MICHIGAN STATE UNIVERSITY

09/02: Risks and Prototypes

The Capstone Experience

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Spring 2025

From Students…
…to Professionals

Risks and Prototypes: Agenda

- Reminders: Attendance and Work
- Risks
- Prototypes
  - What and Why
  - Basketball Play Effectiveness
  - Basketball Player Timer
- What's ahead?

Meeting Attendance vs Work

- MAPP Points
  - 5% of Final Grade
  - Can Go Negative
- All-Hands Meeting Ready
  - 3:00:00 p.m.
  - 3:00:01 p.m. → -0.5 MAPP Points
  - 3:05:01 p.m. → -1.0 MAPP Points
- Excused
  - Meeting Attendance
    - Almost Never For Personal Reasons
    - Occasionally for Professional Reasons
  - Work
    - Never For Any Reasons
    - Missing Work ≥ Missing Meetings
- **Read the Capstone Overview slides and the syllabus.**

Meeting and Work Expectations

- Meetings
  - In Person
  - Possibly Excused but Very Limited
  - If Miss Team Presentation, Must Give Presentation to Instructors
- Work
  - Entire Semester
  - Cannot Excuse Work Even if…
    - …Meeting Attendance Excused
    - …Attending Meetings
  - Missing work…
    - …may affect Technical Contribution.
    - …will affect Team Contribution.
    - …will affect Final Grade.
- Example
  - Miss Entire Week
    - Attendance
      - Excused: -0
      - Unexcused:
        - -3+ MAPP Points == 3+% of Final Grade
        - -10 MAPP Points == 10% of Final Grade
    - Work
      - Attending Meetings or Attendance Excused or Attendance Unexcused
      - 1/15th Semester = 7% Semester ⇒ Earned Team Points ≤ 93% of 70 Points
      - At Least -7% of Team Contribution Grade == At Least -4.9% of Final Grade
- **Read the Capstone Overview Slides and Syllabus.**

Spring 2025 Capstone Grade Distribution

Grade	Count	%	Cume %
4.00	97	55.1%	55.1%
3.50	27	15.3%	70.5%
3.00	11	6.3%	76.7%
2.50	15	8.5%	85.2%
2.00	7	4.0%	89.2%
1.50	4	2.3%	91.5%
1.00	6	3.4%	94.9%
0.50	0	0.0%	94.9%
0.00	9	5.1%	100.0%

Risks and Prototypes: Agenda

✓Reminders: Attendance and Work

➢Risks

- Prototypes
  - What and Why
  - Basketball Play Effectiveness
  - Basketball Player Timer
- What's ahead?

Identifying Risks

- What You Don't
  - Know
  - Understand
  - Know How to Do
- Normally
  - Major Project Features
  - "Showstoppers"
  - Can't Do Feature ⇒ Can't Do Project
- 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

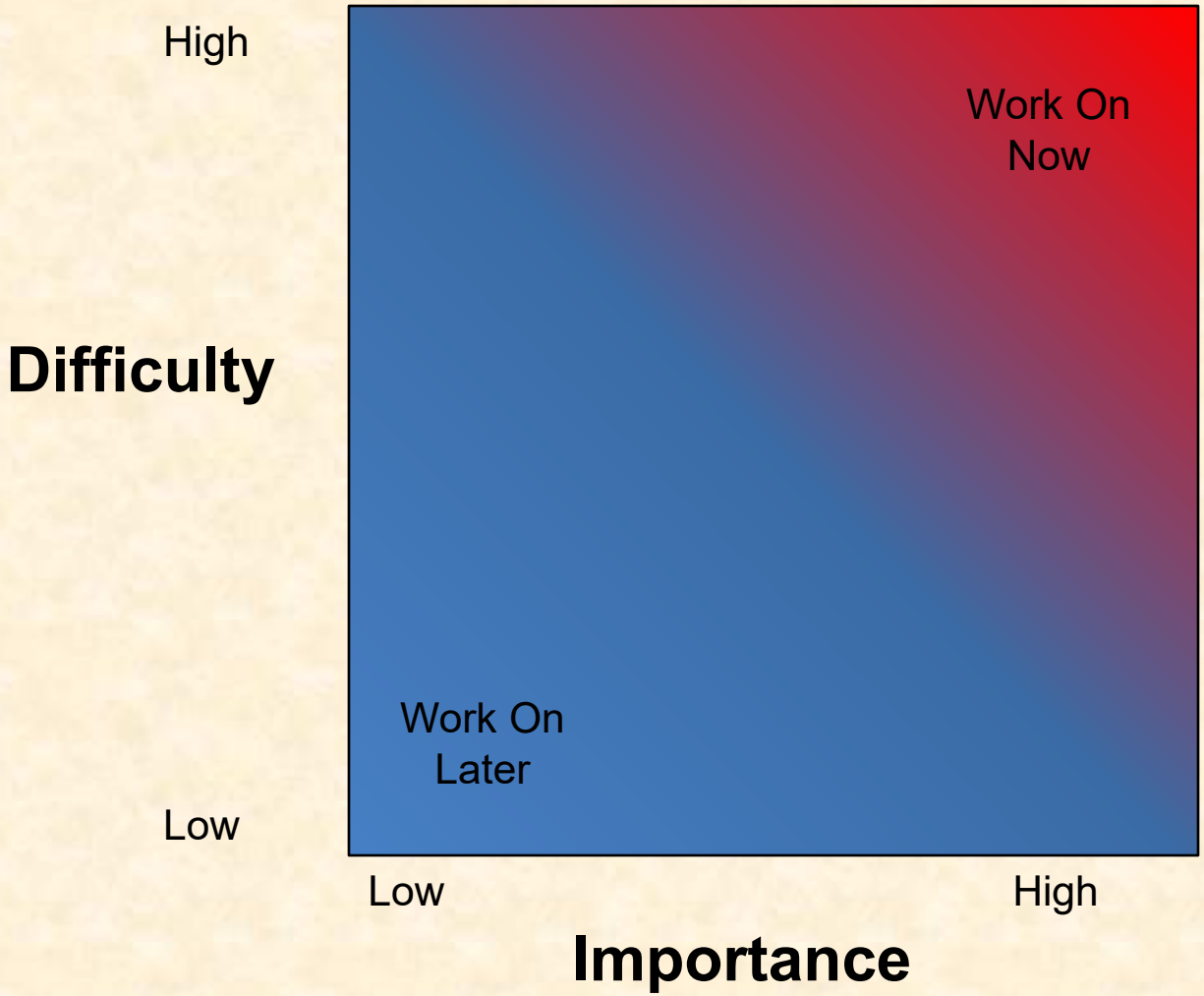
Including but not limited to...

- Business Processes
- Key Application Features
- Hardware Systems
- Software Systems
- Development / Programming Environments
- 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

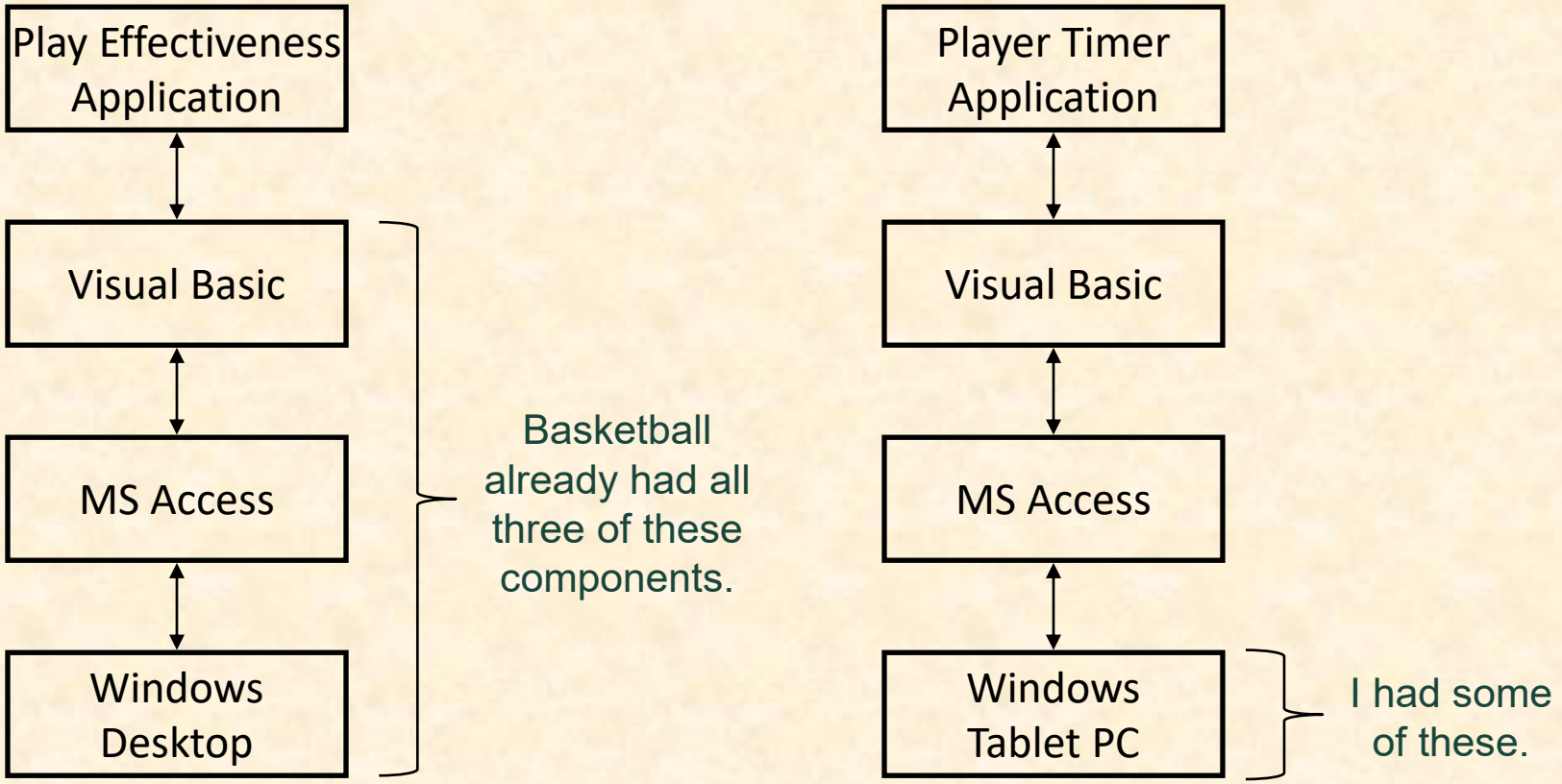
Prioritizing Risks



Case Studies: MSU Men's 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
  - Use On the Bench, During the Game

Basketball Apps Architectures



Basketball Apps Risks

- What SDK/APIs should I use?
- Can I write this in Visual Basic?
- How do I make a UI in VB?
- How do I interface VB with Microsoft Access?
  - Create/Open/Save a Database?
  - Read/Write Records?
  - Traverse Records?
- How do I implement clocks in Windows?
  - Game Clock?
  - Wall Clock?
- How do I generate a report from Access?

Mitigating Risks

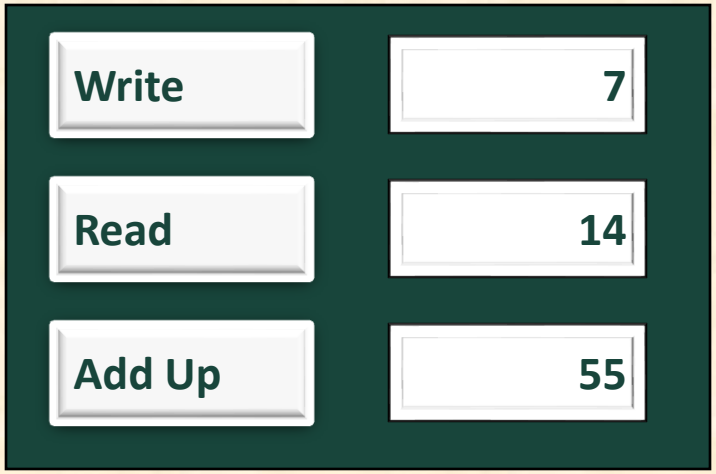
- Use Existing Resources
  - Including But Not Limited To
    - Faculty
    - Other Students
    - Product Demos
    - Online Examples
    - Etc...
  - Test Drive
    - Install
    - Compile
    - Extend
    - Etc...
- Build Prototypes
  - Single Purpose
  - Quick-and-Dirty

Nota Bene:

1. Check license if including in project.
2. Document.
3. Inform client.

Basketball Apps Risk Mitigation

- Implementing a Clock
  - Start /Stop
  - Counts Down
  - By Minutes:Seconds
- Handling Access Records
  - Write Number
  - Read Number
  - Add Up Numbers



Risks and Prototypes: Agenda

- ✓Reminders: Attendance and Work
- ✓Risks
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    - Basketball Play Effectiveness
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Aside: Capstone Transition [1 of 2]

- From… "Make one of these." –CSE Professor
  - Coding
  - Valuable Skills
- …To "Solve my problem." –Customer/Client
  - Gather Requirements
  - Design
    - Architecture
    - User Experience
  - Highly Valuable Skills

Aside: Capstone Transition [2 of 2]

- Coding ← Valuable
  - Implement Piece of Architecture
  - Based On Detailed Specification
- Architecture ← More Valuable
  - Identify Parts and Pieces
  - Organize Into Comprehensive System
  - Based On Design
- Design (Not UX) ← Most Valuable
  - Create Solutions to Problems
  - Gather Requirements
  - Based on Working with Users

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
- 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 onto an iOS device.
- …Etc….

Why? Identify Risks

- 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…

Tradeoffs: Speed (to Write) vs…

- Speed (to Write) vs Best Software Practices
  - Testing
  - Documentation
  - Security
  - Software Engineering
  - Usability
  - Maintainability
  - Performance
  - Coding Standards
  - User Interface Standards
  - Using Real Data
  - Etc…
- Hence, Probably Not Be Appropriate in Final Deliverable

Challenge/Danger

Googling or LLM-ing for Answers

- "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.)
- Do not merely copy and paste.

Often My Biggest Frustration

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  - ✓What and Why
  - ➢Basketball Play Effectiveness
    - Basketball Player Timer
- What's ahead?

Basketball Play Effectiveness App

- Functional Specifications
  - Determine Effectiveness of Plays
  - Record All Plays with Results
  - Produce Reports of Effectiveness
    - Each Play
    - # of Successes / # of Attempts
- Design Specifications?
- Technical Specifications?

Basketball Staff

- Head Coach
- Associate & Assistant Head Coaches
- Video Coordinator
  - Coordinates…
    - …student managers preparing video.
    - …video for coaches to watch.
  - Reverse Engineers Opponents
    - Players
    - Plays
  - Coaches Scout Team
  - Often Transitions to Coaching
- Director of Basketball Operations (DOBO)
- Graduate Assistants (GAs)
- Undergraduate Managers

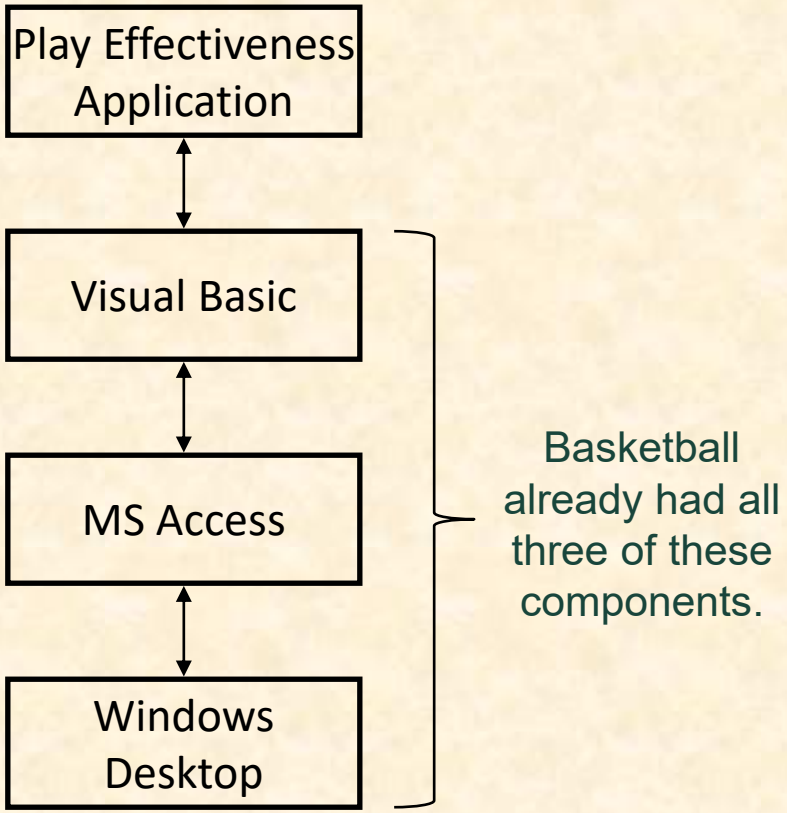
Initial Meeting with Video Coordinator

I Learned…

- Done After Game
  - On Desktop Computer
  - From DVR-Like 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?**

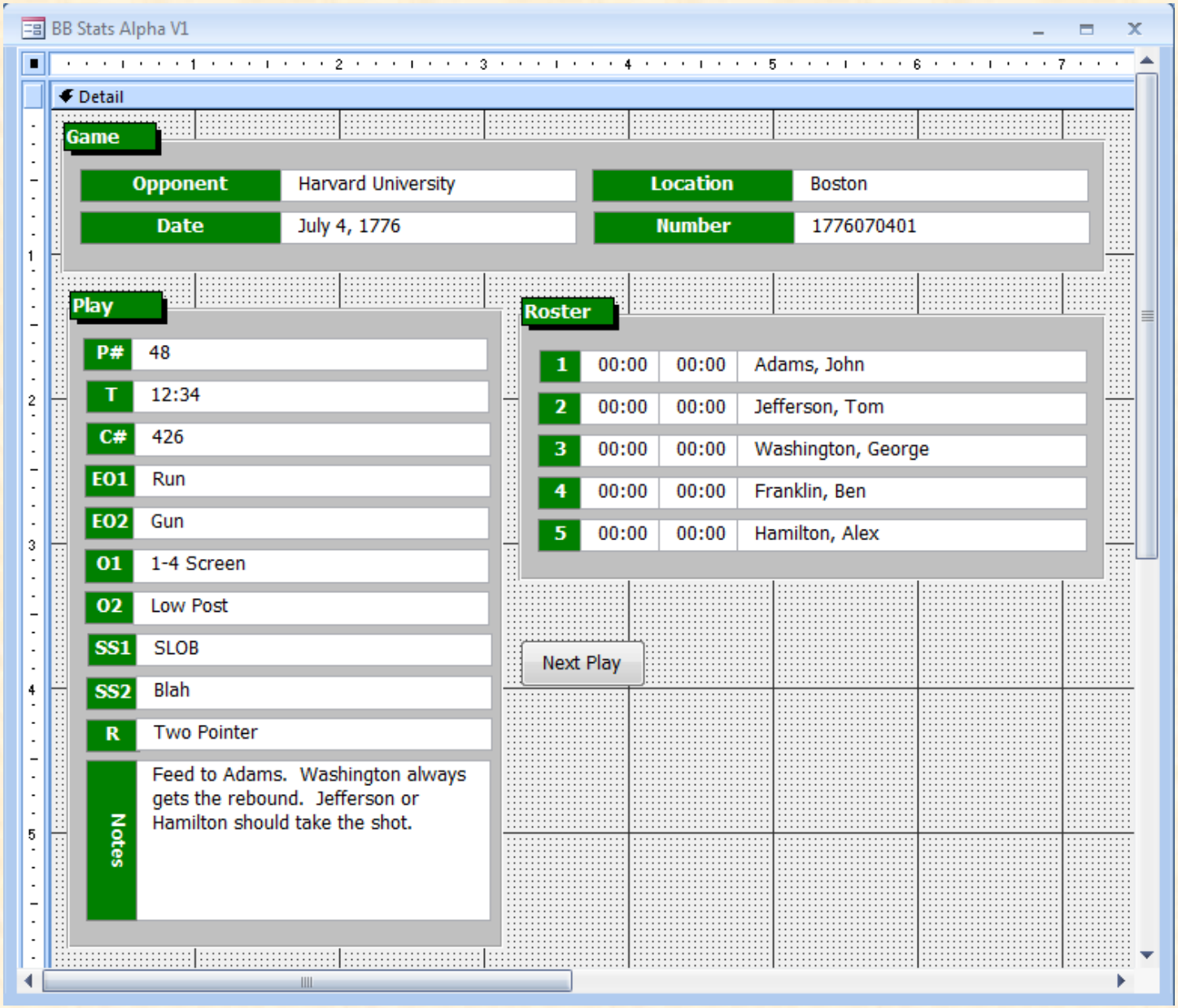
The Business Processes

Play Effectiveness Architecture



Risks

- Learning Basketball Business Processes
- Programming in Visual Basic
  - Not: Can I learn VB?
  - Can this be done in VB?
- Making a UI 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

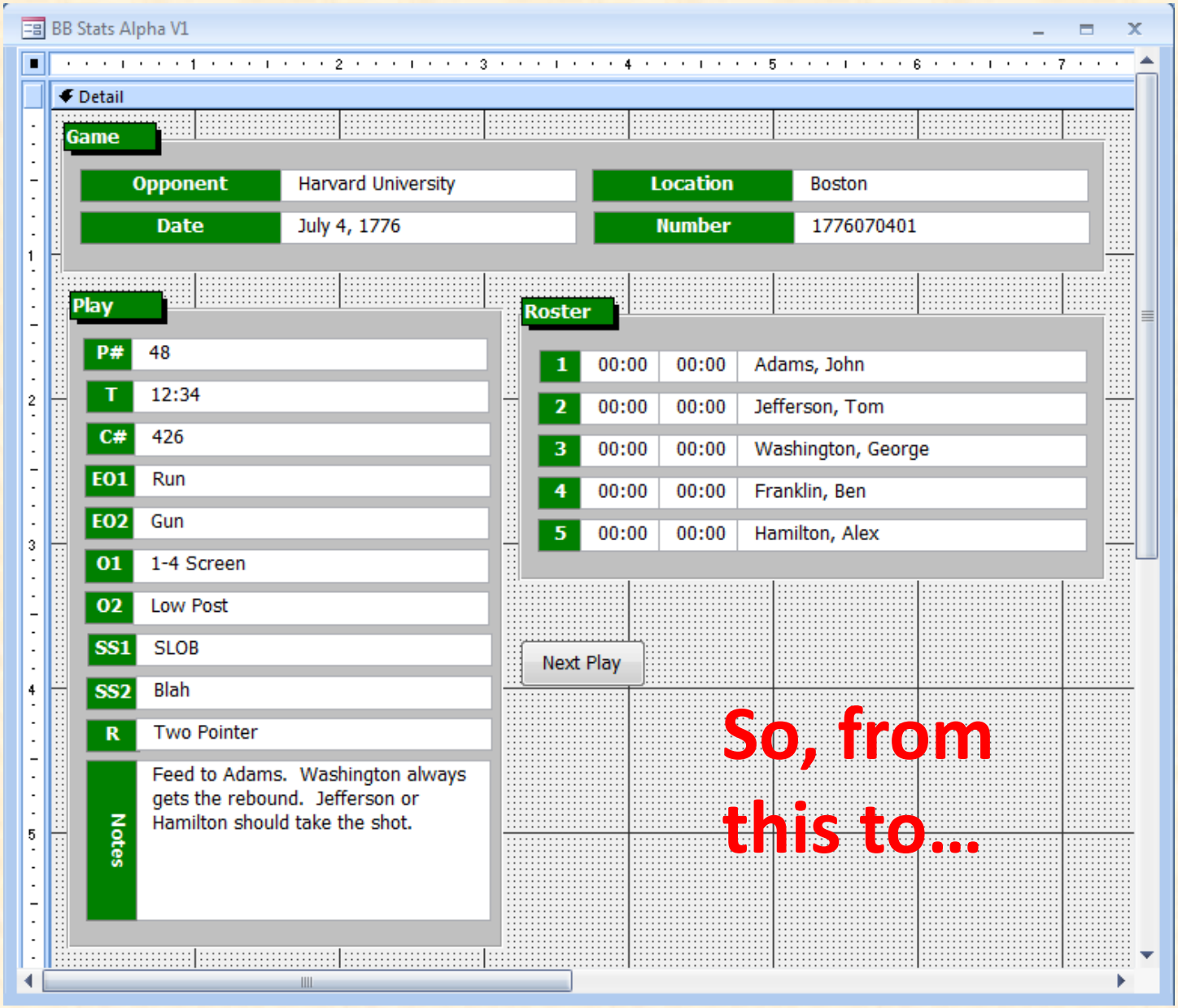
[1 of 2]

- 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
    - CS Paradigm: 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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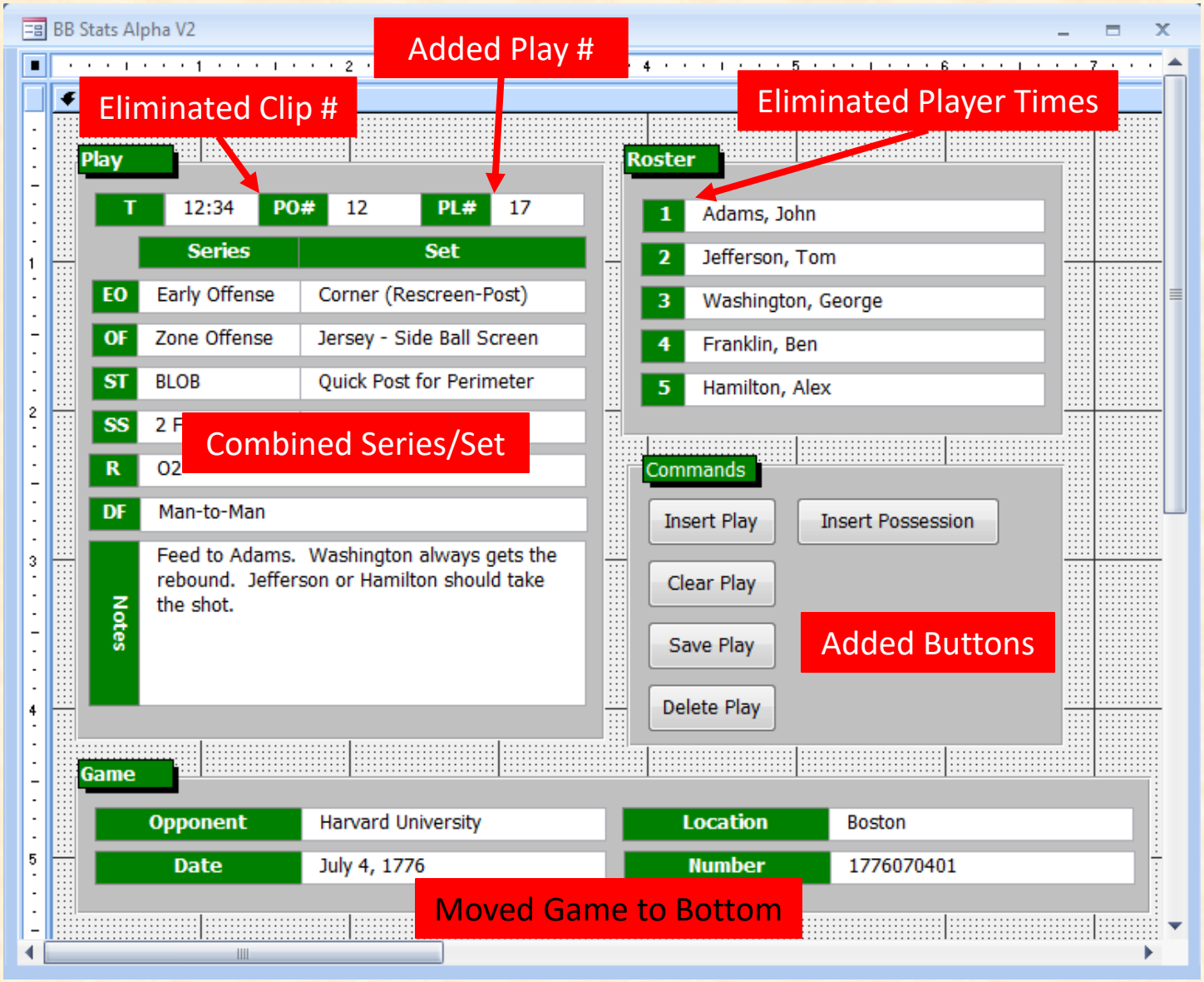


BB PE PV2

Fields

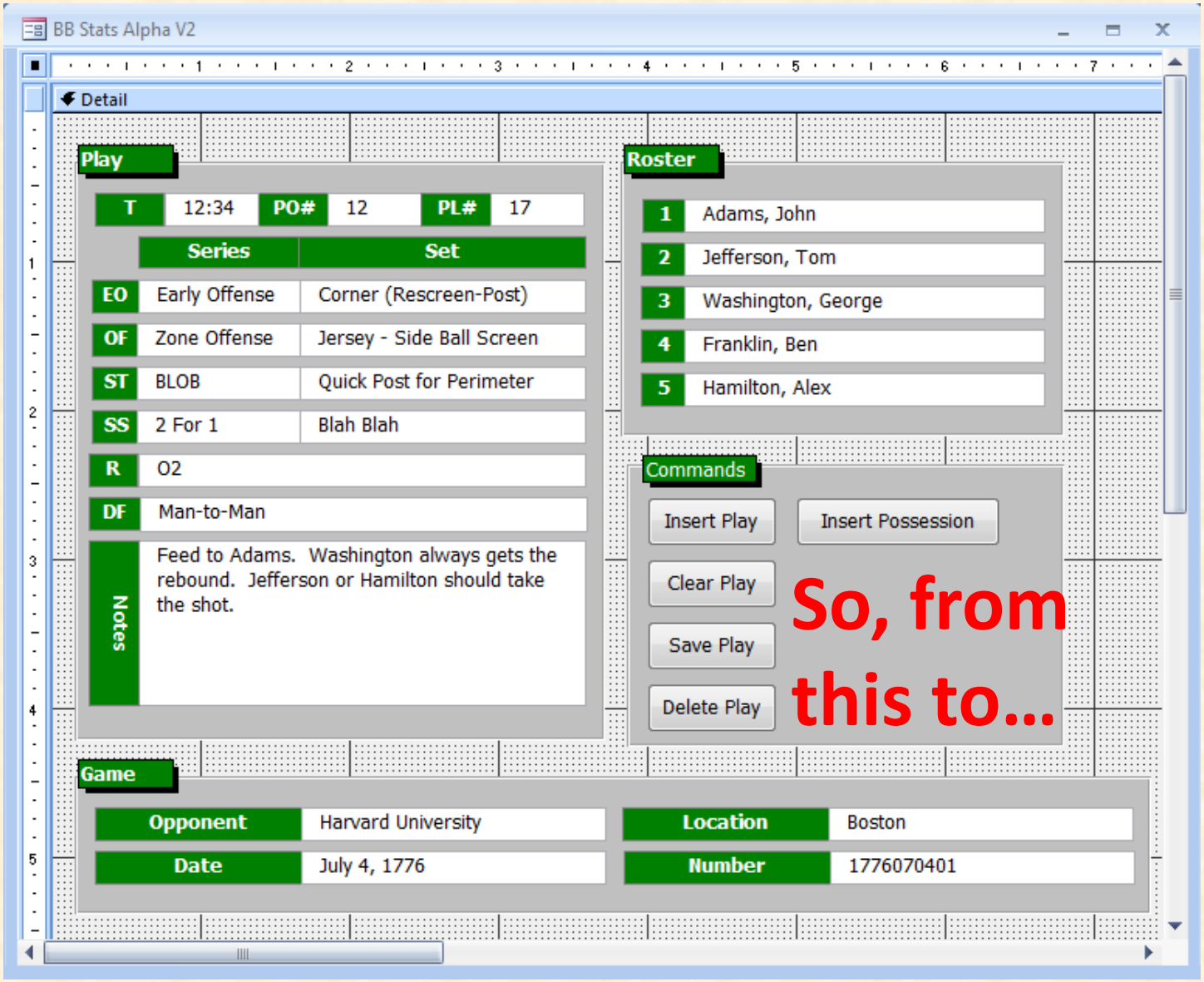
- PO#
  Possession Number
- PL#
  Play Number
- SS
  Special Situations
- DF
  Defense

Nota Bene

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

What I Learned From PV2

- Wanted to Grade Execution of Plays
- Wanted to Record Player Steals and Assists (Remember this…)
- Needed to Navigate Plays and Possessions
- Wanted to See Running Total Score



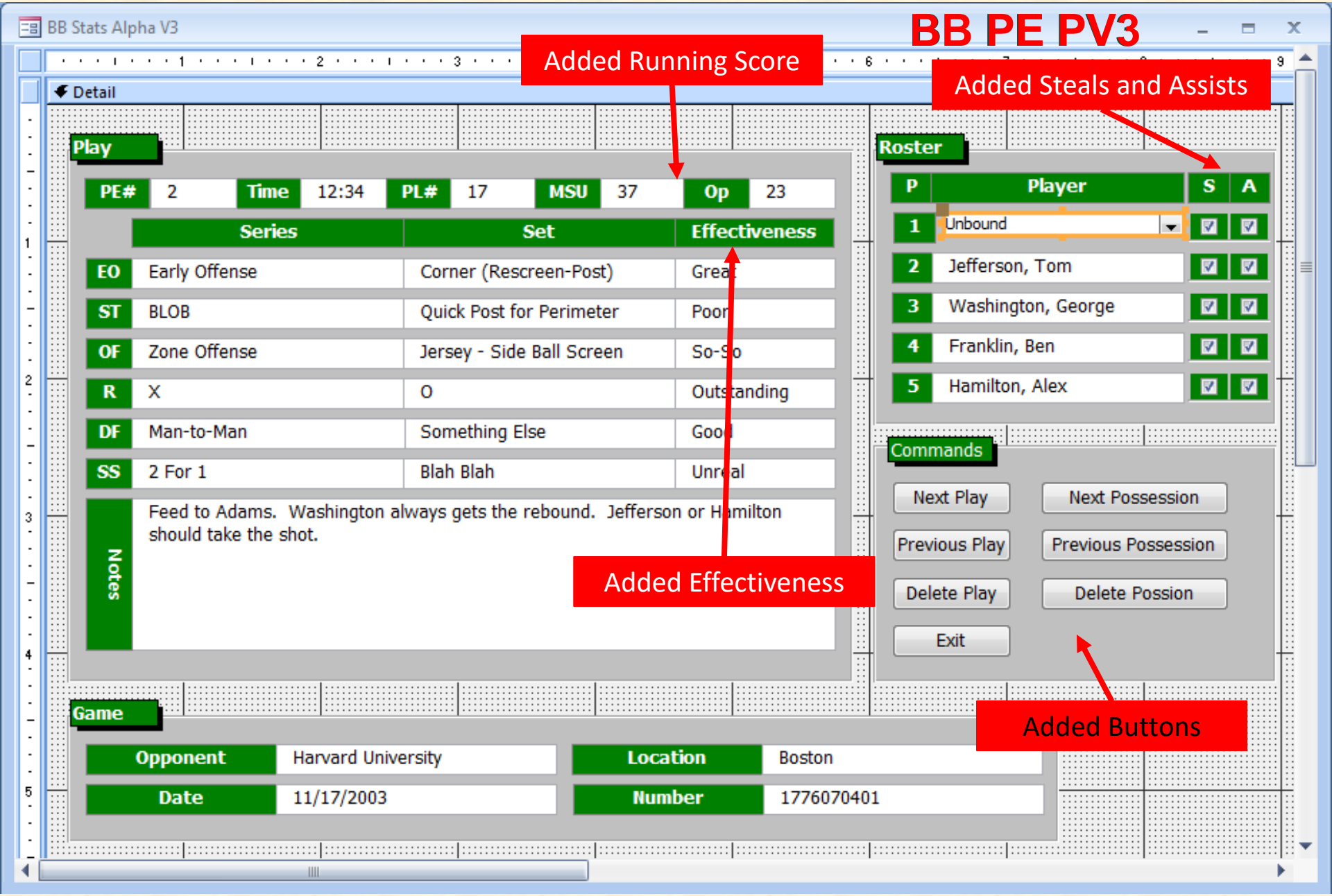
BB PE PV2

Fields

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

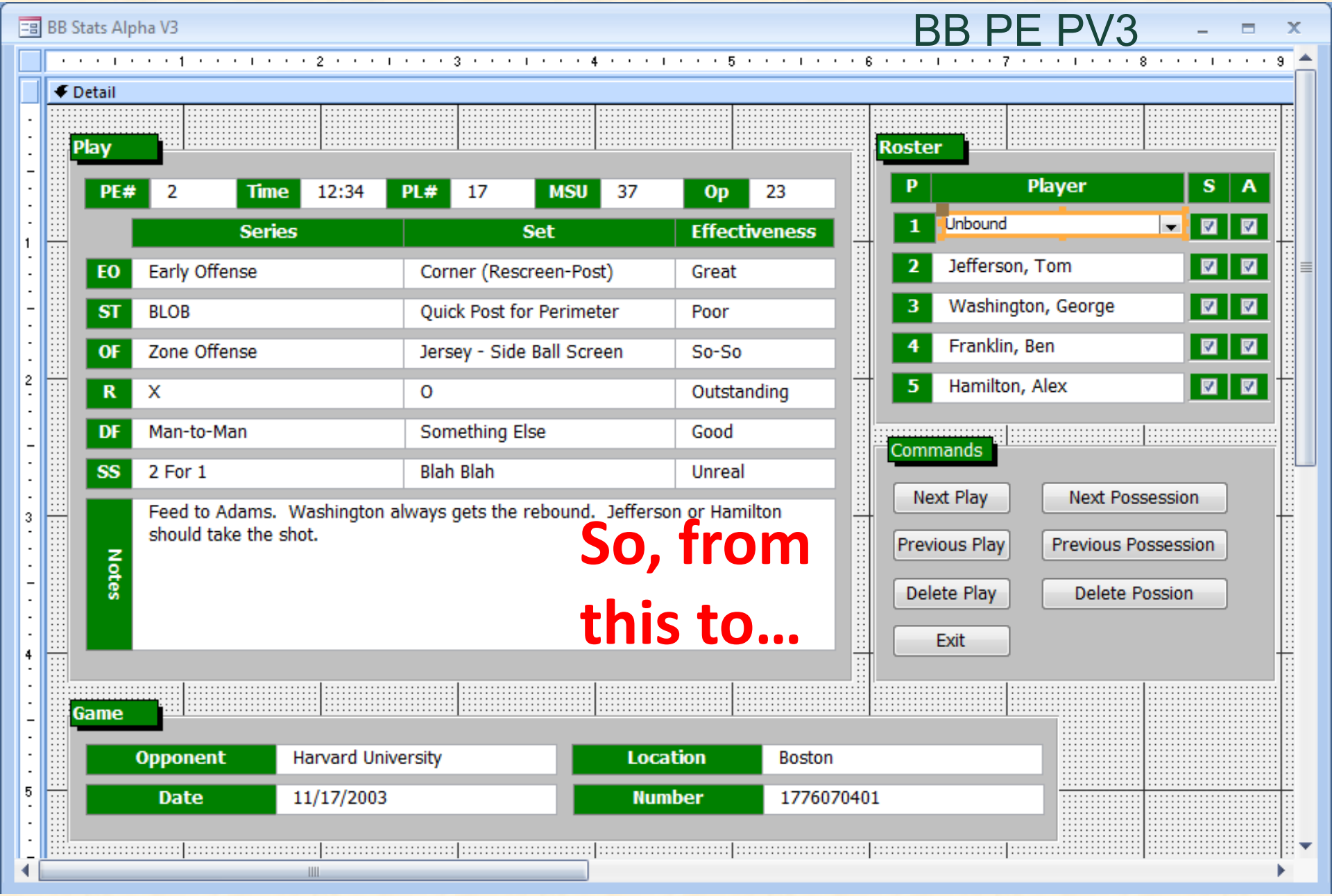
Nota Bene

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


BB Stats Alpha V3
BB PE PV3
Added Running Score
Added Steals and Assists
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.
Added Effectiveness
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
Added Buttons
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 Associated With Players
  - Series/Set Combined
    "Thumbs Up" Rather Than "Thumbs", "Up" or Thumbs(Up)
  - To Record Player Rebound
- Will be used by…
  - Video Coordinator, GAs, and Managers
  - Very Comfortable with DVR Controls
- Did NOT Want to Record Player Steals or Assists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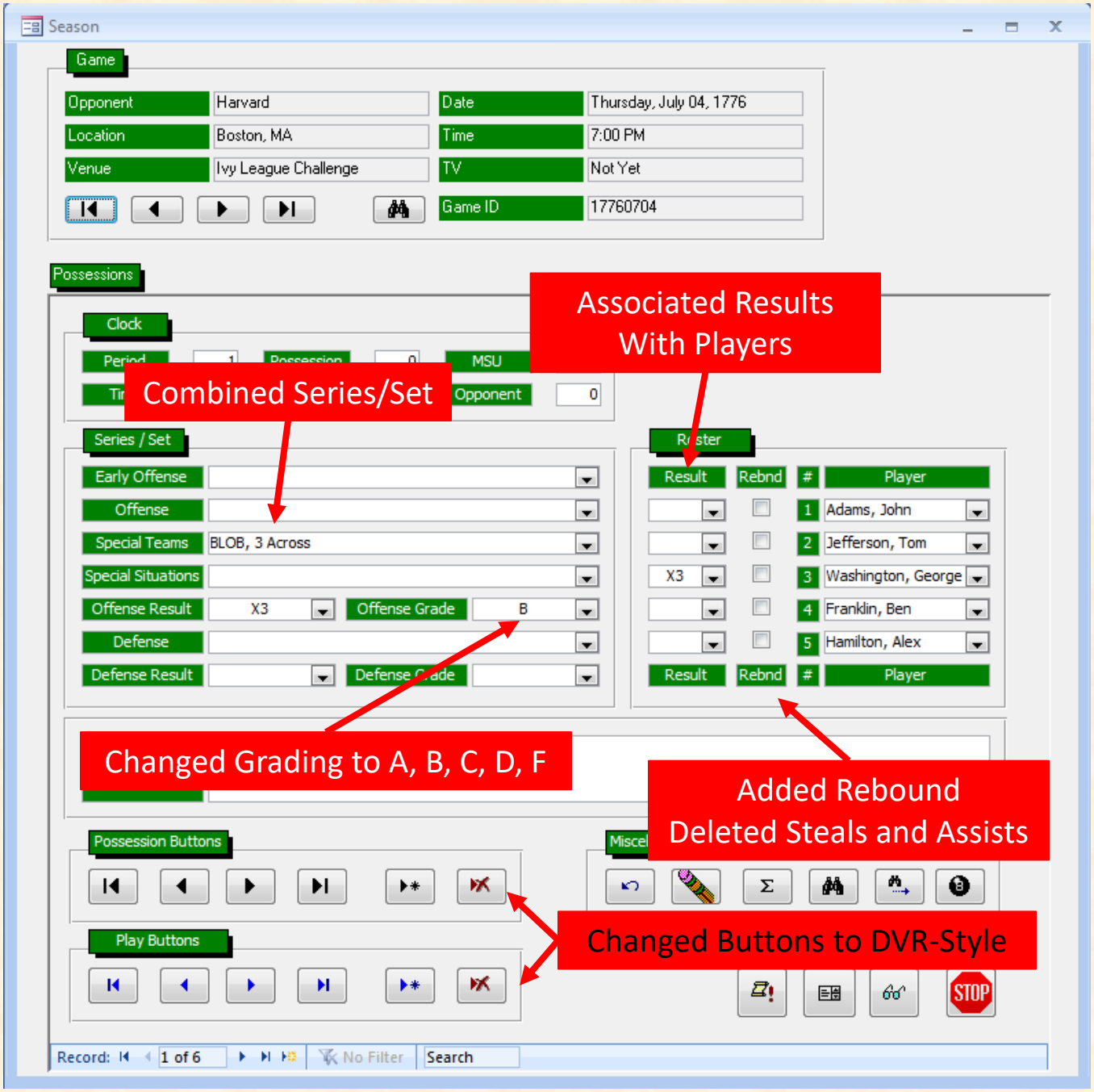


BB PE AV1

(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 AV1

(Alpha Version 1)

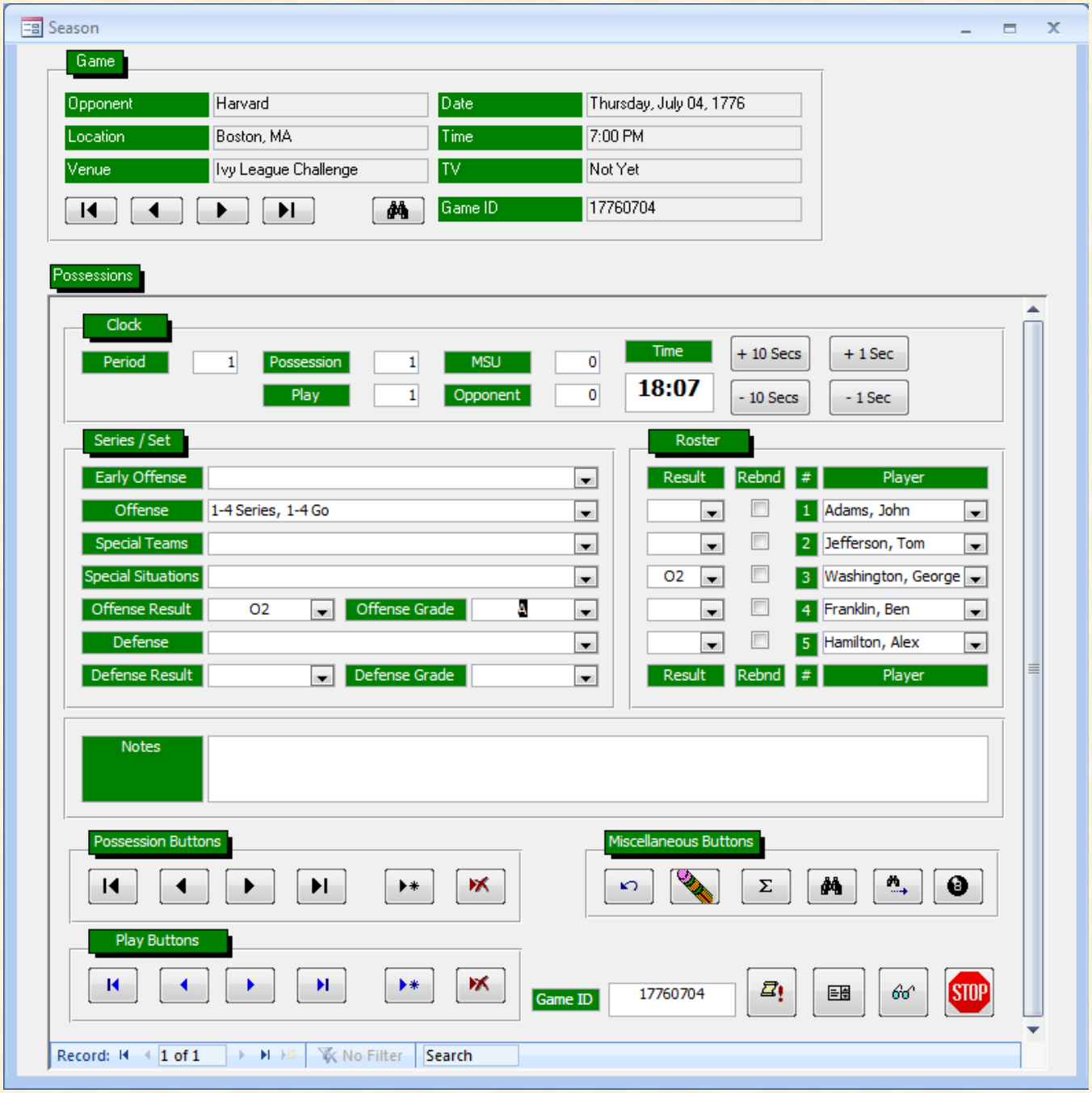
First Version With Code

Not Much Implemented

So, from this to…

BB PE AV1

Still Not Much Implemented



BB PE BV1

(Beta Version 1)

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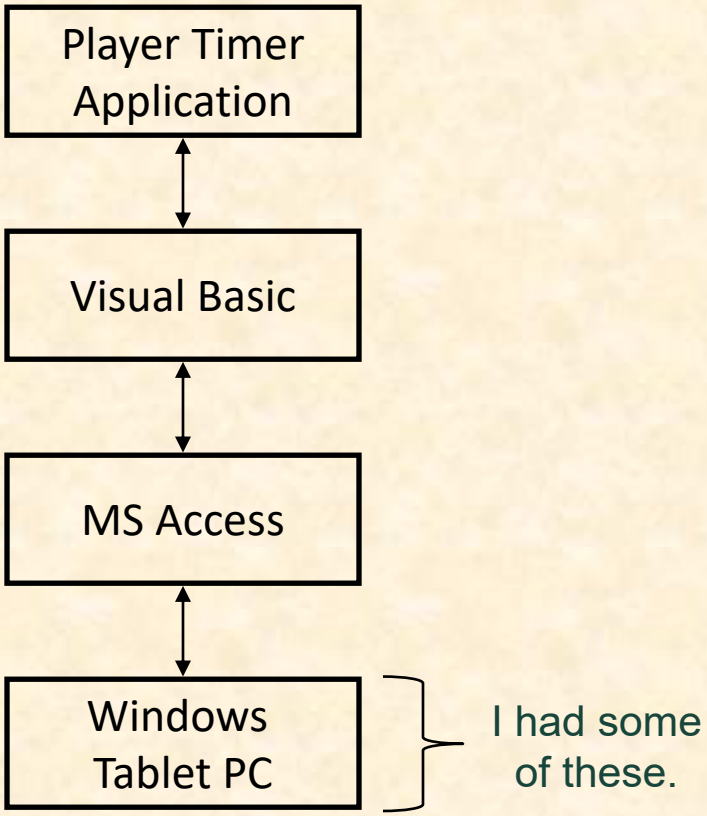
  - ✓What and Why
  - ✓Basketball Play Effectiveness
  - ➢Basketball Player Timer
- What's ahead?

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

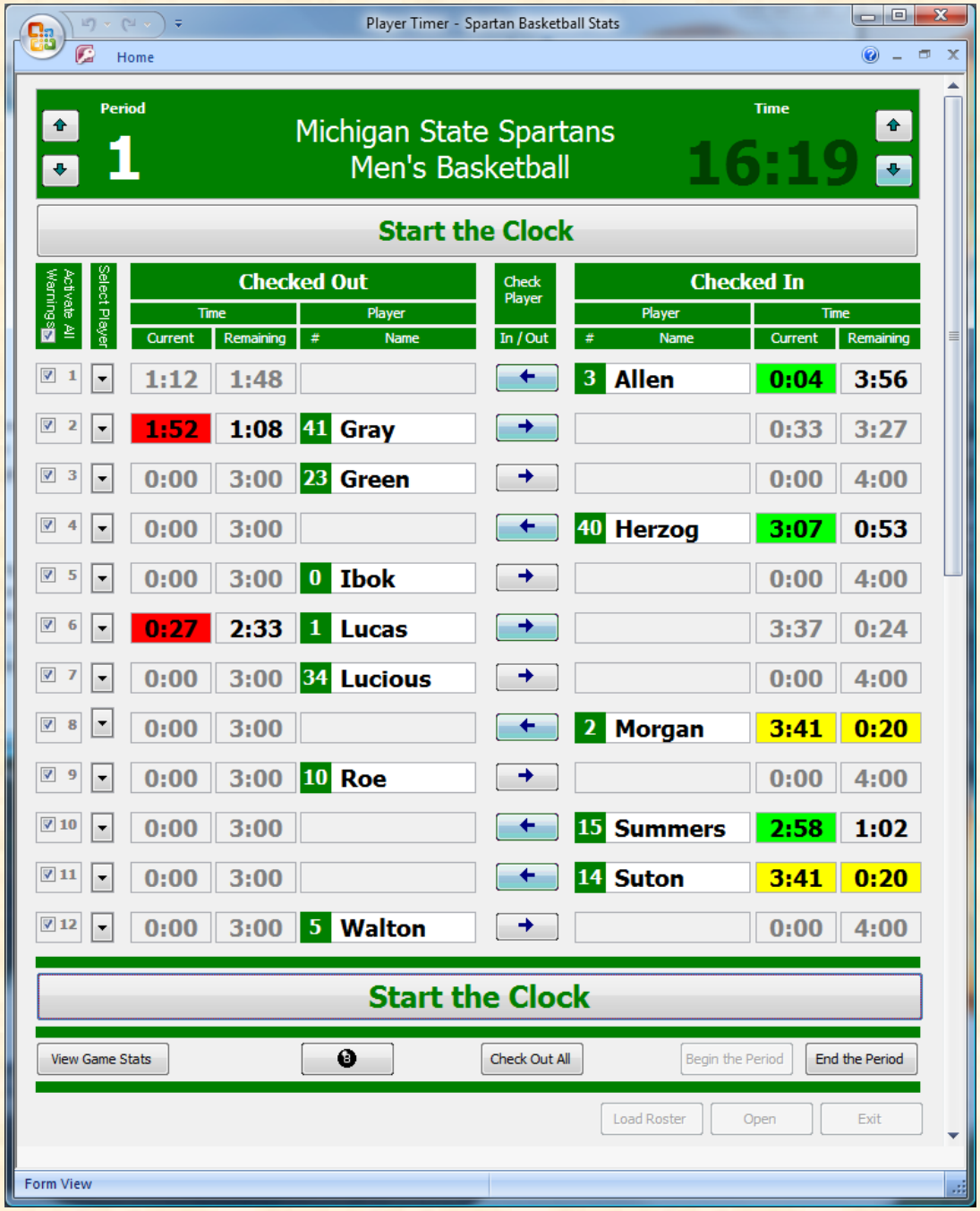
- Learning Basketball Processes
- Implementing Clocks in Windows?
  - Game Clock
  - Wall Clock
- Very Limited Screen Real Estate
  - Different Problem Than Mobile App
  - Must Feel Like Clipboard and Single Piece of Paper
- Computing and Displaying Cumulative Times
- Hidden Risk (“Danger Will Robinson!”)

Player Timer Development

- Knew Exactly What They Wanted, So…
- Designed “Final” Version
  - User Interface
  - Data Base Schema
  - Etc…
- Coded “Final” Version
- Bench Tested “Final” Version
- Field Tested “Final” Version
  - In Practice Scrimmage
  - Totally and Completely Unusable
- Scrapped “Final” Version UI and Started Over

Huge Mistake!

Aside: Great Example of Front-End / Back-End Architecture and Design



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

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What's ahead? [1 of 3]

- Upcoming Meetings
  - ~~09/02, Tu: Risks and Prototypes~~
  - 09/04, Th: Project Plan
  - 09/09, Tu: Team Status Report Presentations
  - 09/11, Th: Schedule and Teamwork
  - 09/16, Tu: Team Project Plan Presentations **←2 Weeks**
  - 09/18, Tu: Team Project Plan Presentations
  - 09/19, Fr: Team Photos (9:00 a.m. – 5:00 p.m.)

What's ahead?

[2 of 3]

Photo Shoot Schedule, Friday, September 19

- 10:00 Auto-Owners
- 10:10 MSUFCU
- 10:20 Magna VRAI4MI
- 10:30 Union Pacific
- 10:40 Launch
- 10:50 GM
- 11:00 Corewell Health
- 11:10 HAP
- 11:20 Magna LLM3DMID
- 11:30 UWM
- 11:40 BREAK
- 11:50 BREAK
- 12:00 BREAK
- 12:10 BREAK
- 12:20 BREAK
- 12:30 BREAK
- 12:40 NetJets
- 12:50 Anthropocene Institute
- 13:00 Kohl's
- 13:10 Vectra AI
- 13:20 Meijer
- 13:30 Delta Dental IQA
- 13:40 Magna AI4CBM
- 13:50 Amazon
- 14:00 Urban Science
- 14:10 Ludus
- 14:20 BREAK
- 14:30 McKesson
- 14:40 MSU CSE
- 14:50 Whirlpool
- 15:00 Ally
- 15:10 Stryker IST
- 15:20 TechSmith
- 15:30 Henry Ford Innovations eLUG
- 15:40 Delta Dental AIRMG
- 15:50 MSU Law
- 16:00 PACE

What's ahead? [3 of 3]

- 09/09: Team Status Report Presentations
  - 1 Week From Today
  - Split-Hands Meeting
  - Slide Deck Template Posted on Downloads Page
    - 4 Slides
    - Presentation 6 Minutes Max
  - Must Use Windows Version of Office 365 **←Note**
    (See Other Links > Syllabus 30. Editing Documents and Presentations Using Office 365)
  - Read Submission Instructions Carefully
  - Due by 11:59 p.m. ET, Monday, 09/08 **←Note**
  - Upload Two Times to Microsoft Teams
    - To General Channel File Space
      Folder "Team Status Report Presentation Slide Decks"
    - To Capstone Team's Private Channel
  - Aggregated Slide Decks by TM
    - On TM's Laptop Used by All Teams
    - One or More Presenters Per Team
    - Random Order

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