System (RARS) and an Oracle database.

The procedures associated with each of these data collection systems were constructed and are executed on an as-needed and best-effort basis without regard for a cohesive data collection and management strategy. The information from the CCIPIW and Department Deployment spreadsheets often needs to be synchronized because of the cyclical nature of the Department Deployment process. This synchronization is done manually by the CCI Administration on paper or in another spreadsheet when necessary. In the recent past, the procedures for collecting the information related to the Student Laptop Distribution and CCI Computer Model Selection and Customization processes were performed only when absolutely necessary and often the resulting data was not

entirely accurate. The new procedures using the RARS and Oracle database system have been a step toward improving this situation. However, by admission of the CCI Administration, this is still a process in development and one of the few bright spots in the current data collection and management strategy.

This cobbled together, organically grown data management strategy has made it increasingly difficult and time-consuming to collect and distribute reliable reports to interested parties, some of which include UNC and ITS administrators, IT professionals in higher education and educators from various educational institutions. UNC and ITS administrators often ask for a report of how many CCI model computers have been distributed to participants in the Department Deployments to date for planning and budgeting purposes. An approximation can be constructed using the department allocation information and the current department's deployment schedule, however this requires significant CCI Administration personnel time and could be automated. Additionally, several times per year IT professionals from other educational institutions visit UNC to learn about the CCI and how they might institute a similar program at their institution. One report these people often ask for is a listing of which students purchased which model of CCI laptop and what other accessories they chose. The CCI Administration, the RAM Shop personnel and the IBM project manager can compile this data from the student orders and distribution statistics. However, until the RARS and Oracle database system was put into place, this meant a manual matching of over three thousand orders.

Given the reduction in personnel since the inception of the CCI program, these inaccuracies and inefficiencies caused by the current set of disjointed data collection

systems and lack of a comprehensive data management strategy have become significant barriers to successfully fulfilling the responsibilities of the CCI Administration.

### **Project Objective**

To resolve these difficulties, the CCI Administration is looking to develop a comprehensive data management solution that ultimately will allow them to better serve CCI stakeholders. The goal of this project is to analyze the data collection and distribution needs of the CCI Administration in managing the three primary CCI processes and subsequently to develop a plan to store the relevant data in a meaningful structure. Development of this plan will facilitate the collection and distribution of this data to the appropriate CCI stakeholders. By doing so, the goal is to improve the efficiency and accuracy of the data collection efforts of the CCI Administration, capture information not currently being captured and enable improved reporting efforts.

In collaboration with all of the CCI Administration personnel, success in this project has been defined as a detailed, implementable design plan for a data management system that will be developed and used by the CCI Administration in managing the three processes discussed previously. This design plan will include:

- A recommendation on which technologies and/or services to employ
- A detailed description of a data storage schema
- Specifications for the required reports and reporting capabilities of the system

With a design plan containing all of the pieces listed above, the CCI Administration will be able to develop and use the data management system prescribed.

## **Information Gathering**

To begin the development of a data management system design for the CCI Administration, a better understanding of the data collection practices and reporting needs of CCI stakeholders was necessary. The first step in achieving this understanding was interviews with the CCI Administration staff, followed by a thorough investigation of issues and opportunities as they arose. Subsequently, observation of each of the CCI Administration personnel in their data management efforts was conducted and facilitated the collection of the relevant artifacts. Finally, interviews with other stakeholders were scheduled.

From the interviews with the CCI Administration personnel, it was revealed that several of the CCI personnel conduct their data collection activities in data management systems that will be outside the scope of this project. These include two ordering systems and the CCI grant management system. The two ordering systems, one for students and a second for UNC departments, were created by the Enterprise Data Management group within ITS. After further investigation into each of these ordering systems, the data storage technologies being used were identified as Oracle databases. Each system has its own database and tables, with access to this data via an Oracle view that is available for use in other data management systems. The CCI grant management system is one part of the UNC financial aid management system, which is part of the Student Information System (SIS). As with the two ordering systems, further investigation into the CCI grant management system revealed that an export of the CCI grant data on a regular schedule was possible, although through a different mechanism than an Oracle view.



With these limitations identified and a means for obtaining the relevant data arranged, each of the CCI Administration personnel was observed while completing their primary data collection and reporting activities. This approach further exposed the range of tools the CCI Administration was using for these tasks and artifacts that would need to be examined more closely to identify relevant data to collect in the new data management system. Examples of these tools and artifacts include the ordering tracking spreadsheets, the grant repayments spreadsheets, the CCIPW and the Department Deployment schedule spreadsheets. Close examination of these tools translated directly into identification of data type and storage requirements for the data structure recommendations.

Having completed this phase of the information gathering, interview opportunities with CCI stakeholders outside ITS and the CCI Administration were sought out. Interviews were conducted with two departmental contact persons from departments in the College of Arts & Sciences and one UNC administrator who has shown interest in CCI-related data in the past. From these interviews, several reports that would necessarily be part of the final solution were developed and the departmental contacts identified additional reporting functionality that would be necessary in the new data management system. Both departmental contacts requested access to the historical data related to their department, including when they received computers, which computers they received and their serial and asset tag numbers, who the computers were assigned to, what type of computers they received and which computers were traded in. They have had access to this data in the past, in the form of receiving and deployment reports, but these reports did not match an individual with a specific computer and required manually

matching data to deduce which computer went to whom. The UNC administrator interviewed was less concerned with individual deployment instances and more interested in statistics related to the Department Deployments and Student Laptop Distributions. For instance, he would like to be able to produce a report that indicates how many eligible faculty members have chosen to pay for an upgrade to a laptop model from the standard desktop model and what are the most requested accessories. In addition, he is interested in how many students chose to purchase a CCI model laptop, how many of each model, and how many students who received CCI Laptop Grants chose to add additional funds to the grant and purchase the more expensive laptop model. This information was very helpful when designing the reporting structure for this data management system.

### **Project Environment**

With the majority of the information gathering complete, defining the project environment became possible. To do so, a preliminary list of project limitations, system requirements and available assets was developed and reviewed with the CCI Administration. Incorporating their response, the project environment was defined by a finalized collection of these limitations, requirements and assets.

### **Project Limitations**

Two of the project limitations for the design of a suitable data management system have already been discussed. The existence of the two ordering systems, one for students and one for UNC departments, and the CCI Laptop Grant Award System outside

the scope of this project limit the data structuring options available for the final design specification.

In addition, during the CCI Administration interviews the AVC-AC limited long-term system support and maintenance options to what is currently available from existing ITS services. CCI Administration personnel should not be required to know or learn a programming or database development language or techniques. The reduction in staff size since the inception of the CCI program forbids this as a long-term support strategy. Additionally, a long-term support or maintenance contract with a commercial agency is currently not a funded option and there are no additional funds outside the current project budget anticipated to fund this as a strategy. This set of project limitations was agreed upon and the collection of system requirements was produced.

### System Requirements

The system requirements were broken into two categories, those related to the data storage and structure and those related to specific capabilities of the resulting data management system. The first requirement related to the data storage is that all data related to the three CCI processes and deemed necessary or relevant by the CCI Administration must be recorded by the new system.

This collection of relevant data was the subject of much of the interviews conducted with the CCI Administration and further investigations into the data management systems currently being used. Understanding the types of data to be stored and the ways in which this data relates to the CCI Processes will be important to ensuring that the system design plan meets or exceeds the system requirements. A detailed

description of the data considered relevant and that will be collected using the new data management system follows in the Data Collection section.

The second of the system requirements for the data storage and structure is that the chosen storage schema should be able to accommodate minor changes in the future. This requirement comes from the CCI Administration's experience with recording data related to the CCI computer models. Specifically, the current data schema was created such that only certain information related to the hardware specifications of each model can be recorded and it does not meet current needs. The specific example used by the CCI Administration to illustrate this issue was the situation with network adapters in the laptops. When the data schema was created, all laptops came with only an ethernet adapter. Now all CCI laptop models are equipped with a wireless adapter, in addition to the ethernet adapter, and the only place that the wireless adapter information can be recorded is in the same field with the ethernet adapter specifications. This has hindered the CCI Administration's reporting efforts and is something they would like to correct in the new system design, as well as anticipate this type of minor change while developing the system's specifications.

The third system requirement for data storage and structure is that SIS must provide all student related data, including the PID, student name and permanent address. SIS is the canonical source of this data at UNC and is where all UNC departments and agencies are to retrieve such data. In order to assure current, pertinent data this information should be imported from SIS and if any conflicts arise, the data in SIS should take precedence over data stored in this system.

The final system requirement related to data storage and structure is also a system capabilities requirement. The data schema and chosen set of technologies must be created and chosen so that data from other systems, such as the ordering systems and CCI Laptop Grant Award System, can easily be integrated. For this project, this means that the system must allow for data from these other data management systems to be programmatically manipulated and entered into the data structure.

The second category of system requirements are those related to required system capabilities. The first and foremost is the incorporation of an authentication mechanism. The CCI Administration specifically asked for this to ensure that only those specifically granted access to this data by CCI Administration personnel are allowed to view, enter or edit data. Additionally, the CCI Administration would prefer to use the “Onyen”, the UNC email ID, and password combination as the authentication credentials. This is the standard for authentication mechanisms at UNC.

In conjunction with this authentication mechanism, the CCI Administration has asked for the ability to grant differentiated levels of access to the data. Members of the CCI Administration will need to be able to read, write and edit all data stored by this system. Department contact people will need to be granted access to enter and edit data related to their department during their department’s cycle and subsequently should need only read-only access. This is because once their department’s cycle is finished, the department contact person should be done entering data. To maintain an accurate history of the Department Deployment activities, the ability to edit this data should be restricted. Additionally, they anticipate that ITS and UNC administrators should only need read-

only access to data in order to produce reports. Therefore, a means of differentiating the type of access a particular user has to the data in this new system is necessary.

In addition to the ability to authenticate users of this system and grant differing levels of access, the CCI Administration requires that this system allow simultaneous access to the data and the system by multiple users from multiple user groups. This is to ensure the availability of the data when it is needed. In the interest of ensuring data availability, the CCI Administration has also asked for the system design to include a strategy for providing for data integrity, backup and security. UNC and IT industry standards should be met or exceeded in these efforts.

The final system requirement related to system capabilities and data availability is access to reports from within the UNC campus and data network and from other outside locations with a network connection. Most of the access, data entry and manipulation will be done while physically on the UNC campus, but the CCI Administration anticipates a need for access to this data from other locations. Thus this data management system must be accessible from data networks other than UNC's data network.

#### Available Assets

The collection of assets available for the completion of this project was identified during the interview process with the AVC-AC. He could offer only very limited funding, \$5,000 or less, for system development. He explained that his budget has been significantly reduced in the three years preceding this project and he is uncertain about future funding. This budget is to cover the cost of any commercial packages purchased for the final solution and any system development services. Additional temporary staff

can be added to the CCI Administration staff, however the anticipated costs of hiring this person or people should fall within this budget.

The most significant resources he could offer were the existing ITS resources and services. These include a high speed data network, data storage services and resources, data backup and recovery services, application hosting services, WWW publishing, multiple interface offerings with authentication mechanisms already in place, and interface development services, any one or combination of which could be used in developing a system design plan.

### **Data Collection**

Identifying the data that is to be collected and managed will be crucial to satisfying the first system requirement that all data related to the three CCI processes and deemed necessary or relevant by the CCI Administration and the system designer must be recorded by the new system. In this section the data that should be recorded is specified and related to its corresponding CCI process.

For the CCI Computer Model Selection and Customization process, the CCI Administration is currently using the RARS forms and Oracle database system to store information related to the hardware components of the computers, the software installed on a computer before it is delivered to UNC and information specific to a particular model type.

For the computer hardware, the information currently being stored using the RARS and Oracle database system is primarily the type of component, the technical specifications for each component and the manufacturer, model line, and model number

of the component where possible. The specific information currently being recorded includes:

- processor specifications
- amount of onboard cache
- fixed disk/hard drive size and speed
- type of fixed disk controller
- communication devices (modems and network adapters)
- front side bus specifications
- video card and memory
- system memory (RAM)
- maximum amount of system memory
- floppy disk
- number and type of ports, expansion slots and drive bays
- type of audio card installed
- optical drive (CD, DVD, etc...)
- keyboard specifications
- type of mouse
- modem installation is standard/non-standard
- type of battery (laptops)
- size and type of monitor (desktops)

In addition to this information, the CCI Administration has asked that modifications made to the original IBM model computer that is customized to become a CCI model be recorded, as well as modifications made to the default software installation for all software installed on the CCI models prior to delivery to UNC. The addition of this information should prove helpful in maintaining the history of the decisions made in regard to the CCI Model Selection and Customization process.

Information on the software being installed on a particular CCI computer model is currently very limited. The only data being captured is the software manufacturer, title, version number and the type of CCI model computer it is installed on before delivery. The CCI Administration would like to keep records on all customizations to the default software installations that are performed before the computer is delivered to UNC in addition to this information.

Finally, data specific to particular CCI model computers are also stored using the RARS and Oracle database system. This includes the following data:



- physical form of the computer (desktop, tower or laptop)
- class of the computer (standard desktop, standard laptop, technology minitower, or multimedia laptop)
- generation of computer (a generation is the set of four CCI computers that are upgraded every six months)
- model number
- IBM product line that each computer was originally chosen from (ThinkPad R40, NetVista M50, etc.)
- original IBM model number
- date of model's first and last delivery to UNC by IBM
- length and type of warranty
- common name by which the computer is referred to (ex. ThinkPad R40).

This collection of information, along with the information related to the hardware components and software, will meet the data collection requirements of the CCI Administration.

For the Department Deployments the data currently be recorded can be divided into five categories: Department Deployment cycle data, the department's cycle data, migration procedure data, trade-in computer data and computer ordering data. As previously referenced, the data related to the Department Deployment cycles is currently being recorded in a collection of spreadsheets on a shared network volume and includes:

- list of qualifying departments
- order in which each department will receive their allocation
- academic and fiscal year that each department will complete their cycle
- estimated and actual yearly total of deployed computers
- estimated and actual total of computers deployed over the three-year Department Deployment cycle
- total number of days required to deploy the estimated number of computers for each year

In addition, this collection of spreadsheets records the following data in reference to an individual department's cycle for a particular Department Deployment cycle:

- department name
- estimate of the department's allocation
- actual department allocation for each Department Deployment cycle

- how the allocation was determined (number of qualifying participants)
- number of computers actually delivered
- department's cycle dates (initial meeting with department, the order date, start date for the migration procedures)
- length of time the department's cycle will take

The aggregate of this data related to the departments' cycles comprises the data related to a single Department Deployment cycle. In this manner, the collection of the data reflects the relationship of each individual department's cycle to the Department Deployment cycle.

In addition to the data being collected in these spreadsheets, the CCI Administration wishes to collect several other pieces of data for each department and Department Deployment cycle. Specifically, the CCI Administration would like to begin collecting the four digit department number used by the UNC administrative departments to identify departments in the College of Arts & Sciences, the department contact's name and contact information, as well as special circumstances surrounding a particular department's cycle. Collecting this information in the new data management system will help to alleviate a coordination problem CCI Administration personnel have had in the past.

The relevant data that pertains to the Department Deployments also includes information about the migration procedures. This data is primarily collected in the CCIPIW. It is entered by both the departmental contacts and by CCI Administration personnel at different times through the department's cycle. Before the CCI Administration can place an order for computers and accessories for a department, the department contact must enter the following:

- first and last names of the participant
- participant's classification (faculty, staff, graduate student or other)
- participant's email address and phone number
- type of computer and any accessories ordered
- location for the new computer and accessories to be set-up
- IP address of computers that need access to UNC's administrative applications
- any additional requirements or special circumstances

Once this information is recorded, the CCI Administration places the order and updates the individual participants' records by inputting the date and time the migration will occur, notes for the migration procedure and updates for any data the department contact person entered. This completes the data collection for the migration procedures that is currently being conducted. In these data collection efforts, the relationship of aggregation continues. Aggregated data from the migration processes constitutes much of the relevant data related to a department's cycle in the Department Deployment process.

The CCI Administration and department contacts would also like to collect some information that is not currently being recorded. As previously mentioned, the department contacts would like to keep records of which computer was delivered to which participant, information on the computer's current location, and historical data related to past department cycles that would be available for reference when completing a current or future cycle. Also in the interest of recording histories, the CCI Administration would like to record what additional software is installed during each of the individual computer migrations in the hopes that this may help to better determine what software is being used by the people receiving the CCI computers. With the addition of this

information, all the data that should be captured for the successful execution of the migration procedures will be recorded.

The two remaining categories of data related to the Department Deployment process are the trade-in computer data and the computer hardware ordering data. The final step in completing the migration procedure is the removal of a trade-in computer. Each department is required to trade an old CCI model computer for a new one from their allocation. Currently this data is being collected in spreadsheets for each individual department. The serial number, model number of the computer and computer location are recorded on these spreadsheets. This set of information related to the trade-in computers is nearly sufficient for the CCI Administration's needs. They would like the ability to record notes about peculiarities related to a particular trade-in computer. The relevant data pertinent to the trade-in computers is thus only these four pieces of data.

The final data category related to the Department Deployments is the computer hardware ordering data. This data is also relevant to other CCI processes, including the Student Laptop Distribution process. For a list of relevant data related to the hardware ordering, the order tracking spreadsheets become very useful. The spreadsheets record an order number, the date the order was placed, the department for whom the order was placed, an order type (deployment, new faculty or other), the details of what was ordered and any notes relevant to that order. In addition to this information, the CCI Administration would like to record the exact computers and accessories associated with each order associated with any one of the three CCI processes. Thus not all CCI model computer orders will be recorded in this system, but more detailed information from both the UNC department and student ordering systems will need to be stored.

The Student Laptop Distribution process also requires that specific information be collected and made readily available for producing reports. This CCI process differs significantly from the other two CCI processes in that the majority of the data collection activities are performed by the other UNC entities with which the CCI Administration co-operates. The RAM Shop is currently collecting information related to the laptop ordering, purchase process and actual laptop distribution and SFA is collecting the information on laptop grant dispersals. The only part of the CCI Laptop Distribution process for which the CCI Administration performs the data collection activities is the laptop grant reclamations. This is being accomplished using the Faculty-Staff Central website, the data from SIS related to a student's enrollment status and their records in the laptop grant management system (also a part of SIS) to determine which grant recipients are responsible for repaying their laptop grant or returning their granted laptop. When a repayment is processed or a laptop returned, the CCI Administration records this in a spreadsheet on their shared network volume and changes the grant status in SIS. Thus the data relevant to the execution of this portion of the CCI Student Distribution process includes:

- student's PID
- full name
- permanent address
- telephone number
- email address
- grant amount
- date the grant was redeemed
- enrollment status of the student
- status of the grant (redeemed or returned)
- information related to the method of grant repayment

### **Solution Alternatives**

With the relevant data identified and the set of project limitations, system requirements and available assets defined, it became apparent that the system design

solution would most likely come from a combination of ITS services and resources. However, in the interest of developing the best possible solution for this project, an investigation of commercially available software packages was conducted. The intent was to find a product that would provide for all the required elements of this project while reducing up-front development time and long-term maintenance efforts by leveraging the system development done by the software manufacturer. Through the browsing of IT trade publications and the use of Google's search engine to perform keyword searches of the WWW, three commercially available software packages were discovered that had the potential for fitting into the project environment.

The first, Birdstep's Raima Database Manager family of embedded database technologies, was found using the Google search engine and keywords "data management system". From the information published at their website, this product appeared to be the best match for the system requirements of the selection of results. It offers database technologies to store and structure the relevant data, provides data integrity, security and backup strategies, offers the ability to accept data from established data management systems, allows multiple simultaneous users to access the data and presents the option of allowing access over a data network from anywhere or from a set of network addresses (IP addresses). In addition, this software offered standards-based (SQL, JAVA and XML), predefined application integration modules to facilitate the interface development. There remained one system requirement that was not specifically addressed in the Birdstep marketing literature. That was an authentication mechanism, including the ability to assign differing levels of access to individual users and the potential to use the Onyen as the authentication mechanism. The availability of this

authentication and data access control mechanism, along with the potential cost and required support resources, determined whether this technology could become part of the final design specifications.

It was necessary to contact Birdstep's sales department over the telephone to obtain the answers to these questions. The required authentication mechanism was available and allowed assignment of various levels of access, including those required by the CCI Administration. In addition, the sales representative was certain this software could make use of the Onyen credentials for authentication. However, the cost for this application was significantly outside the budget for this project. The initial cost was going to be nearly \$20,000 after including additional hardware, software licensing and development services. Furthermore, there was a yearly licensing fee of over \$1,000 and the potential that additional development services could be needed. For the cost alone, this software package was necessarily excluded as an option for the final system design specifications.

The second of the commercially available software packages reviewed was Alpha Software's Alpha Five V6 web database application development suite. Like the Birdstep software package, this software suite was found using keyword searching on Google's WWW search engine. The keywords "database application development" presented a link to Alpha Software's website under "Sponsored Links" on the right side of the results page. Of the result set from this keyword search, Alpha Five V6 emerged as the option that met the most of the system requirements from initial investigations. Alpha Five V6 meets the system requirements by providing for the creation of a database or databases to store data, supplying an authentication mechanism that can differentiate

levels of access for various users, offering the ability to interact with data in other databases, allowing multiple simultaneous users to access the data and providing for connections to the system from any web browser. Moreover, this software has the advantage of being affordable (less than \$1,000) and uses a graphical user interface (GUI) for developing the data structure, application interface and for controlling access levels for users. This could significantly reduce the need for development resources and offer the CCI Administration more long-term flexibility with the application interface and data structure. However, this software failed to meet all of the system requirements. The first and most important of these shortcomings was the lack of a data backup strategy or system for maintaining data integrity. The response from Alpha Software when contacted about these issues was that data backup was the responsibility of the purchaser and that by implementing the Alpha Five V6 solution on a server using the Windows Server operating system the purchaser could use a Microsoft solution called Opportunistic Locking to ensure data integrity. This solution would require the purchase of additional server hardware and software licensing, as well as a long-term support and maintenance commitment. The second shortcoming of this software was its inability to use the standard authentication mechanism used at UNC, the Onyen credentials. While this was not a large enough shortcoming to reject this software as part of the solution, it was a negative aspect of this software to be considered when making the final decision. Ultimately the increase in cost to implement the suggested data backup and data integrity measures dictated that Alpha Five V6 not be part of the data design specification.

The third and final commercial software package discovered and evaluated for use in this project was Business Objects Business Intelligence (BI) products. This



software package was discovered while browsing an issue of Information Week(“There Must” 2004). Business Objects had an advertisement and provided a website where further research on their product offerings was conducted. Like Birdstep and Alpha Software, the BI line of software products proved to be the best offering its class, business intelligence software, for this project. It too offered the ability to record and store data, provided for data integrity, security and backup strategies, integrated with existing authentication mechanisms and allowed multiple simultaneous users to access the data from a wide variety of locations. However, there was no mention of one of the system requirements, integration with other data sources and management systems.

The BI line of products is similar in the system capabilities to Birdstep’s, but the structure of the software is very different. While Birdstep is offering a software package that can be customized to the requirements of the purchaser, BI is offering a package of consultation and development services along with software modules that can be combined and customized to the purchaser’s specifications. This was typical of the business intelligence software provider offerings discovered during the commercial software investigations. No quote for the BI software and services was obtained when it was discovered that licensing one piece of the BI software, the underlying “Information Infrastructure”, would exceed the project budget. Thus the BI line of software products had to be eliminated from consideration for the system design specification.

Having eliminated the commercially available alternatives and given the CCI Administration preference for, zero cost of, and easy availability of ITS resources and services, the system design plan will employ primarily existing ITS resources and services.

## **System Design Recommendations**

With the list of alternatives effectively narrowed to ITS resources and services, a survey of viable offerings was conducted. From the published list of ITS services the list of alternatives was further narrowed by briefly examining the service descriptions and identifying services that might be a part of the data management system design plan.

### Technologies and Services

The choice of technologies and ITS services to employ in the data management system design were the first choices to be made. These choices were likely to play a significant role in all subsequent decisions affecting this system design and thus were decided upon before choosing complimentary technologies and ITS services.

ITS offers a number of services and supporting resources that could meet or exceed the set of system requirements for data storage - AFS (Andrews File System) storage space, ITS Oracle database services, MySQL database hosting and the Mass Storage system – which are all managed by the Enterprise Data Management division of ITS. (ITS Services 2004) A survey of the published information on these service offerings was conducted and appropriate personnel were contacted with questions. This investigation led to ITS Oracle database services being chosen as the service and technology set that best meets the data storage requirements. This service meets all of the data storage related system requirements – provides for the storage of all relevant data types, allows structuring of this data such that minor changes can easily be accommodated and will accept data from other data sources easily given the correct setup, including student related data from SIS. In addition, the Oracle database technology

implementation at UNC provides for easy integration with a number of other technology and service offerings from ITS, including the Onyen authentication mechanism that the CCI Administration preferred. Furthermore, the ITS Oracle database service addresses several other system requirement that the other ITS service and resource offerings do not, such as data integrity, backup and security measures that meet or exceed industry and UNC standards. The combination of these factors and benefits make ITS Oracle database technologies and services the best choice for a data storage solution given the described Project Environment.

Once the data storage technology and service were selected, a complimentary technology to be used for delivering the data was chosen. This user interface technology must accommodate the varying needs of the CCI stakeholders to enter, edit and retrieve data. To do this and to best leverage the available ITS resources, dividing the user interface into two separate interfaces is appropriate. First, for the CCI Administration, developing a data management console in RARS offers the ability to enter, edit and retrieve data and also to manage the access to the data in this system. RARS is an ITS resource and service that includes development resources, namely the Remedy Development group. Contracting with this group for the development of this part of the user interface addresses the system development needs and long-term support of this portion of the data management solution. It allows for flexibility and change in the solution over time and satisfies all of the functionality requirements set forth for this project that were not satisfied by the data storage recommendations. Finally, the CCI Administration staff is already using this strategy for managing the CCI model selection data and thus has the necessary software already in place. For the user interface needs of

the CCI Administration and the requirements of this project, RARS is the best of the available options.

For the other stakeholders in this data management system, using RARS as the user interface is problematic. The use of RARS requires the licensing and installation of software on each computer they would like to access the data from. Additionally, this strategy would require training for the end users, which is not forbidden as a strategy in this project but would be an additional responsibility for the CCI Administration personnel. Adding these additional responsibilities is prohibited by the Project Limitations. Furthermore, the UNC implementation of this application would require that the users or their departments put some development efforts into their RARS configuration. Again, this is not necessarily outside the scope of this project but would be considered a negative side effect of recommending using RARS as the sole user interface. Finally, those stakeholders who are not associated with UNC would not be allowed to access any portion of the UNC RARS implementation because of ITS security policies and thus would be denied access to this data if RARS were the only user interface.

For these reasons, the second part of the user interface should be designed for access over the World Wide Web (Web). This will allow any authorized users, whether associated with UNC or not, to access the data they are interested in and authorized to view from anywhere they have access to the Web. Development of a collection of web pages in a commonly used web programming language - such as Perl, PHP, ColdFusion, ASP or Java - will provide the required reporting capabilities and allow departmental contacts to enter and edit data. Access to the individual web pages can be managed by

the CCI Administration personnel through the RARS interface and reports or data entry forms can be accessed by the appropriate stakeholders using the web portion of the interface.

### Data Storage Schema

Having chosen the technologies and ITS services to be used in this data management solution, the choice of how to satisfy the data structure requirements was addressed. An ANSI/ISO SQL Standards compliant relational database was chosen as the foundation for the data storage specification. This will facilitate the exchange of data between the various data management systems and ensure that future data management needs can be easily integrated into this system. In addition, an international standards compliant solution allows for a wider variety of technology choices when constructing the remaining parts of this system.

Continuing with the data structure specifications is the construction of the data structure itself. In Appendix A is an Entity-Relationship diagram for the relational database that will establish the data structure for this data management system. Appendix B is a Data Dictionary containing detailed descriptions of the entities, attributes and relationships from this diagram. A discussion of the decisions made when constructing this structure follows.

Several entities were created to capture and store the data pertaining to the Department Deployment process, the relationships between them were established and the appropriate attributes were placed within them. The entities created specifically and exclusively to achieve this goal include Deploy, Participants, Depts and Old Computers. In addition to these, several other entities were created to address the data collection and

storage needs of this process along with other CCI Processes. These include Orders, Hardware, Computers, and Accessories.

The Deploy entity was created to collect the data related to a specific instance of a computer migration or deployment. This migration or deployment instance is when an individual participant receives a unique piece or set of hardware at a particular date and time in a specific location. Thus it contains the appt date (appointment date), bldg (building) and room num (room number) attributes which are related to a single participant and at least one unique piece of hardware through the relationships with the Participants, Hardware, Computers and Accessories entities. In addition, several other attributes were added to this table to collect information on the Department Deployment process that the CCI Administration requested.

The Participants entity was added to collect data related to the people participating in the computer migrations processes. The attributes here are all related to identifying a particular person. One decision made when constructing this entity was the decision to use a person's Onyen to uniquely identify them in this system rather than the PID, which is the number used to uniquely identify any person at UNC. This choice was made because the Onyen policy says that one and only one Onyen will be granted for any one person at UNC. The department contact people who will be entering this data into this system usually have a list of the Onyens for the participants from their departments, where they do not always have a list of PIDs. Thus for ease of use, the Onyen was chosen over the PID as the unique identifier or primary key in this case.

The Depts entity is a third entity created for the storage of data related to the Department Deployments. This entity contains attributes that describe a particular

department's participation in a single Department Deployment cycle. All of the attributes in this table will differ from cycle to cycle except the Dept Name and Dept Num.

Therefore the combination of Dept Num and Cycle Num was chosen to uniquely identify a department's participation in a Department Deployment cycle. This strategy allows for a history through cycles to be kept and retrieved while also uniquely identifying a particular instance of a department's participation in a cycle.

The final entity created exclusively for the storage of data related to the Department Deployment process is the Old Computers entity. This addition of this entity is a result of the CCI Administration trade-in policy, which allows any older CCI model computer that a department owns, whether originally part of the Department Deployments or not, to qualify as a trade-in for a new CCI computer from the department's allocation. Thus a listing of computers from past Department Deployment cycles might not be the correct list of computers being traded-in. The attributes contained in this entity identify a specific old or trade-in computer and the location from which it should be picked up. The serial number that uniquely identifies a particular computer was an obvious choice as the unique identifier for the Old Computers.

In addition to these four entities created exclusively for the Department Deployment process is one entity that was created for both this process and the Student Laptop Distribution process. The Orders entity is primarily for collecting data related to a request for a particular piece or collection of hardware through one of the two previously mentioned ordering systems. The relationships Place and Creates link this entity to the data collection efforts of both of these CCI processes. Through the Place relationship specific order instances are linked to a particular department and Department

Deployment cycle, which makes this table an important part of the Department Deployment process. Similarly, through the Creates relationship a specific order instance is linked to a particular student who has requested a CCI laptop and thus makes this table an important part of the Student Laptop Distribution process.

Besides being integral to the data collection for both of these CCI processes, the Orders table is required to accept data from both the student and UNC department ordering systems. This requirement is the reason for choosing a combination of attributes to uniquely identify order instances. Both ordering systems use six digit numbers as the unique identifier that distinguishes one order instance from another inside the respective ordering system. However these numbers are not unique when both sets of order numbers are combined. Thus combining the order type with the order number (order num) is necessary to ensure a specific order instance can be retrieved.

Similarly situated to the Orders entity are the Hardware, Computers and Accessories entities. All four of these entities play an important role in the data collection of the Department Deployment and Student Laptop Distribution processes. Specific order instances are related through the Contain relationship to a single piece or collection of hardware. This hardware is the computer or the accessories that the student or department receives as a result of their request placed through one of the two aforementioned ordering systems. Thus through the Contain relationship, the Orders entity and either the Place or Creates relationship the Hardware, Computers and Accessories entities become part of the data collection associated with these two CCI processes as well.



However, unlike the Orders entity, the Hardware and Computers entities are also related to the CCI Computer Model and Selection process. Through the Are relationship the Computers entity is linked to the CCI Models entity and as a superclass of the Computers entity, the Hardware entity is thus linked to the CCI Models entity as well.

This CCI Models entity is one of three entities created specifically to address the data collection needs of the CCI Computer Model Selection process. The other two are the Software and Components entities. The CCI Models entity contains attributes and data that describe a particular CCI model computer class rather than a specific CCI model computer instance. Through the Installed and Included relationships with the Components and Software entities respectively the CCI Model entity provides for all the data collection required by the CCI Administration.

The Components entity contains data related to the specific parts or components that are assembled to make up a CCI model computer. In the past, recording this information was done by creating an attribute for each type of component in the equivalent of the CCI Models table in the previously mentioned RARS and Oracle data management system. To address specific concerns from the CCI Administration and to meet the system requirement for the ability to accommodate minor change in the future, this Components entity was created and the Ctype (component type) entity was added. This preserves the classification of individual component instances in types or classes and allows for new types to be added in the future.

The Software entity addresses the need to collect information about the software installed by IBM before delivery to UNC. This entity and set of attributes was constructed similarly to its equivalent in the RARS and Oracle system with one addition.

The Mods or modifications attribute was added to capture the changes the CCI Administration requests be made to the default installation options for particular software packages included with a particular CCI Model.

The final part of the data storage specification is related to the Student Laptop Distribution process. The Student entity was created to accept the data from SIS related to identifying and contacting Students who place orders for CCI orders. The attributes in this table were created to mirror the data structure from SIS and collect only what the CCI Administration requested.

The remaining entities – Laptop Grant, Grant Repayment, Check, Laptop – were created to meet the data collection needs for the CCI Laptop Grant management portion of the Student Laptop Distribution process. The Laptop Grant entity contains data referencing a specific laptop grant instance. This is linked to a specific student from the Student entity and thus indicates which student received what grant amount at which time and the current status of their laptop grant. The Grant Repayment entity and the subclasses of this entity – Check and Laptop – were created to facilitate the accepting and crediting of grant repayments by the CCI Administration. When a student repays their grant, with funds or by returning their laptop purchased with the grant, the relevant data is collected in these three entities.

This collection of entities, the attributes contained within them and the relationships between them comprise the data structure recommendation for this data management system. This structure will allow for the collection of all the identified relevant data, will accommodate minor changes in the data collection needs of the CCI

Administration and accept data from the other data management systems at UNC that it must interact with.

### Reporting

The last part of the system design recommendations for this data management system is the reporting strategy. The reporting that this data management system was designed to provide was identified by the CCI Administration and other of the system's stakeholders as necessary or desired. Like the user interface, the reporting strategy can be divided into two strategies or designs.

The first collection of reports is the predefined reports that are part of the Web portion of the user interface. These reports present the most commonly requested data to the stakeholders that will be using this portion of the user interface – ITS and UNC administrators, department contacts, IT professionals in higher education and educators from various educational institutions. The details of each of these reports are outlined in Appendix C.

The second set of reports is those available through the RARS portion of the interface. The intent was to give the CCI Administration as much reporting flexibility as possible while still offering quickly reproducible reports for the most common tasks. The details of these reports are outlined in Appendix D.

### **Lessons Learned**

When the CCI began, it was the first program of its kind at a large public university. There was no model to follow for how to implement the various processes that make up this program or even what these processes should be. Therefore all of the

ITS effort and attention went into defining, creating and making these processes work. Little if any attention was paid to data collection or management unless it was essential to the job at hand. The lack of attention to this important piece of any program is what led to the disparate and disjointed manner in which the CCI Administration has collected and managed their data to date. Valuable data related to the development and workings of the CCI program were lost and the integrity of the data that was collected is somewhat questionable.

However, having been a part of the development and evolution of the CCI program, I can see that the delay in creating a data management system as described above has allowed this program to mature and become operationalized. A program in this state lends itself much more easily to the design of a data management system. Had we undertaken this design effort and paid closer attention to the data we could collect while this program was still being crafted, I believe we would have redesigned this system and the data structure several times in the six years since its inception or potentially have been locked into an operational model by the data model and a lack of the data management skills.

The desire and effort spent on this project is evidence of the first scenario and the CCIPIW is an example of the second. The CCIPIW, as previously mentioned, is a data collection and management system written to administer the CCI computer life-cycling program in the College of Arts & Sciences and has outlived its intended lifespan. Currently over half of the fields listed in the primary form (the Add Participant form) are not used or used for a purpose other than was originally intended. It is run using hardware and services that are no longer offered outside of ITS and are only kept around

for testing purposes and to continue the operation of systems such as the CCIPIW. In the past, the CCI Administration has chosen not to implement operational changes because of the lack of a means for redesigning the CCIPIW. Specifically, the Department Deployment personnel and department contact people have desired an electronic means of associating a particular computer with a specific participant. This would require interfacing with the ordering systems and redesigning the forms and reports in the CCIPIW. Without the skill set for this redesign, the Department Deployment personnel chose not to record this level of detail but rather to produce a report of all the computers delivered to a specific department. This report can easily be produced with the ordering system, but the inevitability of change to this data made the Department Deployment personnel decide that the return for their investment of time and manual matching of a serial number to a participant was not worth the cost of the effort. The solution proposed attempts to prevent a similar situation from developing by choosing services with development and support resources available to support them.

The real tension here is between capturing meaningful data that can be analyzed and used to develop meaningful conclusions and the change to basic assumptions upon which a data management system is built. The first requires consistent, reliable data to be collected over time. The second requires that the data structure be changed to meet the evolving needs of this program. A program that is one of the first of its kind and that is developing and changed on a fairly regular basis, as the CCI program has been until fairly recently, makes it very difficult to create a consistent data structure. However, as one of the first of its kind, the collection of data becomes all the more important and interesting to stakeholders.

The first lesson that I take away from identifying this tension and having been part of both the evolution of this program and the design of the new data management system is that data management and structuring for a program needs to be a part of the planning from the beginning. This should be a continuously evolving and thoughtful process that considers the data needs and interests of stakeholders over time as decisions are being made.

A second lesson from the development of this data management solution was difficult to learn. Detaching oneself from a situation that you are intimately involved with can be a very difficult task. Reliance on the methods and tools of system analysis and project development become increasingly important, as does seeking input and feedback from others aware of the situation. I found that early versions of my proposals reflected assumptions that I had made to facilitate the role I play in the execution of the CCI processes rather than the larger situation that involves all of the CCI stakeholders. Ultimately, stepping outside of the process helped to create a better data management system for all participants involved and improved my understanding of the CCI processes.

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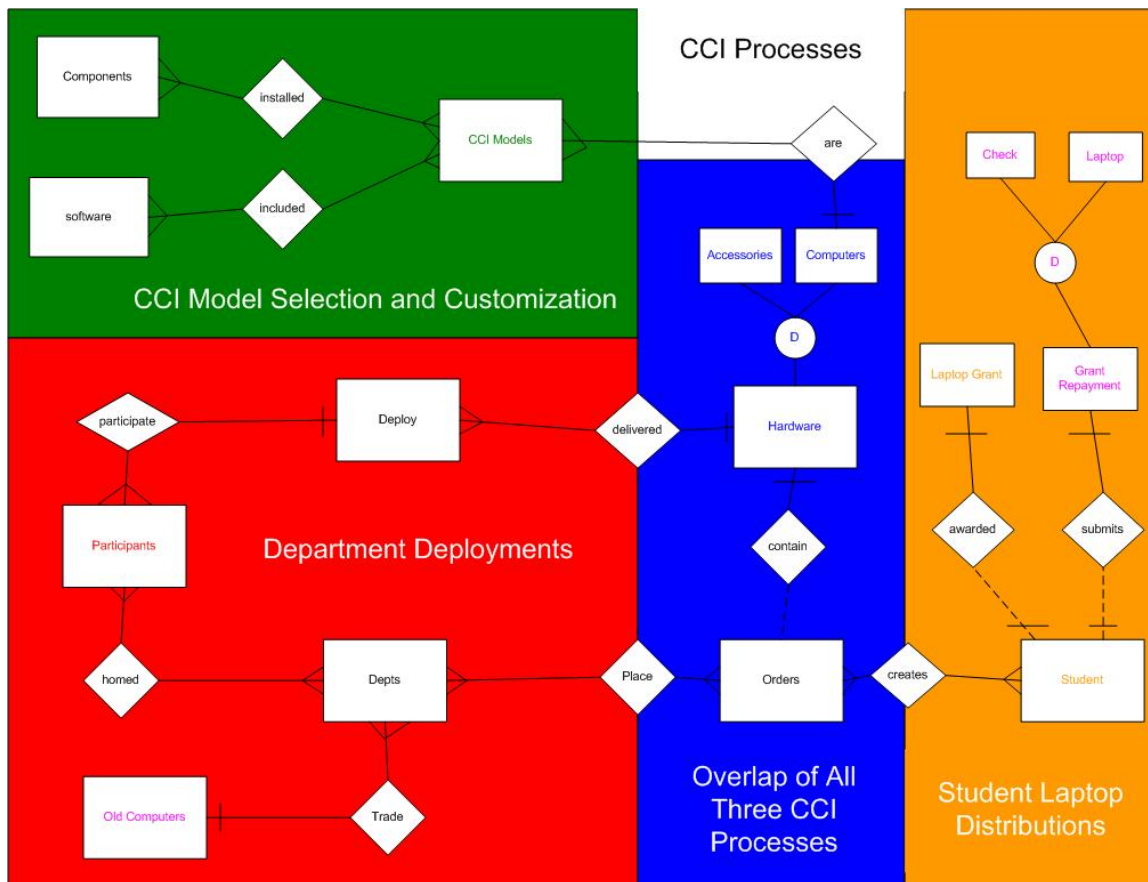
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## Appendix A

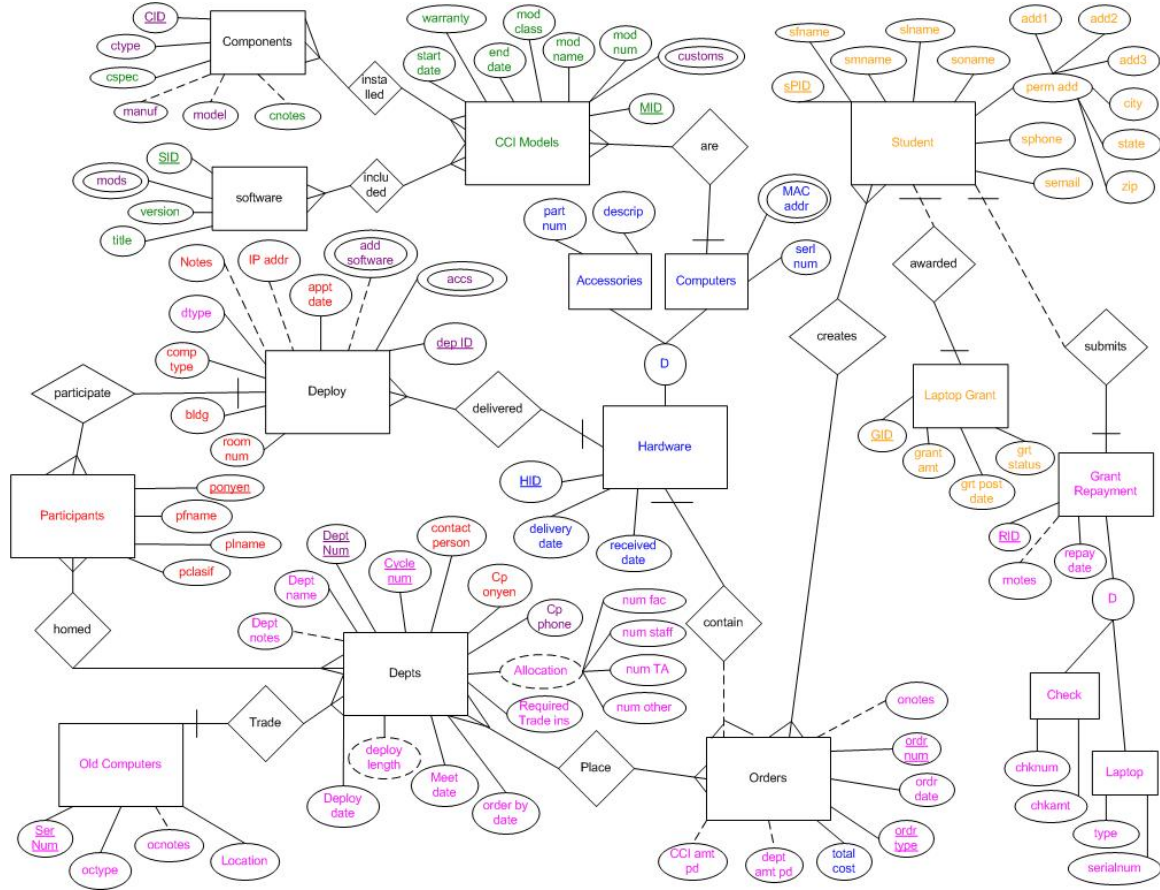
### Entity-Relationship Diagrams

Entities and the CCI Processes they are related to





## All Entities, Attributes and Relationships



### Color Coding

Each color indicates in which data management system the data is currently being kept.

Red = CCIPW

Green = REMEDY/ORACLE

Blue = ITP

Pink = Spreadsheets

Orange = SIS

Purple = New Data

## Appendix B Data Dictionary

**Accessories** – Subclass of Hardware Table

**Description:** Any equipment ordered that is not a computer.

**Accs** – Multi-valued Attribute of the Deploy Table

**Description:** Accessories that are to be installed during a particular deployment instance as part of the Department Deployment process.

**Synonyms:** Accessories

**Values:** Will vary.

**Format:** Text

**Field Size:** 50 Characters

**Add software** – Multi-valued Attribute of the Deploy Table

**Description:** Software that is not part of the collection of software associated with the model of CCI computer being deployed and that is requested by the participant participating in the deploy instance to be installed.

**Synonyms:** Software to install, additional software install.

**Values:** Will vary.

**Format:** Text and numbers. Should include software title and version number.

**Field Size:** Max 50 characters per entry.

**Add1** – Attribute of the Student Table

**Description:** The first or top line of a student's mailing address.

**Synonyms:** Street Address

**Values:** Will vary.

**Format:** Text and numbers.

**Field Size:** Max 80 characters.

**Add2** – Attribute of the Student Table

**Description:** The second line of a student's mailing address.

**Synonyms:** Apartment or Building Number

**Values:** Will Vary

**Format:** Text and numbers

**Field Size:** Max 80 characters

**Add3** – Attribute of the Student Table

**Description:** The third line of a student's mailing address.

**Values:** Will Vary

**Format:** Text and numbers

**Field Size:** Max 80 characters

**Allocation** – Composite Attribute of the Depts Table

**Description:** The sum of num fac, num staff, num TA and num other attributes of the Depts Table.

**Synonyms:** Department's CCI computer allocation

**Values:** Between 1 and 250

**Format:** Whole numbers

**Field Size:** 3 characters

**Appt date** – Attribute of the Deploy Table

**Description:** The time and date when a participant's new CCI computer will be installed.

**Synonyms:** Installation appointment, deployment appointment.

**Values:** Date after the current system date

**Format:** HH:MM MM/DD/YYYY

**Field Size:** 16 characters

**Are** – Relationship

**Description:** Connects specific computer instances to a broader class of computers, CCI models.

**Awarded** – Relationship

**Description:** Indicates that a particular student received a CCI laptop grant.

**Bldg** - Attribute of the Deploy Table

**Description:** The bldg where the new CCI computer is to be installed.

**Synonyms:** Building, location

**Values:** A building at UNC-Chapel Hill.

**Format:** Text

**Field Size:** Max 30 characters

**CCI Amt Pd** – Optional Attribute of the Orders Table

**Description:** The dollar amount that the CCI program pays toward the total cost of a particular order

**Synonyms:** The CCI money allocation.

**Values:** numbers

**Format:** US Currency

**Field Size:** 6 digits left of the decimal and two to the right of the decimal

**CCI Models** – Table

**Description:** A table containing entities and data related to CCI model computers.

**Check** – Subclass of the Grant Repayment Table

**Description:** A check or money order used to repay a CCI laptop grant. One of two accepted forms of laptop grant repayment.

**Synonyms:** Money order, bank draft

**Chkamt** – Attribute of the Check Subclass of the Grant Repayment Table

**Description:** The dollar amount a check is written for.

**Synonyms:** Grant repayment amount.

**Values:** Numbers

**Format:** US Currency

**Field Size:** 4 digits left of the decimal and two to the right of the decimal

**Chknum** – Attribute of the Check Subclass of the Grant Repayment Table

**Description:** The number of listed on the check used to repay a laptop grant.

**Synonyms:** Check number

**Values:** Numbers from 0 to 999,999

**Format:** Whole numbers

**Field Size:** Max 6 characters

**CID** – Attribute of Components Table. Primary Key

**Description:** A sequential auto-number field used to uniquely identify a particular component of a CCI model computer.

**Synonyms:** Component ID number

**Values:** Numbers from 0 to 9,999

**Format:** Whole numbers

**Field Size:** Max 6 characters

**City** – Attribute of the Student Table

**Description:** Part of a grant recipient's permanent address. The city portion of the address.

**Format:** Text

**Field Size:** Max 100 characters

**Cnotes** – Attribute of Components Table

**Description:** Any information related to a particular component that is deemed necessary or helpful to record.

**Values:** Varies.

**Format:** Varies

**Field Size:** Max 4000 characters

**Comp type** – Attribute of the Deploy Table

**Description:** The type of computer being requested for a participant.

**Synonyms:** Computer class

**Values:** One of the following four options: standard desktop, upgraded desktop, standard laptop, upgraded laptop.

**Format:** Text

**Field Size:** Max 16 characters

**Components** – Table

**Description:** A table containing entities and data related to componenets installed in IBM computers to make them custom CCI model computers.

**Synonyms:** Computer parts

**Computers** - Subclass of Hardware Table

**Description:** A particular instance of a CCI model computer with a unique serial number.

**Contact Person** – Attribute of the Depts Table

**Description:** The name of a person from a particular department that is responsible for communicating with the CCI Administration in relation to that department's cycle in Department Deployments process.

**Synonyms:** Liason

**Values:** Names of people who work for the related department.

**Format:** Text

**Field Size:** Max 100 characters

**Contain** – Relationship

**Description:** Associates a particular piece of computing hardware with a CCI order.

**Cp Onyen** – Attribute of the Depts Table

**Description:** The Onyen or user id of the associated contact person

**Synonyms:** Contact person's user id or email id

**Values:** The Onyen of the contact person

**Format:** 8 to 16 characters, including text, numbers and symbols

**Field Size:** Max 16 characters

**Cp Phone** – Attribute of the Depts Table

**Description:** The business phone number of the associated contact person.

**Synonyms:** Office number

**Values:** String of 5 to 10 digits

**Format:** List of the digits

**Field Size:** Max 10 characters

**Creates** – Relationship

**Description:** Associates a particular student with an order for a CCI model computer and/or accessories.

**Cspec** – Attribute of Components Table

**Description:** The technical specification for the associated component.

**Synonyms:** Component specs or technical specs

**Values:** Varies

**Format:** Varies

**Field Size:** Max 255 characters

**Ctype** – Attribute of Components Table

**Description:** The component class into which the particular component fits. Examples include processor, fixed disk, memory, etc....

**Synonyms:** Type of component, component class

**Values:** Generally one of the following list: processor, cache, fixed disk, fixed disk controller, network adapter, BUS, video, audio, RAM, max RAM, floppy, optical drive, display, keyboard, mouse, port, expansion slot, drive bay, battery. Additional values can be added to this list as necessary.

**Format:** Text

**Field Size:** Max 21 characters

**Customs** – Multi-valued attribute of the CCI Models Table

**Description:** A record of changes or customizations made to a standard IBM model computer specifications to create a custom CCI model computer.

**Synonyms:** Customizations or modifications

**Values:** Text

**Format:** Text

**Field Size:** Max 255 characters

**Cycle Num** – Attribute of the Depts Table

**Description:** A number indicating which cycle of the Department Deployment process a particular department cycle is part of.

**Synonyms:** Cycle number or round number

**Values:** Whole numbers up to 999

**Format:** Whole numbers

**Field Size:** Max 3 characters

**Delivered** – Relationship

**Description:** Links a particular piece of hardware, computer or accessory, to a deployment or migration instance.

**Delivery date** – Attribute of Hardware Table

**Description:** The day, month and year that a unique piece of hardware was physically transported to the person or department at UNC that placed the order. The day the person and/or department took ownership of the unique piece of hardware.

**Values:** Dates

**Format:** MM/DD/YYYY

**Field Size:** 10 characters

**Dep ID** – Attribute of the Deploy Table. Primary Key

**Description:** An auto-number field used to uniquely identify a single deployment or migration instance.

**Synonyms:** Deployment ID Number

**Values:** Whole numbers up to 999,999

**Format:** #####

**Field Size:** Max 6 characters

**Deploy – Table**

**Description:** A table containing entities and data related to a specific computer deployment or migration instance.

**Synonyms:** Computer deployment, computer migrations

**Deploy Date – Attribute of the Depts Table**

**Description:** The date of the first day computer migrations/deployments will begin for a particular department.

**Synonyms:** Start date, First delivery date

**Values:** Dates

**Format:** MM/DD/YYYY

**Field Size:** 10 characters

**Deploy Length – Attribute of the Depts Table**

**Description:** An estimate of the number of days required to complete the computer deployment/migrations.

**Synonyms:** Deployment time, Length of the deployment

**Values:** Whole Numbers between 1 and 30

**Format:** ##

**Field Size:** Max 2 characters

**Dept Amt Pd – Optional Attribute of the Orders Table**

**Description:** The dollar amount that the individual department pays toward the total cost of a particular order.

**Synonyms:** Upgrade costs, incremental costs

**Values:** numbers

**Format:** US Currency

**Field Size:** 6 digits left of the decimal and two to the right of the decimal

**Dept Name – Attribute of the Depts Table**

**Description:** The name by which a department is usually known and referred to

**Synonyms:** Department Name, Academic Department

**Values:** Name of a department in the College of Arts & Sciences

**Format:** Text

**Field Size:** Max 100 characters

**Dept Notes – Attribute of the Depts Table**

**Description:** Any information related to a particular department's cycle that is deemed necessary or helpful to record.

**Values:** Varies.

**Format:** Varies

**Field Size:** Max 4000 characters

**Dept Num – Attribute of the Depts Table**

**Description:** The four digit number that is assigned to a department and used to reference this department when conducting business at UNC.

**Synonyms:** Department Number

**Values:** String of 4 numbers.

**Format:** List of the digits

**Field Size:** Max 4 characters

#### **Depts – Table**

**Description:** A table containing entities and data related to a individual departments' cycles in the Department Deployment process.

**Synonyms:** Department record, Department Information

#### **Descrip - Attribute of Accessories Subclass of Hardware Table**

**Description:** A description of a particular piece of hardware.

**Synonyms:** Description, Accessory Specifications

**Values:** Varies

**Format:** Text

**Field Size:** Max 255 characters

#### **Participants – Table**

**Description:** A table containing entities and data related to people who are eligible to receive a computer through the Department Deployment process.

**Synonyms:** Eligible People, Computer recipients

#### **End date – Attribute of CCI Models Table**

**Description:** The date of the last day on which a particular CCI model computer was received from IBM.

**Synonyms:** Last delivery date, Model end date

**Values:** Dates

**Format:** MM/DD/YYYY

**Field Size:** 10 characters

#### **GID – Attribute of the Laptop Grant Table. Primary Key**

**Description:** An auto-number field used to uniquely identify a single laptop grant instance.

**Synonyms:** Laptop Grant ID Number

**Values:** Whole numbers up to 999,999

**Format:** #####

**Field Size:** Max 6 characters

#### **Grant amt – Attribute of the Laptop Grant Table**

**Description:** The dollar amount of the laptop grant a student has been awarded.

**Synonyms:** Grant amount, Laptop grant amount

**Values:** numbers

**Format:** US Currency

**Field Size:** 4 digits left of the decimal and two to the right of the decimal



**Grant Repayment – Table**

**Description:** A table containing entities and data related to grant recipients who have returned their grant amount or granted laptop to the CCI Administration.

**Synonyms:** Laptop grant repayments

**Grt post date – Attribute of the Laptop Grant Table**

**Description:** The date a student redeems the laptop grant they have been awarded.

**Synonyms:** Grant date, Grant redemption date

**Values:** Dates

**Format:** MM/DD/YYYY

**Field Size:** 10 characters

**Grt Status – Attribute of the Laptop Grant Table**

**Description:** One of a select number of statuses indicating what state a particular students laptop grant is in.

**Synonyms:** Grant Status

**Values:** E=Enrolled, G=Graduated, 1=1<sup>st</sup> Letter, 2=2<sup>nd</sup> Letter, C=Submitted to UNC Collections, P=Repaid grant, R= Returned Laptop, D=Deceased, T=Temporary Exception, X=Permanent Exception

**Format:** Single Letter

**Field Size:** 1 character

**Hardware – Table**

**Description:** A table containing entities and data related to a unique piece of computing related hardware.

**HID – Attribute of Hardware Table. Primary Key**

**Description:** An auto-number field used to uniquely identify a single instance of computing hardware.

**Synonyms:** Hardware ID Number

**Values:** Whole numbers up to 999,999,999

**Format:** #####

**Field Size:** Max 9 characters

**Homed – Relationship**

**Description:** Establishes the relationship between a participant and a department for a particular Department Deployment cycle. A participant is homed in their “Home Department” even if they are faculty, staff or a student in several departments.

**Included – Relationship**

**Description:** Links a software instance with a CCI model type.

**Installed** – Relationship

**Description:** Links a component instance with a CCI model type

**IP addr** – Optional attribute of the Deploy Table

**Description:** Internet Protocol Address. The number that uniquely identifies a device on the Internet. For this data management system the IP address of a participant's computer is only recorded if they need access to certain Administrative applications and systems.

**Synonyms:** IP number

**Values:** String of up to 12 numbers separated by dots

**Format:** ###.###.###.###

**Field Size:** Max 15 characters

**Laptop** - Subclass of the Grant Repayment Table

**Description:** A laptop with a unique serial number that was purchased using a laptop grant and that is be returned to the CCI Administration in order to repay a CCI laptop grant. One of two accepted forms of laptop grant repayment.

**Synonyms:** Grant laptop, returned laptop.

**Laptop Grant** – Table

**Description:** A table containing entities and data related to a laptop grant that was awarded to a student and redeemed in order to purchase a CCI laptop.

**Location** – Attribute of the Old Computers Table

**Description:** The physical location of an old computer that is being traded in for a new computer through the Department Deployment process.

**Synonyms:** Building and room number

**Values:** A building name from UNC and a room number from that building.

**Format:** Varies

**Field Size:** Max 100 characters

**MAC addr** - Attribute of Computers Subclass of Hardware Table

**Description:** A set of 6 pairs of hexadecimal characters that uniquely identifies a computer or other networked hardware on a data network.

**Synonyms:** Hardware address

**Values:** String of 6 hexadecimal character pairs separated by colons.

**Format:** xx:xx:xx:xx:xx:xx

**Field Size:** Max 17 characters

**Manuf** – Attribute of Components Table

**Description:** The name of the company that produced a particular component that is part of a CCI model computer.

**Synonyms:** Manufacturer, Producer

**Values:** Varies

**Format:** Text

**Field Size:** Max 100 characters

**Meet Date** – Attribute of the Depts Table

**Description:** The date before which the CCI Administration should meet the associated department in order to meet the other dates in the Depts table.

**Synonyms:** Meet before date, Meeting date

**Values:** Dates

**Format:** MM/DD/YYYY

**Field Size:** 10 characters

**MID** – Attribute of CCI Models Table. Primary Key

**Description:** An auto-number field used to uniquely identify a CCI model type.

**Synonyms:** Model identification (ID) number

**Values:** Whole numbers up to 999,999

**Format:** #####

**Field Size:** Max 6 characters

**Mod class** – Attribute of CCI Models Table

**Description:** The class or category that a CCI model fits into.

**Synonyms:** Model type, model class, model classification

**Values:** Standard desktop, Upgraded desktop, standard laptop, upgraded laptop

**Format:** Text

**Field Size:** Max 16 characters

**Mod name** – Attribute of CCI Models Table

**Description:** This is the name that the particular CCI model is commonly known by. Examples include ThinkPad R40, Netvista M50.

**Synonyms:** Model Name, CCI Name, IBM Product Line Name

**Values:** The name of IBM model computer.

**Format:** Text

**Field Size:** Max 50 characters

**Mod num** – Attribute of CCI Models Table

**Description:** The seven character number that identifies a collection of components to create a complete working computer.

**Synonyms:** Model Number, MTM,

**Values:** CCI computer model numbers

**Format:** #####-xx#

**Field Size:** Max 8 characters

**Model** – Attribute of Components Table

**Description:** This is the manufacturer's model information, number and/or name.

**Synonyms:** Component model name, Component model number

**Values:** Varies

**Format:** Varies

**Field Size:** Max 255 characters

**Mods** – Multi-valued Attribute of Software Table

**Description:** These are modifications made to the default configuration of a software package when it was installed on a CCI model computer.

**Synonyms:** Software modifications, customizations, CCI load changes

**Values:** Varies

**Format:** Varies

**Field Size:** Max 4000 characters

**Notes** = Attribute of the Deploy Table

**Description:** Any information related to a particular deploy or migration instance that is deemed necessary or helpful to record.

**Values:** Varies.

**Format:** Varies

**Field Size:** Max 4000 characters

**Num Fac** – Attribute of the Depts Table

**Description:** The number of computers allocated to eligible faculty members in a particular department. It is one portion of a department's allocation.

**Synonyms:** Number of faculty machines, faculty computer allocation

**Values:** Whole numbers between 0 and 150

**Format:** ###

**Field Size:** Max 3 characters

**Num Other** – Attribute of the Depts Table

**Description:** The number of computers allocated to eligible participants in a particular department that do not fit into the faculty, staff or graduate student classifications. It is one portion of a department's allocation.

**Synonyms:** Number of other machines, other computer allocation

**Values:** Whole numbers between 0 and 150

**Format:** ###

**Field Size:** Max 3 characters

**Num Staff** – Attribute of the Depts Table

**Description:** The number of computers allocated to eligible staff members in a particular department. It is one portion of a department's allocation.

**Synonyms:** Number of staff machines, staff computer allocation

**Values:** Whole numbers between 0 and 30

**Format:** ##

**Field Size:** Max 2 characters

**Num TA** – Attribute of the Depts Table

**Description:** The number of computers allocated to eligible teaching graduate students in a particular department. It is one portion of a department's allocation.

**Synonyms:** Number of TA/grad student machines, TA/grad student computer allocation

**Values:** Whole numbers between 0 and 150

**Format:** ##

**Field Size:** Max 2 characters

**Ocnotes** – Attribute of the Old Computers Table

**Description:** Any information related to a particular old or trade-in computer that is deemed necessary or helpful to record.

**Values:** Varies.

**Format:** Varies

**Field Size:** Max 4000 characters

**Octype** – Attribute of the Old Computers Table

**Description:** The model number of the old/trade-in computer.

**Synonyms:** Trade-in computer model number, old computer type

**Values:** CCI computer model numbers

**Format:** #####-xx#

**Field Size:** Max 8 characters

**Old Computers** – Table

**Description:** A table containing entities and data related to computers being traded in by a department for new computers as part of the Department Deployment process.

**Onotes** – Optional Attribute of the Orders Table

**Description:** Any information related to a particular hardware order that is deemed necessary or helpful to record.

**Values:** Varies.

**Format:** Varies

**Field Size:** Max 4000 characters

**Order by Date** – Attribute of the Orders Table

**Description:** The date before which the department contact must submit their order to the CCI Administration in order to receive computers by the meet the deploy date.

**Synonyms:** Order before date

**Values:** Dates

**Format:** MM/DD/YYYY

**Field Size:** 10 characters

**Order Date** – Attribute of the Depts Table

**Description:** The date on which an order was placed.

**Synonyms:** Order placed date

**Values:** Dates

**Format:** MM/DD/YYYY

**Field Size:** 10 characters

**Order Num** – Attribute of the Orders Table. Primary Key

**Description:** An auto-number field used to uniquely identify an order for a collection of orderable hardware.

**Synonyms:** Order Number, Order ID

**Values:** Whole numbers up to 999,999

**Format:** #####

**Field Size:** Max 6 characters

**Order type** – Attribute of the Orders Table

**Description:** One of four different order types.

**Synonyms:** Order class or classification

**Values:** Deployment, New Faculty, Student, Other

**Format:** Text

**Field Size:** Max 11 characters

**Orders** – Table

**Description:** A table containing entities and data related to hardware orders placed through the UNC department and student ordering systems.

**Part num** - Attribute of Accessories Subclass of Hardware Table

**Description:** A number unique for a particular brand of computer hardware accessory. The manufacturer's part number.

**Synonyms:** Part Number

**Values:** Varies

**Format:** Varies

**Field Size:** Max 50 characters

**Participate In** – Relationship

**Description:** Establishes the relationship between a participant and a computer deployment or migration instance.

**Pclassif** - Attribute of the Participants Table

**Description:** The classification of a particular participant.

**Synonyms:** Participant's classification or category

**Values:** Faculty, staff, TA, other.

**Format:** Text

**Field Size:** Max 7 characters

**Perm add** – Composite Attribute of the Student Table

**Description:** The permanent address for a student who received a laptop grant. Composed of the add1, add2, add3, city, state and zip attributes.

**Synonyms:** Permanent address, home address, parent's address

**Pfname** - Attribute of the Participants Table

**Description:** The first or given name of a participant.

**Synonyms:** First name, given name

**Values:** Varies  
**Format:** Text  
**Field Size:** Max 50 characters

**Place** – Relationship

**Description:** Links a particular order to a department and Department Deployment cycle.

**Pname** - Attribute of the Participants Table

**Description:** The last name of a participant.  
**Synonyms:** Last name, surname  
**Values:** Varies  
**Format:** Text  
**Field Size:** Max 50 characters

**Ponyen** - Attribute of the Participants Table. Primary key

**Description:** A participant's Onyen or user id.  
**Synonyms:** Onyen, user id, email user name  
**Values:** Any valid onyen  
**Format:** Text  
**Field Size:** Max 16 characters

**Received date** – Attribute of Hardware Table

**Description:** The day, month and year that a unique piece of hardware was received by CCI Administration personnel from IBM.  
**Values:** Dates  
**Format:** MM/DD/YYYY  
**Field Size:** 10 characters

**Repay date** – Attribute of the Grant Repayment Table

**Description:** The day, month and year that a grant recipient repays their laptop grant.  
**Values:** Dates  
**Format:** MM/DD/YYYY  
**Field Size:** 10 characters

**Required Trade ins**– Attribute of the Trade in Relationship

**Description:** The number of computers a department is required to trade to the CCI Administration in order to receive all of their allocation for a Department Deployment cycle.  
**Synonyms:** Trade-in number, number of old computers  
**Values:** Whole number between 0 and 250  
**Format:** ###  
**Field Size:** Max 3 characters

**RID** – Attribute of Grant Repayment Table. Primary Key

**Description:** A sequential auto-number field used to uniquely identify a grant repayment instance.

**Synonyms:** Grant repayment ID number

**Values:** Numbers from 0 to 999,999

**Format:** Whole numbers

**Field Size:** Max 6 characters

**Rnotes** – Attribute of the Grant Repayment Table

**Description:** Any information related to a particular grant repayment instance that is deemed necessary or helpful to record.

**Values:** Varies.

**Format:** Varies

**Field Size:** Max 4000 characters

**Room num** – Attribute of the Deploy Table

**Description:** The number of the room where a computer deployment or migration instance is scheduled to occur.

**Synonyms:** Room number

**Values:** Varies

**Format:** Text

**Field Size:** Max 10 characters

**Semail** – Attribute of the Student Table

**Description:** The email address of a grant recipient.

**Synonyms:** Student's email address

**Values:** Valid email addresses from SIS

**Format:** text@text.text.text.....

**Field Size:** Max 255 characters

**Ser Num** – Attribute of the Old Computers Table

**Description:** The serial number of a trade-in computer that uniquely identifies a particular computer amongst all IBM computers.

**Synonyms:** Serial Number

**Values:**

**Format:**

**Field Size:**

**Serialnum** - Attribute of the Subclass of the Grant Repayment Table

**Description:** The serial number of a laptop returned to CCI Administration personnel as a laptop grant repayment that uniquely identifies this laptop amongst all IBM computers.

**Synonyms:** Serial Number

**Values:**

**Format:**

**Field Size:**



**Serlnum** - Attribute of Computers Subclass of Hardware Table

**Description:** The serial number of a new computer that uniquely identifies a particular computer amongst all IBM computers.

**Synonyms:** Serial Number

**Values:**

**Format:**

**Field Size:**

**Sfname** – Attribute of the Student Table

**Description:** The first or given name of a grant recipient.

**Synonyms:** First name, given name

**Values:** Varies

**Format:** Text

**Field Size:** Max 50 characters

**SID** - Attribute of Software Table

**Description:** A sequential auto-number field used to uniquely identify a software package that was installed on a CCI model computer before delivery to UNC.

**Synonyms:** Software ID number

**Values:** Numbers from 0 to 999,999

**Format:** Whole numbers

**Field Size:** Max 6 characters

**Slname** – Attribute of the Student Table

**Description:** The last name of a grant recipient.

**Synonyms:** Last name, surname

**Values:** Varies

**Format:** Text

**Field Size:** Max 50 characters

**Smname** – Attribute of the Student Table

**Description:** The middle name of a participant.

**Synonyms:** Middle name, second name

**Values:** Varies

**Format:** Text

**Field Size:** Max 50 characters

**Software** – Table

**Description:** A table containing entities and data related to software installed on CCI model computers by IBM before delivery to UNC.

**Soname** – Attribute of the Student Table

**Description:** Any other portions of the name of a grant recipient.

**Synonyms:** Prefix, suffix, third name

**Values:** Varies

**Format:** Text

**Field Size:** Max 50 characters

**Sphone** – Attribute of the Student Table

**Description:** The telephone number for a grant recipient.

**Synonyms:** Student's phone number

**Values:** String of 10 digits

**Format:** ###-###-####

**Field Size:** Max 10 characters

**SPID** – Attribute of the Student Table. Primary Key

**Description:** The UNC assigned number that uniquely identifies each grant recipient at UNC.

**Synonyms:** Student's PID

**Values:** String of 9 digits.

**Format:** #####

**Field Size:** Min and Max of 9 characters

**Start date** – Attribute of CCI Models Table

**Description:** The date of the first day on which a particular CCI model computer was received from IBM.

**Synonyms:** First delivery date, Model start date

**Values:** Dates

**Format:** MM/DD/YYYY

**Field Size:** 10 characters

**State** – Attribute of the Student Table

**Description:** The two letter abbreviation of a grant recipient's address that indicates which US state their permanent address is in.

**Values:** Any of the officially recognized two letter abbreviations for the 50 US States

**Format:** XX

**Field Size:** Min and Max of 2 characters

**Student** – table

**Description:** A table containing entities and data related to a student who has received a laptop grant, ie a grant recipient.

**Submits** – Relationship

**Description:** Links a grant recipient to a grant repayment instance.

**Title** - Attribute of Software Table

**Description:** The Title of a software package that the manufacturer has assigned to it.

**Synonyms:** Software name

**Values:** Varies

**Format:** Text

**Field Size:** Max 100 characters

**Total Cost** – Attribute of the Orders Table

**Description:** The amount of money paid for all of the hardware on a particular order.

**Synonyms:** Order cost, total amount

**Values:** numbers

**Format:** US Currency

**Field Size:** 6 digits left of the decimal and two to the right of the decimal

**Trade** – Relationship

**Description:** Links old or trade-in computers to a department and Department Deployment cycle.

**Type** – Attribute of the Laptop Subclass of the Grant Repayment Table

**Description:** The CCI model number of the laptop returned as a grant repayment.

**Synonyms:** Model number

**Values:** CCI computer model numbers

**Format:** #####-xx#

**Field Size:** Max 8 characters

**Version** - Attribute of Software Table

**Description:** The version of a software package that the manufacturer has assigned to it.

**Synonyms:** Version number

**Values:** Varies

**Format:** Varies

**Field Size:** Max 20 characters

**Warranty** – Attribute of CCI Models Table

**Description:** The length of time and service level of the warranty from IBM that is associated with a particular CCI model.

**Synonyms:** Warranty specifications or details

**Values:** Varies

**Format:** Varies

**Field Size:** Max 100 characters

**Zip** – Attribute of the Student Table

**Description:** The five or nine digit code for the city portion of the grant recipient's permanent address.

**Synonyms:** Zip code

**Values:** Any of the officially recognized zip codes for a city or town in the US

**Format:** #####-####

**Field Size:** Min of 5 characters and Max of 9 characters

## Appendix C Web Reports

All of the following reports are read-only. No data editing is possible by those who have access to them.

### **Student Laptop Distribution**

#### **Report 1 – Order Quantities**

<b>Search By Options:</b>	Date range
<b>Sort Results By Options:</b>	
<b>Results Returned:</b>	Number of each computer model ordered by students
	Number of each accessory ordered by students

#### **Report 2 – Laptop Grant Totals**

<b>Search By Options:</b>	Date range or Student Laptop Distribution cycle
<b>Sort Results By Options:</b>	
<b>Results Returned:</b>	Total number of students that redeemed laptop grants -Grouped by grant award amount
	Total dollar amount of grants redeemed for each grant award amount
	Total number of students that redeemed laptop grants
	Total dollar amount of all grants redeemed

## **CCI Computer Model Selection and Customization**

### **Report 1 – CCI Computer Model Summary**

<b>Search By Options:</b>	Model Number
	Model Name
	Date
<b>Sort Results By Options:</b>	If multiple CCI Models returned then sort by model number and require user to choose one.
<b>Results Returned:</b>	Model Number
	Model Name
	Model Class
	Start Date
	End Date
	Warranty
	For each component associated with the chosen model <ul style="list-style-type: none"> <li>- Component Type</li> <li>- Specification</li> <li>- Manufacturer</li> <li>- Model Information</li> <li>- Notes</li> </ul>
	For all software associated with the chosen model <ul style="list-style-type: none"> <li>- Title</li> <li>- Version</li> <li>- Modifications to default installation settings</li> </ul>

## **Department Deployments**

### **Report 1 – Department Deployment Schedule**

<b>Search By Options:</b>	None. Click Department Deployment Schedule link.
<b>Sort Results By Options:</b>	Deployment Start Date from current Department Deployment Cycle
<b>Results Returned:</b>	Department Name
	From previous Department Deployment Cycle <ul style="list-style-type: none"> <li>- Department Deployment Cycle Number</li> <li>- Department Deployment Cycle Start and End date</li> <li>- Deployment Date Range for each department</li> </ul>
	From current Department Deployment Cycle <ul style="list-style-type: none"> <li>- Department Deployment Cycle Number</li> <li>- Department Deployment Cycle Start and End date</li> <li>- Meet by Date</li> <li>- Order by Date</li> <li>- Deployment Date Range</li> </ul>

**Report 2 – Department Deployment Computer Totals**

<b>Search By Options:</b>	None. Click Department Deployment Computer Totals link.
<b>Sort Results By Options:</b>	Department Deployment Cycle Number
<b>Results Returned:</b>	From previous Department Deployment Cycle <ul style="list-style-type: none"> <li>- Department Deployment Cycle Number</li> <li>- Department Deployment Cycle Start and End date</li> <li>- Total number of computers distributed</li> <li>- Yearly totals of computers distributed</li> </ul>
	From current Department Deployment Cycle <ul style="list-style-type: none"> <li>- Department Deployment Cycle Number</li> <li>- Department Deployment Cycle Start and End date</li> <li>- Total number of computers distributed to date</li> <li>- Yearly totals of computer distributed</li> <li>- Projected number of computers to be distributed to complete the deployment cycle.</li> </ul>

The following reports are only available to the group of stakeholders indicated & the CCI Administration personnel. If indicated, then the data contained in the report will be editable.

### **Department Deployments**

#### **Report 1 – Department Summary**

<b>Search By Options:</b>	Department Name
<b>Sort Results By Options:</b>	Migration appointment date and time
	Computer Type
<b>Results Returned:</b>	Department Name & Number
	Contact person name, Onyen, Phone Number
	From previous Department Deployment Cycle <ul style="list-style-type: none"> <li>- Department Deployment Cycle Number</li> <li>- Deployment Date Range</li> <li>- Total Allocation</li> <li>- Number of Eligible Faculty</li> <li>- Number of Eligible Staff</li> <li>- Number of Eligible Teaching Graduate Students</li> <li>- Number of Eligible Others</li> </ul>
	From current Department Deployment cycle <ul style="list-style-type: none"> <li>- Department Deployment Cycle Number</li> <li>- Meet by Date</li> <li>- Order Date</li> <li>- Deployment Date Range</li> <li>- Total Allocation</li> <li>- Number of Eligible Faculty</li> <li>- Number of Eligible Staff</li> <li>- Number of Eligible Teaching Graduate Students</li> <li>- Number of Eligible Others</li> </ul>
<b>Accessible To:</b>	Department contacts (for their department only)

**Report 2 – CCIPIW Deployment Report Replacement (editable)**

<b>Search By Options:</b>	Department Name
<b>Sort Results By Options:</b>	Building and room number -(Location for computer delivery and migration)
	Computer Type
	Migration appointment date and time
	Participant's Classification
	Participant's Last Name
<b>Results Returned:</b>	Accessories to be delivered and installed
	Additional software to be installed
	Computer Type
	IP Address (if listed)
	Location for computer delivery and migration
	Migration appointment date and Time
	Notes
	Participant's Name, Onyen & Classification
<b>Accessible To:</b>	Department contacts (for their department only)



## Appendix D

### Remedy Action Request System Reports

The following are the predefined reports that will be part of the RARS data management interface used by the CCI Administration personnel. All data, besides the aggregates (Totals & Sums), will be editable.

#### Department Deployments

##### **Report 1 – CCIPIW Deployment Report Replacement**

<b>Search By Options:</b>	Department Name
<b>Sort Results By Options:</b>	Building and room number -(Location for computer delivery and migration)
	Computer Type
	Migration appointment date and time
	Participant's Classification
	Participant's Last Name
<b>Results Returned:</b>	Accessories to be delivered and installed
	Additional software to be installed
	Computer Type
	IP Address (if listed)
	Location for computer delivery and migration
	Migration appointment date and Time
	Notes
	Participant's Name, Onyen & Classification

##### **Report 2 – CCIPIW Delivery Replacement**

<b>Search By Options:</b>	Department Name
<b>Sort Results By Options:</b>	Migration appointment date and time
	Computer Type
<b>Results Returned:</b>	Accessories to be delivered and installed
	Computer Type
	Location for computer delivery and migration
	Migration appointment date and Time
	Participant's Name

##### **Report 3 – CCIPIW Department Order Summary Replacement**

<b>Search By Options:</b>	Department Name
<b>Sort Results By Options:</b>	Computer Type
<b>Results Returned:</b>	Count of each computer type ordered for that department
	Count of each accessory type ordered for that department

## Student Laptop Distribution

### **Report 1 – Individual Student's Order**

<b>Search By Options:</b>	PID
	Name
<b>Sort Results By Options:</b>	By last name if more then one record returned - Require user to choose from list of Names & PIDs
<b>Results Returned:</b>	PID
	Student's Name
	Student's Permanent Address
	Student's Phone Number
	Student's Email Address
	<p>For each order placed by the chosen student:</p> <ul style="list-style-type: none"> <li>- Order Number</li> <li>- Order Date</li> <li>- For computers on the orders <ul style="list-style-type: none"> <li>- Model Number</li> <li>- Model Name</li> <li>- Cost</li> </ul> </li> <li>- For accessories on the orders <ul style="list-style-type: none"> <li>- Description</li> <li>- Quantity Ordered</li> <li>- Cost per item</li> </ul> </li> <li>- Total Cost for the order</li> </ul>

**Report 2 – Individual Student’s Grant Information**

<b>Search By Options:</b>	PID
	Name
<b>Sort Results By Options:</b>	By last name if more then one record returned - Require user to choose from list of Names & PIDs
<b>Results Returned:</b>	PID
	Student’s Name
	Student’s Permanent Address
	Student’s Phone Number
	Student’s Email Address
	Grant Amount
	Grant Status
	If Grant Status = “Repaid” (P) or “Returned” (R) then return the appropriate grant repayment information - For “Repaid” (P) - Repaid Date - Check Number - Check Amount - Notes - For “Returned” (R) - Returned Date - Laptop Model Number - Laptop Serial Number - Notes

**Report 3 – Students with a particular grant status**

<b>Search By Options:</b>	Grant Status
<b>Sort Results By Options:</b>	PID
	Last Name
<b>Results Returned:</b>	PID
	Student’s Name
	Student’s Permanent Address
	Student’s Phone Number
	Student’s Email Address
	Grant Amount

**Report 4 – Grant Repayments**

<b>Search By Options:</b>	Date Range
	Repayment Type (Laptops or Cash)
	Combination of both
<b>Sort Results By Options:</b>	Date
	Repayment Type
<b>Results Returned:</b>	For cash repayments <ul style="list-style-type: none"> <li>- PID</li> <li>- Repayment Date</li> <li>- Repayment Amount</li> <li>- Total Amount of repayments</li> </ul>
	For returned laptops <ul style="list-style-type: none"> <li>- PID</li> <li>- Laptop model number</li> <li>- Laptop serial number</li> <li>- Total number of each model laptop returned</li> </ul>

## CCI Computer Model Selection and Customization

### **Report 1 – Individual Computer Information**

<b>Search By Options:</b>	Serial Number
	MAC Address
<b>Sort Results By Options:</b>	
<b>Results Returned:</b>	Serial Number
	Model Number
	MAC address(es)
	Order Number
	Order Type
	Order Date
	Delivery Date
	Notes

### **Report 2 – CCI Computer Model Summary**

<b>Search By Options:</b>	Model Number
	Model Name
	Date
<b>Sort Results By Options:</b>	If multiple CCI Models returned then sort by model number and require user to choose one.
<b>Results Returned:</b>	Model Number
	Model Name
	Model Class
	Start Date
	End Date
	Warranty
	For each component associated with the chosen model <ul style="list-style-type: none"> <li>- Component Type</li> <li>- Specification</li> <li>- Manufacturer</li> <li>- Model Information</li> <li>- Notes</li> </ul>
	For all software associated with the chosen model <ul style="list-style-type: none"> <li>- Title</li> <li>- Version</li> <li>- Modifications to default installation settings</li> </ul>

## **Order Information**

### **Report 1 – Order Report**

<b>Search By Options:</b>	Order Number
	Date Range
<b>Sort Results By Options:</b>	Order Number
<b>Results Returned:</b>	Order Number
	Order Date
	Model Numbers ordered - Total number of each model ordered - Cost per computer
	Accessories ordered - Total number of each accessory ordered - Cost per item
	Total Cost of the order
	Amount CCI Paid (if any)
	Amount to be paid by Department or Student
	Notes