

01/13: Risks and Prototypes

The Capstone Experience

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*From Students...
...to Professionals*

Announcements 01/15

- 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...

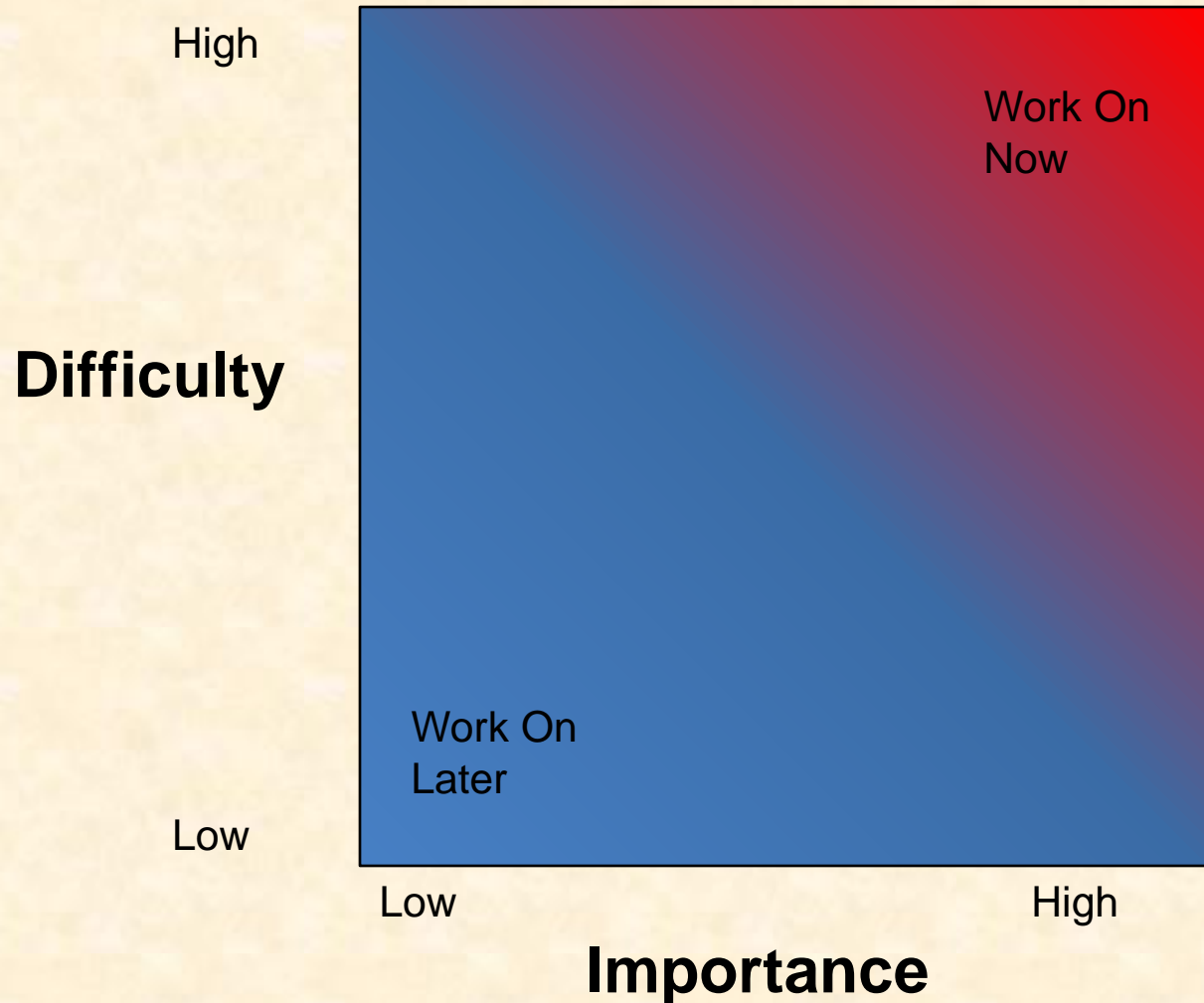


Prioritizing Risks

- 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

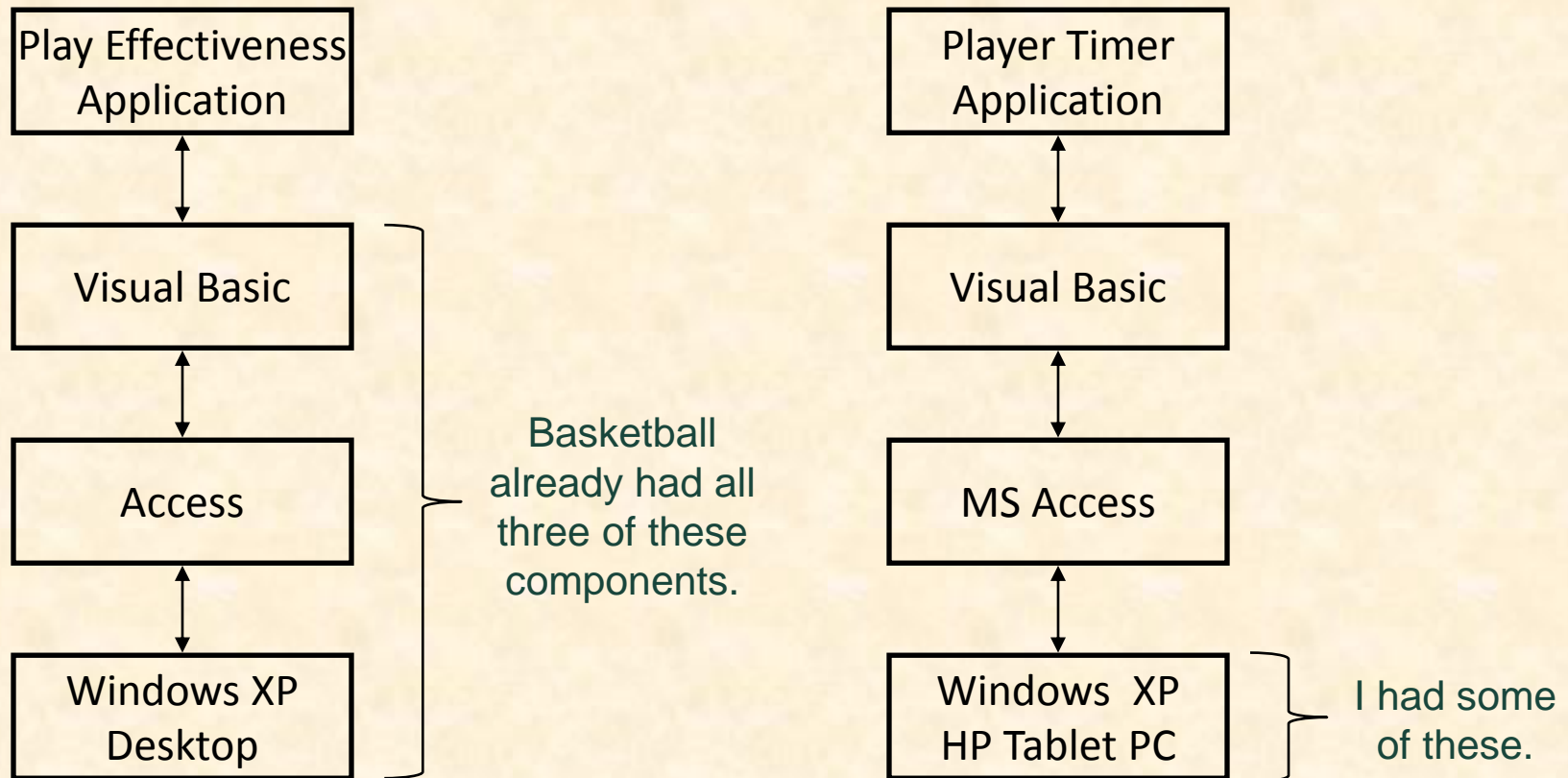


Case Studies: Basketball Apps

- 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



Your Risks?

- Team Auto-Owners
- Team Boeing
- Team Ford
- Team GM
- Team Google
- Team Meijer
- Team MSUFCU
- Quicken Loans
- 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

Often My Biggest Frustration

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



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
 - Each Play
 - # of Success / # of Attempts
- Design Specifications?
- Technical Specifications?



Initial Meeting with Video Coordinator

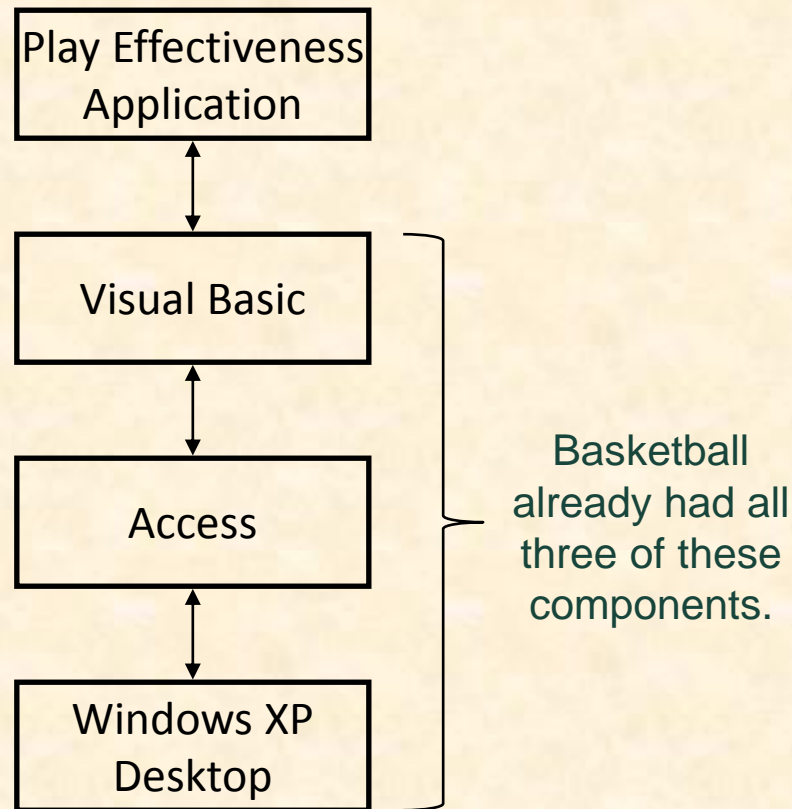
I Learned...

- 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 Stats Alpha V1

Detail

Game

Opponent	Harvard University	Location	Boston
Date	July 4, 1776	Number	1776070401

Play

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.

Roster

1	00:00	00:00	Adams, John
2	00:00	00:00	Jefferson, Tom
3	00:00	00:00	Washington, George
4	00:00	00:00	Franklin, Ben
5	00:00	00:00	Hamilton, Alex

Next Play

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 (Underneath)
- Never Have All Entries Filled at Once



What I Learned From AV1

(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 AV1

(2 of 2)

- 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#*)



BB Stats Alpha V1

Detail

Game

Opponent	Harvard University	Location	Boston
Date	July 4, 1776	Number	1776070401

Play

P#	48
T	12:34
C#	426
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EO2	Gun
O1	1-4 Screen
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2	00:00	00:00	Jefferson, Tom
3	00:00	00:00	Washington, George
4	00:00	00:00	Franklin, Ben
5	00:00	00:00	Hamilton, Alex

Next Play

So, from this to...

BB Stats AV1

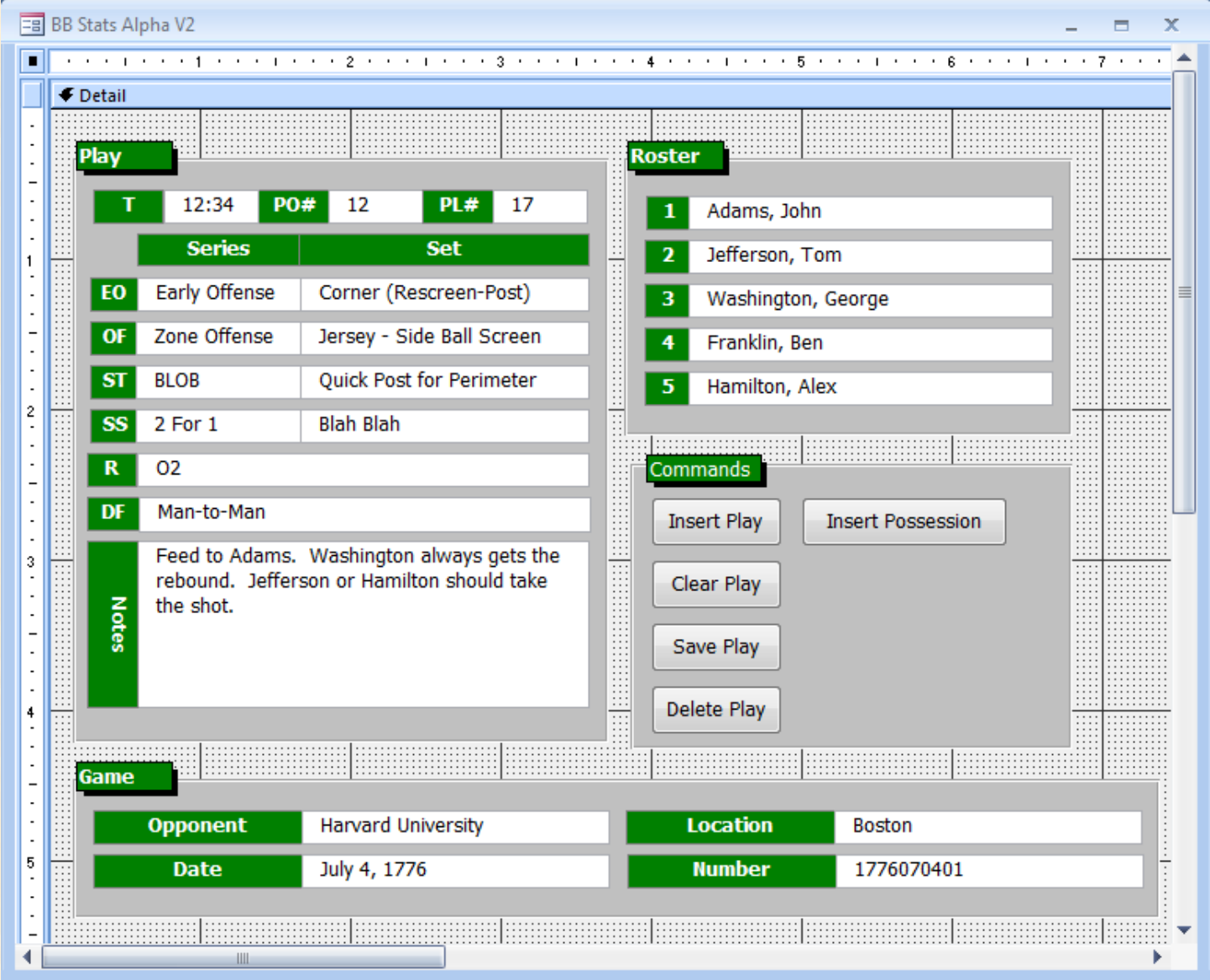
Fields

- 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 (Underneath)
- Never Have All Entries Filled at Once





BB Stats AV2

Fields

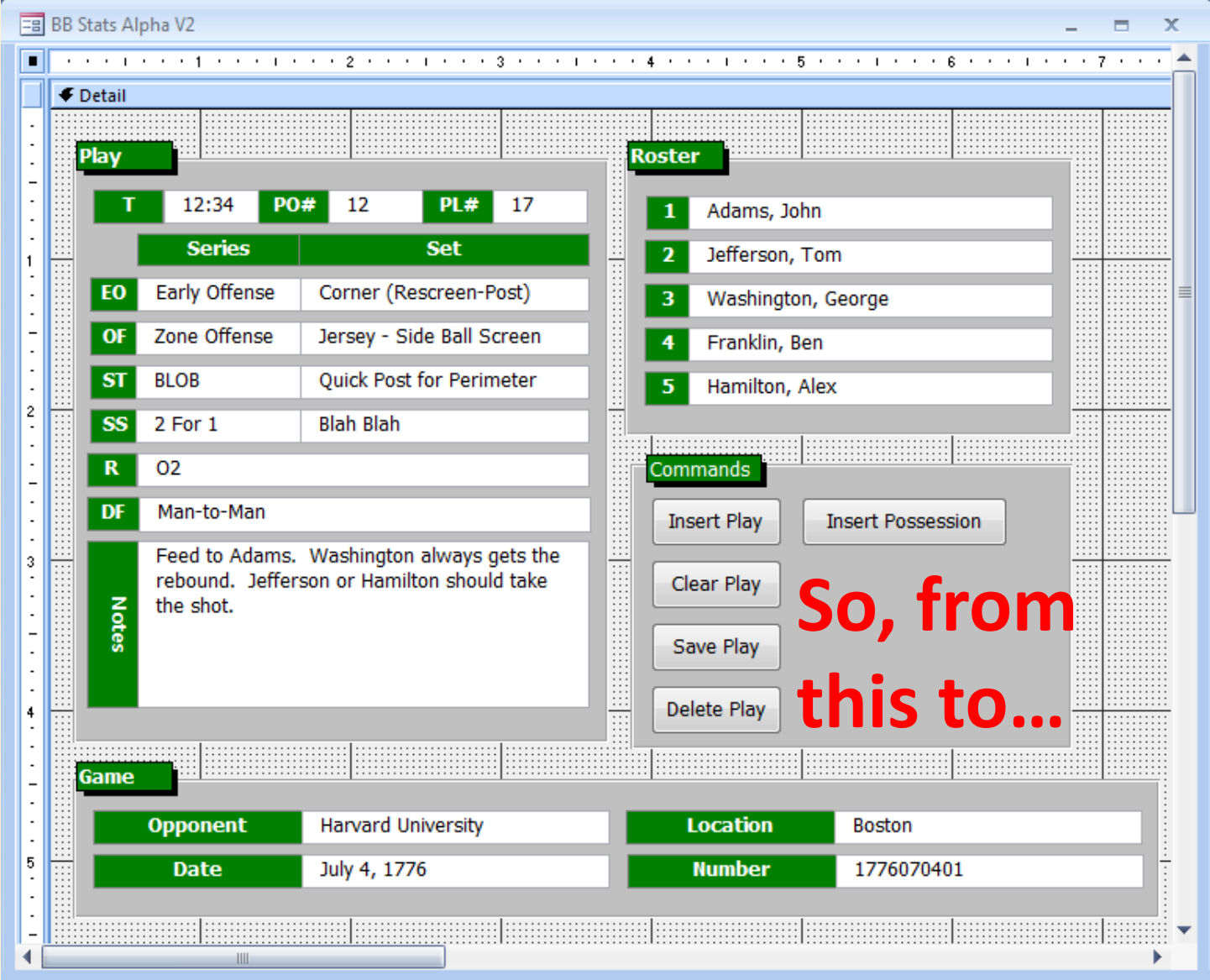
- PO# Possession Number
- PL# Play Number
- SS Special Situations
- DF Defense

Nota Bene

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

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



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

So, from this to...



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.

Game

Opponent	Harvard University	Location	Boston
Date	11/17/2003	Number	1776070401

Roster

P	Player	S	A
1	Unbound	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	Jefferson, Tom	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3	Washington, George	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4	Franklin, Ben	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
5	Hamilton, Alex	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Commands

-
-
-
-
-
-
-



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



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		

Roster

P	Player	S	A
1	Unbound	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	Jefferson, Tom	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3	Washington, George	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4	Franklin, Ben	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
5	Hamilton, Alex	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Commands

Next Play Next Possession

Previous Play Previous Possession

Delete Play Delete Possion

Exit

Notes

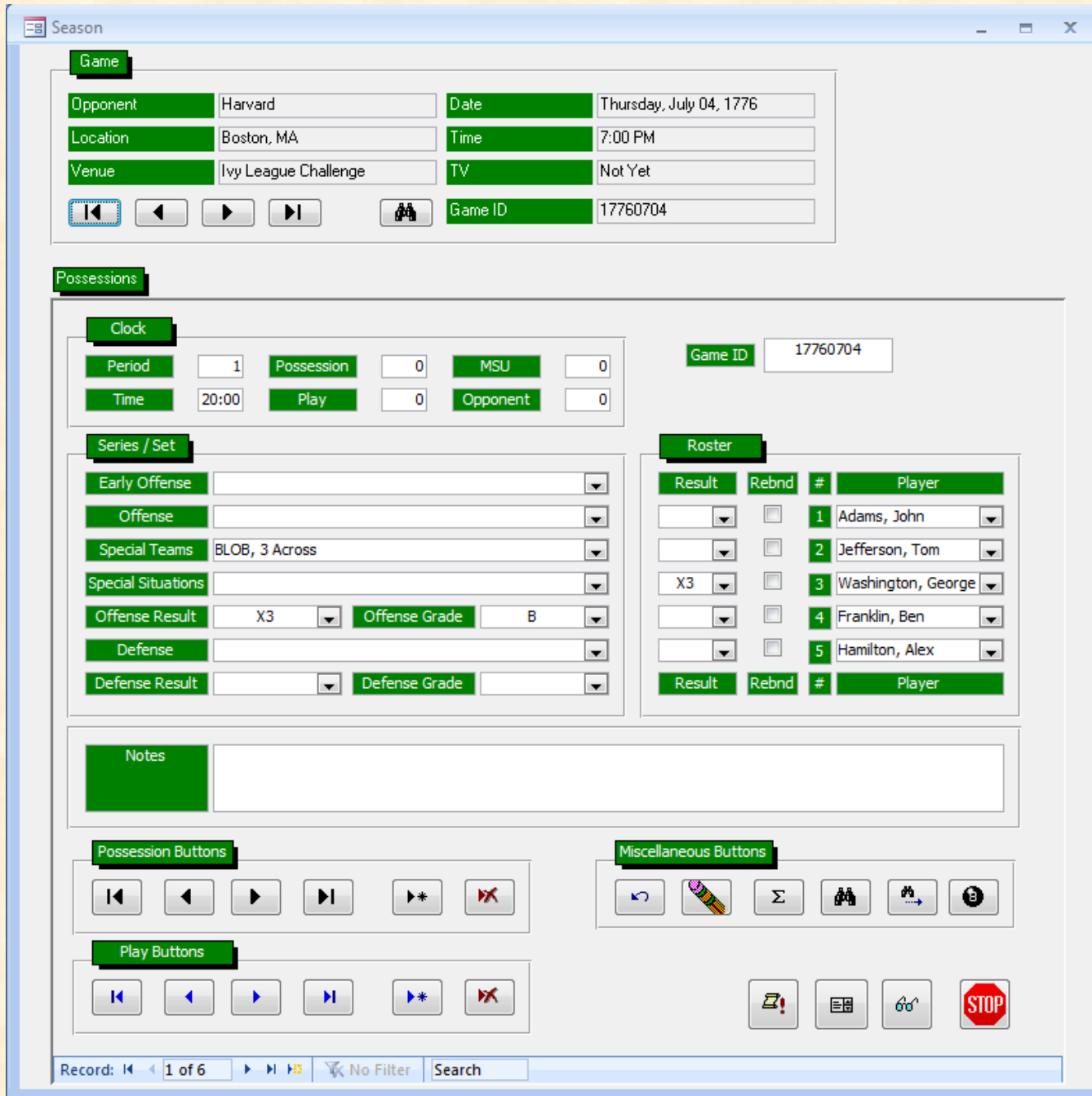
Feed to Adams. Washington always gets the rebound. Jefferson or Hamilton should take the shot.

So, from this to...

Game

Opponent	Harvard University	Location	Boston
Date	11/17/2003	Number	1776070401





BB Stats Beta 1

First Version
With Code

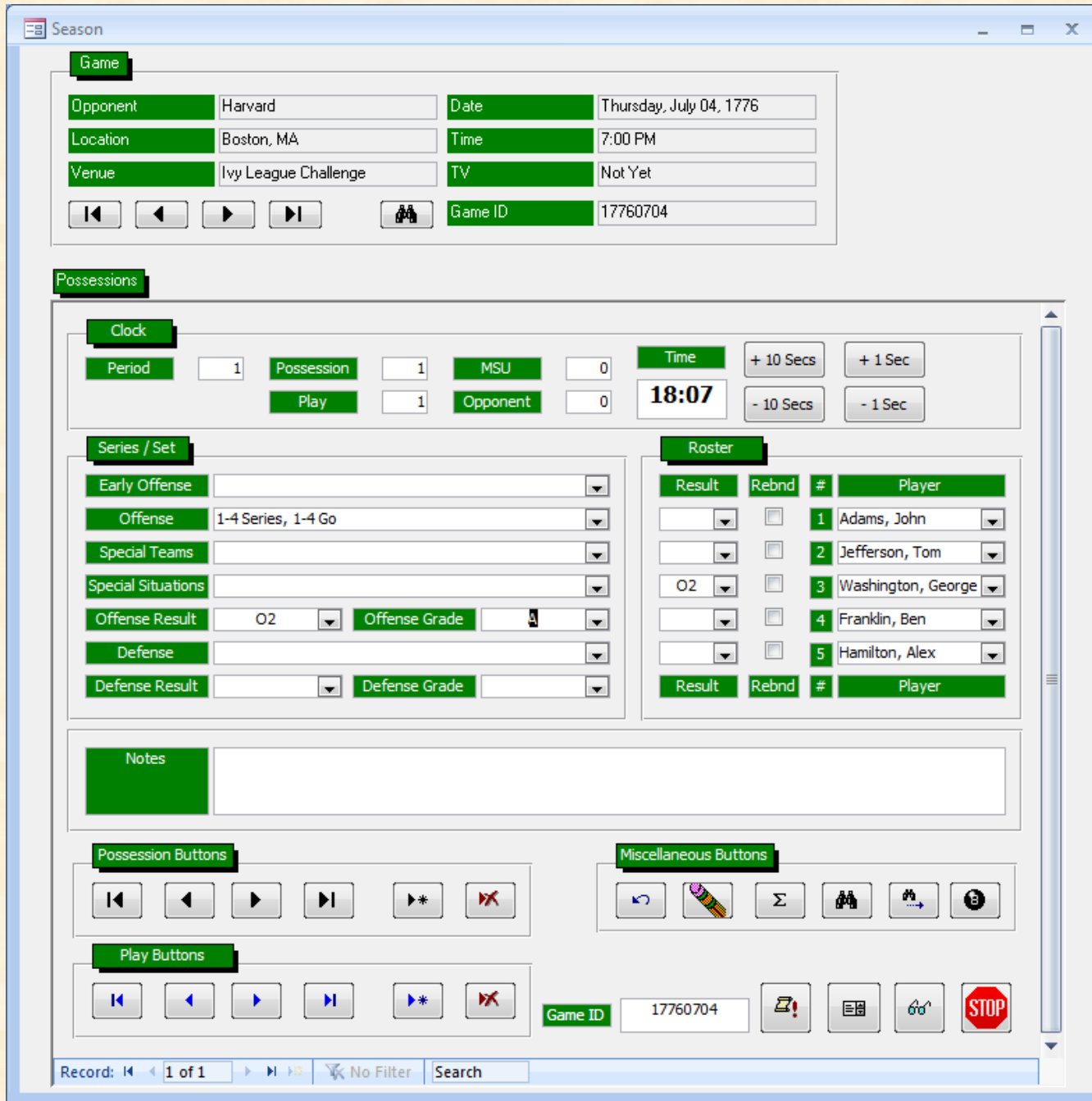
Not Much
Implemented



What I Learned From Beta 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 Stats
Beta 2

Still Not Much
Implemented

So, from
this to...



BB Stats V1.0

Season

Game

Opponent	Harvard	Date	Thursday, July 04, 1776
Location	Boston, MA	Time	7:00 PM
Venue	Ivy League Challenge	TV	Not Yet

Game ID: 17760704

Possessions

Clock

Period	1	Possession	1	MSU	0	Time	18:07
		Play	1	Opponent	0		

Series / Set

Early Offense			
Offense	1-4 Series, 1-4 Go		
Special Teams			
Special Situations			
Offense Result	O2	Offense Grade	
Defense			
Defense Result		Defense Grade	

Roster

Result	Rebnd	#	Player
	<input type="checkbox"/>	1	Adams, John
	<input type="checkbox"/>	2	Jefferson, Tom
O2	<input type="checkbox"/>	3	Washington, George
	<input type="checkbox"/>	4	Franklin, Ben
	<input type="checkbox"/>	5	Hamilton, Alex

Notes

Possession Buttons

Miscellaneous Buttons

Play Buttons

Game ID: 17760704

Record: 1 of 1 | No Filter | Search

Basketball Prototypes Case Studies

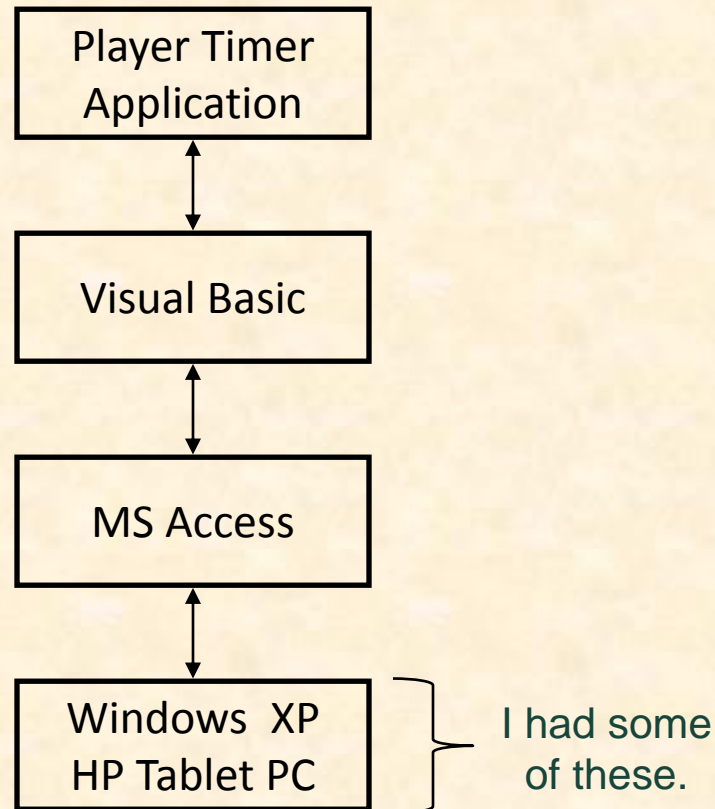
- ✓ Play Effectiveness
 - Player Timer
 - Radio Stats
 - Real Time Play Stats
 - Plus/Minus

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 - Spartan Basketball Stats

Home

Period **1** Michigan State Spartans Men's Basketball Time **16:19**

Start the Clock

Activate All Warnings	Select Player	Checked Out				Check Player In / Out	Checked In			
		Time		Player			Player		Time	
		Current	Remaining	#	Name		#	Name	Current	Remaining
<input checked="" type="checkbox"/>	1	1:12	1:48			←	3	Allen	0:04	3:56
<input checked="" type="checkbox"/>	2	1:52	1:08	41	Gray	→			0:33	3:27
<input checked="" type="checkbox"/>	3	0:00	3:00	23	Green	→			0:00	4:00
<input checked="" type="checkbox"/>	4	0:00	3:00			←	40	Herzog	3:07	0:53
<input checked="" type="checkbox"/>	5	0:00	3:00	0	Ibok	→			0:00	4:00
<input checked="" type="checkbox"/>	6	0:27	2:33	1	Lucas	→			3:37	0:24
<input checked="" type="checkbox"/>	7	0:00	3:00	34	Lucious	→			0:00	4:00
<input checked="" type="checkbox"/>	8	0:00	3:00			←	2	Morgan	3:41	0:20
<input checked="" type="checkbox"/>	9	0:00	3:00	10	Roe	→			0:00	4:00
<input checked="" type="checkbox"/>	10	0:00	3:00			←	15	Summers	2:58	1:02
<input checked="" type="checkbox"/>	11	0:00	3:00			←	14	Suton	3:41	0:20
<input checked="" type="checkbox"/>	12	0:00	3:00	5	Walton	→			0:00	4:00

Start the Clock

View Game Stats Check Out All

Form View

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



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		
<input checked="" type="checkbox"/>	1	R		PF	O1	X1	%O1	O2	O3	Total
Hill, Chris		5	2	2 / 2	100%	0	0	2		
<input checked="" type="checkbox"/>	2	R		PF	O1	X1	%O1	O2	O3	Total
Neitzel, Drew		12	2	1 / 2	50%	2	0	5		
<input checked="" type="checkbox"/>	3	R		PF	O1	X1	%O1	O2	O3	Total
Ager, Maurice		13	3	2 / 3	67%	6	0	14		
<input checked="" type="checkbox"/>	4	R		PF	O1	X1	%O1	O2	O3	Total
Anderson, Alan		15	4	2 / 2	100%	3	3	17		
<input checked="" type="checkbox"/>	5	R		PF	O1	X1	%O1	O2	O3	Total
Torbert, Kelvin		23	5	0 / 0	-	2	1	7		
<input checked="" type="checkbox"/>	6	R		PF	O1	X1	%O1	O2	O3	Total
Bograkos, Tim		30	0	0 / 0	-	0	0	0		
<input checked="" type="checkbox"/>	7	R		PF	O1	X1	%O1	O2	O3	Total
Naymick, Drew		34	1	0 / 0	-	0	0	0		
<input checked="" type="checkbox"/>	8	R		PF	O1	X1	%O1	O2	O3	Total
Davis, Paul		40	3	8 / 10	80%	6	0	20		
<input checked="" type="checkbox"/>	9	R		PF	O1	X1	%O1	O2	O3	Total
Rowley, Delco		50	0	0 / 0	-	0	0	0		
<input checked="" type="checkbox"/>	10	R		PF	O1	X1	%O1	O2	O3	Total
Ibok, Idong		0	0	0 / 0	-	0	0	0		
<input checked="" type="checkbox"/>	11	R		PF	O1	X1	%O1	O2	O3	Total
Gray, Marquise		42	0	0 / 0	-	0	0	0		
<input checked="" type="checkbox"/>	12	R		PF	O1	X1	%O1	O2	O3	Total

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		
<input checked="" type="checkbox"/>	1	R		PF	O1	X1	%O1	O2	O3	Total
Ewing, Daniel		5	3	2 / 4	50%	5	2	18		
<input checked="" type="checkbox"/>	2	R		PF	O1	X1	%O1	O2	O3	Total
Melchioni, Lee		13	1	2 / 2	100%	1	2	10		
<input checked="" type="checkbox"/>	3	R		PF	O1	X1	%O1	O2	O3	Total
McClure, David		14	0	0 / 0	-	0	0	0		
<input checked="" type="checkbox"/>	4	R		PF	O1	X1	%O1	O2	O3	Total
Dockery, Sean		15	3	0 / 0	-	0	0	0		
<input checked="" type="checkbox"/>	5	R		PF	O1	X1	%O1	O2	O3	Total
Nelson, DeMarcus		21	2	2 / 4	50%	3	0	8		
<input checked="" type="checkbox"/>	6	R		PF	O1	X1	%O1	O2	O3	Total
Williams, Shelden		23	5	9 / 10	90%	5	0	19		
<input checked="" type="checkbox"/>	7	R		PF	O1	X1	%O1	O2	O3	Total
Love, Reggie		30	4	0 / 0	-	0	0	0		
<input checked="" type="checkbox"/>	8	R		PF	O1	X1	%O1	O2	O3	Total
Perkins, Ross		40	0	0 / 0	-	0	0	0		
<input checked="" type="checkbox"/>	9	R		PF	O1	X1	%O1	O2	O3	Total
Davidson, Patrick		41	0	0 / 0	-	0	0	0		
<input checked="" type="checkbox"/>	10	R		PF	O1	X1	%O1	O2	O3	Total
Randolph, Shavlik		42	3	0 / 2	0%	0	0	0		
<input checked="" type="checkbox"/>	11	R		PF	O1	X1	%O1	O2	O3	Total
Pagliuca, Joe		45	0	0 / 0	-	0	0	0		
<input checked="" type="checkbox"/>	12	R		PF	O1	X1	%O1	O2	O3	Total

Play Stats - [frmSTATEPlays : Form]

File Edit Insert Records Window Help Type a question for help

MSU vs Purdue

All By Series, Set Print Show Print Reports 1/71

E O	QSO	O	CEH	MOP	ST	Z	OB	S S	
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							

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

O2

--
O2
O3
O2F
O3F
X2
X3
X2F
X3F
O1
X1
FF
TO

A
B
C
D
F

⏪ ⏴ ⏵ ⏩ 🔍 🔄 ⏭ ⏮ STOP

Real Time Play Stats

Spartan Basketball Plus/Minus - Spartan Basketball Plus/Minus

Home

Period **2** Michigan State Spartans Men's Basketball Time **0:00**
 Illinois
 01/16/2010

Start the Clock

Player Roster		Assign Player to Position					Players in Positions			
1	1 Lucas	1	2	3	4	5	1	20 Kebler		
2	34 Lucious	1	2	3	4	5	2	13 Thornton		
3		1	2	3	4	5	3	22 Dahlman		
4	2 Morgan	1	2	3	4	5	4	25 Crandell		
5	3 Allen	1	2	3	4	5	5	40 Herzog		
6	13 Thornton	1	2	3	4	5	Scoring			
7	15 Summers	1	2	3	4	5	Michigan State			
8	22 Dahlman	1	2	3	4	5	73			
9		1	2	3	4	5	O1	O2	O3	↶
10	10 Roe	1	2	3	4	5	Start the Clock			
11	23 Green	1	2	3	4	5	Illinois			
12	40 Herzog	1	2	3	4	5	63			
13	41 Sherman	1	2	3	4	5	O1	O2	O3	↶
14	50 Nix	1	2	3	4	5	Start the Clock			
15		1	2	3	4	5				
16		1	2	3	4	5				
17	20 Kebler		1	3	4	5				
18	25 Crandell	1	2	3	4	5				

Exit Open Game View Report Reset Positions Begin the Period Load Roster

Form View

Plus/Minus

Risks and Prototypes

✓ Risk

✓ Prototypes

