01/14: **Risks and Prototypes**

The Capstone Experience

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Risks and Prototypes

- Risks

- Prototypes
Identifying Risks

• What You Don’t
  ▪ Know
  ▪ Understand
  ▪ Know How to Do

• Normally
  ▪ Major Project Features
  ▪ “Showstoppers”

• Varies From
  ▪ Not Familiar With But (Probably) Can Learn to
  ▪ Absolutely No Idea How to Do It

What are you worried about?
What should you be worried about?
Example Risks

Including but not limited to...
- Key Application Features
- Hardware Systems
- Software Systems
- Development / Programming Environments
- Programming Languages
- Etc...
Prioritizing Risks

• Classify Difficulty
  ▪ High       Very Hard, No Idea How to Do
  ▪ Medium
  ▪ Low        Not Hard, Probably Doable

• Classify Importance
  ▪ High       Showstopper, Must Have
  ▪ Medium
  ▪ Low        Not Vital, Nice to Have
Prioritizing Risks

The Capstone Experience
Risks and Prototypes
Case Studies: Basketball Apps

• Play Effectiveness
  ▪ Determine Effectiveness of Plays
  ▪ Record All Plays with Results
  ▪ Produce Reports of Effectiveness

• Player Timer
  ▪ Keep Track of Player Times
  ▪ Record Minutes Played and Rested
  ▪ On the Bench, During the Game
Basketball Apps Architectures

Play Effectiveness Application
  Visual Basic
  Access
  Windows XP Desktop

Player Timer Application
  Visual Basic
  MS Access
  Windows XP HP Tablet PC

Basketball already had all three of these components.

I had some of these.
Basketball Apps Risks

• What SDK should I use?
• How do I program in Visual Basic?
• How do I make a GUI in VB?
• How do I interface VB with Access?
  ▪ Create/Open/Save a Database?
  ▪ Read/Write Records?
  ▪ Traverse Records?
• How do I do clocks in Windows?
  ▪ Game Clock?
  ▪ Wall Clock?

How would you classify these risks?
Mitigating Risks

• Use Existing Resources
  ▪ Including But Not Limited To
    o Product Demos
    o Book Sample Code
    o downloadable Examples
    o Wizards
    o Etc...
  ▪ Test Drive
    o Install
    o Compile
    o Extend
    o Etc...

• Build Prototypes
  ▪ Single Purpose
  ▪ Quick-and-Dirty

Nota Bene:
1. Check license if including in project.
3. Inform client.
Basketball Apps Risk Mitigation

• Game Clock
  ▪ Start /Stop
  ▪ Counts Down
  ▪ By Minutes:Seconds

• Handling Access Records
  ▪ Write Number
  ▪ Read Number
  ▪ Add Up Numbers

The Capstone Experience

Risks and Prototypes
Your Risks?

• Team Auto-Owners
• Team Boeing
• Team Dow
• Team EA
• Team GM
• Team Meijer
• Team Mozilla
• Team MSUFCU
• Team Spectrum Health
• Team TechSmith
• Team Urban Science
• Team Whirlpool

What are your risks?
Former Capstone Teams
• Men’s Basketball
• Ford
Risks and Prototypes

✔ Risks

➢ Prototypes
Prototypes

• Developed
  ▪ Early
  ▪ Rapidly
• Implement Subset of the Requirements
• Done for Variety of Reasons
• Are Not Finished Goods
• “Hacking” (Good Sense)
Why? Answer Questions

Help Determine...

• Specifications
  ▪ Functional
  ▪ Design
  ▪ Technical

• Usability

• How Existing Code Works

• Programming Languages

• Development Environments

• Operating Environments

• What to Panic About

• Etc...
Why? Determine Schedule

Determine how long it will take to...
• ...learn the new programming language.
• ...learn the development environment.
• ...learn the existing code.
• ...convert the existing code.
• ...convert the existing database.
• ...get libraries working.
• ...deploy the application.
• Etc....
Why? Reduce Risk

• Operability
  ▪ How do we make a game clock?
  ▪ Where do we store the data?

• Interoperability
  ▪ How does the game clock work with other tablets?
  ▪ How do the tablets all write to the same database?

• Scalability
  ▪ Will the game clock propagate in real time?
  ▪ Will the database engine keep up?

• Reliability
  ▪ What happens if the clock tablet dies?
  ▪ What happens if the database tablet dies?

• Etc-Ability...
Speed (to Write)

- Critical
- 2-3 Day Tasks
- Use Whatever Works
  - RAD Languages
  - SDK’s
  - IDE’s
  - Design Tools
  - Wizards
  - Sample Code
  - Etc...
- Stop When Questions Answered
Tradeoffs: Speed (to Write) vs...

• Speed vs Best Practices
  ▪ Testing
  ▪ Documentation
  ▪ Security
  ▪ Software Engineering
  ▪ Usability
  ▪ Performance
  ▪ Coding Standards
  ▪ User Interface Standards
  ▪ Using Real Data
  ▪ Etc...

• Hence, Normally Not Appropriate in Final Deliverable
Challenge/Danger

• “Hack” Solution
  ▪ It works.
  ▪ It’s *a* way to do something.

  vs

• “Correct” Solution
  ▪ It works.
  ▪ It’s the *“right”* way to do something.
    (There may be more than one “right” way to do something.)

Often My Biggest Frustration
Basketball Prototypes Case Studies

• Play Effectiveness
• Player Timer
• Radio Stats
• Real Time Play Stats
• Plus/Minus
Play Effectiveness App

• Functional Specifications
  ▪ Determine Effectiveness of Plays
  ▪ Record All Plays with Results
  ▪ Produce Reports of Effectiveness
    o Each Play
    o # of Success / # of Attempts

• Design Specifications?

• Technical Specifications?
Initial Meeting with Video Coordinator

I Learned...

• Done After Game
  ▪ On Desktop Computer
  ▪ From DVR

• Lots of Plays (~ 200) in Play Book

• ~60-80 Plays Run Per Game

• Plays Categorized
  ▪ Early Offense 1,2 (i.e., Fast Breaks)
  ▪ Offense 1,2 (i.e., Half Court Plays)
  ▪ Special Situations 1,2 (i.e., Out of Bounds)

• Overwhelming

Can you relate?
Play Effectiveness Architecture

Basketball already had all three of these components.
Risks

• Learning Basketball Business Processes
• Programming in Visual Basic
• Making a GUI in VB
• Interfacing VB with Access
  ▪ Creating/Opening/Saving a Database
  ▪ Reading/Writing Records
  ▪ Traversing Records
• Generating Reports in Access
• Etc...
## BB Stats AV1

### Fields
- P# Play Number
- T Time
- C# Clip Number
- EO Early Offense
- O Offense
- SS Special Situations
- R Result

### Nota Bene
- Just Screen Layout
- No Code
- Never Have All Entries Filled at Once

### Game Details
- **Opponent**: Harvard University
- **Location**: Boston
- **Date**: July 4, 1776
- **Number**: 1776070401

### Play Details
- **P#**: 48
- **T**: 12:34
- **C#**: 426
- **EO1**: Run
- **EO2**: Gun
- **O1**: 1-4 Screen
- **O2**: Low Post
- **SS1**: SLOB
- **SS2**: Blah
- **R**: Two Pointer

### Notes
Feed to Adams. Washington always gets the rebound. Jefferson or Hamilton should take the shot.
What I Learned From AV1

- Wanted to Identify Plays Within a Possession
- Plays Categorized Series / Set
  - Set is Variation on Series (“Parameterized Plays”)
  - E.g.
    - Series: Thumbs
    - Sets: Up, Down, Circle
    - Plays: Thumbs Up, Thumbs Down, Thumbs Circle
  - 1, 2 Notation
    - EO1 = Early Offense Series
    - EO2 = Early Offense Set
  - ST (Special Teams) Missing

Huge Impact On Design
What I Learned From AV1

• Results Coded
  ▪ XN Missed N Pointer (X1, X2, X3)
  ▪ ON Made N Pointer (O1, O2, O3)
  ▪ FF Foul on the Floor
  ▪ TO Time Out
  ▪ Etc...

• Wanted to Record Notes on Defense

• Didn’t Care About
  ▪ Player Times
  ▪ Video Clip Number (C#)
So, from this to…
BB Stats AV2

Fields
- PO# Possession Number
- PL# Play Number
- SS Special Situations
- DF Defense

Nota Bene
- Just Screen Layout
- No Code (Underneath)
- Would NOT Have Entries in All Fields

PO# Possession Number
- Possession Number
- Play Number
- Special Situations
- Defense

Just Screen Layout
- No Code (Underneath)
- Would NOT Have Entries in All Fields
What I Learned From AV2

• Wanted to Grade Effectiveness of Plays

• Wanted to Record Player Steals and Assists
  (Remember this...)

• Needed to Navigate Plays and Possessions
The Capstone Experience

BB Stats AV3

Play

<table>
<thead>
<tr>
<th>PE#</th>
<th>Time</th>
<th>PL#</th>
<th>MSU</th>
<th>Op</th>
<th>Series</th>
<th>Set</th>
<th>Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>12:34</td>
<td>17</td>
<td>37</td>
<td>23</td>
<td>Early Offense</td>
<td>Corner (Rescreen-Post)</td>
<td>Great</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BLOB</td>
<td>Quick Post for Perimeter</td>
<td>Poor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Zone Offense</td>
<td>Jersey - Side Ball Screen</td>
<td>So-So</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>O</td>
<td>Outstanding</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Man-to-Man</td>
<td>Something Else</td>
<td>Good</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 For 1</td>
<td>Blah Blah</td>
<td>Unreal</td>
</tr>
</tbody>
</table>

Notes:
Feed to Adams. Washington always gets the rebound. Jefferson or Hamilton should take the shot.

Game

<table>
<thead>
<tr>
<th>Opponent</th>
<th>Location</th>
<th>Date</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvard University</td>
<td>Boston</td>
<td>11/17/2003</td>
<td>1776070401</td>
</tr>
</tbody>
</table>
What I Learned From AV3

• Wanted...
  ▪ Grades to Be A, B, C, D, F
  ▪ Results to Be X1, O1, X2, O2,…
  ▪ Results Associated With Players
  ▪ Series/Set Combined
    (“Thumbs Up” Rather Than “Thumbs”, “Up”)
  ▪ To Record Player Rebound

• Will be used by...
  ▪ Video Coordinator, GAs, and Managers
  ▪ Very Familiar with DVR Controls

• Did **NOT** Want to Record Player Steals or Assists 😊
BB Stats Beta 1
First Version With Code
What I Learned From Beta 1

• Entering a Play
  ▪ Some Things Calculated Automatically
    o Play/Possession Number
    o Score
  ▪ Most Things Entered With Mouse Via Pull-Down Menus
    o Series / Set
    o Result
  ▪ But Time Entered With Keyboard Via Typing Numbers

• Need
  ▪ Mouse-Only Input
  ▪ Easy Way to Adjust Clock
BB Stats
V1.0
Basketball Prototypes Case Studies

✓ Play Effectiveness
  • Player Timer
  • Radio Stats
  • Real Time Play Stats
  • Plus/Minus
Player Timer App

• Keep Track of Player Times
• For Each Player Record
  ▪ Minutes Played
    o Game Clock Time
    o Consecutive & Total
  ▪ Minutes Rested
    o Wall Clock Time
    o Consecutive

• Must
  ▪ Be Usable on the Bench, During the Game
  ▪ Be Portable and Not Require Electrical Outlet
  ▪ Feel Like a Pen and a Clipboard
Player Timer App

Player Timer Application

Visual Basic

MS Access

Windows XP
HP Tablet PC

I had some of these.
Risks

• Learning Basketball Processes
• Implementing Clocks in Windows?
  ▪ Game Clock
  ▪ Wall Clock
• Very Limited Screen Real Estate
• Computing and Displaying Cumulative Times
• Hidden Risk ("Danger Will Robinson!")
Player Timer Development

• Knew Exactly What They Wanted, So…
• Designed “Final” Version
  ▪ User Interface
  ▪ Data Base Schema
  ▪ Etc…
• Coded “Final” Version
• Lab Tested “Final” Version
• Field Tested “Final” Version
  ▪ At a Scrimmage
  ▪ Totally and Completely Unusable
• Scrapped “Final” Version UI and Started Over

Huge Mistake!
Player Timer
Software Updates

• Enable Clock Adjustments  (While Clock Stopped)
• Enable Check In/Out By Touching
  ▪ Check In/Out Button
  ▪ Player Name
  ▪ Player Slot
• Allow > 5 Players Checked In  (While Clock Stopped)
• Enable Pending Check In  (While Clock Running)
• Eliminate All Modal Dialog Boxes
Basketball Prototypes Case Studies

✓ Play Effectiveness
✓ Player Timer
  • Radio Stats
  • Real Time Play Stats
  • Plus/Minus
### Real Time Play Stats

#### MSU vs Purdue

<table>
<thead>
<tr>
<th>EO</th>
<th>QSO</th>
<th>Q</th>
<th>CEF</th>
<th>MOP</th>
<th>ST</th>
<th>Z</th>
<th>OB</th>
<th>SS</th>
</tr>
</thead>
</table>
| No Series | No Set
| Break | Blitz
| Break | Break
| Early Offense | Carolina
| Early Offense | Early Post
| Early Offense | Reversal
| Early Offense | Rub
| ZZZ Early Offens | ZZZ EO 1
| ZZZ Early Offens | ZZZ EO 2
| ZZZ Early Offens | ZZZ EO 3

#### Risks and Prototypes

- Aerts
- Ager
- Brown
- Davis
- Gray
- Hamo
- Ibok
- Maurice
- Naymick
- Neitzel
- Rowley
- Suton
- Trannon

**Walton**
Plus/Minus
Your Prototypes?

- Team Auto-Owners
- Team Boeing
- Team Ford
- Team GE Aviation
- Team Google
- Team Meijer
- Team Mozilla
- Quicken Loans
- Team Spectrum Health
- Team TechSmith
- Team Urban Science
- Team Whirlpool
Risks and Prototypes

✓ Risk
✓ Prototypes
What’s ahead?  

The key word is “status”.

- Team Status Report Presentations
  - **PowerPoint Template**
  - Due Midnight, Tuesday, January 22
  - Email to Dr. D.
    - Subject: Team <Company Name>: Status Report
    - Subject: Team Auto-Owners: Status Report
    - Attachment: team-<company-name>-status-report-presentation.ppt
      - Attachment: team-urban-science-statue-report-presentation.ppt
  - Dr. D. Will Combine Into Single PowerPoint
    - To Speed Things Up During Meeting
    - Do NOT Modify Master Slide Page
  - Each Team Presents
    - Using Dr. D.’s Laptop
    - At Most 5 Minutes (Rehearse Timing)
    - Single or Multiple Presenters (Your Choice)
What’s ahead? (2 of 3)

• All-Hands Meetings
  ▪ W, 01/16: Schedule and Teamwork
  ▪ M, 01/21: MLK Day, No Meeting
  ▪ W, 01/23: Team Status Reports
  ▪ M, 01/28: Team Project Plan Presentations
  ▪ W, 01/30: Team Project Plan Presentations
  ▪ M, 02/04: Team Project Plan Presentations
  ▪ W, 02/06: Team Project Plan Presentations
  ▪ M, 02/11: Resume Writing and Interviewing
  ▪ W, 02/13: Creating and Giving Presentations
  ▪ M, 02/18: Alpha Presentations
What’s ahead?

• Project Plan Presentations
  ▪ PowerPoint Template
    o Download Now
    o Read the Read Me Slide (Over and Over and Over…)
  ▪ Submission
    o Both Project Plan Document and PowerPoint Slide Deck
    o Due Midnight, Sunday, January 27
    o See Submission Instructions in Template
  ▪ Presenting
    o 3 Teams Per Meeting Over 2 Meetings
    o Schedule Posted Sunday Evening
    o Strict 15 Minute Time Limit
    o Use Team Member Laptop
      ❖ Bring Power Cord
      ❖ Test In Meeting Room (in Advance)
    o Rehearse
    o 5% of Final Grade
    o Business Casual Dress
  ▪ Formal Team Photos
    o Immediately Following Meeting
    o In Capstone Lab
01/16: Schedule and Teamwork

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