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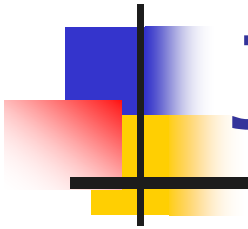

J2ME Case Study

David Moskowitz

Productivity Solutions, Inc.

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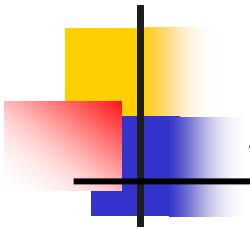

Agenda

- The Vision / Mission
- Building thin clients
- J2ME
- Security
- The economic justification
- The extraordinary results

This is a companion presentation to "Patterns Are for More than Code: Building a Real-life Web Service-based Application". The economic results in this presentation apply to both.

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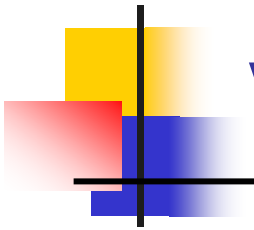

Vision

- Web Services can be extended…
  - to provide information-focused tools and…
  - simultaneously expand the reach of Business Intelligence (BI).
- The goal for the implementation: Make information available everywhere, anytime.
  - Mobile enablement of the workforce is not just a business requirement it is also (and more importantly) a business differentiator.
  - Traditional access models no longer sufficient.

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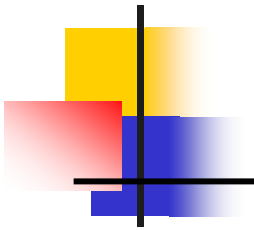

Mission

- Start the initial pilot with field sales people
  - Furthest away from the source
- Sales automation including BI on wireless PDAs
  - (phase 2 added sales support personnel and others).
- The application will include Java enabled phones (and other devices), as the installed base of suitable devices grows.

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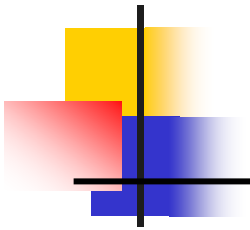

Initial Decisions

- Information everywhere anytime means mobile devices.
- Two choices
  - Daily sync with data on the mobile device
  - Wireless request with current data
- The initial goal was to craft a Customer Relationship Management (CRM) application to help build share of customer.

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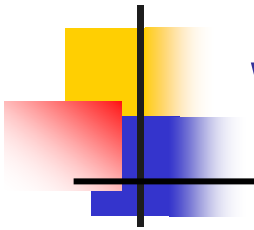

Wireless Value Proposition

- Wireless adds value in more than person interconnected
  - Mange supply and demand
  - Interconnections that add value
  - Timely response to the customer
  - Adds a totally new dimension to high-tech, high-touch, customer relationship management
- You win in the wireless space by making information available where it needs to be.

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Mobile App Pieces

Application	**CRM, ERP, Inventory, Vertical**
Devices	**PDA, Laptop/tablet, phone, RIM, Symbian**
Connectivity	**Wireless, Wire line, VPN, RAS, Dial-up**
Mobile Middleware	**Data Sync, e-mail sync SysMgmt, Personalized**
Integration points	**Database servers, File/Web servers, Exchange/Domino**

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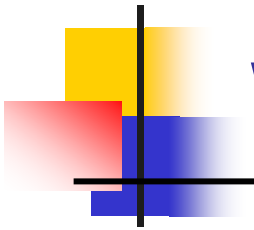

Wireless Pros and Cons

- Increased sales
- Decreased costs
- Improved customer service
- Competitive advantage
- Rapid ROI

- Coverage
- Reliability
- Standards
- Speed
- Costs
- Small devices add constraints
- Unpredictable connectivity

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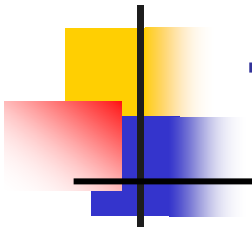

The Initial Questions

- What if the requested service isn't available?
- How are messages correlated?
- What if there isn't a connection available?
- What if the response is delayed?
- What if…?

- See the companion presentation for more information about these areas.

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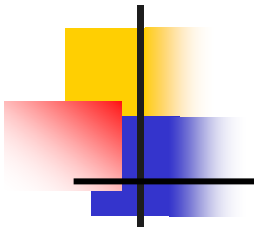

How Do We Provide…?

- Mobile users with the ability to seamlessly roam from device to device…
- Access to the same applications
  - With some commonality of information.
- Synchronized data to a mobile device for access at a later time or to operate even when (occasionally?) disconnected.
- Can we meet these requirements, today?

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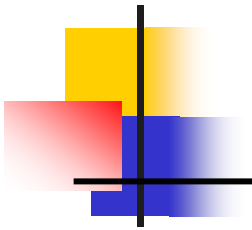

Driving Ideas

- It's about integrating disparate databases to gain real Business Intelligence.
- The information is there, the problem is integration analysis, access, and presentation
  - The only parts we can do on the mobile device are transaction preparation and presentation – and that is very limited
- Need a way to measure ROI & determine payback

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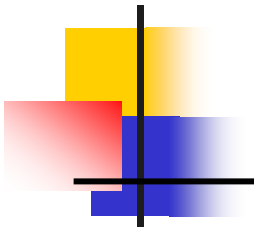

Driving Ideas

- "With the correct use of information technology, we can create virtual databases that will enable XYZ to become much more competitive because we won't have to constantly negotiate with constituencies."
- Change customer experience – CRM, billing, delivery, demonstrations, choice and fulfillment

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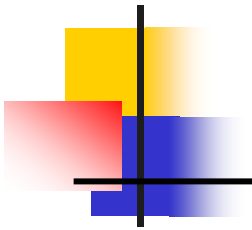

Driving Services

- Notification: alert, change or request
- Location-based: GPS
- User-context: If it's Tuesday: on-site
- Device services: device specific transforms and/or device specific content.
- Synchronization: content sent to and from the device (typically app messages or e-mail)
- These services interact with each other

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Tools Used (Partial List)

- J2ME
- WMA (http://java.sun.com/products/wma/)
- J2EE (on the server)
- Various emulators (some 3rd party, some home grown).
- TLS (RFC 3546) and SSL
  - Also http://www.bouncycastle.org/
- Palm OS, Motorola, Nokia, RIM
- Wi-Fi, Verizon Wireless and others

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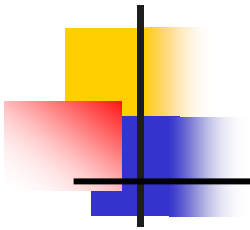

Building Thin Clients

- Don't even think about doing a lot
  - When the developers first started, the "little list" of neat things to do was huge…
  - Then reality…
- Web programming model revolves around application servers
  - Clients render HTML
  - Too many constraints for a small device

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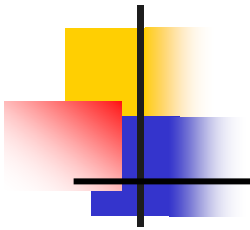

Building Thin Clients

- What about WAP and WML?
  - Tied too closely to current Web app model
  - Limits the messages
- Requires specialized tools and languages
  - J2ME and emulators (the real device is too slow and cumbersome for extensive testing)
  - Minimal functionality means less complexity and faster time to market
  - Functionality specifically tailored to need

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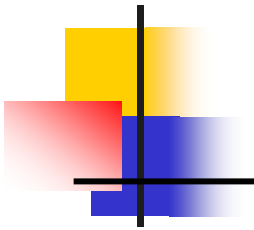

Building Thin Clients

- Lower bug count – not without challenges to create
  - Most problems exist on the server
  - Simpler programming model
- Lower admin costs – easier to deploy
- Better application and data security
  - Most data still on the server
- Idiosyncrasies of wireless connectivity & limitations of current technology devices make building wireless thin clients a hard problem.

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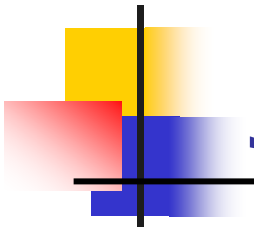

J2ME

- Evolving faster than desktop/server Java
- Suitable for small devices with limited capabilities (cell phones and PDAs).
- J2ME devices have:
  - Limited input capabilities (no keyboard!)
  - Small display sizes
  - Restricted storage memory and heap sizes
  - Slow CPUs

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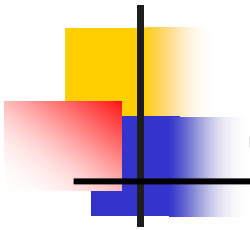

J2ME Configurations

- Connected, Limited Device Configuration (CLDC)
  - Specifies Java environment for mobile phone, pager, and PDA class devices
  - Usually wireless
- Connected Device Configuration (CDC)
  - Specifies Java environment for digital television set top boxes, high end wireless devices, and automotive systems.
  - CDC devices may be wired (DTV cable, *etc.*)

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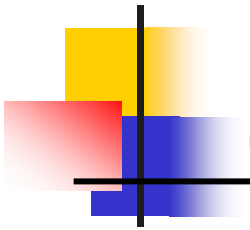

J2ME Profiles

- Supplements a configuration to provide capabilities for a specific vertical market or device type
- Mobile Information Device Profile (MIDP)
  - Application runtime environment for devices based upon CLDC
- Foundation profile
  - Non-GUI networked devices based upon CDC
- Personal basis, personal & RMI profiles
  - Basic graphics – next generation Personal Java

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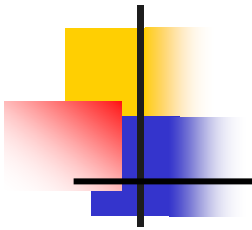

CLDC

- Target devices:
  - 160KB to 512KB total available memory
  - Limited power (usually battery)
- Limited (intermittent) connectivity to a network (usually wireless)
- Constrained UI (very small screen)
- CLDC reference implementation built using the KVM

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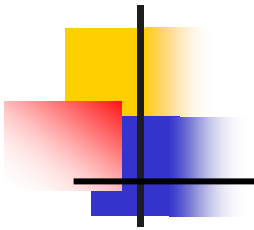

MIDP

- Targets mobile two-way devices implementing J2ME CLDC
- Profile addresses
  - Display toolkit, user-input methods
  - Persistent data storage using simple record oriented database model
  - HTTP-based networking using CLDC Generic Connection framework

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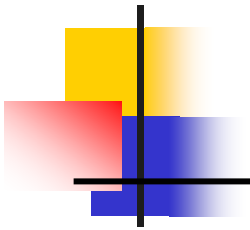

Implementation Overview

- The application is implemented as n-tier:
  - The user interface on the mobile device (client tier) provided by a MIDP application (or MIDlet).
  - The MIDlet talks to (not directly) a servlet in the Web tier to access the business logic tier.
    - After authentication – both one-way and two-way
  - The servlet also supports seamless access to the database tier through the JDBC API.
    - Servlet is actually a set of servlets as "Controller"

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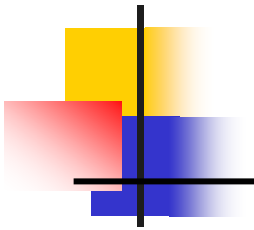

MIDP Applications

- Lifecycle: Paused, Active, Destroyed
- Packaging
  - MIDlets JAR files including
    - Class files of the MIDlet(s)
    - Resource files
    - Manifest with application properties
  - Application Descriptors (JAD files) accompany MIDlet JARs and provide deployment information (name, version, size, *etc.*)

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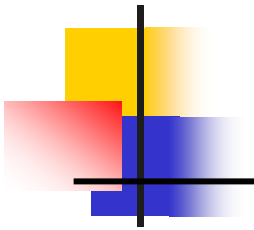

MIDP UI Design Principles

- **Mobile Information Devices are consumer products, *not* desktop computers**
  - Constantly think of end user
  - Solve the ***real*** problem for the "real client"
- Use simple traversing and selection metaphor
- Must be usable in all devices
  - One handed, two handed, stylus operation
  - Screen (10s (100s) of pixels by 10s (100s) of pixels)
  - Some don't have a pointing device
- Look & behave consistently on any given device

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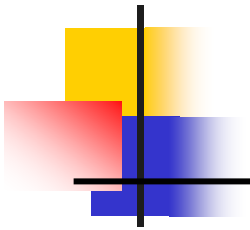

Other Application Information

- Security
  - Both SSL and TLS used to encrypt messages
  - Depending upon types of requests (determined by state information) both 1-way and 2-way authentication used.
- Transaction IDs built into messages
- Used J2ME Wireless Toolkit
  - Includes Wireless Message API (WMA) for SMS
  - James Osbourn: "Writing Java Applications for Mobile Information Devices"

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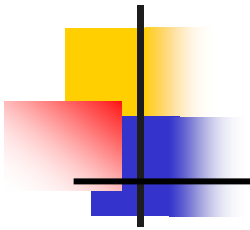

On- and Off-line Connectivity

- Service-based require "server-level" support
  - What if connectivity isn't available?
  - What if it's just the end point that's down?
- How much local data is (or will be) available?
  - Can local data be used?
  - How much data is pre-loaded (and how)?
- How much can be done on the mobile device while waiting for connection restoration?
  - Is the time of the user transaction significant (versus server-level timestamp)

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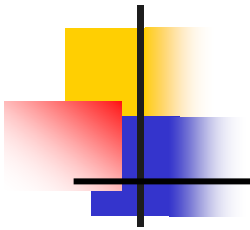

On- and Off-line Connectivity

- Design app transactions to use message-based UI interactions.
  - Takes extra effort to manage optimistic locking & the transaction results based upon old data
    - Assumes that any commit has a chance to fail
    - Optimistic locking avoids deadlocks – critical in this type of environment
  - Submit both old and new data and let the service resolve conflicts (if any)

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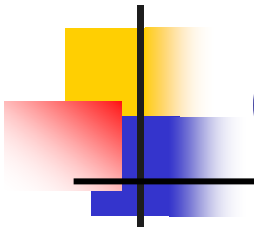

On- and Off-line Connectivity

- Local cache for read-only data?
  - Include time-out information if relevant
- Implement an off-line business service that has the same interface as the server
  - Use store and forward
- Add functionality to the UI to inspect outbox
  - In some cases, allow requests to be deleted
  - Raises security questions
- Let user persist state to memory card

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Economic Justification

- Company examined various costs
  - Cost of sales
  - Cost to support field personnel
- Sales cycle time
- Stable (slight decline) market share relative to competitors because of response time
- New product introductions required extensive field training
- Bottom line: cut costs, increase revenue and productivity

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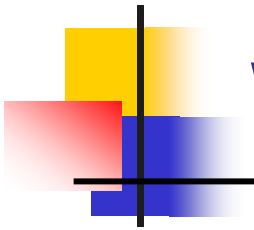

What Does It Take to Do It?

- Commitment – the process can be arduous
  - Have to focus on the end results
- Need buy-in from every internal constiuency
- Costs can be scary (in this case…)
- What is your guess?
  - Does it help you estimate if you know the new infrastructure cost was close to $900K for the h/w and support staff?

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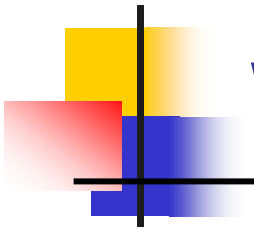

What Does It Take to Do It?

- Partner with multiple vendors
  - Including consultants
- Recognize the impact will be broader than IT
- Consider both TCO and TBO
  - Total Benefit of Ownership (what you're getting for what you're paying)
- Ask the right questions about your business
  - What business are you in?
    - Do your customers agree?
  - What can you do to anticipate customer expectations – in real time?
    - How do you know the questions they'll ask…?

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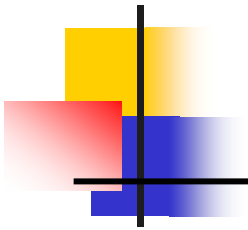

Results

- 15% of sales electronic
  - Old system cost almost $60 more per order
- Lost or late orders cost $150 per to track
  - 2.57 missing or delayed items per 1000 items *vs.*
  - 3.98 items per 1000 items prior
- Reduced maintenance costs saves 11%
  - Almost $9M
- Cut costs & increase revenue exploiting data warehouse — about $10M/yr through better data analysis

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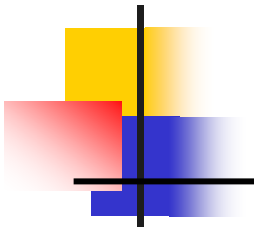

Results

- Mobile office:
  - Wireless e-mail, IM, calendaring, order entry, support
  - Yearly cost savings per sales person: $24K
  - Facilities, separate communications, storage, support
- Wireless sales force automation
  - Increased sales 10 to 20 percent by allowing almost two additional orders per day per sales person
- Wireless field service automation
  - 20% more inspections/day; 50% less waiting for clients
- New customer experience and satisfaction
  - 12% more orders; each order 4% higher

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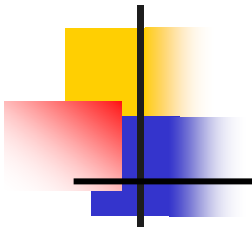

Results

- By finding canonical ways to express, capture and record transaction information, estimate savings of $40M
  - Canonical expression reduces training costs by over 25%
- Bottom line: projected payback period was 2+ years
  - In actuality – less than 6 months

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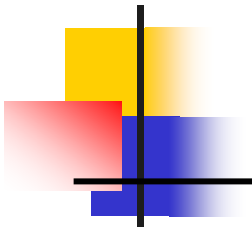

Results

- Not only did they save money, but, anytime, any place, anywhere to anybody actually helped them identify new business
- Turn information into an asset that produced $120 million between 7/2003 and 10/25/2003)
  - Projected to grow, over the next 3 years to be over $1 billion.

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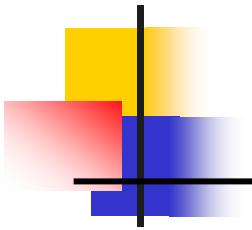

Results

- This project involved change
  - Business process changes within the company to accommodate the new mission (information everywhere)
  - Development process changes to build software for mobile devices.
- Change is painful, sooooo….
  - … don't make changes – experiment with new possibilities
  - Expect acceptance *vs.* participation

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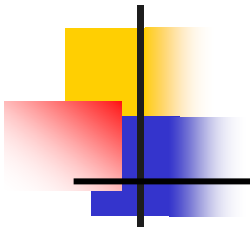

Questions & Thank you

- For more information

David Moskowitz
Productivity Solutions, Inc.
147 Ashland Avenue
Bala Cynwyd, PA 19004
Voice: 610-664-7726
Fax: 610-667-1798
E-mail: davidm2@usa.net