#### Project Planning and Management - Unit 4 -

### Agenda

- Homework assignment Question 3
- Project management knowledge areas
- Project roles
- Project manager's role
- Project planning
- Work breakdown structure, tasks, cost and labor estimates
- Critical path analysis
- Project management triangle
- Quiz

#### Homework Question 3



3A. Graph above
3B. 17 weeks
3C. see red
3D. 2,4,6,8,10,Done = 21 (no longer critical path), Both 19 become critical path

1,3,5,7,9,10,Done = 21 2,4,6,8,10,Done = 17 (21) 1,3,6,8,10,Done = 19 (23) 1,3,5,7,8,10,Done = 19 2,4,7,9,10,Done = 21 2,4,7,8,10,Done = 19

5203 Systems and Infrastructure Lifecycle Management

#### Homework Question 3



# What are knowledge areas for Project Mangement?

Project Management Institute's (PMI) 5 lifecycle domains for Project Management Professional (PMP) certification:

- 1. Initiating the project
- 2. Planning the project
- 3. Executing the project
- 4. Monitoring and controlling the project
- 5. Closing the project

#### These map to 10 knowledge areas:

- 1. Project Integration Management
- 2. Project Scope Management
- 3. Project Schedule Management
- 4. Project Cost Management
- 5. Project Quality Management
- 6. Project Resource Management
- 7. Project Communications Management
- 8. Project Risk Management
- 9. Project Procurement Management
- 10. Project Stakeholder Management

https://en.wikipedia.org/wiki/Project\_Management\_Professional

#### Project roles

#### **Typical Project Management Organization Chart**



# Project Manager juggles many activities



#### Phases of Project Management Process

- Phase 1: Initiation
- Phase 2: Planning
- Phase 3: Execution
- Phase 4: Closedown

5203 Systems and Infrastructure Lifecycle Management

#### Project Plan

Should define clear, discrete activities and the work needed to complete each activity. Tasks include:

- 1. Describing Project Scope
- 2. Dividing the Project into Manageable Tasks
- 3. Estimating Resources and Creating a Resource Plan
- 4. Developing a Preliminary Schedule
- 5. Developing a Communication Plan

- 6. Determining Project Standards and Procedures
- 7. Identifying and Assessing Risk
- 8. Creating a Preliminary Budget
- 9. Setting a Baseline Project Plan

# Project Planning

Answers the following questions:

- What tasks must be done to complete the project?
- What are the dependencies among tasks?
- Who is responsible for each task?
- What resources are required to complete the tasks?
- How long will it take to complete the project?
- Is the project possible, given the known parameters?
- Where is the project most at risk?



# Project Planning

- Phase 1: Initiation
- Phase 2: Planning
- Phase 3: Execution
- Phase 4: Closedown

Is a 5-step process that defines a "road map" for successful project completion:

- 1. Define the work
  - What problem or opportunity does the project address?
  - What are the quantifiable results to be achieved?
  - What needs to be done?
  - How will success be measured?
  - How will we know when we are finished?
- 2. Develop initial project schedule
- 3. Refine project plans
- 4. Assess project risk
- 5. Set fixed delivery date and publish plans

### Project Planning – Define the work

Project Manager does the following:

- Reviews historical project information
- Identifies major project activities
- Decomposes major activities and identifies individual tasks
- Establishes task ownership
- Identifies skills and resources needed

Outputs of this step:

- Work Breakdown Structure (WBS)
- Clearly defined tasks and deliverables
- Tasks assigned to the Functional Leads
- Specify resources by task

# Planning Detail



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Level of project planning detail should be high in the short term, with less detail as time goes on

- The general principal is that we need to accept the fact of uncertainty, and that things will change over time
- Although we want a detailed idea of what we're going to do in the immediate future, we allow for more flexibility as time goes on
- This implies that planning is always going on
- Plans are revisited and evolve over time

#### Agenda

✓ Homework Question 3

✓ Project management knowledge areas

✓ Project roles

- ✓ Project manager's role
- ✓ Project planning
- Work breakdown structure, tasks, cost and labor estimates
- Critical path analysis
- Project management triangle
- Quiz

### Project Planning – Work Breakdown Structure (WBS)

Is a "top down" logical structuring of project work

At the highest level, the WBS may be broken down into major work packages that reflect phases of the SDLC, for example:

- 1. Planning
- 2. Analysis
- 3. Design
- 4. Implementation

Each work package is further broken down into tasks of greater detail, for example:

- 2. Analysis
  - A. Workflow requirement analysis
  - B. Functional requirements analysis
  - C. Data requirements analysis
  - D. Information security requirements analysis
- 3. Design
  - A. User interface design
  - B. Database design
  - C. Applications processing design

Т	ask Name
4	Software Development
	Scope
	Analysis/Software Requirements
	Design
	Development
	Testing
	Training
	Documentation
	Pilot
	Deployment
	Post Implementation Review

Task Name
Software Development
Scope
Analysis/Software Requirements
⊿ Design
Review preliminary software specifications
Develop functional specifications
Develop prototype based on functional specifications
Review functional specifications
Incorporate feedback into functional specifications
Obtain approval to proceed
Design complete

### Work Breakdown Structure (WBS) – RAD example

Task Name	
EWS Project	Notice RAD Development Iterations
Planning	

- 38 > System Development
- 159 Implementation

#### Task Name

2

1	▲ EWS Project
2	▲ Planning
3	Plan and Schedule Project
4	Requirements Analysis and Specifications
15	Prepare Development Team
21	Setup Development Environment
38	System Development
159	Implementation

Which kind of requirements would an IT Auditor find missing here?

	Task Name
	▲ Planning
	Plan and Schedule Project
	A Requirements Analysis and Specifications
	User Requirements Finalize
	Functional Requirements
	System Architecture
	Data Model
_	User Interface and Interaction
1	Data Sources, Formats, and Data Flow
	Flow of Control
2	Maps
3	Test Cases
Ļ	Specifications Complete
5	Prepare Development Team
	Setup Development Environment
3	System Development
9	Implementation

#### Task Name

EWS Pr	oject	
⊿ Plann	ling	
Pla	n and Schedule Project	
⊿ Red	quirements Analysis and Sp	pecifications
U	Iser Requirements Finalize	
F	unctional Requirements	
S	system Architecture	
E	ata Model	
U	Iser Interface and Interaction	
D	ata Sources, Formats, and D	ata Flow
F	low of Control	
N	laps	
Т	est Cases	
S	pecifications Complete	
Pre	pare Development Team	
Set	up Development Environm	ent
⊿ Syste	m Development	
Dev	velop Application - V 0.1 Inc	ident
De	velop Application - V0.1.1 In	cident Analysis
Dev	velop Application V0.2 Back	ground Water Quality
De	velop Application V0.3 Histo	orical Incidents
> Imple	mentation	15

#### Work Breakdown Structure (WBS) – RAD example...

	Task Name					
1	✓ EWS Project					
2	⊿ Planning					
3	Plan and Schedule Project					
4	Requirements Analysis and Specifications					
5	User Requirements Finalize					
6	Functional Requirements					
7	System Architecture					
8	Data Model					
9	User Interface and Interaction					
10	Data Sources, Formats, and Data Flow					
11	Flow of Control					
12	Maps					
13	Test Cases					
14	Specifications Complete					
15	Prepare Development Team					
21	Setup Development Environment					
38	▲ System Development					
39	Develop Application - V 0.1 Incident					
70	Develop Application - V0.1.1 Incident Analysis					
93	Develop Application V0.2 Background Water Quality					
32	Develop Application V0.3 Historical Incidents					
59	Implementation					

	Fask Name					
38	A System Development					
39	Develop Application - V 0.1 Incident					
40						
41	Incident Schemas					
42	Incident New Workflow Capabilities					
43	Incident Workflow Rules					
44	⊿ Develop Database					
45	Incident Entities Database Schema					
46	Incident Entities Table Definitions and Views					
47	Incident XML Mapping Schemas					
48	✓ Setup ArcSDE					
49	Setup Spatial Tables and Layers					
50	Index Spatial Layers					
51	Views and Stored Procedures					
52	Incident Entities					
53	Develop Data Integration Layer					
54	Base Map Integration Service					
55	GeoCoding Integration Service					
56	Telephony Data Integration Service					
57						
58	A Develop UI SubSystem (ArcIMS - CAPIT) Interface					
59	Coordinate Map and non-Map Pages					
60	Login and Main Pages					
61	New Widgets and UI Capabilities					
62	Improve Validation Error Feedback					
63	✓ Incident Pages					
64	Task Bars					
65	Menues					
66	Forms					
67	Pages					
68	Integration and Testing					
69	Milestone 1 - V0.1 Complete					

#### **1**<sup>st</sup> Development Iteration

# WBS is an integral part of the Gantt chart

#### E-Commerce project plan for Pine Valley Furniture webstore



You can see this WBS is similar to a waterfall approach

Note:

- Overlap between logical and physical design
- Overlap between design and implementation
- Critical path shown with red bars in the Gantt chart (more on this later in this lecture)

#### WBS can also be illustrated using network diagrams



#### WBS can also be illustrated using network diagrams



#### Exercise

- Open up MS Project on IS-Dev Project Gantt Example (find zip file in Unit 04 Wrap Up)
- Analyze and explain what this this project about?

|--|

	Designation of			Q19 1, 2016 Q19 2, 2036 Q19 3, 2016 Q19 4, 25 Day Jun Fish May Any May Jun Jul Any Sen Ort
roject Example	37 days	Wed 12/16/15	Fri 2/5/16	The are the me the and the me me me the or
Meeting (Task 3.1) pment Plan (Task 3.2)	0 days 33 days	Wed 12/16/15 Tue 12/22/15	Wed 12/16/11 Fri 2/5/16	• 12/16
Development Plan	18 days	Tue 12/22/15	Thu 1/14/16	Draft Development Plan Delivered
Review of Development Plan	9 days	Mon 1/18/16	Thu 1/28/16	
Feedback on Development Plan Received te Development Plan	0 days 4 days	Fri 1/29/16 Mon 2/1/16	Fri 1/29/16 Thu 2/4/16	1/29
opment Plan Delivered	0 days	Fri 2/5/16	Fri 2/5/16	Development Plan Delivered
perience Design (Task 3.3)	62 days	Mon 1/4/16	Tue 3/29/16	
UX Review sign Sprint Workshop	25 days 2 days	Mon 1/4/16 Mon 2/8/16	Fri 2/5/16 Tue 2/9/16	
ilete UX Design Sprint Summary Report	8 days	Wed 2/10/16	Fri 2/19/16	UX Dealers Sprint Summary Report Delivered
op Functional Specifications	20 days	Wed 3/2/16	Tue 3/29/16	
Technical Infrastructure Setup and Rollout (Task 3.3) Technical Infrastructure Setup	20 days 0 days	Fri 1/15/16 Fri 1/15/16	Thu 2/11/16 Fri 1/15/16	4/15
Coordination Hub	10 days	Fri 1/15/16	Thu 1/28/16	
Development/Test Environment	10 days	Fri 1/29/16	Thu 2/11/16	
ical Infrastructure in Place delina	0 days 161 days	Thu 2/11/16 Fri 1/29/16	Thu 2/11/16 Fri 9/9/16	₹ 4/11
pase Development	26 days	Fri 1/29/16	Mon 3/7/16	1
city Run Time Logical Database Model (Task 6) a Loading	5 days 5 days	Fri 1/29/16 Mon 2/29/16	Thu 2/4/16 Mon 3/7/16	
ad IS Critical Infrastructure Data (Tasks 4.2.2 - 4.2.5, 4.2.7, 4.3) urret & Load &dmin, HLKC, and Birck Group Data (Task 4.2.2, Task 4.2.5)	5 days 3 days	Mon 2/29/16 Mon 2/29/16	Fri 3/4/16 Wed 3/2/16	
urce & Load Hydrography and Cartographic Basemap Data (Tasks 4.2.2 - 4.2.5, 4.2.7, 4.3)	2 days	Thu 3/3/16	Fri 3/4/16	¥
PreProcessor (Task 4.2.2, Task 4.2.4, Task 4.2.5)	91 days	Fri 2/12/16	Mon 6/20/16	1
cify Data PreProcessor (Task 4.2.2, Task 4.2.4, Task 4.2.5, Task 8.2.4) Iement Infrastructure AlignLine Generalizations (Task 4.2.2, Task 4.2.5)	3 days 10 days	Fri 2/12/16 Mon 2/29/16	Tue 2/16/16 Fri 3/11/16	
lement Admin/HUC Contexts' Infrastructure Measurements (Task 4.2.2)	10 days	Mon 3/14/16	Fri 3/25/16	
rement Intrastructure Generalizations (1884-8.2.4) Iement DataPreprocessor Update Automation (Task 4.2.2, Task 4.2.4, Task 4.2.5)	10 days	Mon 6/6/16	Fri 6/17/16	fin.
a PreProcessor Complete mir Man	0 days 96 days	Mon 6/20/16 Fri 1/29/16	Mon 6/20/16 Mon 6/13/16	€ 6/20
tographic Design	20 days	Fri 1/29/16	Fri 2/26/16	
ecify Admins Map Style w/drawing,labeling,click behavior (Task 4.2.2, Task 4.2.5, Task 8.2.4) ecify HUCS Map Style w/drawing,labeling,click behavior (Task 4.2.2, Task 4.2.5, Task 8.2.4)	5 days	Fri 2/5/16	Thu 2/4/16 Thu 2/11/16	in.
ecity Detailed Infrastructure System Map. (Task 4.2.4, Task 8.2.4)	10 days	Fri 2/12/16	Thu 2/25/16	2/26
a Display Capability	91 days	Fri 2/5/16	Fri 6/10/16	
splement Base Map Display (Task 4.2.2, Task 4.2.5) splement Interactive Infrastructure Map Display (Task 4.2.2, Task 4.2.5)	10 days 10 days	Fri 2/5/16 Mon 3/14/16	Thu 2/18/16 Fri 3/25/16	
uplement Static Drill-Down Map Context Display Capture Engine (Task 4.2.2)	10 days	Mon 3/28/16	Fri 4/8/16	
splement Dynamic Infrastructure Segments Interactive CRUD Capabilities (Task 4.2.4)	20 days	Mon 5/2/16	Fri 5/27/16	
iplement Detailed Infrastructure Map Display 2 w/inspectionlines(Task 4.2.4) amic Map Complete	5 days 0 days	Mon 6/6/16 Mon 6/13/16	Fri 6/10/16 Mon 6/13/16	4/10
-alone Map Viewer (Task 4.2.5)	141 days	Fri 2/26/16	Fri 9/9/16	
lement Stand-alone Map Viewer (Task 4.2.5)	20 days	Mon 8/15/16	Fri 9/9/16	
tion Development Pages	165 days 165 days	Mon 2/15/16 Mon 2/15/16	Mon 10/3/16 Fri 9/30/16	
ding Page (Task 4.2.1 and Task 4.2.3)	20 days	Mon 2/15/16	Fri 3/11/16	
anced Query Page (Task 4.2.3)	40 days	Man 2/15/16	Fri 4/8/16	
splement Attribute Query Page splement Query Results Page	20 days 20 days	Mon 2/15/16 Mon 3/14/16	Fri 3/11/16 Fri 4/8/16	
tial Content Drill-down Page (Task 4.2.2)	30 days	Mon 4/11/16	Fri 5/20/16	
splement simple Drill-down - HUCS	10 days	Mon 5/9/16	Fri 5/20/16	
astructure System Detail Page (Task 4.2.4) splement Infrastructure System Detail Page (Iteration 1)	60 days 15 days	Man 5/23/16 Man 5/23/16	Fri 8/12/16 Fri 6/10/16	
nplement Data Editing (Attributes, Media upload & managment)	15 days	Mon 6/13/16	Fri 7/1/16	
spiement ninnssructure system becau rage (nerasion z w/gen. urspiag) spiement Reaches Editing	20 days	Mon 7/18/16	Fri 8/12/16	
lement Identity, Authorization and Access Security (Task 4.2.1) splement Security Management-Login, Access Control, Session Management (Task 4.2.6)	95 days 30 days	Mon 2/15/16 Mon 2/15/16	Fri 6/24/16 Fri 3/25/16	
splement Login Page	5 days	Mon 3/28/16	Fri 4/1/16	
rganization Page (Task 5.1)	20 days	Mon 4/18/16	Fri 5/13/16	
Organization Details User Roles and Data Stewardship	5 days 15 days	Mon 4/18/16 Mon 4/25/16	Fri 4/22/16 Fri 5/13/16	
tegrate Page-Level Information Security (Task 4.2.1, Task 4.2.6)	10 days	Mon 5/16/16	Fri 5/27/16	
eloper Support Page(s)	105 days	Mon 5/9/16	Fri 9/30/16	
ISTful Web API Draft RESTful Web API Specification (Task 3.3)	80 days 15 days	Mon 5/9/16 Mon 5/9/16	Fri 8/26/16 Fri 5/27/16	
Draft RESTful Web API Specification Delivered	0 days	Fri 5/27/16	Fri 5/27/16	By Bit RESTful Web API Specification Delivered
evelop Geospatial Services API (Task 5.3)	15 days	Mon 9/12/16	Fri 9/30/16	
Complete Milestone	0 days 40 days	Mon 10/3/16 Fri 2/26/16	Mon 10/3/16 Fri 4/22/16	÷ 10/3
op Quality Control Plan (Task 8.1)	40 days	Fri 2/26/16	Fri 4/22/16	
It Unit and System Integration Test Plan	15 days	Fri 2/26/16	Thu 3/17/16	diama dia dia dia dia dia dia dia dia dia di
ft Information Security Test Plan ft User Acceptance Test Plan	20 days 40 days	Man 2/29/16 Fri 2/26/16	Fri 3/25/16 Thu 4/21/16	
Plans Complete	0 days	Fri 4/22/16	Fri 4/22/16	* 4/22
uct Unit Testing	160 days	Mon 2/15/16	Fri 9/23/16	
uct System Integration Testing uct Information Security Tests	160 days 196 days	Mon 3/21/16 Fri 1/29/16	Fri 10/28/16 Fri 10/28/16	
uct User Acceptance Testing	35 days	Mon 9/12/16	Fri 10/28/16	Internet
entation	191 days	Fri 2/5/16	Fri 10/28/16	
ment Logical Data Model (Task 6) System Documentation (Task 8,2,4)	166 days 25 days	Fri 2/5/16 Mon 9/26/16	Fri 9/23/16 Fri 10/28/16	
on Delivery	40 days	Mon 9/5/16	Mon 10/31/16	
p Data Delivery Package	15 days	Mon 9/12/16 Mon 9/12/16	Fri 9/30/16	
p Code Delivery Package w/code documentation on Client IT infrastructure	20 days 10 days	Mon 9/5/16 Mon 10/3/16	Fri 9/30/16 Fri 10/14/16	
d Debug Production Application Deployment	10 days	Mon 10/17/16	Fri 10/28/16	
ered to Chent	185 days	Mon 10/31/16 Fri 2/12/16	Fri 10/28/16	
ne D - Development Infrastructure in Place ne 1 - Functional Specifications Complete, Design Document & Application Configuration Guide Drafted	0 days 0 days	Fri 2/12/16 Fri 2/26/16	Fri 2/12/16 Fri 2/26/16	<ul> <li>Milestone 0 - Development Infrastructure In Place</li> <li>Milestone 1 - Functional Specifications Complete, Design Document &amp; J</li> </ul>
ne 2 - Landing Page, Queries and Results Pages Implemented	0 days	Fri 4/8/16	Fri 4/8/16	Milestone 2 - Landing Pape, Queries and Results Pages Imp     Milestone 3 - Simple Drill-down Pages Implement
ne 4 - Data PreProcessor and Map Display Implemented	0 days	Mon 6/20/16	Mon 6/20/16	Milestone 4 - Data PreProcessor and
ne 5 - Infrastructure System Details Page Implemented ne 6 - Standalone Map Viewer Implemented	0 days 0 days	Fri 8/12/16 Fri 9/9/16	Fri 8/12/16 Fri 9/9/16	<ul> <li>Milestone 5 - Infrastru</li> <li>Milestone 6 -</li> </ul>
ne 7 - Code Complete	0 days	Man 10/3/16	Mon 10/3/16	+ Milest
ine e - is beginved urveillance Meetings	190 days	Mon 2/1/16	Mon 10/24/16	· · · · · · · · · · · · · · · · · · ·
1 Review - Development Plan 2 Review - Milestone 0	0 days 0 days	Man 2/1/16 Man 2/15/16	Mon 2/1/16 Mon 2/15/16	<ul> <li>2/1</li> <li>2/15</li> </ul>
3 Review - Milestone 1	0 days	Mon 2/29/16	Mon 2/29/16	• 2/29
4 nevew - un uesign summary and buildus kelease 5 Review - Build02 Release	0 days	Tue 3/29/16	mon s/14/16 Tue 3/29/16	• 3/29
6 Review - Build03 Release and Milestone 2 7 Review - Build04 Release and Test Plan	0 days 0 days	Tue 4/12/16 Tue 4/26/16	Tue 4/12/16 Tue 4/26/16	<ul> <li>4/12</li> <li>4/26</li> </ul>
8 Review - Build05 Release	0 days	Tue 5/10/16	Tue 5/10/16	¢ 5/10
9 nevew - sundu6 Release and Milestone 3 0 Review - Build07 Release	0 days 0 days	Tue 5/24/16 Tue 6/7/16	Tue 5/24/16 Tue 6/7/16	♦ 5/24 ♦ 6/7
1 Review - Build08 Release and Milestone 4 2 Review - Build08 Release	0 days 0 days	Tue 6/21/16	Tue 6/21/16	6/21 ♦ 7/5
3 Review - Build10 Release	0 days	Tue 7/19/16	Tue 7/19/16	• 7/19
4 Review - Build11 Release 5 Review - Build12 Release and Milestone 5	0 days 0 days	Tue 8/2/16 Tue 8/16/16	Tue 8/2/16 Tue 8/16/16	♦ 8/2 ● 8/16
6 Review - Build 13 Release 7 Review - Build 14 Release	0 days	Mon 8/29/16	Mon 8/29/16	♣ 8/23
8 Review - Build 15 Release	0 days	Mon 9/26/16	Mon 9/26/16	• 9/12 • 9/26
9 Review - Build 16 Release and Milestone 7	0 days	Mon 10/10/16	Mon 10/10/16	• 10/

#### Cost Estimation

Can be based on:

- Analogous estimating using experience from prior projects
- Parametric estimating extending cost models from similar prior projects
- Bottom-up estimating building up costs from detailed Work Breakdown Structure
- Actual costs leveraging actual historic costs from identical prior project

#### Software Size Estimation Techniques:

- Source Lines of Code (SLOC)
- COnstructive COst Model (COCOMO)
- Function Point Analysis (FPA)
- FPA With Feature Points

#### COCOMO – COnstructive COst MOdel

#### Models for estimating effort, cost, and schedule

Boehm, B. (1981) Software Engineering Economics

- Derived from fitting regression formulas to historical project data
- Applies to 3 classes of software development projects
  - **Organic projects** small teams with "good" experience working with flexible requirements
  - Semi-detached projects "medium" teams with mixed experience working with a mix of rigid and less than rigid requirements
  - Embedded projects developed within a set of "tight" constraints
- A hierarchy of three increasingly detailed models:
  - **1. Basic COCOMO** for quick, early, rough order of magnitude estimates of software costs
  - 2. Intermediate COCOMO added "Cost Drivers"
  - 3. Detailed COCOMO added influence of individual project phases

	ntermediate COCOMO
Cost	Drivers
	Product attributes
Requ	ired software reliability
Size	of application database
Com	plexity of the product
	Hardware attributes
Run-t	time performance constraints
Mem	ory constraints
Volati	ility of the virtual machine environment
Requ	ired turnabout time
	Personnel attributes
Analy	/st capability
Appli	cations experience
Softw	vare engineer capability
Virtua	al machine experience
Progr	ramming language experience
	Project attributes
Appli	cation of software engineering methods
Use o	of software tools
Requ	ired development schedule

# Cost Estimation – Function Point Analysis (FPA)

A technique used to determine size of a development task, based on the number of function points

Function points are factors such as inputs, outputs, queries, and logical processing units

Parameter	Simple	Average	Complex
# of Screens	5	10	5
# of Services	0	2	2
# of Database Tables	4	2	0
# of Data Files	0	4	0
# of Reports	0	2	3
# of External Interfaces	1	1	1
# of Environment Variables	3	4	0
Total:	13	25	11

# Cost Estimation – Function Point Analysis (FPA)

A technique used to determine size of a development task, based on the number of function points

Function points are factors such as inputs, outputs, queries, and logical processing units

Parameter	Simple	Simple Weight	Average	Average Weight	Complex	Complex Weight	Function Points
# of Screens	5	5	10	10	5	15	200
# of Services	0	10	2	20	2	40	120
# of Database Tables	4	10	2	15	0	20	70
# of Data Files	0	5	4	10	0	15	40
# of Reports	0	20	2	30	3	40	180
# of External Interfaces	1	20	1	40	1	60	120
# of Environment Variables	3	20	4	30	0	40	180
Total:	13	90	25	155	11	230	910

#### Cost Estimation – Function Point Analysis

D	Simple	Simple Weight Average		Average	Complex	Complex	Function	Labor	Labor
Parameter		weight		weight		weight	POINTS	nouis	COSIS
# of Screens	5	5	10	10	5	15	200	2,000	200,000
# of Services	0	10	2	20	2	40	120	1,200	120,000
# of Database Tables	4	10	2	15	0	20	70	700	70,000
# of Data Files	0	5	4	10	0	15	40	400	40,000
# of Reports	0	20	2	30	3	40	180	1,800	180,000
# of External Interfaces	1	20	1	40	1	60	120	1,200	120,000
# of Environment Variables	3	20	4	30	0	40	180	1,800	180,000
Total:	13	90	25	155	11	230	910	9,100	910,000
Labor Hours/Function Point:	10								
Cost/Function Point:	1,000								

#### Example of a complex project's WBS and labor estimate

	A	E 0
1		Task Hours
2	Intermodal Transportation Model	
3	Task 1 - Evaluate existing data sets	1,284
31	Task 2 - Integration Strategy	2,974
88	Task 3 - Intermodal Transportation Model	4,244
129	Task 4 - Intermodal Visualization Tool	1,496
139	Total Hours:	9,998

	A	0
1		Task Hours
2	Intermodal Transportation Model	
3	Task 1 - Evaluate existing data sets	1,284
31	Task 2 - Integration Strategy	2,974
88	Task 3 - Intermodal Transportation Model	4,244
129	Task 4 - Intermodal Visualization Tool	1,496
139	Total Hours:	9,998

	A	N	0
1		Activity Hours	Task Hours
2	Intermodal Transportation Model		
3	Task 1 - Evaluate existing data sets		1,284
4	Data sourcing	156	
9	Develop data quality assurance and finishing tool	236	
13	Visual proof reading and data repair tool	420	
20	Analyze existing datasets' content, format, organization, integrity and routability	320	
29	Integrate dataset models	152	

	A
1	
2	Intermodal Transportation Model
3	Task 1 - Evaluate existing data sets
4	Data sourcing
5	Research and acquire data sources and QA proofing materials
6	Acquire and manage existing Commond CCT datasets and documentation
7	Identify Open Source transportation datasets
8	Proofing support imagery
9	Develop data quality assurance and finishing tool
10	Setup development environment
11	Holistic transportation feature extraction and network gap identification
12	Holistic dataset attribute value tester
13	Visual proof reading and data repair tool
14	Gap reviewer
15	Intermodal connection evaluation
16	Random NavUnit sampler and road/rail connection reviewer
17	Random road/rail connection sampler and reviewer
18	Route runner and reviewer (for visually proof reading while surfing route)
19	Geospatial bug creation, tracking - reproduction, assignment and resolution
20	Analyze existing datasets' content, format, organization, integrity and routability
21	Model waterborne datasets UML
22	Model roadway datasets UML
23	Model railway datasets UML
24	Model Opensource transportation datasets UML
25	Model aviation datasets UML
26	Model Census datasets UML
27	Model Administrative, populated places, and other stakeholder reporting area datasets UML
28	Integrate dataset models

1 2

3

Task 1 - Evaluate existing data sets

Data sourcing

Intermodal Transportation Model Task 1 - Evaluate existing data sets Task 2 - Integration Strategy Task 3 - Intermodal Transportation Model Task 4 - Intermodal Visualization Tool

Develop data quality assurance and finishing tool 236 Visual proof reading and data repair tool 420 13 320 Analyze existing datasets' content, format, organization, integrity and routability 20 152 Integrate dataset models 29 2,974 Task 2 - Integration Strategy 31 Document results of Task 1 dataset view integration and evaluation 56 112 34 Identify case studies and develop data, functional and user requirements for Intermodal Transportation Model and Viewer Design Intermodal Transportation Model - Data models 480 Develop Data Model Intergration Plan 44 **Router 1 Integration Plan** 45 260 256 **Router 2 Integration Plan** 49 **Router 3 Integration Plan** 244 53 256 57 **Router 4 Integration Plan** Design Intermodal Transportation Model - Router V2 508 68 292 74 Design Intermodal Transportation Model - Router V3 Design Intermodal Transportation Model - Router V4 260 79 **Develop Intergration Strategy Report** 40 86 Task 3 - Intermodal Transportation Model 4,244 88 Setup N-Tier Geospatial Application System Development Environment 168 89 Develop Intermodal Transportation Model - Routing 91 92 Router 1 - Basic 884 Router 2 - Traffic and Congestion 768 100 880 Router 3 - Traffic and Congestion and Freight Movement 106 Router 4 – Traffic and Congestion, Freight Movement, and Community Impact and Environmental Vulnerablity 760 112 382 118 Publishing Tool **Develop Intermodal Transportation Model Documentation** 160 126 242 Prepare and Package Intermodal Transportation Model for delivery 127 Task 4 - Intermodal Visualization Tool 1,496 129 Develop User Experience (UX) Design Specification based on case requirements 130 104 160 Evolve geospatial application system development environment to support web application development 131 **Develop and test Intermodal Visualization Tool** 1.032 132 **Develop Intermodal Visualization Tool Documentation** 40 136 Prepare and package Intermodal Visualization Tool for delivery 160 137 138 9,998 **Total Hours:** 9,998 139 Cost 140 479.904 Raw Cost: 5203 Systems and Infrastited ture Lifecycle Management Loaded Cos9: 1,286,143

Α.

Intermodal Transportation Model

N.

**Activity Hours** 

156

Ο.

**Task Hours** 

1,284

		Projec	t Manager	UX-Designer	Database De	v. Develop	er 1 Develo	per 2 Deve	eloper 3	Developer 4	Data Do	v Testing	Hours
Intermodal Transportation Model	1												
Task 1 - Evaluate existing data sets													
Data sourcing													
Research and acquire data sources and QA proofing materials												24	24
Acquire and manage existing burrow are datasets and documentation				24								40	64
Identify Open Source transportation datasets			4	4								24	32
Proofing support imagery				4								16 16	36
Develop data guality assurance and finishing tool													
Setup development environment				16						1	6		32
Lal-11-11-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1	Project Ma	an agor	11X-Designe	A Database Dou	Developer 1	Developer 2	Developer 3	Developer	4 Data Da	u Tosting	A Hours A	otinitu Hourd	Linek Hourse
Intermedal Transportation Model	Tropectric	arrager	ON Designe	1 Database Dev	. Developer r	Developer 2	Developer a	- Destendper -	- Data De	e resting	TICOLS 1	ctivity mours	Task Hours
Task 4 Evolution aviation data ante													4 204
Task 1 - Evaluate existing data sets												100	1,284
Data sourcing									-	24	24	150	
Research and acquire data sources and UA prooring materials				24					+	24	24		
Module and manage existing downed and datasets and documentation		4		4					+	24	22		
Desilise susset in security		4		4					+ · ·	10 10	32		
Prooring support imagery				4						0 0	30	226	
Develop data quality assurance and finishing tool				16				<u> </u>	e		32	230	
Setup development environment Helistia transportation feature entraction and naturely and identification		24		10					0	+ +	32		
Holistic data set studie to use to testes		24		4				°		10	60		
Holistic dataset attribute value tester		4		4						10	60	420	
Visual proof reading and data repair tool		4		16	40				16		76	420	
Depreviewen		4			40			· · · · ·	<u> </u>	+ +			
Random Naul Init campler and road/rail connection reviewer		4		16	40			1	16	+ +	76		
Random road/rail connection sampler and reviewer		4		16	40			1	31	+ +	76		
Boute runner and reviewer (for visually proof reading while surfing route)		4		16	40			<u> </u>	16	+ +	76		
Seospatial bug creation tracking - reproduction, assignment and resolution		4		16	80			1	101	+ +	116		
Analyze existing datasets' content, format, organization, integrity and routability												320	
Model waterborne datasets UML		8		4	0 8	8					64		
Model roadway datasets UML		8			4					40	52		
Model railway datasets UML		8			4				-	40	52		
Model Opensource transportation datasets UML		8			4					40	52		
Model aviation datasets UML		8			4					40	52		
Model Census datasets UML		8			4	24					36		
Model Administrative, populated places, and other stakeholder reporting area datasets UML		8			4						12		
Integrate dataset models		40	2	24	8					40 40	152	152	

30	Task 2 - Integration Strategy
31	Document results of Task 1 dataset view integration and evaluation
32	Identify case studies and develop data, functional and user requirements for Intermodal Transportation Model and Viewer
33	Validate need for Router 1, Router 2, Router 3, and Router 4
34	Specify the data, functional, and user requirements for Intermodal Transportation Model and Viewer
35	Design Intermodal Transportation Model – Data models
36	Design intermodal transportation infrastructure data model
37	Design routing network data model
38	Design agency freight movement statistics data model
39	Besign geographic context data model (Census, Admins, Risk zones)
40	Develop Data Model Intergration Plan
41	Router 1 Integration Plan
42	Identify transportation network datasets for integration within Router 1
43	Detail source to data model mappings and integration steps for Router 1
44	Develop test plan for Router 1
45	Router 2 Integration Plan
46	Identify transport carrier (vessel, container, car ?) movement datasets for integration with Router 2
47	Detail source to data model mappings and dataset integration steps for Router 2
48	Develop test plan for Router 2
49	Router 3 Integration Plan
50	Identify freight movement datasets for integration with Router 3
51	Detail source to data model mappings and dataset integration steps for Router 3
52	Develop test plan for Router 3
53	Router 4 Integration Plan
54	Identify community impact datasets for integration with Router 4
55	Detail source to data model mappings and dataset integration steps for Router 4
56	Develop test plan for Router 4
57	
58	Design Intermodal Transportion Model – Router V1
59	Design routing criteria options (all modes, > 1 modes, shortest/least-cost/quickest)
60	Design map GUI for viewing and analyzing routing network results
61	Design route description report
62	Develop data integration strategy for Router 1
63	Design Intermodal Transportation Model – Router V2
64	Design traffic measurement and congestion detection algorithm
65	Design feeding traffic and congestion for use by router to reroute for quickest/least-cost/
66	Design traffic and congestion summary map and report
67	Develop integration strategy for Router 2
68	Design Intermodal Transportation Model – Router V3
69	Uesign freight movement and conflation model
70	Design freight movement statistical summary map and report
71	Develop integration strategy for Router 3
72	Design Intermodal Transportation Model - Kouter V4
73	Design community impact model
74	Design community impact summary map and report Design community impact summary map and report
75	Design environmental vulnerability model Design environmental vulnerability model
76	Design environmental vulnerability summary map and report
11	Develop Integration strategy for Houter 4
78	Develop Intergration Strategy Report

5203 Systems and Infrastructure Lifecycle Management

Image: Constraint of the state interpretation of the state inte		A	С	D	E	F	G	н	1	J	к	L	N	0
1       10       1000000000000000000000000000000000000	1		Project Manager	UX-Designer	Database Dev.	Developer 1	Developer 2	Developer 3	Developer 4	Data Dev	Testing	Hours	Activity Hours	Task Hours
Non-control of a latis of view integration and evaluation         Non-control of a latis of view integration is integration in the integration in the integration is integration. In the integration is integration is integration in the integration is integration. In the integration is integration is integratenew is integration. In the integration is integrate	30	Task 2 - Integration Strategy												2,974
Image: Proceed and search for the search of the s	31	Document results of Task 1 dataset view integration and evaluation	16	3						40		56	56	-
9         Value regist fracts fra	32	Identify case studies and develop data, functional and user requirements for Intermodal Transportation Model and Viewer	32	2 80	1							112	112	
Image: Note: Index	33	Validate need for Bouter 1. Bouter 2. Bouter 3. and Bouter 4	4	4								8		
Desc         Desc <thdesc< th="">         Desc         Desc         <thd< td=""><td>34</td><td>Specify the data functional and user requirements for Intermodal Transportation Model and Viewer</td><td>32</td><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>72</td><td></td><td></td></thd<></thdesc<>	34	Specify the data functional and user requirements for Intermodal Transportation Model and Viewer	32	2								72		
Bit Degrammedial acquanced         Set of the	35	Decing Intermedial Transportation Model - Data mendels										12	480	
Distry submit yeak model         All         All         All         All         All         All           Distry submit yeak model         3         3         3         3         4         4         4         4           Distry submit yeak model         3         3         3         4         5         6 <td>36</td> <td>Design intermodal transportation infrastructure data model</td> <td>24</td> <td>1 24</td> <td>32</td> <td></td> <td></td> <td></td> <td>16</td> <td>40</td> <td>40</td> <td>176</td> <td></td> <td></td>	36	Design intermodal transportation infrastructure data model	24	1 24	32				16	40	40	176		
Image: appropring interment nuture data node!       32	37	Resign routing betwark data model	1 8	3 40					40	16	40	144		
Sing page part or even data and lights, Ahren, But 2004.         Sing page part or even data and lights, Ahren, But 2004.         Sing page part or even data and lights, Ahren, But 2004.         Sing page part or even data and lights, Ahren, But 2004.         Sing page part or even data and lights, Ahren, But 2004.         Sing page part or even data and lights, Ahren, But 2004.         Sing page part or even data and lights, Ahren, But 2004.         Sing page part or even data and lights, Ahren, But 2004.         Sing page part or even data and lights, Ahren, But 2004.         Sing page part or even data and lights, Ahren, But 2004.         Sing page part or even data and lights, Ahren, But 2004.         Sing page part or even data and lights, Ahren, But 2004.         Sing page part or even data and lights, Ahren, But 2004.         Sing page part or even data and lights, Ahren, But 2004.         Sing page part or even data and lights, Ahren, But 2004.         Sing page part or even data and lights, Ahren, But 2004.         Sing page part or even data and lights, Ahren, But 2004.         Sing page part or even data and lights, Ahren, But 2004.         Sing Page page part or even data and lights, Ahren, But 2004.         Sing Page page part or even data and lights, Ahren, But 2004.         Sing Page page part or even data and lights, Ahren, But 2004.         Sing Page page part or even data and lights, Ahren, But 2004.         Sing Page page page page page page page page p	38	Design agency freight movement statistics data model	32	24	32				24			112		
Decisity and Model integration Plan         Image: Plan Model integration Plan         Image: Plan Model integration Plan Model integratintegration Plan Model integration Plan Model integr	39	Design geographic context data model (Census Admins Bisk zones )	16	8 8					8	8	8	48		
Image: Intergration Plan         Image:	40	Develop Data Model Intergration Plan	1						-		-			
41       Usering insergences network distance for megation with Route 1       6 <t< td=""><td>41</td><td>Bouter 1 Integration Man</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>260</td><td></td></t<>	41	Bouter 1 Integration Man											260	
9       Detail source to data noted mapping and triggers in tr	42	Identify transmission network datasets for integration within Boyter 1	4	L	4					8	8	24	200	
Image: Develop set plane (Posted 1)       Posted 1	43	Petail source to data model mappings and integration states for Bouter 1	16	8 8	32				24	40	40	160		
House 2 integration Plan         Image: A find plan in	44	Developitest plan for Bouter 1	4	1 24					8	16	24	76		
Herryl stranger stratefores (ownare) to Whower (aw Tregation integro Tregation with Route 2         Image: Control of an order integration strate for the regation with Route 2         Image: Control of an order integration with Route 2         Image: Control of an order integration with Route 2         Image: Control of an order integration with Route 2         Image: Control of an order integration with Route 3         Image: Control of an order integration Route 3         Image: Control of an order integ	45	Bouter 2 Internation Plan								10		10	256	
Product of use model mapping and dataset rine gation vitep for Plouter 2         Part of a model mapping and dataset rine gation vitep for Plouter 3         Plant and the plot is pl	46	Identify transport partier (vesse) container, car ?) movement datasets for integration with Bouter ?	4	L	4		4			8	8	28	200	
Beneforter plant of Power 2         Image and the program of Power 2         Image and the program of Power 3         Image and the prower 3	47	Detail source to data model mappings and dataset integration steps for Bouter 2	16	8 8	32				24	40	40	160		
Hours 3 Integration Plan         Image: Second	48	Developitest plan for Bouter 2	4	16					8	16	24	68		
90       Hendly height negation with Rours?       4       4       6       8       8       8         91       Dead source data and for Rours?       6       8       32       2       4       40       60         92       Dead source data and for Rours?       6       8       32       2       5       2       5	49	Bouter 3 Integration Plan	1						-				244	
9       Detail souces 1 data model mapping and data set integration steps for Pouter 3       0	50	Identify freight movement datasets for integration with Bouter 3	4	1	4					8	8	24		
Sevelop text plant of Roure 3         Sevelop text plant of Roure 4         Se	51	Detail source to data model mappings and dataset integration steps for Router 3	16	6 8	32				24	40	40	160		
50         Bouter 4 integration Plan         6         6         6         6         6         6         6         6         6         6         7           50         Detail source to data model magning and dataset integration steps for Pouter 4         6         32         6         24         40         40         76           1         Detail source to data model magning and dataset integration steps for Pouter 4         6         2         80         24         60         24         60         24         60         24         60         24         60         24         60         24         60         24         60         24         60         24         60         24         60         24         60         24         60         24         60         24         60         24         60         24 <td>52</td> <td>Develop test plan for Router 3</td> <td>4</td> <td>16</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>16</td> <td>24</td> <td>60</td> <td></td> <td></td>	52	Develop test plan for Router 3	4	16						16	24	60		
1       Identify community impact datasets in gration with Pouter 4       4       6       6       4       4       38         0       Develop test plant of Pouter 4       6       8       22       6       6       62       6       6       62       6       6       62       6	53	Router 4 Integration Plan											256	
Detail source to data incident mapping and dataset integration steps for Pouter 4       16       8       32       1       24       40       40       160         Detail source to data incident mapping and dataset integration steps for Pouter 4       1	54	Identify community impact datasets for integration with Router 4	4	L .			16		8	4	4	36		
96       Develop test plant for Bouter 4       16 <td>55</td> <td>Detail source to data model mappings and dataset integration steps for Router 4</td> <td>16</td> <td>6 8</td> <td>32</td> <td></td> <td></td> <td></td> <td>24</td> <td>40</td> <td>40</td> <td>160</td> <td></td> <td></td>	55	Detail source to data model mappings and dataset integration steps for Router 4	16	6 8	32				24	40	40	160		
Product Transportion Model – Router V1         Control	56	Develop test plan for Router 4	4	l 16	i					16	24	60		
Beign Internotal Transportion Model – Router V1         Cell of the set of the	57		1											
98       Beign routing online (all modes, ) Innodes, shortexilleart-conflucidescl.)       16       8       16       58         1       Design routing online (all modes, ) Innodes, shortexilleart-conflucidescl.)       8       40       16       8       58         1       Design routing online (all modes, ) Innodes, shortexilleart-conflucidescl.)       4       24       16       16       58         1       Develop data integration stategy (or Router 1       16       8       24       16       16       76         1       Develop data integration stategy (or Router 1       16       24       40       40       60       20         1       Design traffic measurement and congestion devolution algorithm       16       24       40       40       60       20         1       Design traffic and congestion strutegy (or Router 1       16       8       24       40 <td>58</td> <td>Design Intermodal Transportion Model – Router V1</td> <td></td> <td>210</td> <td></td>	58	Design Intermodal Transportion Model – Router V1											210	
0       Design map CUI for viewing and analyzing routing network results       4       4       6       6       6       6       6       6       6       6       6       6       6       6       7       7         0       Design route description report       4       6       24       6       6       7       7       7         0       Design intermodal Transportation Model - Router V2       6       6       7 <t< td=""><td>59</td><td>Design routing criteria options (all modes. &gt; 1 modes. shortest/least-cost/quickest)</td><td>2</td><td>2 16</td><td></td><td></td><td></td><td></td><td>16</td><td>8</td><td>16</td><td>58</td><td></td><td></td></t<>	59	Design routing criteria options (all modes. > 1 modes. shortest/least-cost/quickest)	2	2 16					16	8	16	58		
1       Design nume description regord       4       24       1       6       7         Develop data integration strategy for Router 1       0       1       6       7       7         Design numer description regord       1       1       1       1       1       508         Design numer description regord       1       1       1       1       1       508         Design numer description regord       1       1       1       1       508       1       508         Design numer description regord       16       24       40       40       60       200       1       508         Design redenigratific and congestion description regord       16       24       40       40       60       200       1	60	Design map GUI for viewing and analyzing routing network results	1 8	3 40	1							48		
Besign Intermodal Transportation Model + Router 1         Image: Constraint of transportation Model + Router 1/2         Image: Constraint of transportration Model + Router 1/2         Image: Cons	61	Design route description report	4	1 24								28		
Besign Intermedal Transportation Model - Router V2       Image: Control of the Section algorithm       Image: Control of the Se	62	Develop data integration strategy for Router 1	4	I в	24				16	8	16	76		
1       Design traffic one conjection summary map and report       16       24       40       40       80       200         16       Design reding traffic and congestion for use by router to recorde for quickest/least-cost/       16       24       40       40       80       200         16       Design reding traffic and congestion strategy for Router 2       16       24       40       <	63	Design Intermodal Transportation Model – Router V2											508	
66       Design feeding traffic and congestion for use by router to reroute for quickest/least-cost/       16       24       40       40       80       20         66       Design feeding traffic and congestion for use by router to reroute for quickest/least-cost/       8       32       6       6       8       40         67       Develop integration strategy for Router 2       4       8       24       6       8       8       6         68       Design feight movement and conflation model       A       8       24       6       6       8       29       6       6       8       29       6       6       8       29       7       29       29       29       29       29       29       29       29       29       29       29       29       29       29       29       29       29       29       20 <td>64</td> <td>Design traffic measurement and congestion detection algorithm</td> <td>16</td> <td>6 24</td> <td></td> <td>40</td> <td>40</td> <td></td> <td>80</td> <td></td> <td></td> <td>200</td> <td></td> <td></td>	64	Design traffic measurement and congestion detection algorithm	16	6 24		40	40		80			200		
	65	Design feeding traffic and congestion for use by router to reroute for quickest/least-cost/	16	3 24		40	40		80			200		
67       Develop integration strategy for Router 2       16       8       8       68         68       Design Intermodal Transportation Model – Router V3       68       68       68       68       68       68         69       Design freight movement and conflation model       16       8       40       40       60       68       292         69       Design freight movement statistical summary map and report       8       32       60	66	Design traffic and congestion summary map and report	8	32	:							40		
Design Intermodal Transportation Model - Router V3       Image: Contract of the contra	67	Develop integration strategy for Router 2	4	1 8	24				16	8	8	68		
Besign freight movement and conflation model       16       8       40       40       80       184         Design freight movement statistical summary map and report       8       32       6       6       40         Develop integration strategy for Router 3       64       8       24       6       6       8       8       8         Design Intermodal Transportation Model - Router V4       6	68	Design Intermodal Transportation Model – Router V3	1										292	
70       Design freight movement statistical summary map and report       6       32       0       0       0       40         71       Develop integration strategy for Router 3       0	69	Design freight movement and conflation model	16	6 8		40	40		80			184		
1Develop integration strategy for Router 316886872Design Intermodal Transportation Model - Router V420073Design community impact model20074Design community impact summary map and report1674Design community impact summary map and report1616	70	Design freight movement statistical summary map and report	8	32 32								40		
Pesign Intermodal Transportation Model - Router V4       Image: Community impact model       Image: Communi	71	Develop integration strategy for Router 3	4	1 8	24				16	8	8	68		
73       Design community impact model       16       1       1       16       1       16         74       Design community impact summary map and report       16       1       1       16 </td <td>72</td> <td>Design Intermodal Transportation Model – Router V4</td> <td></td> <td>260</td> <td></td>	72	Design Intermodal Transportation Model – Router V4											260	
74       Design community impact summary map and report       16       1       16       16       16         75       Design environmental vulnerability model       8       8       40       40       24       120         76       Design environmental vulnerability summary map and report       68       32       1       1       120         76       Design environmental vulnerability summary map and report       68       32       1       1       10       10         76       Develop integration Strategy for Router 4       64       24       1       10 </td <td>73</td> <td>Design community impact model</td> <td>16</td> <td>6</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>16</td> <td></td> <td></td>	73	Design community impact model	16	6								16		
75       Design environmental vulnerability model       6       6       40       40       24       120         76       Design environmental vulnerability summary map and report       8       32       0       0       40       40         77       Develop integration strategy for Router 4       8       24       0       16       8       68         78       Develop Integration Strategy Report       40       0       0       40       40       40	74	Design community impact summary map and report	16	6								16		
76       Design environmental vulnerability summary map and report       8       32       9       9       40         77       Develop integration strategy for Router 4       8       24       16       8       8       68         78       Develop Integration Strategy Report       40       60       60       40       40       40       40	75	Design environmental vulnerability model	8	8 8		40	40		24			120		
77     Develop integration strategy for Bouter 4     8     24     16     8     8       78     Develop Integration Strategy Report     40     0     0     0     16     8     8     68	76	Design environmental vulnerability summary map and report	8	32								40		
78         Develop Intergration Strategy Report         40         40         40         40         40	77	Develop integration strategy for Router 4	4	3 4	24				16	8	8	68		
	78	Develop Intergration Strategy Report	40	)								40	40	

Task 3 - Intermodal Transportation Model

# WBS and labor est

	Setup N-Tier Geospatial Application System Development Environment
	Develop Intermodal Transportation Model - Routing Pouter 1 - Basia
	Implement freight router 1 for basic routing test equiropment
	Implement Router 1 geodetabase data model and integrate data
/RS and	Eind and fix intermedal network connection gans
I D J AI U	Test and improve intermodal network connections using router 1
	Implement intramode and intermodal freight movement integrity rules in router 1
hor actimato	Test and improve freight movement integrity rules in router 1
	rescand improve neight movement integrity rules in router i
	Router 2 – Traffic and Congestion
	Evolve Router 1 to Router 2 for traffic and congestion test environment
	Implement Router 2 geodatabase data model changes and integrate additional data
	Find and fix routing and traffic and congestion modeling errors
	Test and improve intermodal routing of transport movements (no freight)
	Router 3 – Traffic and Congestion and Freight Movement
	Evolve Router 2 to Router 3 for freight movement test environment
	Implement Router 3 geodatabase data model changes and integrate additional data
	Find and fix routing, traffic and congestion modeling, and freight movement modeling
	Test and improve intermodal routing of freight movements (no freight)
	Bouter 4 - Traffic and Congestion, Freight Movement, and Community Impact and Environmental Vulnerablity
	Evolue Bouter 3 to Bouter 4 for community impact and environmental uniperability test environment
	Implement Bouter 4 geodatabase data model changes and integrate additional data
	Eind and fix routing, traffic and congestion, freight movement and community impact and environmental vulnerability modeling.
	Test and improve intermodal routing of freight movements (no freight)
	Publishing Tool
	Data Generalization Processing Determine exitemation is generalization requirements for Intermedial Intermedial Transportation Medial and Vieualization Teal
	Implement generalization processing of intermedial transportation potwork for multiceale map displays in AraCIS ModelBuilder
	Remove pop-routing intermodal transportation petwork infrastructure feature classes and attributes for biob-performance routing
	Data reformatting and organizing for production (create file geodatabases) and target production databases
	Data Copuing
F202 Systems and Infrastructure Life such Ma	Nevelop Intermodal Transportation Model Documentation
5205 Systems and minastructure Lifecycle Ma	Prepare and Package Intermodal Transportation Model for delivery

Image: Problem in the state of the state		A	С	D	E	F	G	н	1	J	К	L	N	0
2)       12-iteration State yrange on any late on	1		Project Manager	UX-Designer	Database Dev.	Developer 1	Developer 2	Developer 3	Developer 4	Data Dev	Testing	Hours	Activity Hours	Task Hours
Image: Non-serie of a f a f data set we not gradeware in hore model analysis of hore and each of the serie of th	30	Task 2 - Integration Strategy												2,97
Image: Note: and studies and decelop data, handware requises for handware intermed intermedial transportation Model and Veve         S	31	Document results of Task 1 dataset view integration and evaluation	16	6						40		56	56	
9     Value result Roots     Notes' About Programmer's Descriptions's Descri	32	Identify case studies and develop data, functional and user requirements for Intermodal Transportation Model and Viewer	32	2 80	1							112	112	
1         Second data inducation synchronic bine band inducations by data of bindow inducations by data of bine band inducations by d	33	Validate need for Router 1. Router 2. Router 3. and Router 4	4	4								8		
Disk         Desc         Desc <thdesc< th="">         Desc         Desc         <thd< td=""><td>34</td><td>Specify the data functional and user requirements for Intermodal Transportation Model and Viewer</td><td>32</td><td>2 4r</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>72</td><td></td><td></td></thd<></thdesc<>	34	Specify the data functional and user requirements for Intermodal Transportation Model and Viewer	32	2 4r								72		
Image: The proceed at a node in some of the node in the proceed at a node in the proceed at node in the proceed at a node in the proceed at node in	35	Design Intermodal Transportation Model - Data models			, 								480	
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Image:         Image:<	37	Design routing network data model	8	3 40	1				40	16	40	144		
Image program control lands, Abria, Rate, Call, Lands         Rate (Integration) Plan         Rate (Integratin) Plan         Rate (Integration) Plan <td>38</td> <td>Design agency freight movement statistics data model</td> <td>32</td> <td>2 24</td> <td>32</td> <td></td> <td></td> <td></td> <td>24</td> <td></td> <td></td> <td>112</td> <td></td> <td></td>	38	Design agency freight movement statistics data model	32	2 24	32				24			112		
Proceed plans Model long atom Plan	39	Design geographic context data model (Census, Admins, Bisk zones)	16	8 8					8	8	8	48		
Image:         Image:<	40	Develop Data Model Intergration Plan												
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9       Detail source is data nodel negrong and negro (Photer 1)       10       24       00       00       10	42	Identify transportation network datasets for integration within Bouter 1	4	L I	4					8	8	24		
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House 2 integration Plan         House 2	44	Develop test plan for Router 1	4	1 24					8	16	24	76		
Herry is nampor any disease intergence, containe, core "inverse data asset intergence and asset intergen	45	Bouter 2 Integration Plan								10		10	256	
10       Development of an advert of renge sion velop for flower 2       0 </td <td>46</td> <td>Identify transport carrier (vesse), container, car?) movement datasets for integration with Bouter 2</td> <td>4</td> <td>L I</td> <td>4</td> <td></td> <td>4</td> <td></td> <td></td> <td>8</td> <td>8</td> <td>28</td> <td></td> <td></td>	46	Identify transport carrier (vesse), container, car?) movement datasets for integration with Bouter 2	4	L I	4		4			8	8	28		
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Mater 3 Integration Plane       Mater 3 Integration Plane       Mater 4       Mater 3 Integration Plane       Mater 4       Mater	48	Develop test plan for Bouter 2	4	16					8	16	24	68		
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20       Develop text plan (Ploures 3       - <t< td=""><td>51</td><td>Detail source to data model mappings and dataset integration steps for Router 3</td><td>16</td><td>6 8</td><td>32</td><td></td><td></td><td></td><td>24</td><td>40</td><td>40</td><td>160</td><td></td><td></td></t<>	51	Detail source to data model mappings and dataset integration steps for Router 3	16	6 8	32				24	40	40	160		
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17         Image: Control and any price of the appoint of the ap	56	Develop test plan for Router 4	4	l 16	;					16	24	60		
Besign Internedal Transportion Model – Router V1         Cell of the set of th	57													
98       Design nouting onterial and etc. > I modes, shorterile arc cost/quickes)       2       16       0       16       8       16       58         98       Design nouting ontering and analyzing to uting network results       8       40       0       0       68       0       68       0       68       0       68       0       68       0       68       0       68       0       68       0       68       0       68       0       68       0       68       0       68       0       68       0       68       0       68       0       68       0       68       0	58	Design Intermodal Transportion Model – Router V1											210	
Design map CUI for viewing and analyting routing network results                4                 5	59	Besign routing criteria options (all modes. > 1 modes. shortest/least-cost/guickest)	2	2 16	i				16	8	16	58		
1       Design numer description regort       4       24       0       16       28         1       Develop data integration strategy for Router 1       16       8       16       76         1       Design numer and congestion strategy for Router 1       16       8       28       16       76         1       Design numer and congestion detection algorithm       16       24       40       40       80       200         1       Design redmigratific measurement and congestion detection algorithm       16       24       40       40       80       200         1       Design redmigratific measurement and congestion summary map and report       16       24       40       40       80       200         1       Design redmigratific measurement and congestion summary map and report       16       8       80       200       200         1       Design redmigratific measurement and congestion measurement and congestion summary map and report       16       8       80       200       200         1       Design redign transportation Model - Router V3       16       8       40       40       80       80       200         1       Design redign transportation Model - Router V4       16       8       80       200	60	Design map GUI for viewing and analyzing routing network results	1 8	3 40	1							48		
Besign Intermedal Transportation Model Router 12         Image: Construct	61	Design route description report	4	24								28		
Design Intermedal Transportation Model - Router V2         Image: Control of the Spring Products of an approximation Products of an approximation Products of an approximation Products of an approximation Products of an approximate Product Product Product Product Product Product Product Products of an approximate Product Produ	62	Develop data integration strategy for Router 1	4	1 8	24				16	8	16	76		
4       Design traffic measurement and congestion detection algorithm       16       24       40       40       80       200         68       Design fradit concogestion summary map and report       16       24       40       40       80       200         67       Design fradit concogestion summary map and report       8       32       16       8	63	Design Intermodal Transportation Model - Router V2											508	
Image: Segen Leading traffic and congestion for use by router to reroute for quickest/least-cost/       16       24       40	64	Design traffic measurement and congestion detection algorithm	16	6 24	+	40	40		80			200		
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67       Develop integration strategy for Router 2       16       8       8       68         68       Design Intermodal Transportation Model – Router V3       68       68       69       69       16       8       24       16       8       8       68       292         69       Design freight movement and conflation model       16       8       40       40       80       18       292         69       Design freight movement statistical summary map and report       8       32       0       80       18       293         71       Develop integration strategy for Router 3       9       4       8       24       0       16       8       8       68         72       Design Intermodal Transportation Model – Router V4       8       24       0       16       8       8       68         73       Design community impact model       16       6       6       6       6       6         74       Design environmental wulnerability model       16       6       6       6       6       6         75       Design environmental wulnerability summary map and report       6       6       2       6       6       6       6         76	66	Design traffic and congestion summary map and report	8	32	2							40		
Design Internodal Transportation Model - Router V3       Image: Constraint of conflation model       Image: Constraint of constrate constraint of constraint of constraint of co	67	Develop integration strategy for Router 2	4	н – E	24				16	8	8	68		
Besign freight movement and conflation model       16       8       40       40       80       184         Design freight movement statistical summary map and report       8       32       6       6       40       40       6       40       40       6 <t< td=""><td>68</td><td>Design Intermodal Transportation Model – Router V3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>292</td><td></td></t<>	68	Design Intermodal Transportation Model – Router V3											292	
1       Design freight movement statistical summary map and report       0 </td <td>69</td> <td>Design freight movement and conflation model</td> <td>16</td> <td>6 8</td> <td>}</td> <td>40</td> <td>40</td> <td></td> <td>80</td> <td></td> <td></td> <td>184</td> <td></td> <td></td>	69	Design freight movement and conflation model	16	6 8	}	40	40		80			184		
1Develop integration strategy for Router 3188682Design Intermodal Transportation Model - Router V426073Design community impact model16	70	Design freight movement statistical summary map and report	8	32	2							40		
Design Intermodal Transportation Model - Router V4       Control       Contro       Control       Control	71	Develop integration strategy for Router 3	4	ι ε	24				16	8	8	68		
73       Design community impact model       16       1       1       16	72	Design Intermodal Transportation Model – Router V4											260	
74       Design community impact summary map and report       16       1       16       16       16         75       Design environmental vulnerability model       0       0       0       120       120         76       Design environmental vulnerability summary map and report       0       32       0       0       0       0       40       40         76       Develop integration Strategy for Router 4       0	73	Design community impact model	16	3								16		
75       Design environmental vulnerability model       8       8       40       40       24       120         76       Design environmental vulnerability summary map and report       8       32       0       0       40       40         77       Develop integration Strategy For Nouter 4       8       24       0       16       8       68         78       Develop Integration Strategy Report       40       0       0       40       40       40	74	Design community impact summary map and report	16	6								16		
Design environmental vulnerability summary map and report       8       32       9       9       40         Develop integration strategy Report       40       8       32       9       9       16       8       8       68         Memory map and report       40       9       9       16       8       68       40	75	Design environmental vulnerability model	8	8 8	)	40	40		24			120		
77     Develop integration strategy for Bouter 4     8     24     16     8     8       78     Develop Integration Strategy Report     40     0     0     0     40     40	76	Design environmental vulnerability summary map and report	8	3 32	2							40		
Develop Intergration Strategy Report         40         0         40         40         40         40	77	Develop integration strategy for Router 4	4	1 8	24				16	8	8	68		
	78	Develop Intergration Strategy Report	40	)								40	40	

Task 4 - Intermodal Visualization Tool

Develop User Experience (UX) Design Specification based on case requirements

Evolve geospatial application system development environment to support web application development

Develop and test Intermodal Visualization Tool

Prototype 1 development, testing and bug fixing

Prototype 2 development, testing and bug fixing

Prototype 3 develoment, testing and bug fixing

**Develop Intermodal Visualization Tool Documentation** 

Prepare and package Intermodal Visualization Tool for delivery

- 4	A	U U	U	E .	F	a			0	N N	L	N	0
1		Project Manager	UX-Designer	Database Dev.	Developer 1	Developer 2	Developer 3	Developer 4	Data Dev	Testing	Hours	Activity Hours	Task Hours
121	Task 4 - Intermodal Visualization Tool												1,496
122	Develop User Experience (UX) Design Specification based on case requirements	24	80								104	104	
123	Evolve geospatial application system development environment to support web application development		32	32	32		32	32			160	160	
124	Develop and test Intermodal Visualization Tool						120				120	1,032	
125	Prototype 1 development, testing and bug fixing	8	40			16	120	120			304		
126	Prototype 2 development, testing and bug fixing	8	40			16	120	120			304		
127	Prototype 3 develoment, testing and bug fixing	8	40			16	120	120			304		
128	Develop Intermodal Visualization Tool Documentation		40								40	40	
129	Prepare and package Intermodal Visualization Tool for delivery		40	40			40	40			160	160	

Task 4 - Intermodal Visualization Tool
Develop User Experience (UX) Design Specification based on case requirements
Evolve geospatial application system development environment to support web application development
Develop and test Intermodal Visualization Tool
Prototype 1 development, testing and bug fixing
Prototype 2 development, testing and bug fixing
Prototype 3 develoment, testing and bug fixing
Develop Intermodal Visualization Tool Documentation
Prepare and package Intermodal Visualization Tool for delivery

# IT Auditor should evaluate the WBS and check validity of labor and cost estimates

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ask 2 - Integration Strategy Report Document results of Task 1 dataset view intervation and evaluation		16									2,3/4
			-								
Identify case studies and develop data, functional and user requirements for Intermodal Transportation Model and Viewer		32 80	0	-					112	111	4
Specify the data, functional, and user requirements for Intermodal Transportation Model and Viewer		32 4	40	+							
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Design Intermodal Transportation Model - Data models								-	176	400	1
Design routing network data model		1 4	30	1			40 10	40	144		
Design agency freight movement statistics data model		32 20	14 3	a			24		112		
Design geographic context data model (Census, Admins, Risk zones)		16 1	-	+					- 48		1 1
Develop Data Model Intergration Plan				-							1
Router 1 Integration Plan				-						250	4
Identity transportation network datasets for integration within Router 1 Detail source to data model mappings and integration stress for Router 1	_	4		4			26 **	1 1	24		+
Develop test plan for Router 1		4 3	14	1			8 11	1 24	76		
Router 2 Integration Plan								_		254	4
Identify transport carrier (vessel, container, car 7) movement datasets for integration with Router 2 Data1 severe to data model mannings and dataset integration stars for Bouter 2		4		4			34 44	1	28	-	
Develop test plan for Router 2		4 1	16 3	1			8 10	8 24	100		
Router 3 Integration Plan										24	4
Identify freight reavement datasets for integration with Router 3 Datal second to data model monoism and dataset integration states for Buster 3		4		4			8	1 8	24	-	
Develop test plan for Router 3	_	4 1	16	1			40	6 24	60	-	
Router 4 Integration Plan										254	4
Identify community impact datasets for integration with Router 4		4			16		1 4	4	36		
Develop text plan for Router 4	-	4 1	15	1	-		40	a 40 24	100	-	
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Design Intermodal Transportion Model - Router VI										210	1
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Design route description report		4 24	14						28		
Develop data integration strategy for Router 1	_	4	8 2	4			35 8	16	76		-
Design Intermodal Transportation Model - Router V2		-		-			-	-	-	50	4
Design traffic measurement and congestion detection algorithm		16 21	14	40	40		80		200		1
Design feeding traffic and congestion for use by router to reroute for quickest/least cost/		16 24	14	40	40		80		200		
Design trans and congritten summary map and report Develop internation strategy for Bouter 2		4	8 2	24			16 1				
Design Intermodal Transportation Model - Router V3			-	-						293	4
Design freight mevement statistical summary map and report		10 1	12				~		40		
Develop integration strategy for Router 3		4 /	8 2	54			20 8	5 8	68		
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Design community impact summary map and report		16							16		
Design environmental vulnerability model Design environmental vulnerability model	_		8	40	40		24		120		
Develop integration strategy for Router 4		4 7	8 2	64			25 8	8 8	68		
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Develop Intergration Strategy Report	_	40			_				40	- 40	4
ask 3 - Intermodal Transportation Model - ArcGIS Desiston ArcGIS for Server Oracle		-	-				_		-		4 244
Setup N-Tier Geospatial Application System Development Environment		4	10 6	10 21	24		40		168	16	4
	_			-							
Router 1 - Basic	_			-			-		_		á 👘
Implement freight nutter 1 for basic routing test environment		40					40		80		
Implement Router 1 geodatabase data model and integrate data		4 40	40	-			10		124		
Test and improve intermodul network connections using router 1	-	4 14	d	+	-		80 83	80	204		
Implement intramode and intermodul freight movement integrity rules in router 1		4 16	40		16		40		116		
Test and improve freight movement integrity rules in router 1	_	4 16	+	+	-		40 40	40	140		
Router 2 - Traffic and Congestion		-	-	-			-	-	-	26	4
Evolve Router 1 to Router 2 for traffic and congestion test environment		8 40	-		40	5	20		208		
Implement Router 2 geodatabase data model changes and integrate additional data End and factor tips and traffic and conserving modeling arrows		40		-	24		80 40		104		
Test and improve intermodal routing of transport movements (no freight)	_	4 16	1	+	40		40 45	43	156	_	
Router 3 - Traffic and Corgention and Freight Movement Darke Router 3 to Enviro 1 to Enviro 1 for Environment I test environment			40	-			120	-	200	800	1
Implement Router 3 geodatabase data model changes and integrate additional data	_	- 4	40 N	10	40		40	+ +	176		
Find and fix routing, traffic and congestion modeling, and freight movement modeling		4 1	15 4	0	40		80 80	2 80	340		
test and improve intermodul routing of freight movements (no freight)	_	4 1		+	56		40 40	40	156		-
Router 4 - Traffic and Congestion, Freight Movement, and Community Impact and Environmental Vulnerability		-		-			-		_	25	4
Evolve Router 3 to Router 4 for community impact and environmental vulnerability test environment		8 40	s0				80	_	128		
Imprement nouter 4 geocatabase data model changes and integrate additional data End and fix routing stuffic and consection fixedst movement and community impact and anyiocomercity for the first			16	40			100 40	0 00	200		
Test and improve intermodal routing of freight, movements (no freight)		8 1	16	24			40 40	3 40	144		
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Publishing Tool			-	-						343	1
Determine cartographic generalization requirements for intermodal Intermodal Transportation Model and Visualization Tool	_	4 3	12	+			32	-	68		
Implement generalization processing of intermodal transportation network for multiscale map displays in AroSIS ModelBuilder		2	-				40 80	2	122		
Remove non-routing intermodal transportation network infrastructure feature classes and attributes for high-performance routing	_		4					+ - 7	16		
Data Cooving and organizing for production (create the geodatabases) and target production databases	_	32	12	-			8 14	++	204		
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Develop Intermodal Transportation Model Documentation		8 40	16				16 40	40	160	16/	2
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require and rackage intermotation categorization Model for delivery to USACE	_	-	-	-	-		-	-	_		1.496
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	Project Manager	UX-Designer	Database Dev.	Developer 1	Developer 2	Developer 3	Developer 4	Data Dev	Testing	Hours	Task %	Activity Hours	Task Hours					
Total Hours:	734	1,812	876	528	532	552	2,544	1,300	1,204	10,082		9,998	9,998					
	Cost																	
										10,078				0.84%				
														84				
										Activity Hours and Task Hours have lost 84 hours somewhere?								

# Critical Path Analysis

An algorithm for scheduling a set of project activities

- Used with Program Evaluation and Review Technique (PERT) network diagram
- Determines
  - 1. Critical path by identifying and measuring the time required to complete the longest path of dependent activities (i.e. tasks) from start to finish
  - 2. Earliest and latest that each task can start and finish without making the project longer
    - Slack time is the amount of time a task can be delayed without making the project longer
      - Critical path has 0 slack



Critical Path Exercise



#### What is the critical path? What is the slack time?

#### Calculate Expected Time Duration of Activities (Tasks)





**PERT Time Estimate =** 

6

Projects are planned and managed in the context of 3 constraints: Scope, Schedule and Budget

- Project Managers can trade among these 3 constraints
- Changes in one constraint necessitate changes in others or quality will suffer



Project planning and management accomplished in context of 3 constraints:

Scope, Schedule and Budget



**Scope** involves getting information required to start a project, and the features the product would have that would meet its stakeholders requirements

- **Project Scope:** "The work that needs to be accomplished to deliver a product, service, or result with the specified features and functions"
- **Product Scope:** "The features and functions that characterize a product, service, or result."

Scope Risks: If requirements are not completely defined and described and if there is no effective change control in a project, scope creep or requirements creep may result

A Guide to the Project Management Body of Knowledge (PMBOK Guide) - Fourth Edition. Project Management Institute, 2008. ISBN 978-1-933890-51-7

Project planning and management accomplished in context of 3 constraints: Scope, Schedule and Budget



#### Schedule Risks:

- Tasks which are exceptionally complicated
- Tasks with durations longer than two weeks
- Tasks on the critical path
- Tasks which have several predecessors or dependencies
- Tasks that have minimal slack
- Optimistically estimated tasks
- Tasks reliant on external resources
- Start-to-Start and Finish-to-Finish dependencies
- Dependencies with lags
- Major milestones
- Unforeseen issues (e.g., sicknesses, relocations, reorganizations)
- Unstated assumptions

Project planning and management accomplished in context of 3 constraints: Scope, Schedule and Budget



#### **Budget Risks:**

Under-budgeted or unbudgeted

- Development tasks
- Testing and bug fixing tasks
- Documentation tasks
- Hardware, software, other equipment, or datasets
- Meetings
- Training of clients

Project planning and management accomplished in context of 3 constraints: Scope, Schedule and Budget



#### **Resource Risks:**

- Tasks with one key individual assigned
- Tasks using scarce resources
- Tasks which are mismatched with the people assigned
- Tasks which require large amounts of resources
- Availability of tools and/or techniques
- Tasks which rely on sub-consultants or third party vendors for their completion
- Tasks which rely on resources within another organizational division or group for their completion

Project planning and management accomplished in context of 3 constraints: Scope, Schedule and Budget



#### **Preventative Tasks to Mitigate Risk**

- Schedule high risk tasks earlier in the development cycle
- Shift more experienced people to tasks
- Add prototyping tasks to prove concepts
- Add review tasks
- Change the approach to eliminate high risk tasks
- Add resources to tasks for cross-training, if budget can support it
- Establish independent parallel efforts
- Reduce project scope
- Design in redundancy

#### Agenda

✓ Homework Question 3

✓ Project management knowledge areas

✓ Project roles

- ✓ Project manager's role
- ✓ Project planning
- ✓ Work breakdown structure, tasks, cost and labor estimates
- ✓ Critical path analysis
- ✓ Project management triangle
- Quiz

#### What is MOST important to consider as part of planning an IT project?

- a) Deliverables and functionality
- b) Timeline
- c) Costs for labor, hardware and software
- d) All of the above

Who is responsible for providing direction to the team and ensuring project is completed on-time, on-budget, am meets business needs?

- a) Executive sponsor
- b) User management
- c) Steering committee
- d) Project Manager

The quality assurance (QA) manager on a \$10 million ERP migration project for PetNow pet supply company reports to the Project Manager (PM). The PM believes this will expedite the delivery of the project using the agile SDLC methodology.

What should the Internal Auditor, who recently joined the project team, do?

- a) Nothing, as it makes sense to expedite project delivery
- b) Demand changes to the project team right away, as the project is likely to fail
- c) Understand the project's goal, current state of the project, and then advise Steering Committee to possibly make changes so the QA manager is independent from both the PM and user manager
- d) Wait for a problem to surface before making the case for a change

Which of the following would BEST help to prioritize project activities and determine the timeline for a project?

- a) Gantt chart
- b) Earned value analysis (EVA)
- c) Program evaluation review technique (PERT)
- d) Function point analysis (FPA)

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