KEL156

MARK JEFFERY

A&D High Tech (A):
Managing Projects for Success

In his twelve years as a technology project manager at A&D High Tech, Chris Johnson had a strong track record of delivering projects on time and on budget. His techniques for project planning, estimating, and scheduling had become best practices at the St. Louis-based computer products company. He had just led a project team that successfully revamped the supply chain systems in less than eighteen months. He was especially proud since many observers had doubted that the project could be completed on time. As part of the strategic initiatives set forth by its CEO and founder, Ted Walter, A&D was to be second to none in utilizing technology to increase operational efficiency and reduce costs. The supply chain project therefore received notable attention in the boardroom and with its competitors. Time and again, Johnson was asked to tackle difficult assignments that were critical to the company's growth and profits. He had already been mentioned as the successor to the vice president of e-business, Chuck Gagler, pending his retirement. (See **Exhibit 1** for the A&D High Tech organizational chart.)

In early May 2003 Johnson received an urgent message from the company's CIO, Matt Webb. Webb asked Johnson to join him for a meeting with A&D's senior managers to discuss taking over the company's online store project. Johnson realized that up to that point the company's top brass had virtually ignored the Internet and its sales potential. But that situation was about to change. As Webb explained, A&D's vice president of sales, Jeff White, had advised CEO Ted Walter that A&D was losing its competitive advantage by not selling online. As a result, Walter had made the online store project the company's highest priority. Walter wanted to know whether the project could be completed in time for the holiday shopping season, when A&D's cyclic business traditionally boomed. The current project manager, Eric Robertson, was taking a one-month leave of absence due to a family emergency, just as he was about to begin formulating the project plan and make staffing decisions.

Johnson immediately began thinking about the best way to ensure the online store project's success. He was concerned that there was too little time to get up to speed on this new project. It was already May, and the holiday season would approach soon. Given the urgency put forth by Webb and Walter, Johnson was already feeling pressure to come up with solid recommendations in short order.

Company History

A&D High Tech sold computer products, accessories, and services to consumers and small businesses. The company had its roots in Lincoln, Nebraska, where Ted Walter started its first store in 1988. A&D's made-to-order products were very innovative at the time, and were the first to be introduced in the personal computer industry**.** Walter emphasized friendly customer service, a value that was deeply ingrained in the culture of the Midwestern heartland where Walter had lived his entire life. A&D's revenues grew consistently for ten years and approached $400 million for fiscal year 2000. The company was primarily a regional player, with more than 90 percent of sales coming from customers in the Midwestern states. However, Walter was strategically seeking to increase its distribution nationally.

A&D sales had come predominantly through retail outlets in shopping malls across the Midwest and via phone orders handled by its fifty-person call center in Lincoln. Before 1999, sales orders at the call center were written on paper and then passed to order-entry clerks. This added time to order entry, delayed shipment, and resulted in poor accuracy. Consequently, sales representatives often had to contact customers to correct errors or to suggest different options due to inventory shortages. On average, 30 percent of the orders required customer callbacks, compared to only 5 percent at A&D's primary competitor.

In 1999 A&D implemented its first enterprise resource planning (ERP) system, using software from J. D. Edwards. A&D opted to use J. D. Edwards primarily because its software could be customized to handle the thousands of parts that A&D used for production. The customization required many outside consultants to design and build the system, and since they left soon after the system was implemented there were some concerns that the system might be difficult to maintain. Even so, the project was deemed a success: after ERP was up and running, customer callbacks were reduced to less than 1 percent of orders.

In 2001, given the successful implementation of ERP, A&D decided to further invest to improve its systems in handling the supply chain, payment process, customer relationship management (CRM), and order management. A series of technology initiatives was launched. A&D saw immediate benefits in reduced costs, as well as a significant return on investment on its supply chain and data warehousing projects.

Business Case

In 2002, faced with tough competition and decreasing margins, A&D decided to explore new segments of the market for growth. In particular, it focused on sales via the Internet. Historically, A&D was shy to adopt the Internet as a sales channel because it did not seem to play to the company's sales strength of friendliness and customer service. However, since A&D's products were approaching commodity status, the product cost was largely the determining factor for a customer. Furthermore, competitors had successfully increased their revenues and recognized cost savings in selling, general, and administrative expenses (SG&A) per order after starting to sell through the Internet.

So in early 2002, Ted Walter and vice president of sales Jeff White gave the go-ahead to CIO Webb to begin the project to create an online store.

One of the first decisions Webb faced was "build vs. buy." A custom-developed program would allow A&D the opportunity to build exactly what it needed, whereas a commercial application might not meet all of the requirements. For example, the commercial off-the-shelf (COTS) software might not have the formats, input processes, reporting capabilities, and other elements needed to make the program work well for A&D. Moreover, buying off the shelf might require A&D to purchase functionality it did not need and would not use.

On the other hand, Webb realized that a commercial application could potentially cost much less than a custom application. However, this was not always the case, especially if the commercial application required more than 10 percent custom modifications to meet all the requirements.

Webb knew that the key questions in the build vs. buy decision were:

- Were there resources available in-house for project management, software development, hardware support, and long-term maintenance?
- How much budget was available for the project?
- How unique were the processes that the new application would automate?
- Would the company be paying for commercial software functionality that it did not need and would not use?

In his analysis, Webb listed some key determiners that pointed toward the "build" decision:

- "Hidden" risks and costs of purchasing software increased as the need to customize a package increased.
- Information technology (IT) could be used as a strategic weapon and a point of differentiation, versus just trying to keep up.
- Potential benefits of an integrated but flexible system in custom-built software (versus simply integrating multiple vendors) could be significant.
- There was a possible competitive advantage to be gained from a custom-built system.
- The off-the-shelf package's elements only met 60 percent of A&D's functional requirements.
- A few established quality vendors were committed to the market but no single vendor was a clear market leader.

After deliberating for a month with his top managers, Webb was set on the "build" option.

Project History

Webb created a cross-functional team of six people to plan the project based on his "build" decision (see Exhibit 1). Led by Eric Robertson, a young but bright IT project manager, the team's planning components included:

- Define the business requirements
- Define the process flows
- Create the technical architecture requirements
- Build a simple prototype of the system
- Create the work breakdown structure (WBS) for the project
- Estimate the effort for each of the tasks in the WBS
- Define the resources available for the project and assign resources to project tasks
- Create a schedule with task dependencies and proper resource allocation

After four weeks, the team presented its findings to the steering committee. A summary outcome for each of the planning tasks is listed below.

BUSINESS REQUIREMENTS

The scope and business requirements of the online store included new orders, add-on orders, order amends, order status, and lead capture with the following capabilities:

- Configuration and pricing
- Delivery date based on standard lead times
- Real-time payment processing
- 100 percent validation of required data
- Collection of prospect data about customers
- Integration to back-end (ERP) for manufacturing and order management

Senior management was adamant that the system incorporate this set of minimum functionality, since customers must have the same experience across all sales channels. As Jeff White put it:

> *Once an order has been made and it gets into [J. D.] Edwards, I don't see why we need to distinguish whether the customer shopped in our stores or made the order on the phone or the Internet. We should serve them with the exact care and quality that one comes to expect from A&D.*

PROCESS FLOW

The introduction of Internet sales would have little impact on the current process at A&D, since it simply served as a new front to its existing activities. In fact, all existing activities would remain the same. New activities to support Internet sales, such as exception handling due to system errors, would be added to the IT support procedures.

TECHNICAL ARCHITECTURE

Since A&D carried a range of products that ran the Windows 2000 operating system, A&D had standardized all custom applications to run on this platform. The online store's architecture was N-tiered for greater flexibility and future scalability (see **Exhibit 2**).

The first tier was the Web server layer. The Web server was the Microsoft Internet Information Server (IIS). Server side scripts were to be coded in MS Application Server Pages (ASP). The second tier was the application server layer. The application server was the Microsoft Transaction Server (MTS). The application components would leverage Microsoft Site Server and the Microsoft Site Server Commerce Edition components.

Databases to support the application were to run on Microsoft SQL Server. The communication tier was the middleware Microsoft Messaging Queue (MSMQ). Through MSMQ, the application would access J. D. Edwards. Other back-end applications and databases existed but would not be interfaced by the online store. All software licenses were already in-house, so Robertson did not expect to incur any expenses from procuring software.

PHYSICAL INFRASTRUCTURE

A&D's physical infrastructure was planned to be fairly typical for a company that conducted commerce over the Internet. For security, two firewalls were set up with a demilitarized zone (DMZ) in between (see **Exhibit 3**). Situated in the DMZ were servers that were accessible by the Internet and by A&D's partners. Behind the second firewall was A&D's internal network, or intranet. The servers behind this second firewall were only accessible in the intranet. Robertson's team estimated that they would need twelve Windows 2000 workstations (at $3,000 each) and five Windows 2000 servers (at $12,500 each) for the project.

PROTOTYPE

A prototype, consisting of static HTML pages, was built by Robertson's team to demonstrate a user interface and general flow of the application. **Exhibit 4** shows a screen print of the order confirmation page. The prototype was approved by the vice presidents of sales and marketing, and would serve as a basis for the actual application's appearance and functionality.

PROJECT WBS

Robertson's team created a complete WBS that detailed all the tasks that needed to be performed for the project as of May 26, 2003. See **Exhibit 5** for the complete WBS.

TASK ESTIMATES

Estimates were created for each task as part of the planning effort. Robertson's team had some experience in IT project estimating, so they were fairly confident that the total project estimate would be close to the actuals. See **Exhibit 6** for listing of the estimates for each task.

PROJECT RESOURCES

All the resources for the project had been identified except for the software developers. For A&D in-house developers, a flat rate of $75/hour was traditionally used for estimating purposes. But since there were no developers available internally, Robertson had solicited a contracting

company, Geneva, to staff these positions. For the contractors, the rates varied depending on skill level and their market value. Moreover, the overtime rates for contractors were different from the A&D standard rate. (Overtime was defined to be more than eight hours of work in a day.)

By May, Geneva was still identifying the actual resources needed, but had provided the resources' rates so that Robertson could prepare the estimates. See **Exhibit 7** for a list of the resources and their appropriate rates. Robertson's team also examined the tasks and made assignments accordingly. See **Exhibit 8** for the resource assignments.

PROJECT SCHEDULING

As a final step in preparing for the project plan, Robertson scheduled all the tasks by adding dependencies (or predecessors) and calculating the leveling delay required to properly allocate all the resources. See **Exhibit 9** for the schedule.[1]

Review Meeting

When Johnson walked into the conference room fifteen minutes before the start of his meeting with A&D's senior managers to discuss the online store project, he found Webb and Robertson already there. As the other attendees filed into the room, Robertson was sorting through a stack of papers, giving a set to each of them. Jeff White, the vice president of sales, and Chuck Gagler, the vice president of e-commerce, arrived just as Webb was ready to start the meeting.

Webb outlined the purpose of the meeting, which was to facilitate the effective transition between Robertson and Johnson, as well as to update senior managers on the project's status. As Robertson was going through the details of the work that had been performed by his team, Johnson began to feel more at ease. He recognized that Robertson had done well in gathering all the relevant data to create a good project plan. Despite the challenge to quickly overcome the learning curve of a new project, Johnson felt more comfortable that he could come up with a detailed recommendation along with strong facts and potential issues.

As the meeting ended, Webb pulled Johnson aside and told him, "I know I may be asking a lot here, but I really need you to get the plan together in the next week. Walter really wants to know if we can get this thing done by Christmas."

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[1] The predecessors were identified using a Task ID. This was different from the WBS ID.

Exhibit 1: Organization Chart

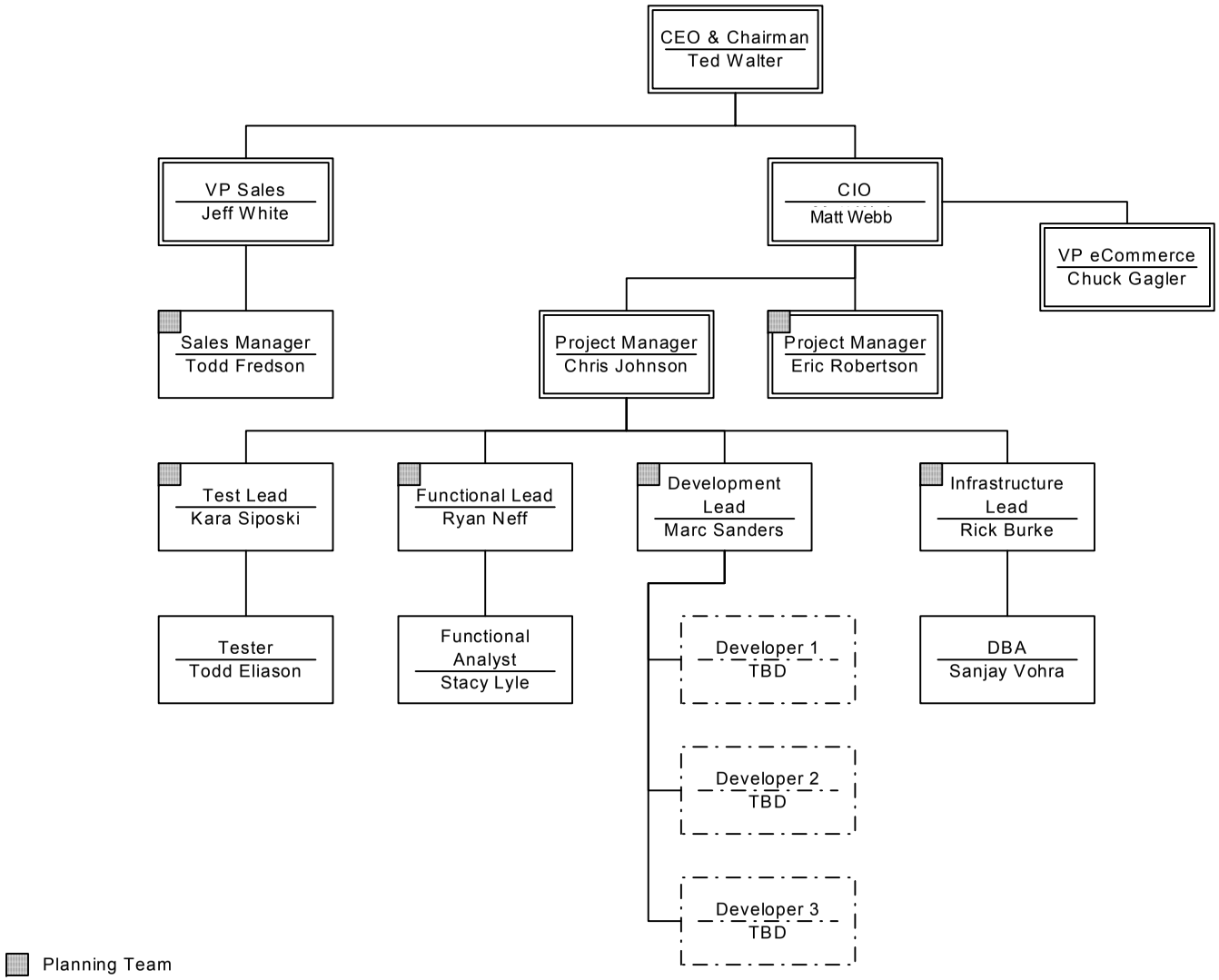


Exhibit 2: Technical Architecture

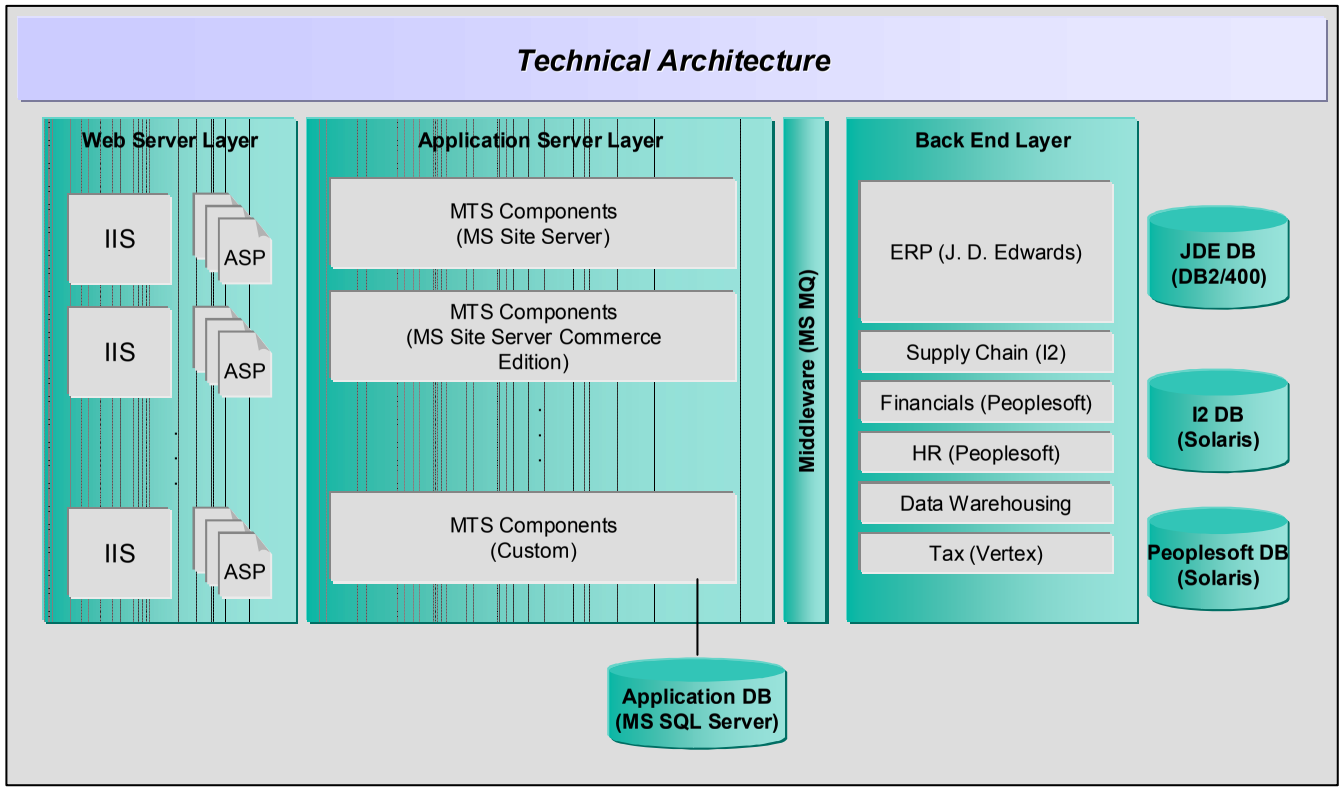


Exhibit 3: Physical Infrastructure

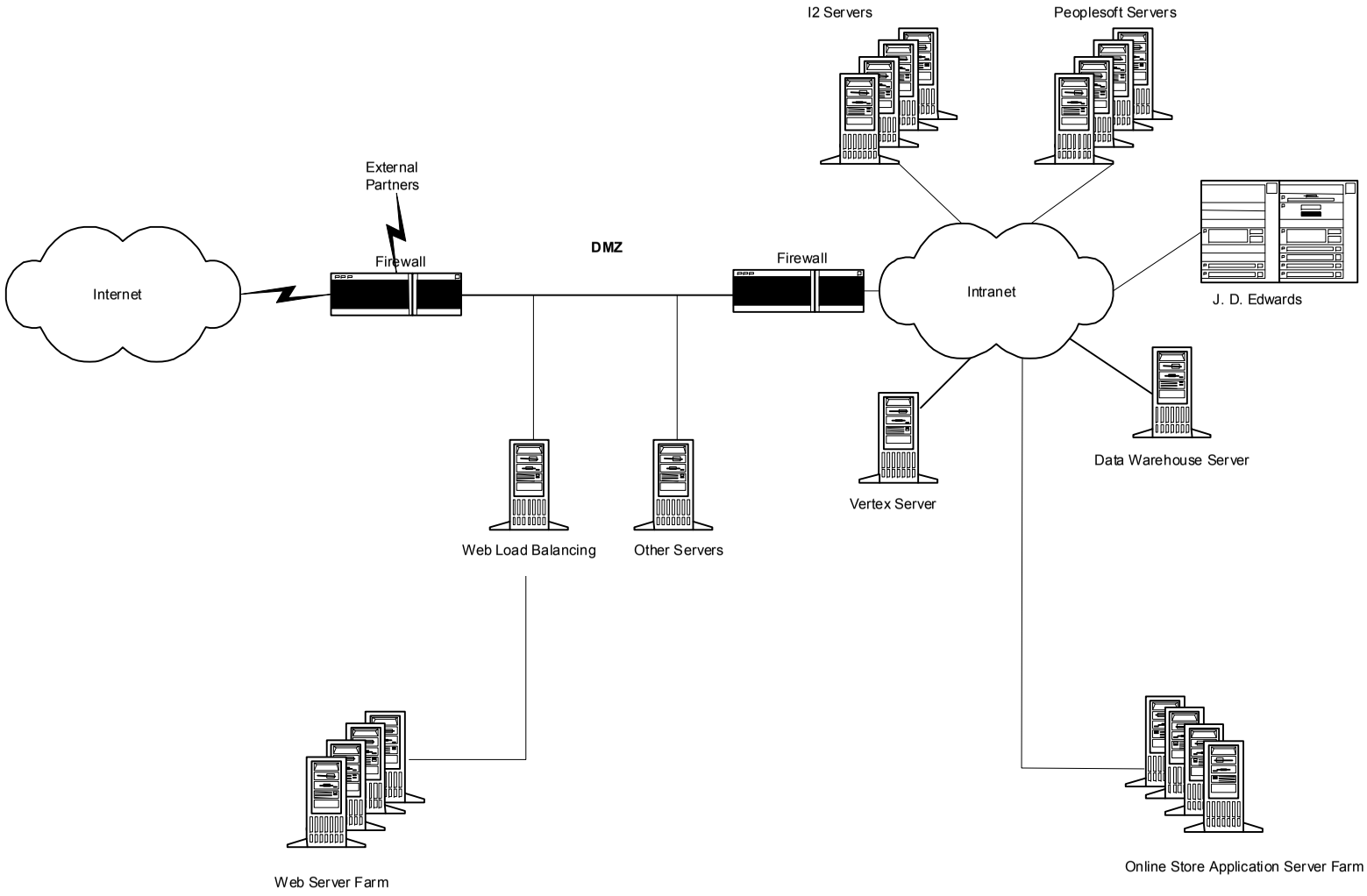
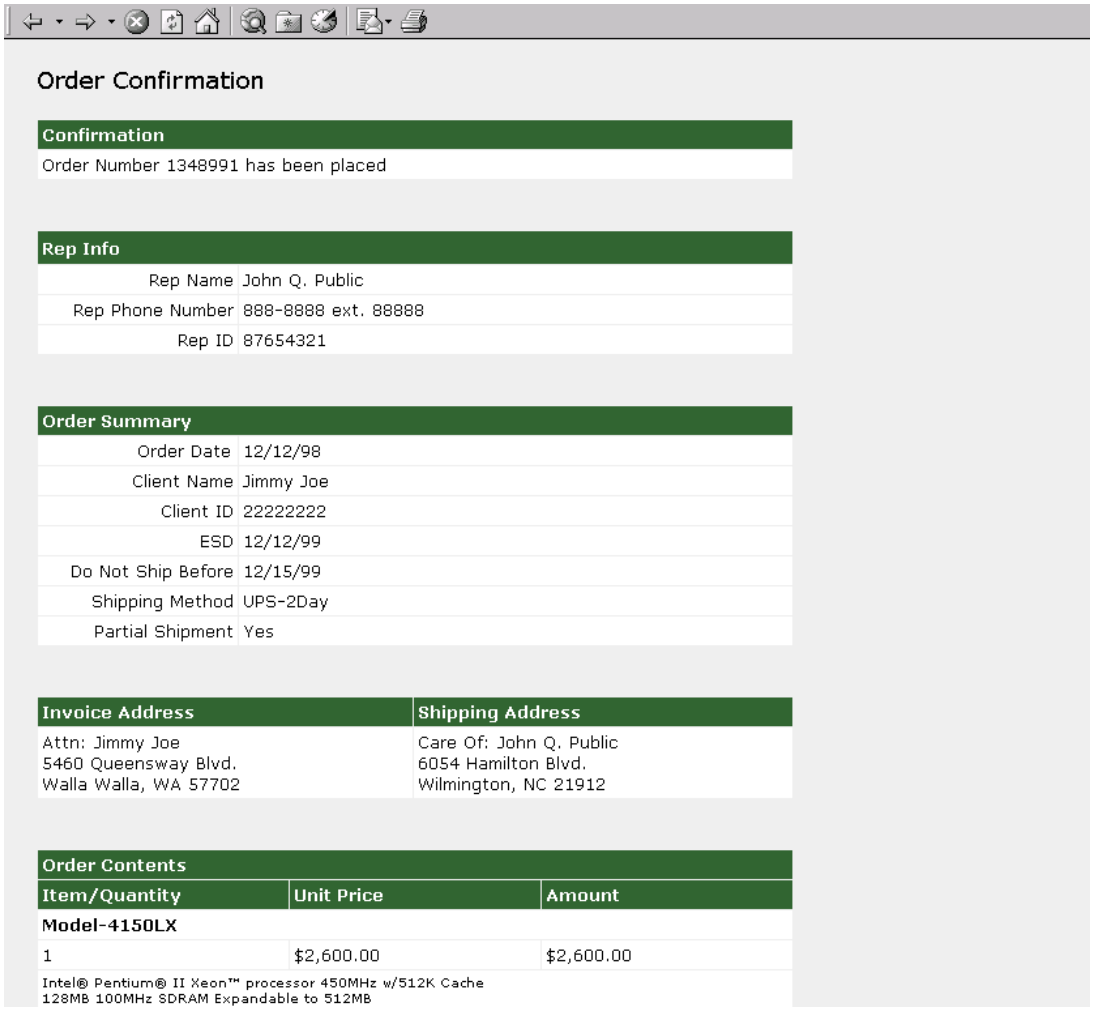


Exhibit 4: Prototype



Order Confirmation

Confirmation
Order Number 1348991 has been placed

Rep Info	
Rep Name	John Q. Public
Rep Phone Number	888-8888 ext. 88888
Rep ID	87654321

Order Summary	
Order Date	12/12/98
Client Name	Jimmy Joe
Client ID	22222222
ESD	12/12/99
Do Not Ship Before	12/15/99
Shipping Method	UPS-2Day
Partial Shipment	Yes

Invoice Address	Shipping Address
Attn: Jimmy Joe 5460 Queensway Blvd. Walla Walla, WA 57702	Care Of: John Q. Public 6054 Hamilton Blvd. Wilmington, NC 21912

Order Contents		
Item/Quantity	Unit Price	Amount
Model-4150LX		
1	$2,600.00	$2,600.00
Intel® Pentium® II Xeon™ processor 450MHz w/512K Cache 128MB 100MHz SDRAM Expandable to 512MB		

Exhibit 5: Work Breakdown Structure (WBS)

WBS ID	Task Name
1	Overall Project
1.1	*Project Management*
1.1.1	Manage Project
1.2	*System Requirements*
1.2.1	Gather Business Requirements
1.2.2	Design Business Process Flows
1.2.3	Finalize Technical Requirements
1.2.4	Create Operational Requirements
1.2.5	Identify Technical Infrastructure Needs
1.3	*Software Requirements*
1.3.1	Create Functional Requirements
1.3.1.1	Capture Customer Profile
1.3.1.2	View and Search Product Catalog
1.3.1.3	Updating and Calculating Shopping Cart
1.3.1.4	Taking Payments
1.3.1.5	Submit Order
1.3.1.6	Check Order History & Order Status
1.3.2	Create Data Requirements
1.3.3	Create ERP Interface Requirements
1.3.4	Create User Interface Requirements
1.4	*Detailed Design*
1.4.1	Design Capture Customer Profile Pages & Components
1.4.2	Design View and Search Product Catalog Pages & Components
1.4.3	Design Updating and Calculating Shopping Cart
1.4.4	Design Taking Payments Pages & Components
1.4.5	Design Submit Order Pages & Components
1.4.6	Design Check Order History & Order Status Pages & Components
1.4.7	Design Logical & Physical Data Model
1.4.8	Design ERP Interface
1.5	*Test Planning*
1.5.1	Gather Testing Requirements
1.5.2	Create System Test Plan & Test Cases
1.5.3	Write System Test Scripts
1.6	*Technical Infrastructure*
1.6.1	Create Development Environment
1.6.2	Create Testing Environment
1.6.3	Support Development Environment
1.6.4	Support Testing Environment & Deployment
1.6.5	Support Database

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Exhibit 5 *(continued)*

WBS ID	Task Name
1.7	*Development & Unit Test*
1.7.1	Build Capture Customer Profile Pages & Components
1.7.2	Build View and Search Product Catalog Pages & Components
1.7.3	Build Updating and Calculating Shopping Cart
1.7.4	Build Taking Payments Pages & Components
1.7.5	Build Submit Order Pages & Components
1.7.6	Build Check Order History & Order Status Pages & Components
1.7.7	Build Logical & Physical Data Model
1.7.8	Build ERP Interface
1.7.9	Support Development & Assembly Test
1.8	*Testing*
1.8.1	Perform Assembly Testing
1.8.1.1	Perform Phase 1 Testing
1.8.1.2	Perform Phase 2 Testing
1.8.2	Perform System Testing
1.8.3	Perform Validation Testing
1.9	*Deployment*
1.9.1	Implement System
1.9.2	Deploy To Production
1.9.3	Project Wrap-Up

Exhibit 6: Task Estimates

WBS ID	Task Name	Work Estimate (days)
1	Overall Project	
1.1	*Project Management*	
1.1.1	Manage Project	127
1.2	*System Requirements*	
1.2.1	Gather Business Requirements	8
1.2.2	Design Business Process Flows	4
1.2.3	Finalize Technical Requirements	6
1.2.4	Create Operational Requirements	15
1.2.5	Identify Technical Infrastructure Needs	2
1.3	*Software Requirements*	
1.3.1	Create Functional Requirements	
1.3.1.1	Capture Customer Profile	4
1.3.1.2	View and Search Product Catalog	6
1.3.1.3	Updating and Calculating Shopping Cart	3
1.3.1.4	Taking Payments	6
1.3.1.5	Submit Order	4
1.3.1.6	Check Order History & Order Status	3

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Exhibit 6 *(continued)*

WBS ID	Task Name	Work Estimate (days)
1.3.2	Create Data Requirements	3
1.3.3	Create ERP Interface Requirements	7
1.3.4	Create User Interface Requirements	4
1.4	*Detailed Design*	
1.4.1	Design Capture Customer Profile Pages & Components	13.5
1.4.2	Design View and Search Product Catalog Pages & Components	13.5
1.4.3	Design Updating and Calculating Shopping Cart	6
1.4.4	Design Taking Payments Pages & Components	6
1.4.5	Design Submit Order Pages & Components	16
1.4.6	Design Check Order History & Order Status Pages & Components	4
1.4.7	Design Logical & Physical Data Model	18
1.4.8	Design ERP Interface	20
1.5	*Test Planning*	
1.5.1	Gather Testing Requirements	14
1.5.2	Create System Test Plan & Test Cases	20
1.5.3	Write System Test Scripts	22
1.6	*Technical Infrastructure*	
1.6.1	Create Development Environment	20
1.6.2	Create Testing Environment	34.2
1.6.3	Support Development Environment	3.8
1.6.4	Support Testing Environment & Deployment	46
1.6.5	Support Database	4.6
1.7	*Development & Unit Test*	
1.7.1	Build Capture Customer Profile Pages & Components	13
1.7.2	Build View and Search Product Catalog Pages & Components	12
1.7.3	Build Updating and Calculating Shopping Cart	7
1.7.4	Build Taking Payments Pages & Components	6
1.7.5	Build Submit Order Pages & Components	24
1.7.6	Build Check Order History & Order Status Pages & Components	6
1.7.7	Build Logical & Physical Data Model	15.5
1.7.8	Build ERP Interface	18
1.7.9	Support Development & Assembly Test	46
1.8	*Testing*	
1.8.1	Perform Assembly Testing	
1.8.1.1	Perform Phase 1 Testing	12
1.8.1.2	Perform Phase 2 Testing	20
1.8.2	Perform System Testing	160
1.8.3	Perform Validation Testing	80
1.9	*Deployment*	
1.9.1	Implement System	80
1.9.2	Deploy To Production	8
1.9.3	Project Wrap-Up	90

Exhibit 7: Resources

Resource Name	Standard Rate	Overtime Rate
Chris Johnson (Project Manager)	$75.00/hr	$75.00/hr
Ryan Neff (Functional Lead)	$75.00/hr	$75.00/hr
Stacy Lyle (Functional Analyst)	$75.00/hr	$75.00/hr
Rick Burke (Infrastructure Lead)	$75.00/hr	$75.00/hr
Marc Sanders (Development Lead)	$75.00/hr	$75.00/hr
Developer 1 (TBD)	$165.00/hr	$230.00/hr
Sanjay Vohra (DBA)	$75.00/hr	$75.00/hr
Kara Siposki (Test Lead)	$75.00/hr	$75.00/hr
Todd Eliason (Tester)	$75.00/hr	$75.00/hr
Developer 2 (TBD)	$175.00/hr	$250.00/hr
Developer 3 (TBD)	$175.00/hr	$250.00/hr

Exhibit 8: Resource Assignments

WBS ID	Task Name	Work Estimate (days)	Resource Name
1	Overall Project		
1.1	*Project Management*		
1.1.1	Manage Project	127	Chris Johnson (Project Manager)
1.2	*System Requirements*		
1.2.1	Gather Business Requirements	8	Ryan Neff (Functional Lead), Stacy Lyle (Functional Analyst)
1.2.2	Design Business Process Flows	4	Ryan Neff (Functional Lead), Stacy Lyle (Functional Analyst)
1.2.3	Finalize Technical Requirements	6	Rick Burke (Infrastructure Lead)
1.2.4	Create Operational Requirements	15	Ryan Neff (Functional Lead), Stacy Lyle (Functional Analyst), Rick Burke (Infrastructure Lead)
1.2.5	Identify Technical Infrastructure Needs	2	Rick Burke (Infrastructure Lead)
1.3	*Software Requirements*		
1.3.1	Create Functional Requirements		
1.3.1.1	Capture Customer Profile	4	Ryan Neff (Functional Lead)
1.3.1.2	View and Search Product Catalog	6	Ryan Neff (Functional Lead)
1.3.1.3	Updating and Calculating Shopping Cart	3	Ryan Neff (Functional Lead)
1.3.1.4	Taking Payments	6	Stacy Lyle (Functional Analyst)
1.3.1.5	Submit Order	4	Ryan Neff (Functional Lead)
1.3.1.6	Check Order History & Order Status	3	Ryan Neff (Functional Lead)
1.3.2	Create Data Requirements	3	Stacy Lyle (Functional Analyst)
1.3.3	Create ERP Interface Requirements	7	Stacy Lyle (Functional Analyst)
1.3.4	Create User Interface Requirements	4	Stacy Lyle (Functional Analyst)

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Exhibit 8 *(continued)*

WBS ID	Task Name	Work Estimate (days)	Resource Name
1.4	*Detailed Design*		
1.4.1	Design Capture Customer Profile Pages & Components	13.5	Marc Sanders (Development Lead), Ryan Neff (Functional Lead) [50%]
1.4.2	Design View and Search Product Catalog Pages & Components	13.5	Developer 1 (TBD), Ryan Neff (Functional Lead) [50%]
1.4.3	Design Updating and Calculating Shopping Cart	6	Developer 1 (TBD), Ryan Neff (Functional Lead)
1.4.4	Design Taking Payments Pages & Components	6	Marc Sanders (Development Lead), Stacy Lyle (Functional Analyst)
1.4.5	Design Submit Order Pages & Components	16	Marc Sanders (Development Lead), Ryan Neff (Functional Lead)
1.4.6	Design Check Order History & Order Status Pages & Components	4	Marc Sanders (Development Lead), Ryan Neff (Functional Lead)
1.4.7	Design Logical & Physical Data Model	18	Sanjay Vohra (DBA), Stacy Lyle (Functional Analyst)
1.4.8	Design ERP Interface	20	Developer 1 (TBD), Stacy Lyle (Functional Analyst)
1.5	*Test Planning*		
1.5.1	Gather Testing Requirements	14	Kara Siposki (Test Lead), Todd Eliason (Tester)
1.5.2	Create System Test Plan & Test Cases	20	Kara Siposki (Test Lead), Todd Eliason (Tester)
1.5.3	Write System Test Scripts	22	Kara Siposki (Test Lead), Todd Eliason (Tester)
1.6	*Technical Infrastructure*		
1.6.1	Create Development Environment	20	Rick Burke (Infrastructure Lead)
1.6.2	Create Testing Environment	34.2	Rick Burke (Infrastructure Lead) [90%]
1.6.3	Support Development Environment	3.8	Rick Burke (Infrastructure Lead) [10%]
1.6.4	Support Testing Environment & Deployment	46	Rick Burke (Infrastructure Lead)
1.6.5	Support Database	4.6	Sanjay Vohra (DBA) [10%]
1.7	*Development & Unit Test*		
1.7.1	Build Capture Customer Profile Pages & Components	13	Developer 2 (TBD)
1.7.2	Build View and Search Product Catalog Pages & Components	12	Developer 3 (TBD)
1.7.3	Build Updating and Calculating Shopping Cart	7	Developer 3 (TBD)
1.7.4	Build Taking Payments Pages & Components	6	Developer 2 (TBD)
1.7.5	Build Submit Order Pages & Components	24	Developer 2 (TBD), Developer 3 (TBD)
1.7.6	Build Check Order History & Order Status Pages & Components	6	Marc Sanders (Development Lead)
1.7.7	Build Logical & Physical Data Model	15.5	Sanjay Vohra (DBA) [50%]
1.7.8	Build ERP Interface	18	Developer 1 (TBD)
1.7.9	Support Development & Assembly Test	46	Ryan Neff (Functional Lead), Stacy Lyle (Functional Analyst)

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Exhibit 8 *(continued)*

WBS ID	Task Name	Work Estimate (days)	Resource Name
1.8	*Testing*		
1.8.1	Perform Assembly Testing		
1.8.1.1	Perform Phase 1 Testing	12	Marc Sanders (Development Lead)
1.8.1.2	Perform Phase 2 Testing	20	Marc Sanders (Development Lead), Developer 1 (TBD), Developer 2 (TBD), Developer 3 (TBD)
1.8.2	Perform System Testing	160	Kara Siposki (Test Lead), Todd Eliason (Tester), Marc Sanders (Development Lead), Developer 1 (TBD), Developer 2 (TBD), Developer 3 (TBD), Ryan Neff (Functional Lead), Stacy Lyle (Functional Analyst)
1.8.3	Perform Validation Testing	80	Kara Siposki (Test Lead), Todd Eliason (Tester), Marc Sanders (Development Lead), Developer 1 (TBD), Developer 2 (TBD), Developer 3 (TBD), Ryan Neff (Functional Lead), Stacy Lyle (Functional Analyst)
1.9	*Deployment*		
1.9.1	Implement System	80	Kara Siposki (Test Lead), Todd Eliason (Tester), Marc Sanders (Development Lead), Developer 1 (TBD), Developer 2 (TBD), Developer 3 (TBD), Ryan Neff (Functional Lead), Stacy Lyle (Functional Analyst)
1.9.2	Deploy To Production	8	Kara Siposki (Test Lead), Todd Eliason (Tester), Marc Sanders (Development Lead), Developer 1 (TBD), Developer 2 (TBD), Developer 3 (TBD), Ryan Neff (Functional Lead), Stacy Lyle (Functional Analyst)
1.9.3	Project Wrap-Up	90	Kara Siposki (Test Lead), Todd Eliason (Tester), Marc Sanders (Development Lead), Developer 1 (TBD), Developer 2 (TBD), Developer 3 (TBD), Ryan Neff (Functional Lead), Stacy Lyle (Functional Analyst), Rick Burke (Infrastructure Lead)

Exhibit 9: Scheduling

Task ID	WBS ID	Task Name	Work Estimate (days)	Leveling Delay (edays)	Predecessors	Resource Name
1	1	Overall Project		0		
2	*1.1*	*Project Management*		*0*		
3	1.1.1	Manage Project	127	0	59FF	Chris Johnson (Project Manager)
4	*1.2*	*System Requirements*		*0*		
5	1.2.1	Gather Business Requirements	8	0		Ryan Neff (Functional Lead), Stacy Lyle (Functional Analyst)
6	1.2.2	Design Business Process Flows	4	0	5	Ryan Neff (Functional Lead), Stacy Lyle (Functional Analyst)
7	1.2.3	Finalize Technical Requirements	6	0		Rick Burke (Infrastructure Lead)
8	1.2.4	Create Operational Requirements	15	0	5, 6	Ryan Neff (Functional Lead), Stacy Lyle (Functional Analyst), Rick Burke (Infrastructure Lead)
9	1.2.5	Identify Technical Infrastructure Needs	2	0	7, 8	Rick Burke (Infrastructure Lead)
10	*1.3*	*Software Requirements*		*0*		
11	1.3.1	Create Functional Requirements		0	5, 6, 8	
12	1.3.1.1	Capture Customer Profile	4	0		Ryan Neff (Functional Lead)
13	1.3.1.2	View and Search Product Catalog	6	5		Ryan Neff (Functional Lead)
14	1.3.1.3	Updating and Calculating Shopping Cart	3	0	13	Ryan Neff (Functional Lead)
15	1.3.1.4	Taking Payments	6	6		Stacy Lyle (Functional Analyst)
16	1.3.1.5	Submit Order	4	0	12, 13, 14, 15	Ryan Neff (Functional Lead)
17	1.3.1.6	Check Order History & Order Status	3	0	16	Ryan Neff (Functional Lead)
18	1.3.2	Create Data Requirements	3	0	12, 13	Stacy Lyle (Functional Analyst)
19	1.3.3	Create ERP Interface Requirements	7	0	16SS	Stacy Lyle (Functional Analyst)
20	1.3.4	Create User Interface Requirements	4	0	11SS	Stacy Lyle (Functional Analyst)

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Exhibit 9 *(continued)*

Task ID	WBS ID	Task Name	Work Estimate (days)	Leveling Delay (edays)	Predecessors	Resource Name
21	*1.4*	*Detailed Design*		*0*	10	
22	1.4.1	Design Capture Customer Profile Pages & Components	13.5	0		Marc Sanders (Development Lead), Ryan Neff (Functional Lead) [50%]
23	1.4.2	Design View and Search Product Catalog Pages & Components	13.5	0		Developer 1 (TBD), Ryan Neff (Functional Lead) [50%]
24	1.4.3	Design Updating and Calculating Shopping Cart	6	0	23	Developer 1 (TBD), Ryan Neff (Functional Lead)
25	1.4.4	Design Taking Payments Pages & Components	6	11		Marc Sanders (Development Lead), Stacy Lyle (Functional Analyst)
26	1.4.5	Design Submit Order Pages & Components	16	0	22, 23, 24, 25	Marc Sanders (Development Lead), Ryan Neff (Functional Lead)
27	1.4.6	Design Check Order History & Order Status Pages & Components	4	0	26	Marc Sanders (Development Lead), Ryan Neff (Functional Lead)
28	1.4.7	Design Logical & Physical Data Model	18	0		Sanjay Vohra (DBA), Stacy Lyle (Functional Analyst)
29	1.4.8	Design ERP Interface	20	0	22, 23, 24, 25	Developer 1 (TBD), Stacy Lyle (Functional Analyst)
30	*1.5*	*Test Planning*		*0*		
31	1.5.1	Gather Testing Requirements	14	23	11	Kara Siposki (Test Lead), Todd Eliason (Tester)
32	1.5.2	Create System Test Plan & Test Cases	20	0	31, 21	Kara Siposki (Test Lead), Todd Eliason (Tester)
33	1.5.3	Write System Test Scripts	22	0	32	Kara Siposki (Test Lead), Todd Eliason (Tester)
34	*1.6*	*Technical Infrastructure*		*0*		
35	1.6.1	Create Development Environment	20	0	9	Rick Burke (Infrastructure Lead)
36	1.6.2	Create Testing Environment	34.2	0	35	Rick Burke (Infrastructure Lead) [90%]
37	1.6.3	Support Development Environment	3.8	0	35	Rick Burke (Infrastructure Lead) [10%]
38	1.6.4	Support Testing Environment & Deployment	46	0	36	Rick Burke (Infrastructure Lead)
39	1.6.5	Support Database	4.6	0	47	Sanjay Vohra (DBA) [10%]

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Exhibit 9 *(continued)*

Task ID	WBS ID	Task Name	Work Estimate (days)	Leveling Delay (edays)	Predecessors	Resource Name
40	*1.7*	*Development & Unit Test*		*0*	*35*	
41	1.7.1	Build Capture Customer Profile Pages & Components	13	0	22	Developer 2 (TBD)
42	1.7.2	Build View and Search Product Catalog Pages & Components	12	0	23	Developer 3 (TBD)
43	1.7.3	Build Updating and Calculating Shopping Cart	7	0	24, 42	Developer 3 (TBD)
44	1.7.4	Build Taking Payments Pages & Components	6	14	25	Developer 2 (TBD)
45	1.7.5	Build Submit Order Pages & Components	24	0	26, 41, 42, 43, 44	Developer 2 (TBD), Developer 3 (TBD)
46	1.7.6	Build Check Order History & Order Status Pages & Components	6	0	27	Marc Sanders (Development Lead)
47	1.7.7	Build Logical & Physical Data Model	15.5	0	28	Sanjay Vohra (DBA) [50%]
48	1.7.8	Build ERP Interface	18	0	29	Developer 1 (TBD)
49	1.7.9	Support Development & Assembly Test	46	0	21	Ryan Neff (Functional Lead), Stacy Lyle (Functional Analyst)
50	*1.8*	*Testing*		*0*		
51	1.8.1	Perform Assembly Testing		0	31	
52	1.8.1.1	Perform Phase 1 Testing	12	0	41, 42, 43	Marc Sanders (Development Lead)
53	1.8.1.2	Perform Phase 2 Testing	20	0	44, 45, 46, 52, 47, 48	Marc Sanders (Development Lead), Developer 1 (TBD), Developer 2 (TBD), Developer 3 (TBD)
54	1.8.2	Perform System Testing	160	0	51, 32, 33	Kara Siposki (Test Lead), Todd Eliason (Tester), Marc Sanders (Development Lead), Developer 1 (TBD), Developer 2 (TBD), Developer 3 (TBD), Ryan Neff (Functional Lead), Stacy Lyle (Functional Analyst)
55	1.8.3	Perform Validation Testing	80	0	54	Kara Siposki (Test Lead), Todd Eliason (Tester), Marc Sanders (Development Lead), Developer 1 (TBD), Developer 2 (TBD), Developer 3 (TBD), Ryan Neff (Functional Lead), Stacy Lyle (Functional Analyst)

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Exhibit 9 *(continued)*

Task ID	WBS ID	Task Name	Work Estimate (days)	Leveling Delay (edays)	Predecessors	Resource Name
56	*1.9*	*Deployment*		*0*	*50*	
57	1.9.1	Implement System	80	0		Kara Siposki (Test Lead), Todd Eliason (Tester), Marc Sanders (Development Lead), Developer 1 (TBD), Developer 2 (TBD), Developer 3 (TBD), Ryan Neff (Functional Lead), Stacy Lyle (Functional Analyst)
58	1.9.2	Deploy To Production	8	0	57	Kara Siposki (Test Lead), Todd Eliason (Tester), Marc Sanders (Development Lead), Developer 1 (TBD), Developer 2 (TBD), Developer 3 (TBD), Ryan Neff (Functional Lead), Stacy Lyle (Functional Analyst)
59	1.9.3	Project Wrap-Up	90	0	58	Kara Siposki (Test Lead), Todd Eliason (Tester), Marc Sanders (Development Lead), Developer 1 (TBD), Developer 2 (TBD), Developer 3 (TBD), Ryan Neff (Functional Lead), Stacy Lyle (Functional Analyst), Rick Burke (Infrastructure Lead)