MICHIGAN STATE UNIVERSITY

09/08: Risks and Prototypes

The Capstone Experience

Dr. Wayne Dyksen

Department of Computer Science and Engineering
Michigan State University

Fall 2014

From Students…
…to Professionals

09/08: Announcements

- Capstone Lab Construction
- Website Team Photo Names and Hometowns
- Google Calendar
  - Must Use MSU Email Address
  - Watch for Double Booking
- Apple Developer License
  - Request Invitation from Dr. D.
  - Team Members are Members
  - Malcolm is Admin
- Submission Instructions
  - Read Carefully
  - File Name Conventions
    - All Lower Case
    - Replace Blanks with Dashes
- Does anyone need equipment?
- Project Plan Document and Presentation
  - Presenting and Due Dates
  - Schedule Conflicts
  - Read READ ME
- Issues? Problems? Questions?

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

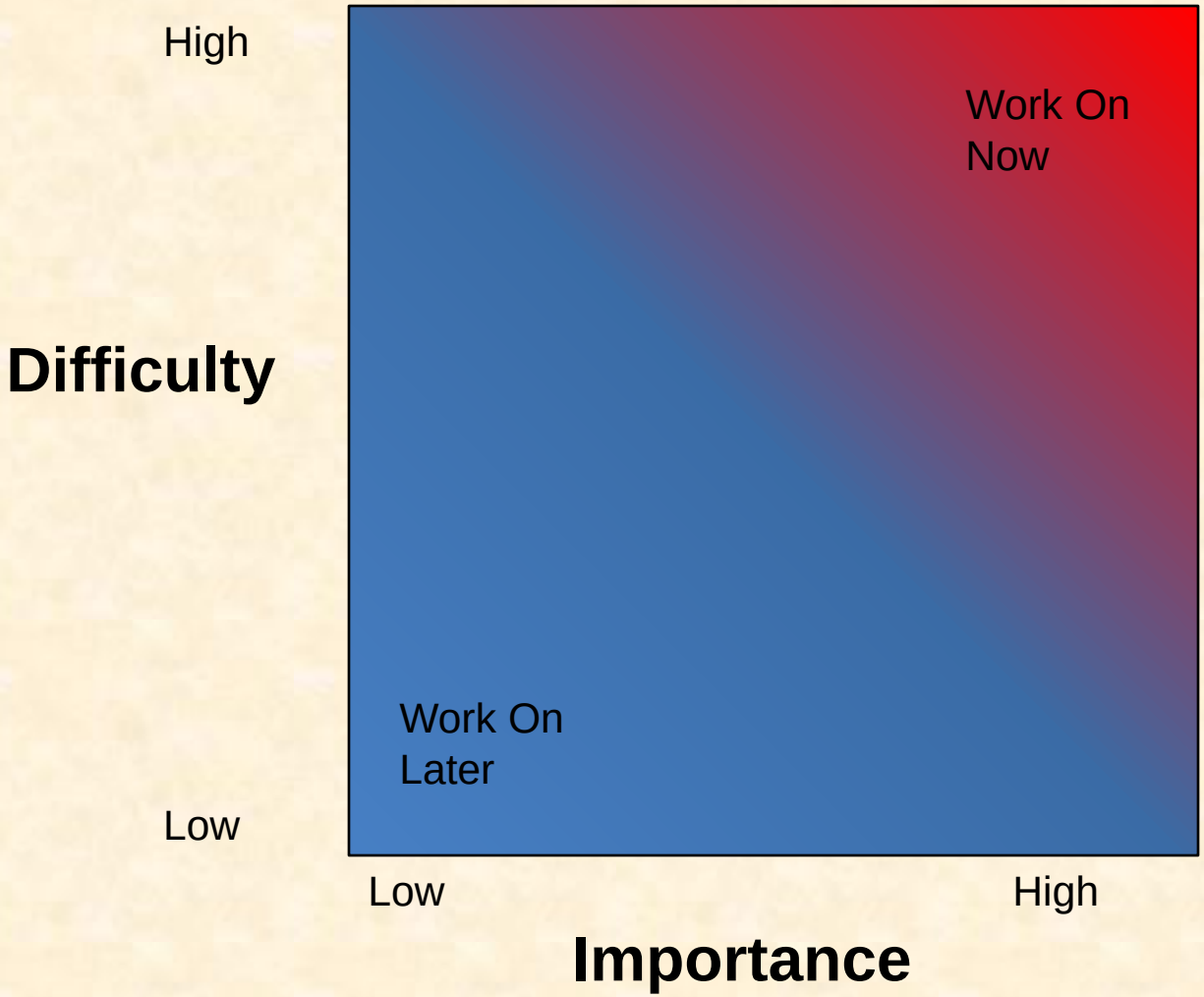
Including but not limited to...

- 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

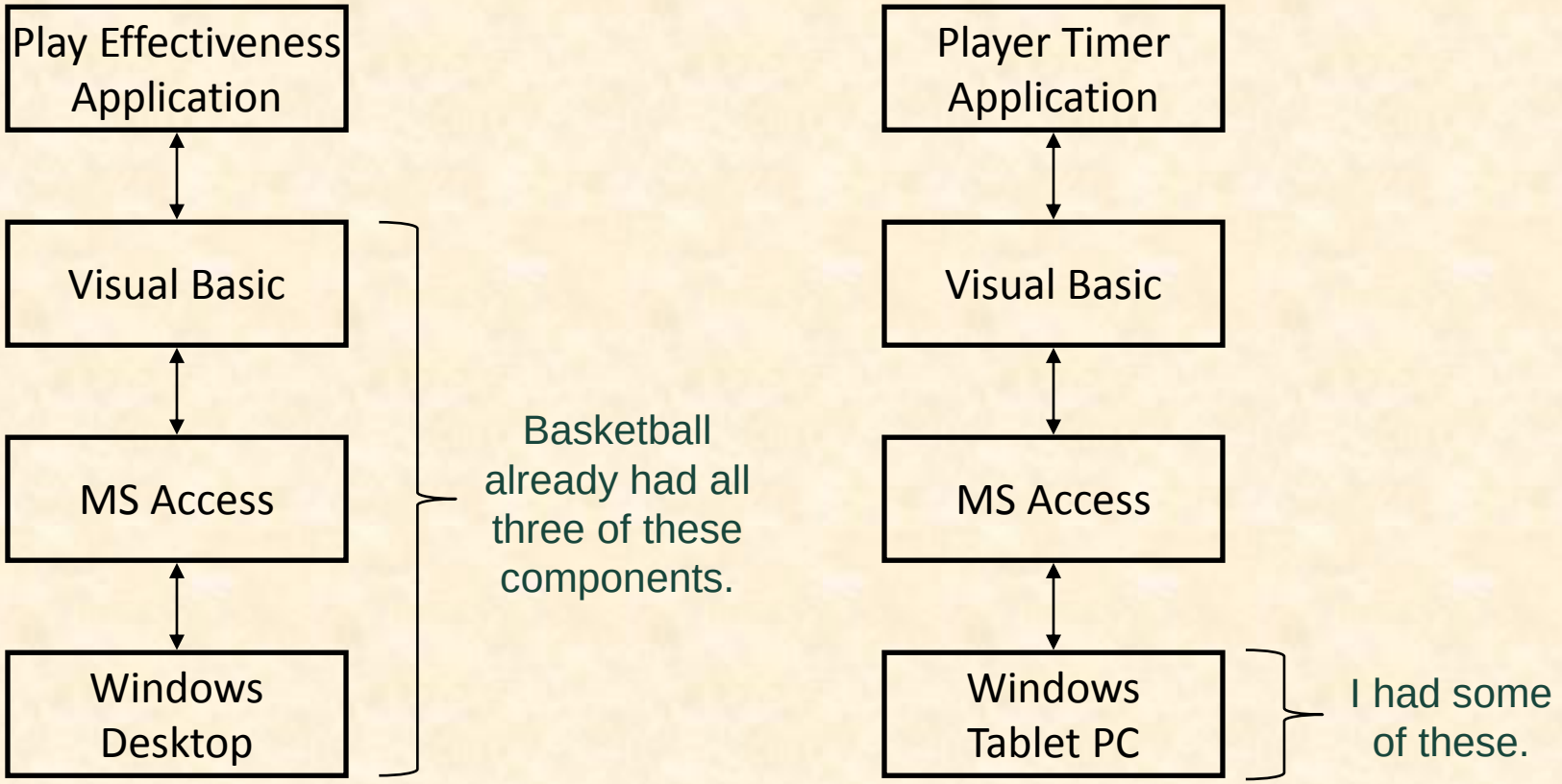
Prioritizing Risks



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



Basketball Apps Risks

- What SDK should I use?
- How do I program in Visual Basic?
- How do I generate a report from Access?
- 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
    - Product Demos
    - Book Sample Code
    - Downloadable Examples
    - Wizards
    - Etc...
  - Test Drive
    - Install
    - Compile
    - Extend
    - Etc...
- Build Prototypes
  - Single Purpose
  - Quick-and-Dirty

Nota Bene:

1. Check license if including in project.
2. Document.
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

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 By
  - Recording All Plays with Results
  - Producing Reports of Effectiveness
    - Each Play
    - # of Success / # of Attempts
- Design Specifications?
- Technical Specifications?

Initial Meeting with Video Coordinator

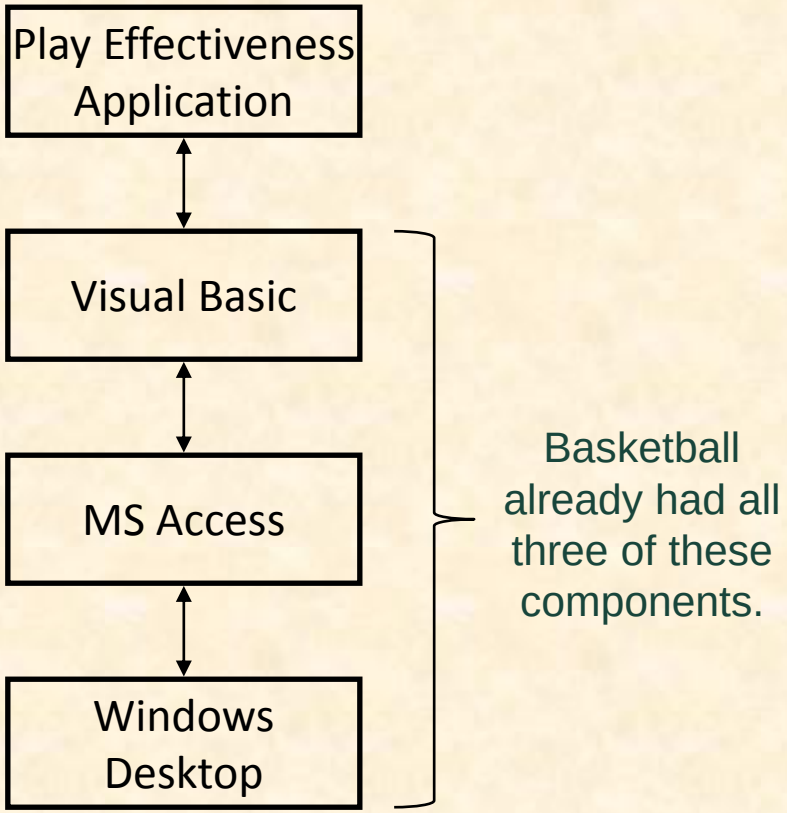
I Learned…

- Done After Game
  - On Desktop Computer
  - From DVR App
- Lots of Plays (~ 200) in Play Book
- ~20-40 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?

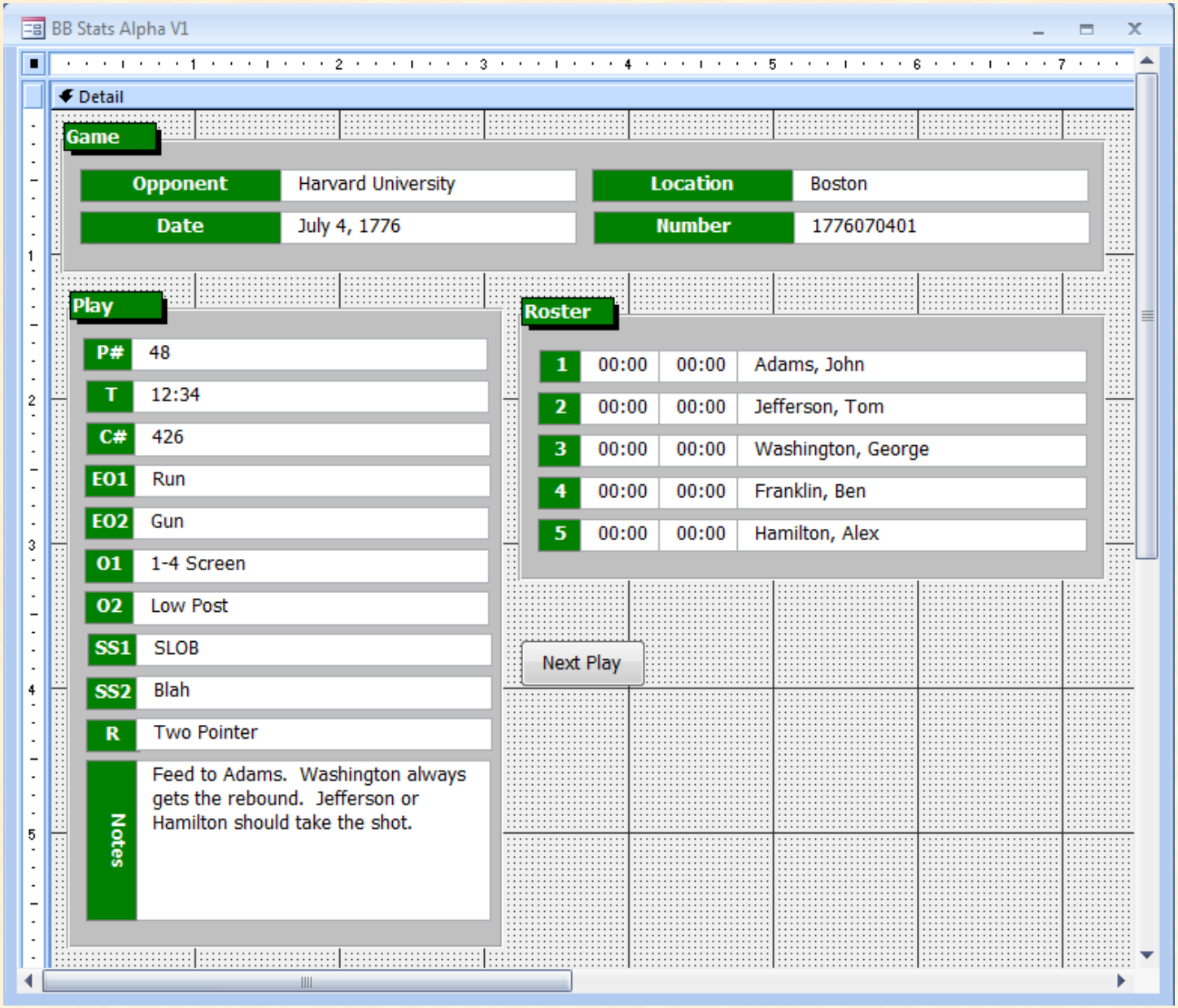
The Business Processes

Play Effectiveness Architecture



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 PE PV1

(Prototype Version 1)

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 (Underneath)
- Never Have All Entries Filled at Once

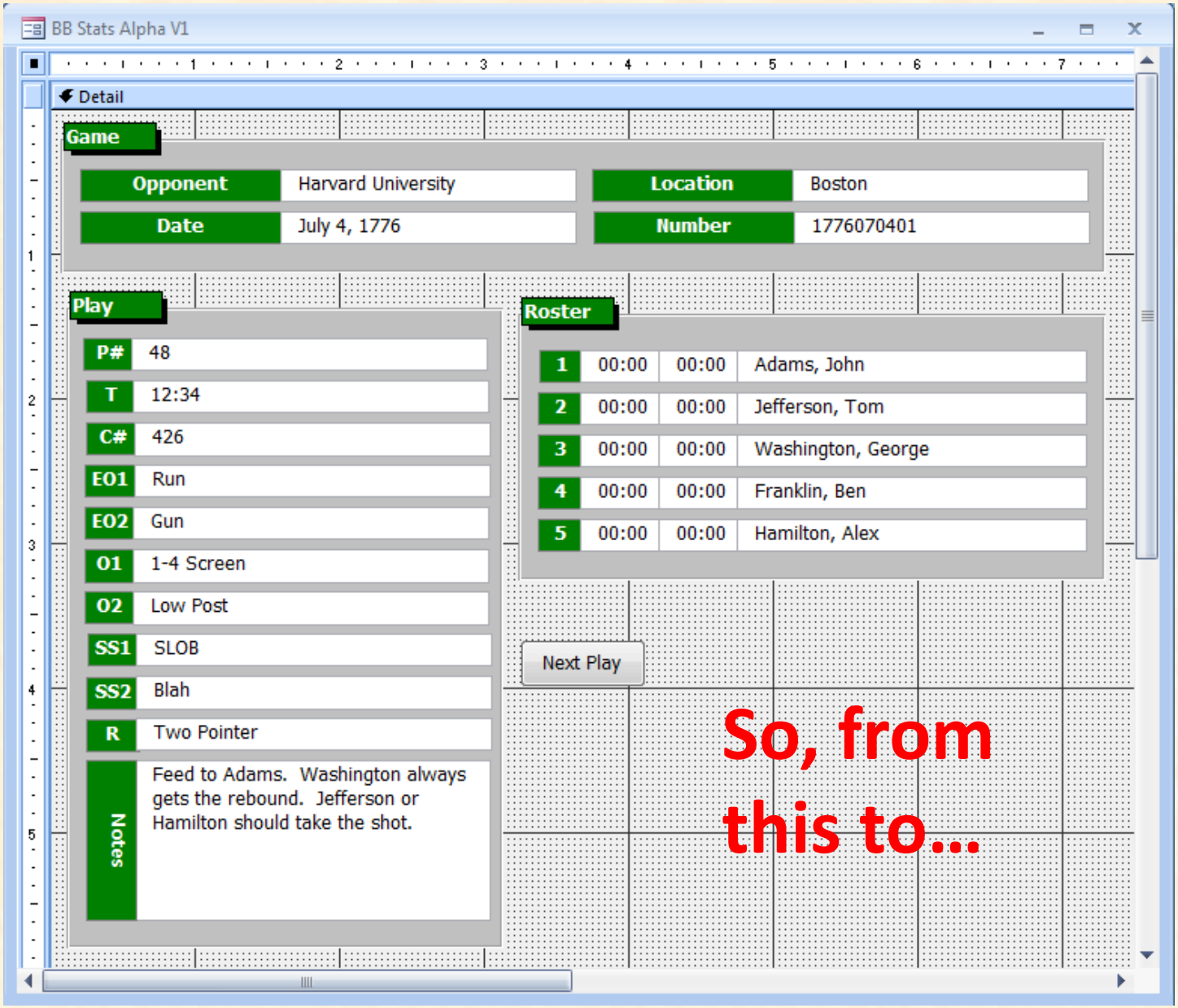
What I Learned From PV1 (1 of 2)

- 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 PV1 (2 of 2)

- Results Coded
  - X*N* Missed *N* Pointer (X1, X2, X3)
  - O*N* 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#)



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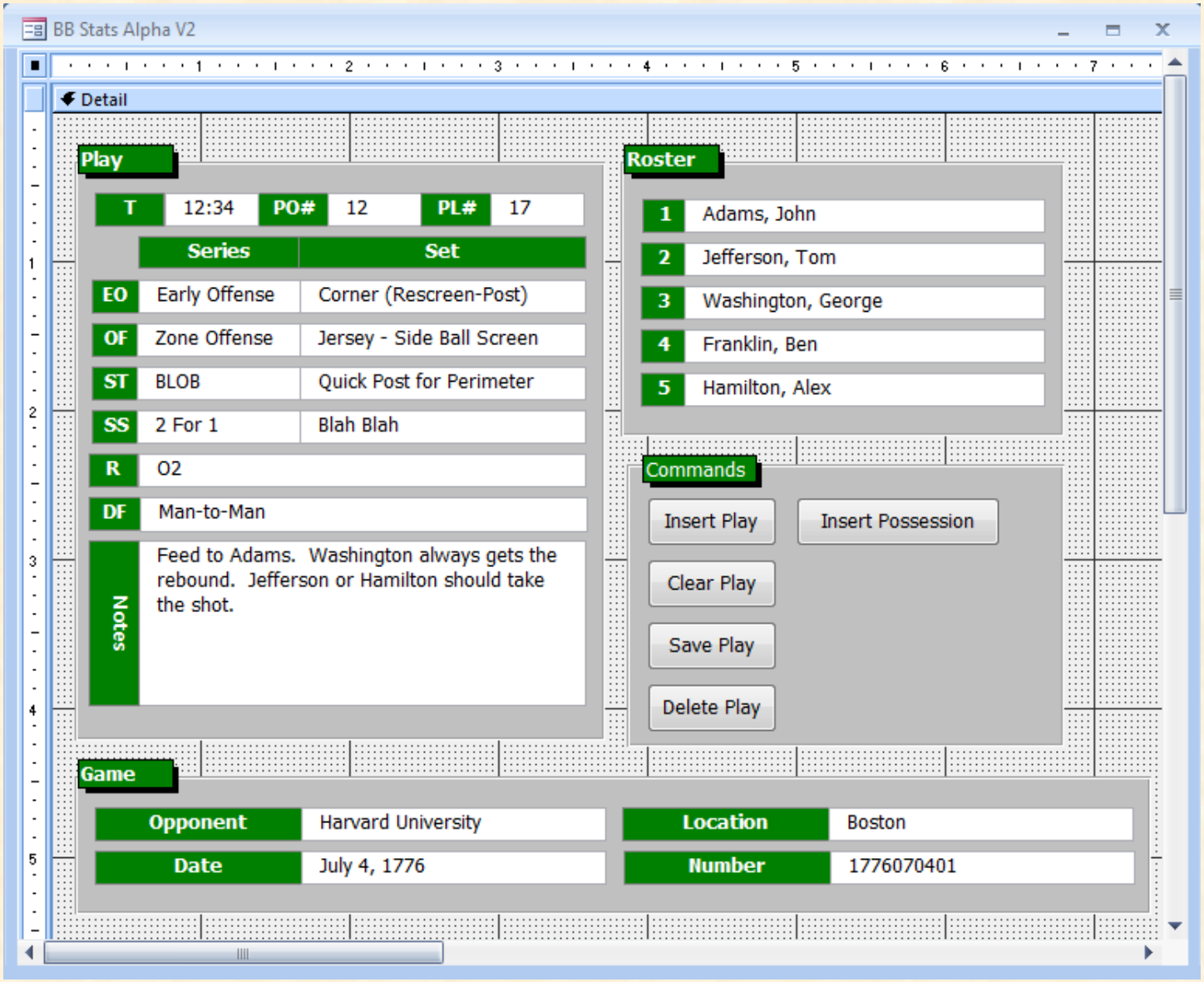


BB PE PV2

Fields

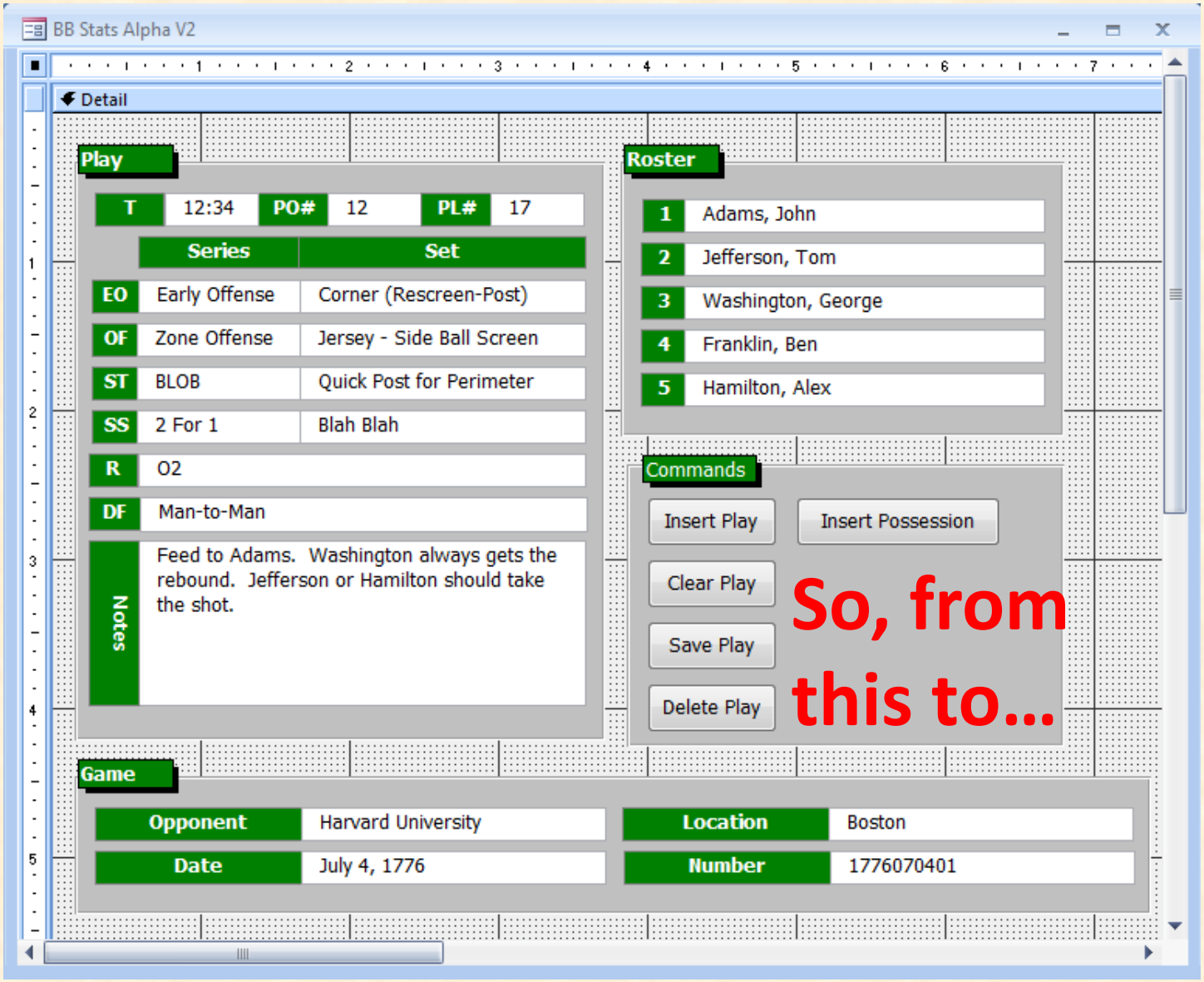
- PO#
  Possession Number
- PL#
  Play Number
- SS
  Special Situations
- DF
  Defense

Nota Bene

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

What I Learned From PV2

- Wanted to Grade Effectiveness of Plays
- Wanted to Record Player Steals and Assists (Remember this…)
- Needed to Navigate Plays and Possessions



BB PE PV2

Fields

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

Nota Bene

- Just Screen Layout
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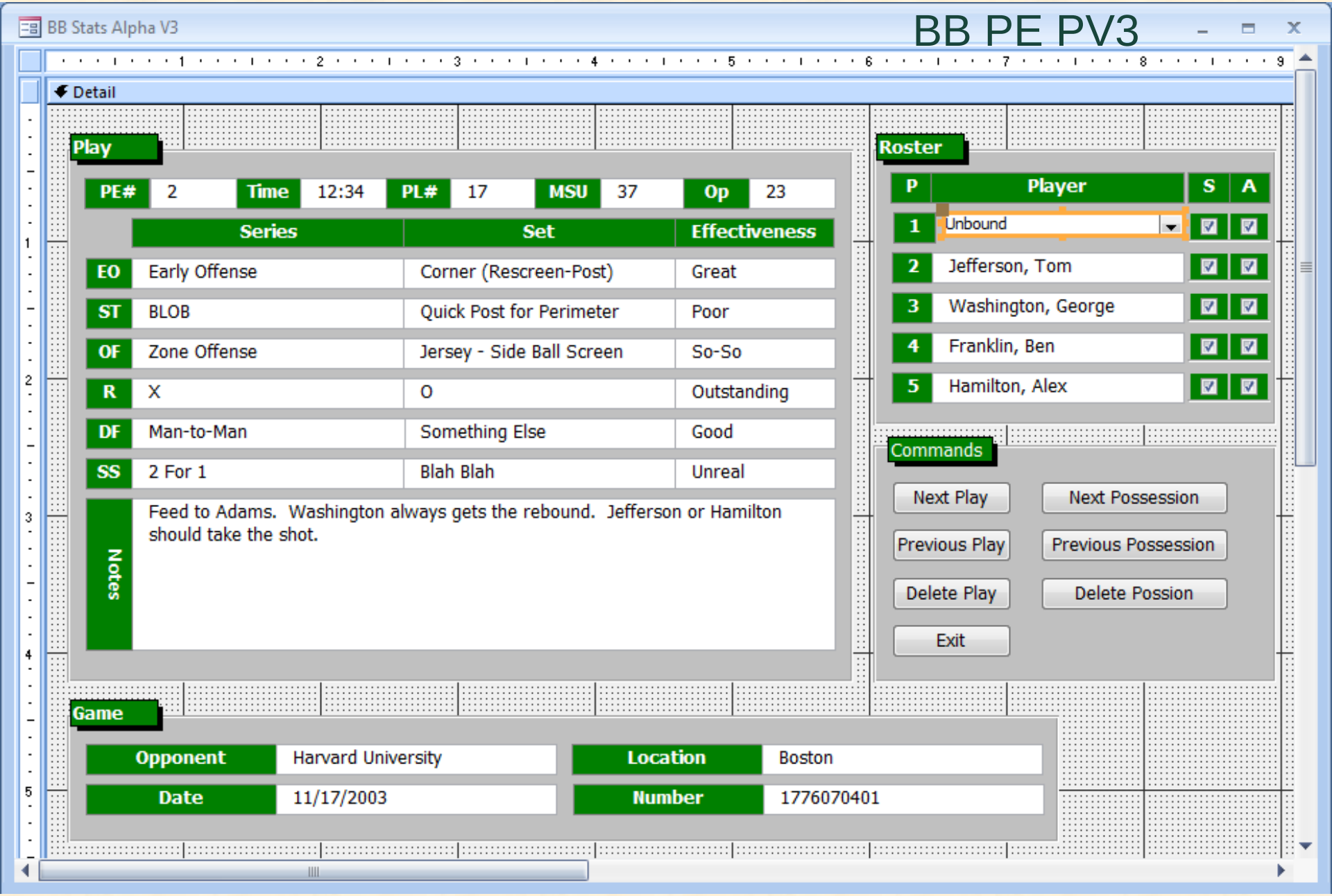
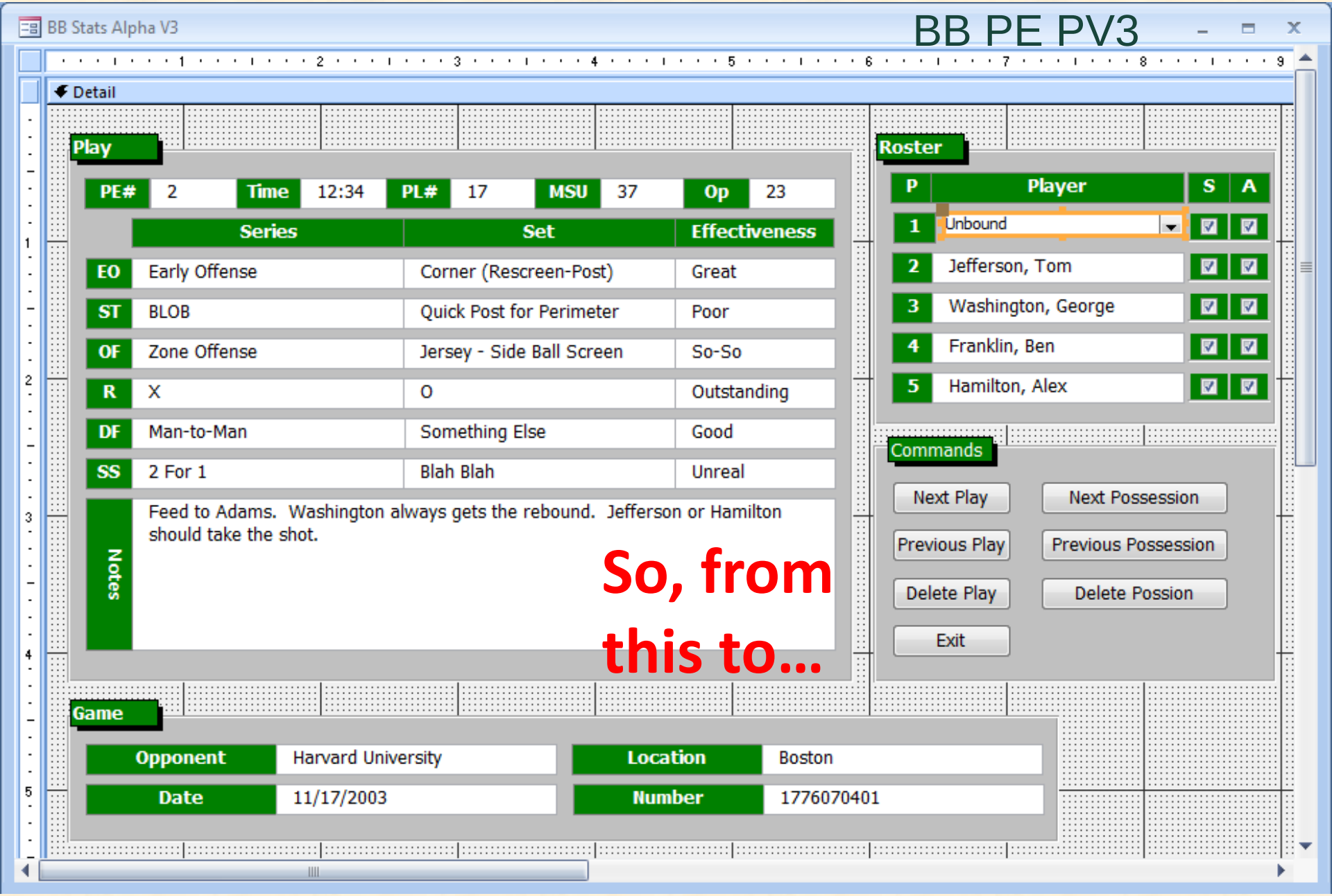
- Would **NOT** Have Entries in All Fields


BB Stats Alpha V3
BB PE PV3
Detail
Play
PE# 2
Time 12:34
PL# 17
MSU 37
Op 23
Series
Set
Effectiveness
EO Early Offense Corner (Rescreen-Post) Great
ST BLOB Quick Post for Perimeter Poor
OF Zone Offense Jersey - Side Ball Screen So-So
R X O Outstanding
DF Man-to-Man Something Else Good
SS 2 For 1 Blah Blah Unreal
Notes
Feed to Adams. Washington always gets the rebound. Jefferson or Hamilton should take the shot.
Roster
P Player S A
1 Unbound
2 Jefferson, Tom
3 Washington, George
4 Franklin, Ben
5 Hamilton, Alex
Commands
Next Play
Next Possession
Previous Play
Previous Possession
Delete Play
Delete Possion
Exit
Game
Opponent Harvard University
Location Boston
Date 11/17/2003
Number 1776070401

What I Learned From PV3

- 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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So, from this to…
Roster
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Commands
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Next Possession
Previous Play
Previous Possession
Delete Play
Delete Possion
Exit
Game
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BB PE AV1

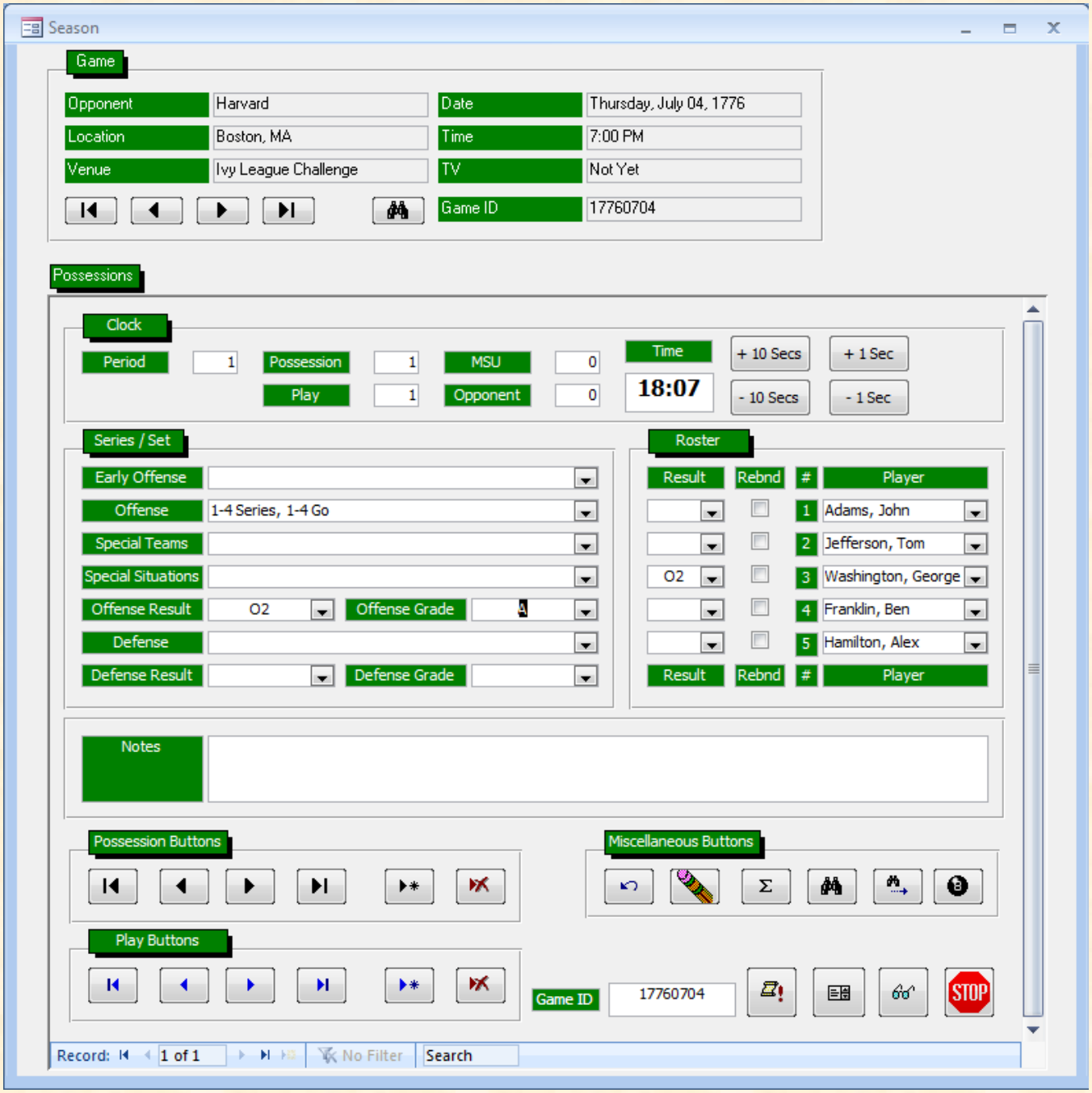
(Alpha Version 1)

First Version With Code

Not Much Implemented

What I Learned From Alpha 1

- Entering a Play
  - Some Things Calculated Automatically
    - Play/Possession Number
    - Score
  - Most Things Entered With Mouse Via Pull-Down Menus
    - Series / Set
    - Result
  - But Time Entered With Keyboard Via Typing Numbers
- Need
  - Mouse-Only Input
  - Easy Way to Adjust Clock



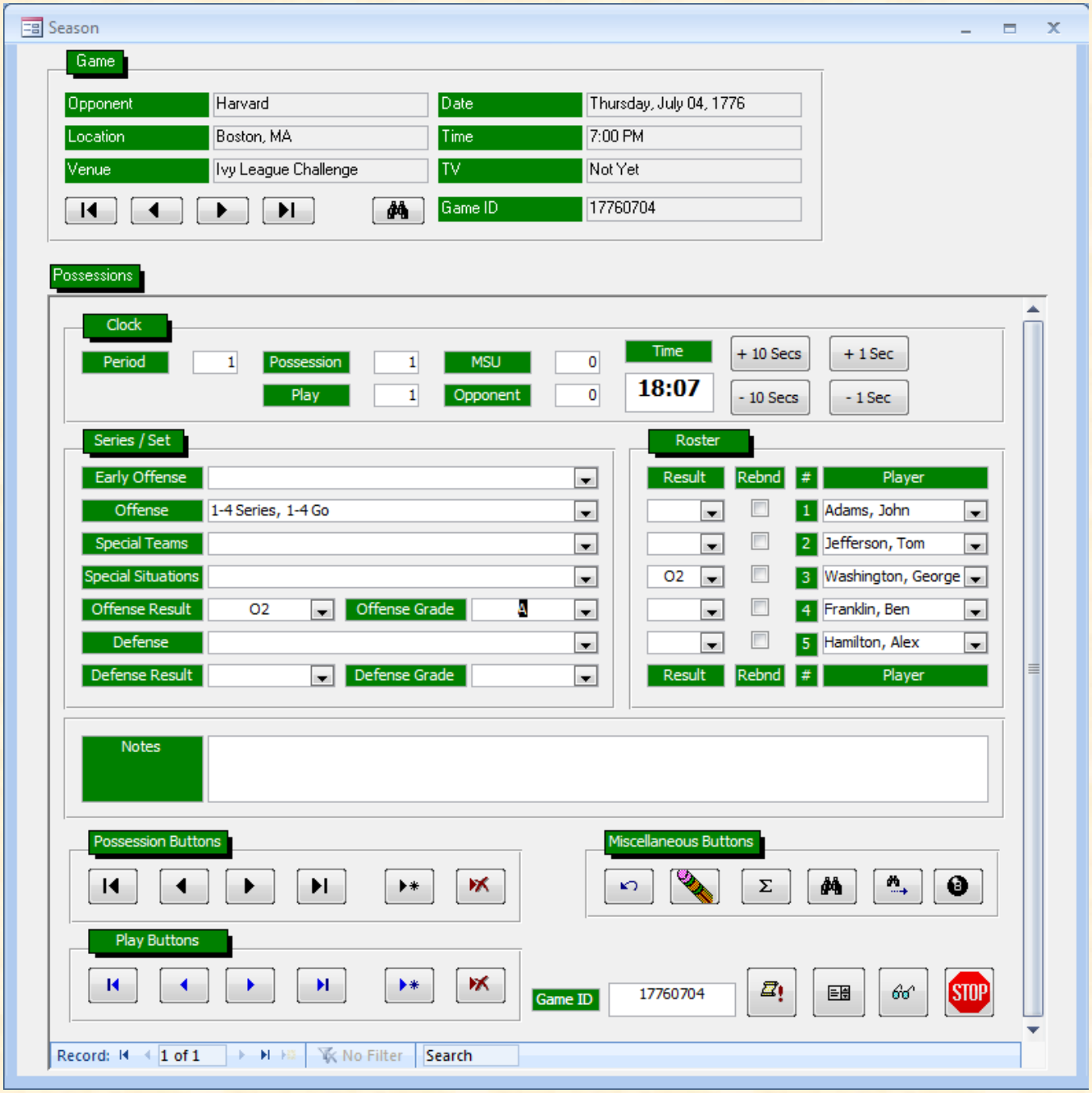
BB PE AV2

Still Not Much Implemented

So, from this to…

BB PE BV1

(Beta Version 1)



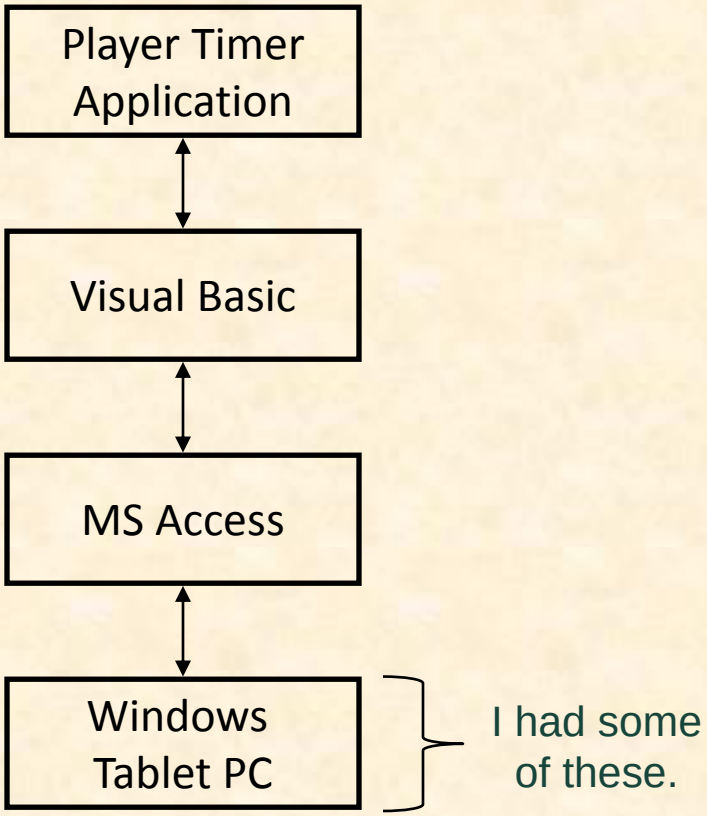
Basketball Prototypes Case Studies

- ✓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
    - Game Clock Time
    - Consecutive & Total
  - Minutes Rested
    - Wall Clock Time
    - 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



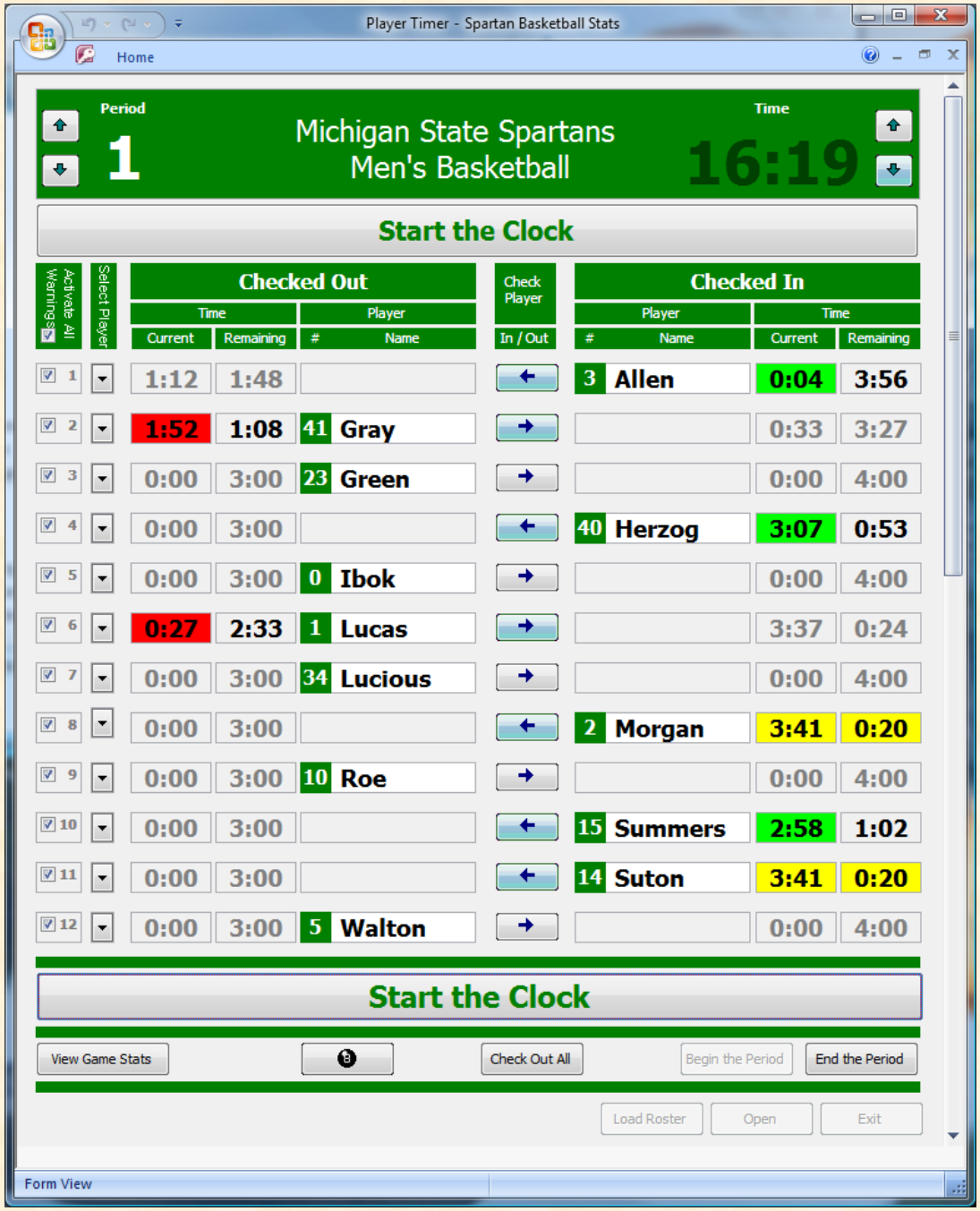
Risks

- 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
  - In Practice Scrimmage
  - Totally and Completely Unusable
- Scrapped “Final” Version UI and Started Over

Huge Mistake!



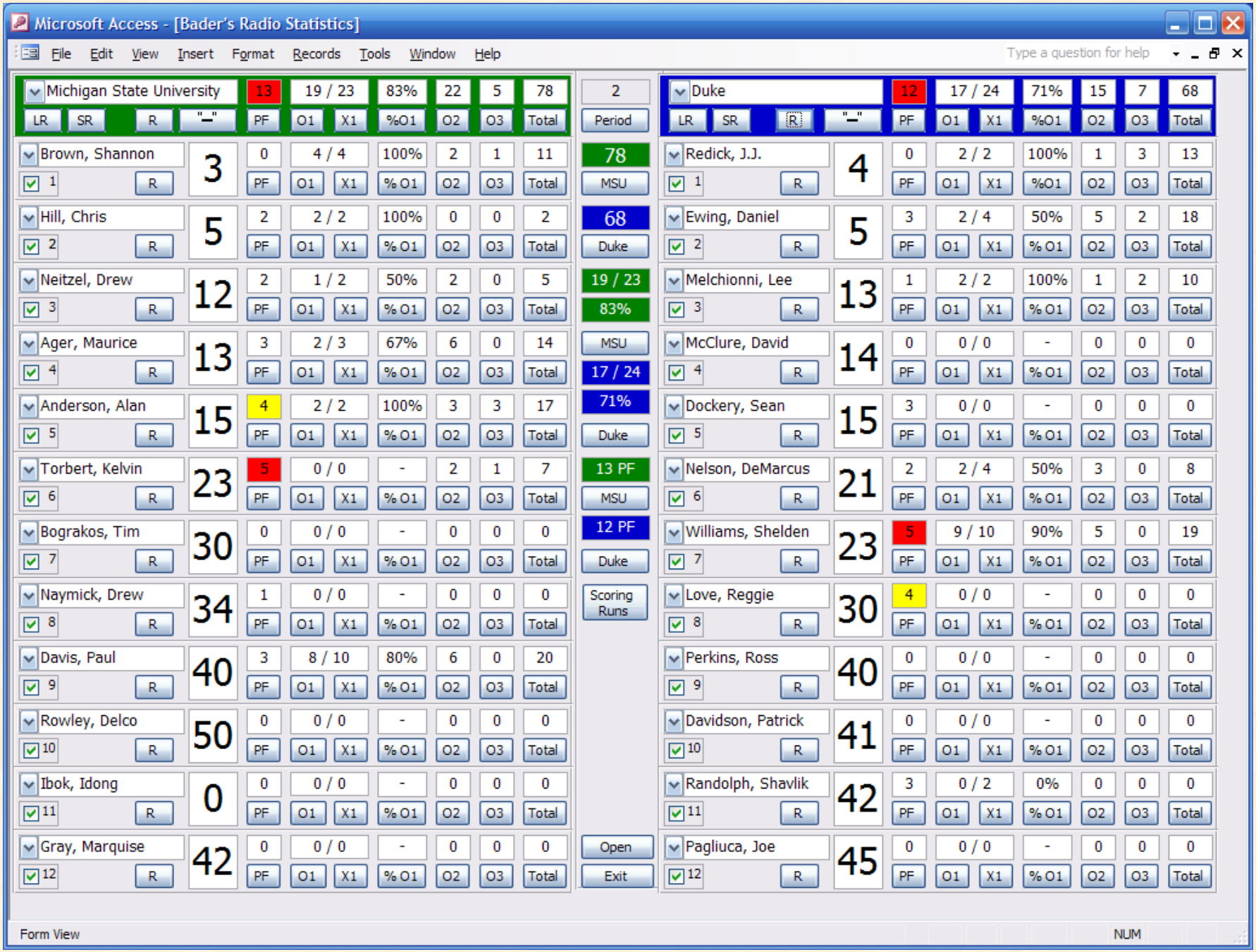
Player Timer

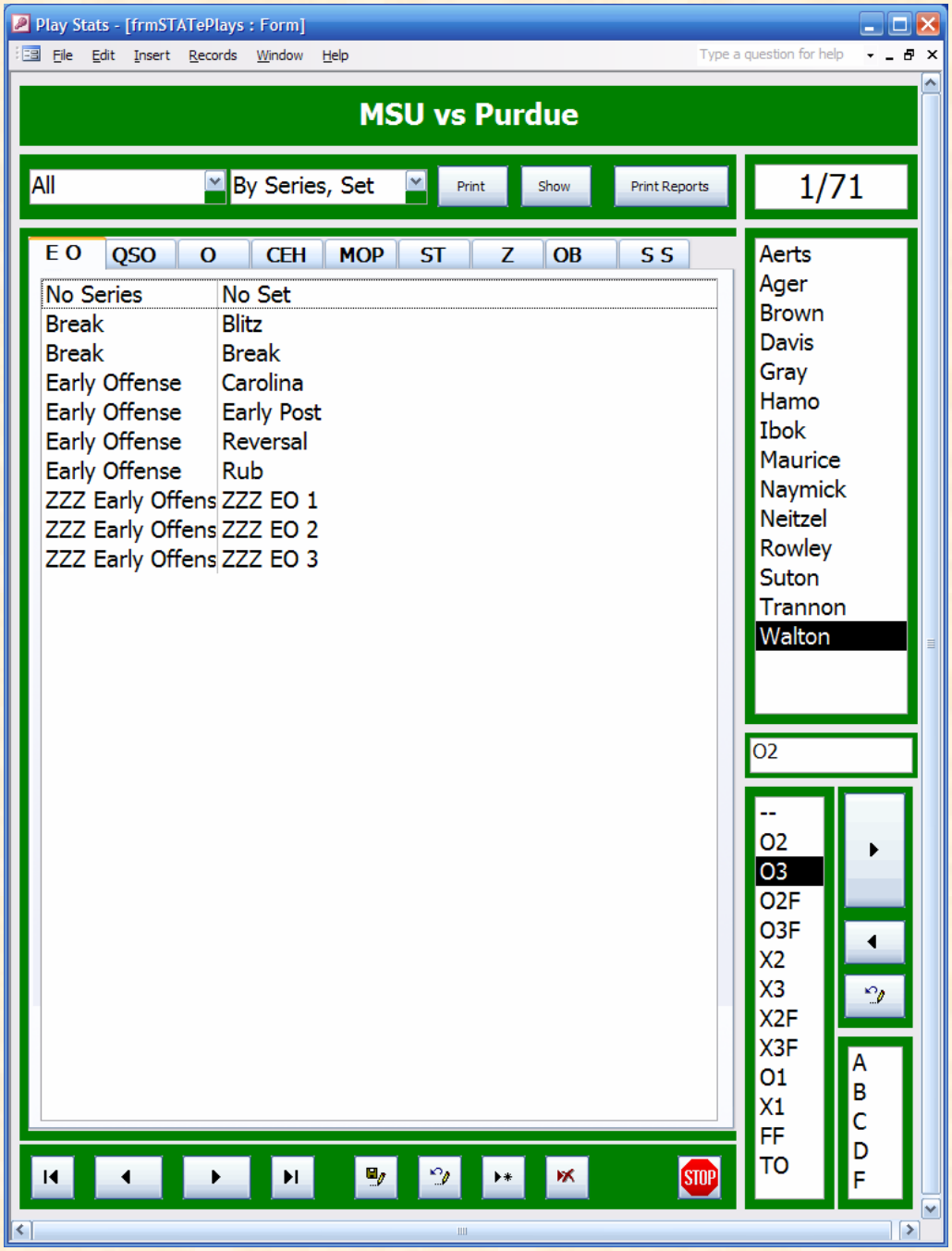
Software Updates

- 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

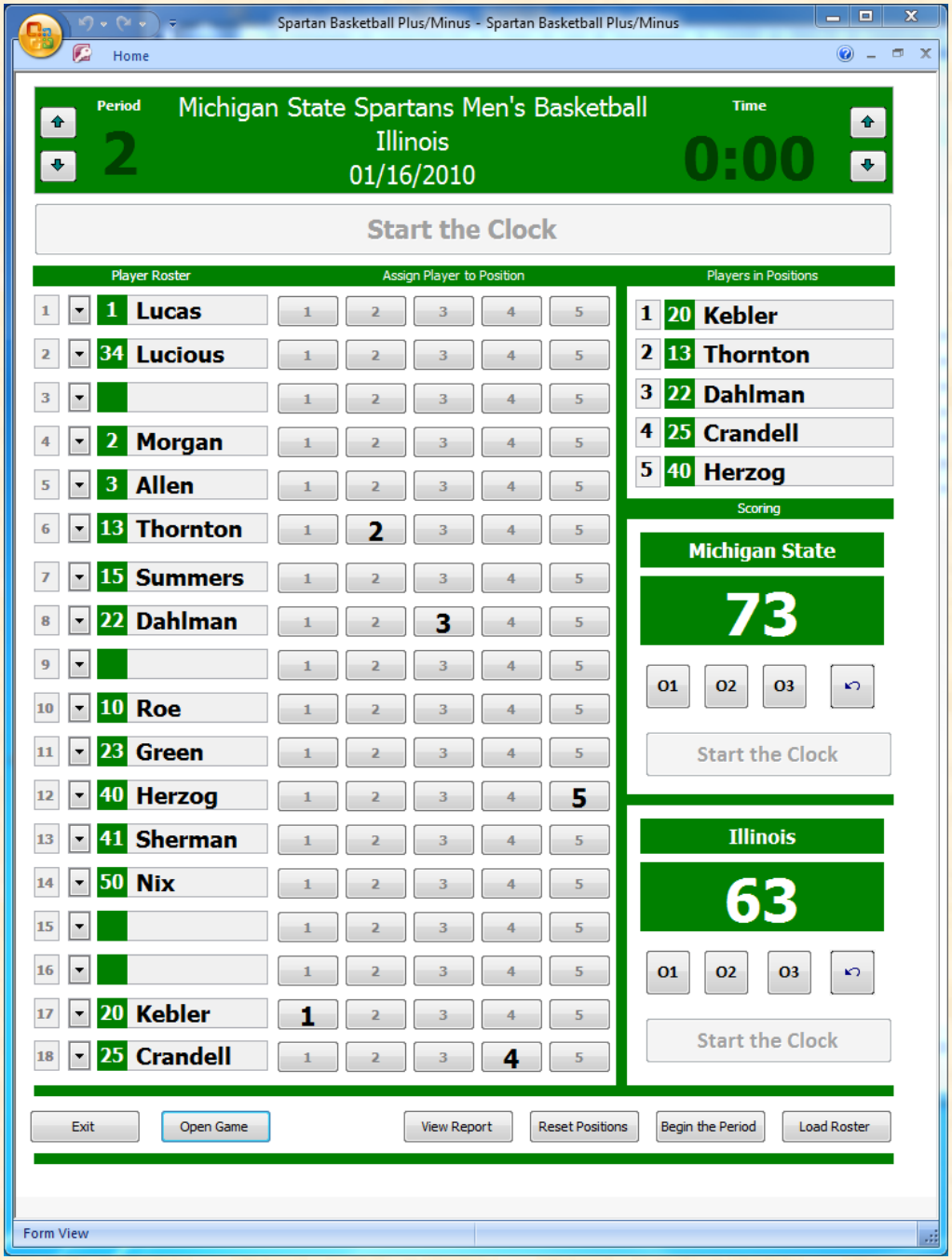
Basketball Prototypes Case Studies

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


Microsoft Access - [Bader's Radio Statistics]
File Edit View Insert Format Records Tools Window Help
Type a question for help
Michigan State University 13 19 / 23 83% 22 5 78
LR SR R "–" PF O1 X1 %O1 O2 O3 Total
Brown, Shannon 3 0 4 / 4 100% 2 1 11
Hill, Chris 5 2 2 / 2 100% 0 0 2
Neitzel, Drew 12 2 1 / 2 50% 2 0 5
Ager, Maurice 13 3 2 / 3 67% 6 0 14
Anderson, Alan 15 4 2 / 2 100% 3 3 17
Torbert, Kelvin 23 5 0 / 0 - 2 1 7
Bograkos, Tim 30 0 0 / 0 - 0 0 0
Naymick, Drew 34 1 0 / 0 - 0 0 0
Davis, Paul 40 3 8 / 10 80% 6 0 20
Rowley, Delco 50 0 0 / 0 - 0 0 0
Ibok, Idong 0 0 0 / 0 - 0 0 0
Gray, Marquise 42 0 0 / 0 - 0 0 0
2 Period
78 MSU
68 Duke
19 / 23
83%
MSU
17 / 24
71%
Duke
13 PF
MSU
12 PF
Duke
Scoring Runs
Open
Exit
Duke 12 17 / 24 71% 15 7 68
LR SR R "–" PF O1 X1 %O1 O2 O3 Total
Redick, J.J. 4 0 2 / 2 100% 1 3 13
Ewing, Daniel 5 3 2 / 4 50% 5 2 18
Melchionni, Lee 13 1 2 / 2 100% 1 2 10
McClure, David 14 0 0 / 0 - 0 0 0
Dockery, Sean 15 3 0 / 0 - 0 0 0
Nelson, DeMarcus 21 2 2 / 4 50% 3 0 8
Williams, Shelden 23 5 9 / 10 90% 5 0 19
Love, Reggie 30 4 0 / 0 - 0 0 0
Perkins, Ross 40 0 0 / 0 - 0 0 0
Davidson, Patrick 41 0 0 / 0 - 0 0 0
Randolph, Shavlik 42 3 0 / 2 0% 0 0 0
Pagliuca, Joe 45 0 0 / 0 - 0 0 0
Form View
NUM



Real Time Play Stats


Spartan Basketball Plus/Minus - Spartan Basketball Plus/Minus
Home
Period
2
Michigan State Spartans Men's Basketball
Illinois
01/16/2010
Time
0:00
Start the Clock
Player Roster
Assign Player to Position
Players in Positions
1 1 Lucas
2 34 Lucious
3
4 2 Morgan
5 3 Allen
6 13 Thornton
7 15 Summers
8 22 Dahlman
9
10 10 Roe
11 23 Green
12 40 Herzog
13 41 Sherman
14 50 Nix
15
16
17 20 Kebler
18 25 Crandell
1 20 Kebler
2 13 Thornton
3 22 Dahlman
4 25 Crandell
5 40 Herzog
Scoring
Michigan State
73
O1
O2
O3
Start the Clock
Illinois
63
O1
O2
O3
Start the Clock
Exit
Open Game
View Report
Reset Positions
Begin the Period
Load Roster
Form View

Plus/Minus

Risks and Prototypes

✓Risk

✓Prototypes

What's ahead?

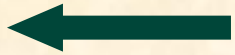
(1 of 3)

- All-Hands Meetings
  - ~~M, 09/08: Risks and Prototypes~~
  - W, 09/10: Team Status Report Presentations
  - M, 09/15: Team Project Plan Presentations
  - W, 09/17: Team Project Plan Presentations
  - M, 09/22: Team Project Plan Presentations
  - W, 09/24: Team Project Plan Presentations
  - M, 09/29: Resume Writing and Interviewing
  - W, 10/01: Career Gallery

What's ahead?

(2 of 3)

- Team Status Report Presentations
  - PowerPoint Template
  - Due 4:00 a.m., Wednesday, September 10
  - Tomorrow
  - 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-status-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)
- Official Team Photo
  - Presenting Team Must Dress Business Casual
  - Team Photos After Meeting



Panic!

MICHIGAN STATE UNIVERSITY

09/10: Team Status Reports

The Capstone Experience

Dr. Wayne Dyksen

Department of Computer Science and Engineering
Michigan State University

Fall 2014

From Students…
…to Professionals

Instructions
(Delete this slide before submitting.)

- Required Template
  - Do not edit the master slides.
  - Do not change the organization or number of slides.
  - Make your presentation fit within these four slides.
- Content
  - For the slide titles, replace <Company Name> with your company name as in “Team Auto-Owners”.
  - All presentations will be posted on the course web site so do not include company confidential information or anything that your client would not want posted.
  - Delete this slide from the presentation.
- Presenting
  - The order of the presentations during our meeting will be team numerical order.
  - The time limit for your presentation is 5 minutes, which will be strictly enforced. Practice your presentation to ensure that you will finish within the allotted time.
- Submission by Email
  - All presentations are due via email to me by 4:00 a.m., Wednesday, September 10.
  - For subject, use “Team <Company Name>: Status Report” as in “Team Urban Science: Status Report”.
  - Attach the PowerPoint source file named “team-<company-name>-status-report-presentation.pptx” as in team-auto-owners-status-report-presentation.pptx.

DELETE THIS SLIDE.

Team <Company Name>

Status Report (1 of 4)

<Project Title>

- Project Description
  - Description Point 1
  - Description Point 2
  - Description Point 3
  - Description Point 4
- Project Plan Document
  - Status Point 1
  - Status Point 2
  - Status Point 3
  - Status Point 4

Include STATUS information.
What's the status of your project plan document?
Have you started it?
How much have you written?
What percentage complete is it?
Delete this text box and the brace to the left.

Team <Company Name>

Status Report

(2 of 4)

<Project Title>

- Server Systems / Software
  - Description &/or Status Point 1
  - Description &/or Status Point 2
  - Description &/or Status Point 3
- Development Systems / Software
  - Description &/or Status Point 1
  - Description &/or Status Point 2
  - Description &/or Status Point 3

Include STATUS information.
Are all systems up and running?
Have you tested everything?
Delete this text box and the brace to the left.

Team <Company Name>

Status Report

(3 of 4)

<Project Title>

- Client Contact
  - Status Point 1
  - Status Point 2
- Team Meetings
  - Status Point 1
  - Status Point 2
- Team Organization
  - Description Point 1
  - Description Point 2

Include STATUS information.
Have you talked with/met with your client?
Have you scheduled a weekly conference call? When?
Have you schedule an in-person meeting? When?
How many times has your team met so far?
Have you scheduled team meetings? How often?
Delete this text box and the brace to the left.

Team <Company Name>

Status Report (4 of 4)

<Project Title>

Risks

- Risk 1
  - Description
  - Mitigation
- Risk 2
  - Description
  - Mitigation
- Risk 3
  - Description
  - Mitigation
- Risk 4
  - Description
  - Mitigation

What's ahead?

(3 of 3)

- Project Plan Presentations
  - PowerPoint Template
    - Download Now
    - Read the Read Me Slide (Over and Over and Over…)
  - Submission
    - Both Project Plan Document and PowerPoint Slide Deck
    - Due Midnight, Sunday, September 14
    - See Submission Instructions in Template
  - Presenting
    - 3 Teams Per Meeting Over 4 Meetings
    - Schedule Posted Sunday Evening
    - Strict 15 Minute Time Limit
    - Use Team Member Laptop
      - Bring Power Cord
      - Test In Meeting Room (in Advance)
    - Rehearse
    - 5% of Final Grade
    - Business Casual Dress
  - Formal Team Photos
    - Immediately Following Meeting
    - In Capstone Lab
  - Schedule Conflicts
    - Only for Interview Trips
    - Notify Dr. D. Well In Advance

Read Me Carefully (Delete this slide.)

- Required Template
  - Do not edit the Slide Masters.
  - Do edit the Handout Master (6 Slides Per Page)
    - In the lower left footer, change <Company Name> to your company name.
    - In the lower left footer, change <Project Title> to your project title as found on our Projects web page.
  - Do not change the organization of slides.
  - You may duplicate slides as necessary but keep in mind that your presentation time is limited strictly to 15 minutes.
- Content
  - Do not include any company confidential information in your presentation since all presentations will be posted on the web site.
  - Submit your presentation to your client for approval at least two working days in advance.
  - Throughout the PowerPoint template, replace placeholders <…> with the appropriate information.
  - Edit the center footer by clicking the Header & Footer button on the Insert ribbon. Change <Company Name> in the footer to your company name as in "Team GM Project Plan".
  - Delete the example Screen Mockups and System Architecture slides and this Read Me slide from your presentation.
- Presenting
  - Although the presentations are scheduled over the course of four meetings, all teams must be prepared to present on the first day scheduled, Monday, September 15.
  - The order of the presentations will be posted on our All-Hands Meetings page in the afternoon or evening of the day before the first day scheduled for presentations.
  - The time limit for your presentation is 15 minutes, which will be strictly enforced. Practice your presentation to ensure that you will finish within the allotted time.
  - All team members are required to dress business casual on the day of your presentation.
  - "Formal" team photos of the presenting teams will be taken in the Capstone Lab immediately following these all-hands meetings.
- Submission
  - Email both the project plan document and presentation to Dr. D. by 4:00 a.m., Monday, September 15.
  - For subject, use "Team <Company Name>: Project Plan" as in "Team Boeing: Project Plan".
  - Attach the Word source file named "team-<company-name>-project-plan.docx" as in "team-urban-science-project-plan.docx".
  - Attach the PowerPoint source file named "team-<company-name>-project-plan-presentation.pptx" as in "team-quicken-loans-project-plan-presentation.pptx".

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MICHIGAN STATE UNIVERSITY

Project Plan

<Project Title 36pt>

The Capstone Experience

Team <Company Name 24pt>

<Team Member 1 16pt>
<Team Member 2 16pt>
<Team Member 3 16pt>
<Team Member 4 16pt>
<Team Member 4 16pt>

Department of Computer Science and Engineering
Michigan State University

Fall 2014

From Students…
…to Professionals

Functional Specifications

- Point 1
- Point 2
- Point 3
- Etc…

This is your project overview.

Describe what problem your project solves.

Answer the question “What does your project do?”

This is your “elevator pitch”.

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Design Specifications

- Point 1
- Point 2
- Point 3
- Etc…

Articulate a summary of your project's major features as well as its overall design.

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Screen Mockup: <Title>

You may include as many screen mockups as you have like, but include at least two examples.

To include more than two, you can duplicate this slide as many times as necessary.

Give each mockup slide a title.

See below for examples and instructions.

DELETE THIS TEXT BOX.

Screen Mockup: <Title>

You may include as many screen mockups as you have like, but include at least two examples.

To include more than two, you can duplicate this slide as many times as necessary.

Give each mockup slide a title.

See below for examples and instructions.

DELETE THIS TEXT BOX.

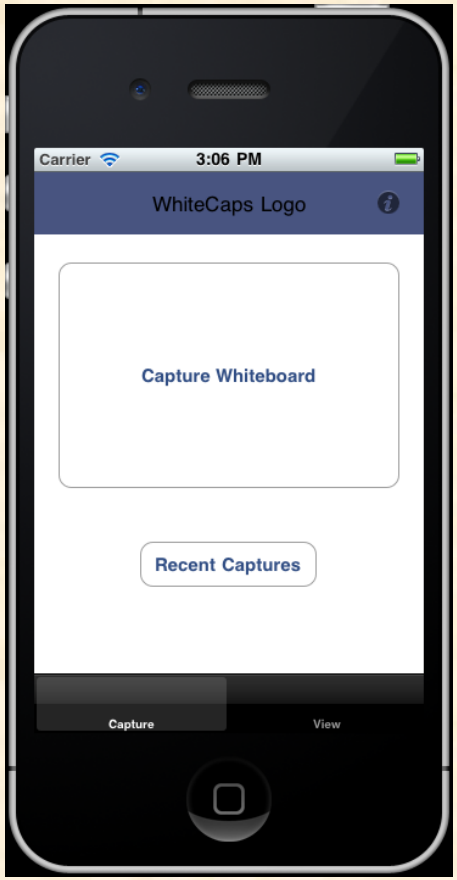
Screen Mockup

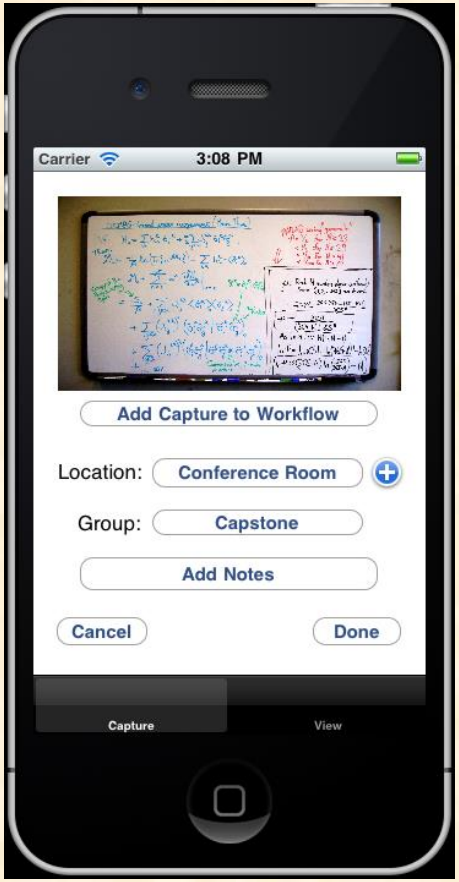
Notes on Making Your Mockups
Delete this slide.

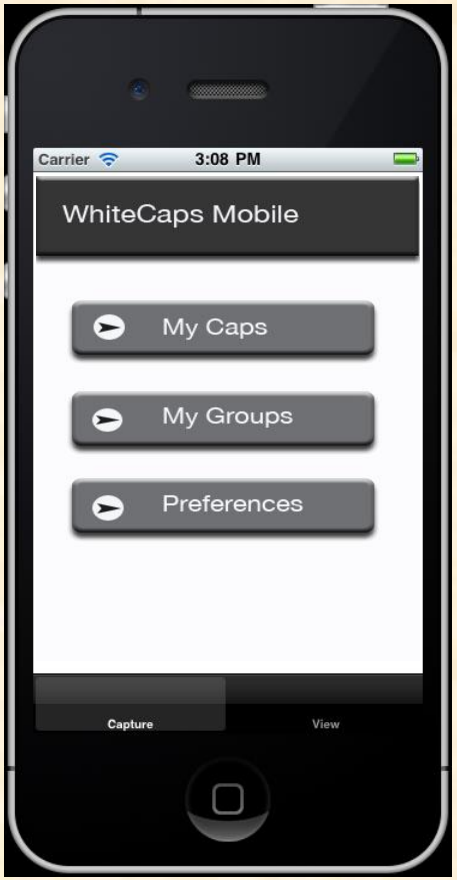
- Ensure that your mockups are…
  - readable (size-wise),
  - scalable, and
  - centered vertically (between the green bar in the title and the footer) and horizontally (Use Home > Arrange > Align).
- In PowerPoint use Home > Arrange > Group to group the objects in your mockup into a single object that can be copied-and-pasted (and scaled).

DELETE ME.

Screen Mockups: iPhone Interface







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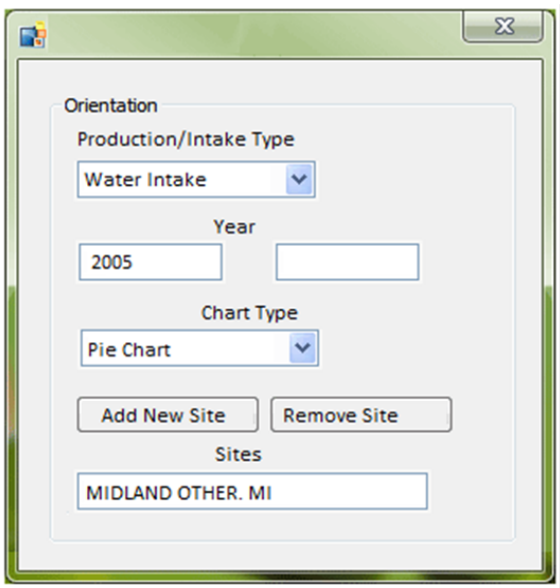
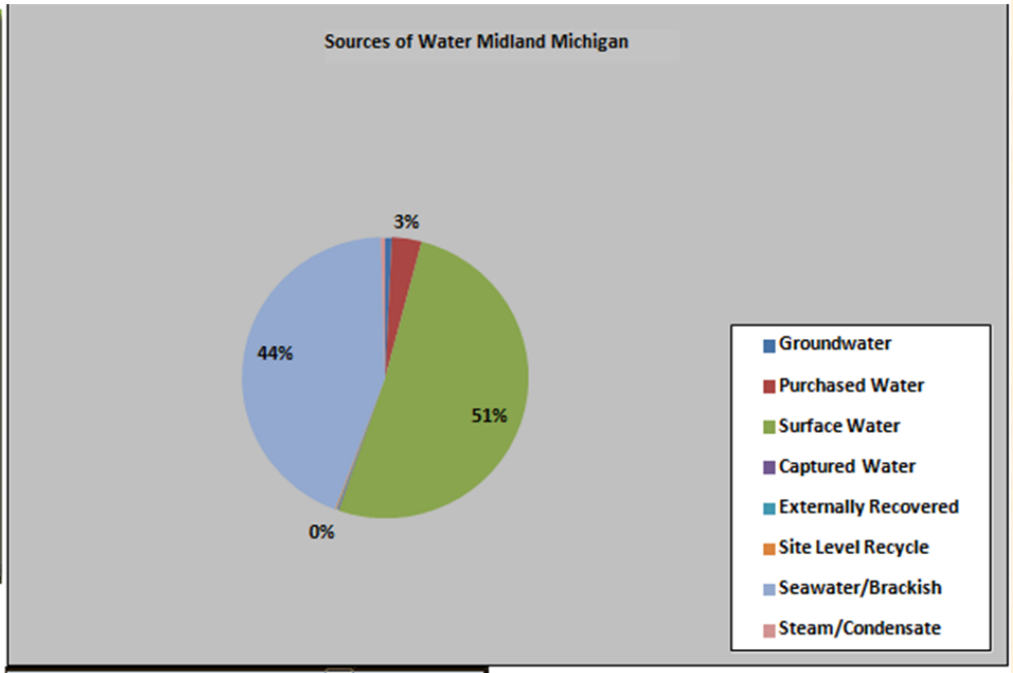
Screen Mockup: Home Page





Row Labels	Sum of 2005
MIDLAND OTHER, MI	34097
Freshwater One Pass Cooling	4011
Potable Water	4011
Process Water	4011
Purchased Water	4013
Steam/Condensate	4011
Steam/Condensate Production	4011
Surface Water	6018
Transfer to Third Party	4011
Grand Total	34097

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Technical Specifications

- Point 1
- Point 2
- Point 3
- Etc…

List the technical components of your project.

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System Architecture

Show a diagram that illustrates the overall architecture of your project including how all of the parts and pieces are connected and interact.

See below for examples and instructions.

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System Architecture

Notes on Making Your Diagram
Delete this slide.

- Ensure that your diagram is…
  - readable (size-wise),
  - scalable, and
  - centered vertically (between the green bar in the title and the footer) and horizontally (Use Home > Arrange > Align).
- In PowerPoint use Home > Arrange > Group to group the objects in your diagram into a single that can be copied-and-pasted.
- Use Paint.NET to make the background of your diagram transparent.
  - Download and install it from www.getpaint.net.
  - Copy your diagram into Paint.NET.
  - Select Tool > Magic Wand.
  - Click on a background area.
  - Push the Delete button (on your keyboard).
  - The background area should be a checkerboard pattern.
  - (N.B.: Paint.NET was a capstone project at the University of Washington.)

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System Architecture

Example System Architecture
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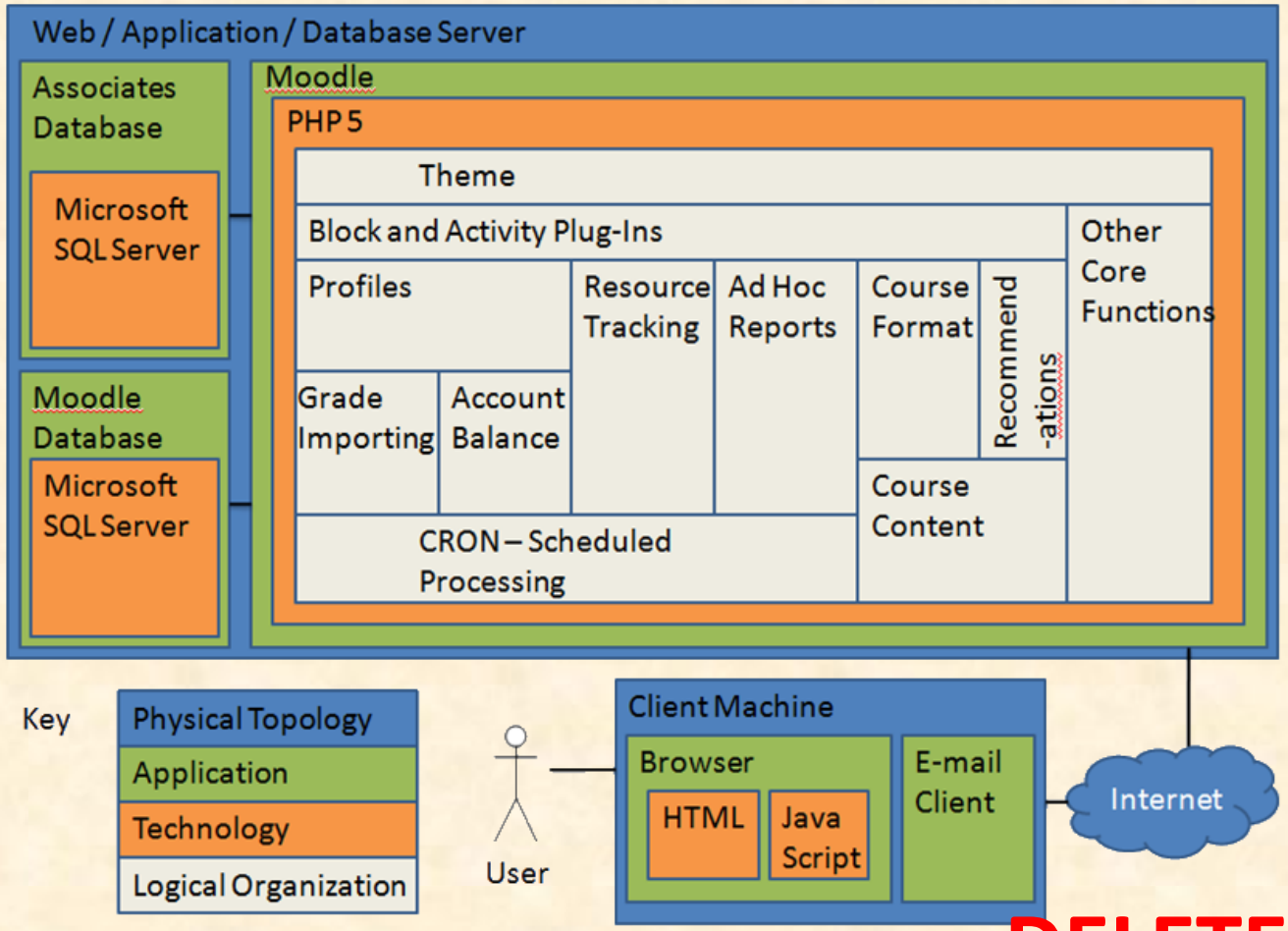
Auto-Owners Insurance Enterprise Learning Management System Architecture Diagram



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System Architecture

Example System Architecture
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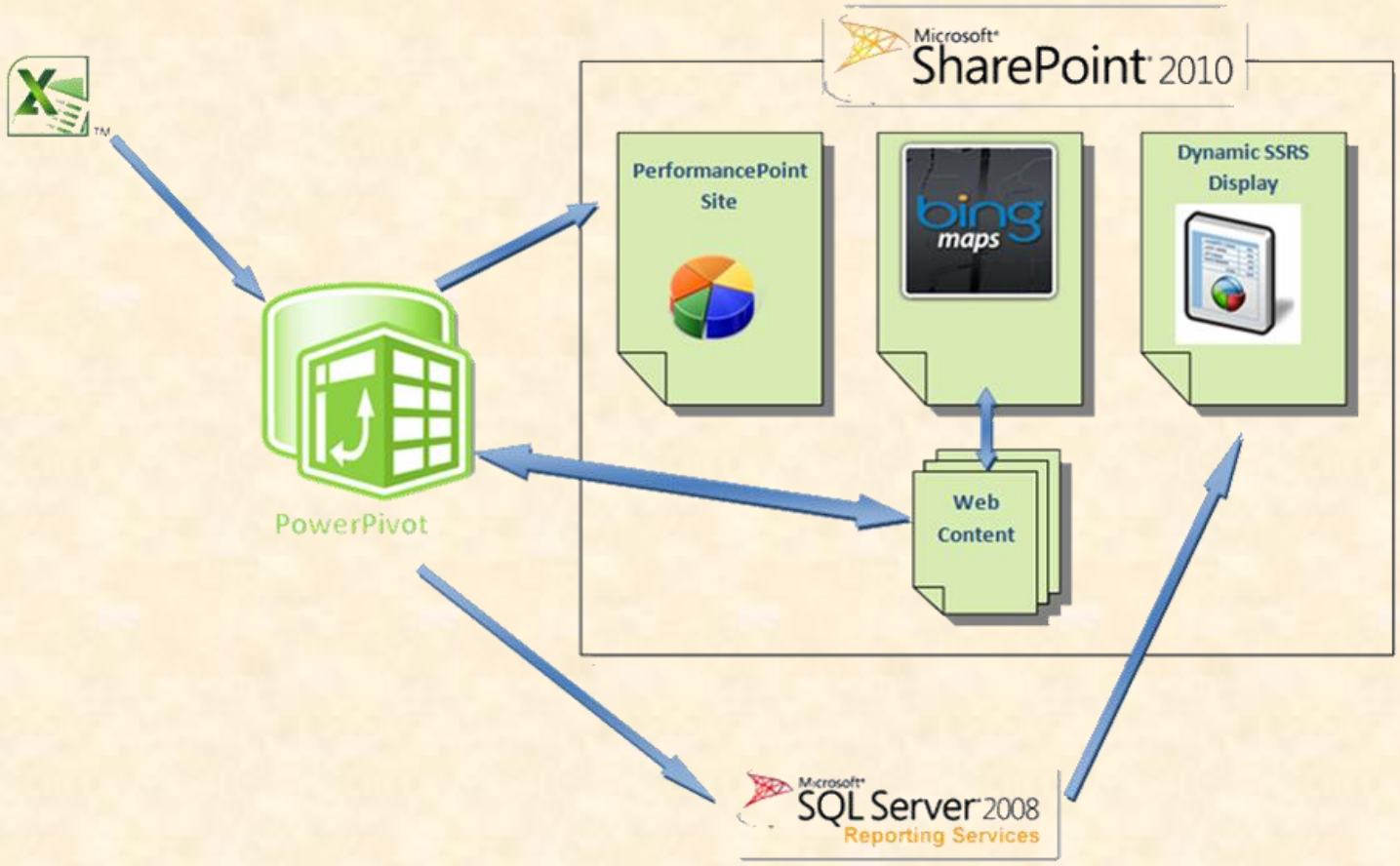

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System Components

- Hardware Platforms
  - Point 1
  - Point 2
  - Point 3
  - Etc…
- Software Platforms / Technologies
  - Point 1
  - Point 2
  - Point 3
  - Etc…

List your hardware and software platforms including all of the technologies that your project will use.

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Testing

- Point 1
- Point 2
- Point 3
- Etc…

Articulate your plans for testing your software system.

List any tools that you plan to use.

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Risks

- Risk 1
- Risk 2
- Risk 3
- Risk 4
- Etc…

Articulate your major risks.

For each risk, describe what the risk is and how you plan on mitigating it.

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