Where I Am Coming From

- **Academic computer science**
  - PhD at MIT AI Lab, Prof. in Cornell CS Dept.
  - Many roles: teaching, advising, research, technology transfer
    - But hard to do anything “real”

- **Corporate research lab**
  - Schlumberger AI Lab, Xerox PARC
  - Research code that made it into products
    - Still hard to do anything “real”

- **Chief technologist at a startup**
  - Sole focus: a new product that provides value
    - Hard to do anything else
An Entrepreneur in the Valley

- Being true to the vision – when to change
- Creating new value – a startup edge?
- Learning from the valley culture
- Pace of innovation
- The “practice of software”

- An example: electronic trading systems
  - When the hubris gets too far ahead of reality
  - Need technology plus domain expertise!

Age of the Entrepreneur?

- Good at innovation but not invention
  - Application and adaptation, not discovery
- Agile, but building from scratch
  - How important is flexibility versus relationships
- Engaged in “practice of software”
  - Big companies can do this, not just startups
- Risk/reward structure
  - Current environment yielding some bum deals
- Once burned twice shy customers
  - Prospects may be afraid of startups
Innovation in the Valley

- World class resources and opportunity
  - Technical, legal, capital, research labs, ...
  - Incubators have little to offer, its all there
- Risk takers
  - Entrepreneurs, employees, capital
- Constant movement of people
  - Breeds high organizational intelligence
    - E.g., learning by shipping products at several companies in different market segments
- Venture funding process
  - Each round brings validation, diversity of views

Harness the Valley Not Vice Versa

- Limitations of the valley model
  - Manic depressive – “new new” to “all junk”
  - Burnout – focus on hours rather than output
  - Herd mentality – cultural groupthink
  - Search for billion dollar businesses
- Talented, motivated, focused people
  - Ideas and approaches “in the air”
  - Loyalty to ideas and ideals, more than company
  - Innovate and deliver with small team
    - Not invention, not perfection, not empire building
Rates of Change are Fundamental

- Bandwidth, computing grow exponentially
  - Exploit this and don’t get caught by it
    - Commodity path is networks of microprocessors
    - Better have expertise in distributed computing
- Software grows organically – unpredictably
  - But providing value usually requires it
  - Build the strategic part and obtain the rest
    - Buy, re-sell, open source, ...
  - Focus on building a great software team
  - Keep it simple – don’t just layer on new features and new code, rethink it

The Practice of Software

- Mentality of the team
  - Craft or profession more than art or engineering
  - Relentless pruning of code and features – ship!
- Building a shared vocabulary
  - From sales, to product marketing, to product management, to developers, to testers
  - Making the tacit explicit without losing it
    - Written documents as records of understanding
- Software is flexible – needs users early
  - Let the customer in on design and prototypes
  - Iterative development, deliver early and often
    - LINUX project benefited from this
Software Methodologies

- Heavyweight development methods can become the focus rather than the product
  - Waterfall, Capability-Maturity (CMM)
- Lightweight development methods can leave you with too much tacit knowledge
  - Cult of the star, Extreme Programming (XP)
- Regardless of methodology, important to
  - Have high technical knowledge in product design, marketing, management – Microsoft
  - Explicitly document functionality and design
  - Have small teams
  - Focus on shipping the product

Software Productivity

- Two orders of magnitude
  - Software developers may be only professionals where competent to outstanding is 100x
- Good software has coherent underlying “theories” that guide its construction
  - Few external constraints, so these come from the minds of the creators of the software
  - Hard for a big team to share a theory
- Productivity decreases worse than linearly with team size
  - So 1000 competent programmers can’t do what 10 outstanding ones can
Producing Quality Software

- Simplify the user experience
  - Abstraction and combination over “featuritis”
  - Processes that force dropping features
- Get users involved early
  - In-house experts, alpha and beta partners
  - Internal code delivery every few weeks
- Redesign and rewrite code
  - Knowing what are band-aids versus cleanups
- More eyeballs increase quality
  - Open source, paired programming (e.g. XP), code reviews, design reviews

Managing a Software Team

- Software design process – clearly separate
  1. Business need – why building it
  2. Feature(s) that meet that need – what building
  3. User experience – how to use/interact with it
  4. Technical design – how its built
- Dev lead structure to development team
  - Small teams of (e.g. 3 or 4) developers
    - Led by one more senior person who can work with product managers to produce #3 and #4
    - Close interactions with technical product managers and testers – on a daily basis
Managing in a Startup

- Clarity of purpose, but often you are so busy doing you don’t see
  - Hiring
    - Number of product cycles and number of companies – learned how to and how not to
    - Low degree of separation from your company
  - Firing
    - Need to consider the whole company, not just “your organization”
  - Sustaining
    - Overly optimistic deadlines, but not so much that you lose your people or their best abilities

Wearing Many Hats

- Efficiency – little communication overhead
- Exhilarating – get a lot done
- Loss of objectivity – bias towards one hat
- Lack of clarity – which hat being worn
  - Particularly hard when everyone has multiple roles, need to be explicit
- Few political struggles
- Energizing – switch when tire of one hat
- Overwhelming – too much to keep up with
Staying Grounded

- Lack of peers
  - Few people with similar skills in your company
  - Others are potential competitors, leaks

- Validation
  - Quickly turn your ideas into a product/service
  - Get it in front of prospective customers
  - Everyone else (inside and outside) will have strong opinions but often be wrong

- Understanding competitors and not
  - Generally both more and less than you see

Delivering Your Vision

- Adapting the vision to the customers
  - Vision critical to creating and delivering change
  - Customers often not yet ready for big changes
  - Creative tension: lead without leaving behind

- Preserving a vision in the valley
  - Mega trends – “New new thing” such as B2B
    - Keeping investors, employees, yourself focused

- Building a company to deliver the vision
  - Not growing too fast in the late 90’s or too slowly in the early 00’s
A Twisty Maze to Value

- Core value: automating institutional securities trading
  - Unlike retail equities trading, trading by large institutions is over-the-phone and inefficient

- First take: BuySideDirect, a marketplace for directly trading convertible bonds
  - Automated; brings buyers and sellers together
  - Not enough interest in new process

- Second take: a trading platform for “sell side” firms – intermediaries
  - Automate the current process

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Getting Through the Maze

- Launched BuySideDirect with 100 institutional clients in August 2000
  - From concept to launch in under a year
  - First 3 months: $2B orders, $150M trades
    - Not enough – Buy Side firms turned out to be more dependant on their brokers than thought

- Shipped Alta sell side trading platform in August 2001
  - Fall ’01 was a difficult time in financial industry
    - Firms starting to make strategic software investments
    - Installed and running at customer sites
Electronic Trading

- The late 90’s brought a lot of hype about revolutionary new electronic markets
  - Has proven largely unfounded
    - Most markets remain relatively unchanged
  - How markets actually work illustrates why

- Focus on what works
  - Not expecting new market structures to succeed just due to going electronic
  - Recognizing value provided by intermediaries
    - Software to make trading easier, not to try to change how it’s done

Different Types of Transactions

- Trading: buying and selling for profit
  - Commodity items
    - Widely agreed upon: stocks, bonds, options
    - Doesn’t matter who seller is

- Purchasing: buying for use/consumption
  - May be commodity or unique items
  - Often small number of sellers (producers)

- Collecting: buying for hobby
  - One-of-a-kind items
    - Seller matters
  - Often eventually re-sold
Pricing Mechanisms

- Set price: determined by seller
  - Universal or regional price
  - Promotional price
  - Differentiated price (price discrimination)
    - E.g., commonly used by airlines

- Price discovery: determined by buyer(s) and seller(s) together
  - Negotiation, with or without broker/agent
  - Auction, forward and reverse
  - Exchange, utility for member-traders

Which Mechanisms Work Where

- Set price is used for most purchasing
  - Seller constrained by cost of goods
  - Buyer doesn’t want to spend time negotiating
    - Negotiation may set a contract price used for many goods, not per transaction (discovery)
  - Major exception is surplus goods

- Price discovery is used for trading and collecting
  - Value of goods less constrained by their cost
  - For collectors, price discovery is part of the fun
Price Discovery Mechanisms

- Buyer(s) and seller(s) determining price

<table>
<thead>
<tr>
<th>Many Buyers</th>
<th>One Buyer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auction</td>
<td>Negotiation</td>
</tr>
<tr>
<td>Exchange</td>
<td>Reverse Auction</td>
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Cost-Benefit of Price Discovery

- Good for items where transaction price can be highly variable
  - Trading, being re-sold
  - Collecting, being re-sold, one-of-a-kind
  - Surplus, get whatever value can
  - Cost of production not dominant factor
    - E.g., “first one expensive”, “others cheap”, such as software, airline seats
- Need knowledgeable buyers and sellers, time to negotiate
  - Process must be worthwhile to both parties
Differentiated Price is not Discovery

- Prices can be “dynamic” in either case
  - With price discovery, buyers and sellers can assign different value at different times
    - E.g., movement of a stock or bond price
  - With price discrimination, seller sets different price based on who is buying, when
    - E.g., Amazon.com experiment, the airlines
- Key difference is whether price is set by seller or via cooperative process
  - Yield management, customer loyalty, etc. by seller vs. joint agreement on value

An Illustration

- Difference between price discovery and price discrimination
  - Price discrimination used by most vendors
    - Preferred/large customer discounts
  - Price discovery not appropriate mechanism
- Sunbid web site – for new Sun computers
  - McNealy: “price lists will be obsolete”
  - Buyers bidding for equipment – price discovery
    - Little interest, high cost low benefit
- Has its place – Sun is a large user of Ebay
  - For selling refurbished (surplus) hardware
What is a (Commodity) Exchange

- Organization of traders that facilitates their trading according to a set of rules
  - E.g., NYSE not “flower exchange”
- Characterized by
  - Participation of multiple buyers/sellers
  - Presence of two-way continuous markets
    - Bids (buyers) and asks (sellers)
- Rules help ensure “orderly” markets
  - Market makers or specialists who must provide two-way markets
  - Dissemination of trade prices, bid-asks

Where Exchanges Work

- Commodity items
  - Many people buying and selling the same thing
    - Took years to agree on agricultural futures
- Highly liquid items
  - “Readily salable”
    - E.g., a single transaction does not move the price
  - Only commodity items can be liquid
- Even many financial instruments don’t trade on exchanges – via broker-dealers
  - Corporate bonds, mortgages, etc.
What Is Liquidity?

- Liquidity is an abstract notion
  - Individual transaction not moving market price
  - Trade size and trading volume good indicators
- For liquidity, need
  - Two-way market
  - Enough transactions to determine market price
- First order “grants free option”
  - Neither side willing to go first

B2B “Exchanges”

- Bring together buyers and sellers of items for business use
  - Producers/vendors are sellers
  - Consumers/users are buyers
- Items may or may not be commodities
- Transaction model may or may not be full exchange, with bids and offers
  - Can be auctions or reverse auctions
- Revenue model is fee per transaction
  - Value must be large to produce much revenue
Problems With B2B “Exchanges”

- They are usually not full exchanges
  - Transactions are purchases, not trades
  - Generally limited number of suppliers/buyers, not two-way markets
- Absence of continuous markets
  - Exchange mechanism problematic, “free option”
- Could try introducing futures
  - Need stable set of agreed upon commodities
  - Speculators want volatility in commodity prices
  - Bandwidth, power, chips good candidates?
- Trading volume is not revenue

Some Illustrations

- Exchanges need multiple buyers and sellers who want a price discovery mechanism
  - Dell procurement site, open 4 months
    - Not providing value beyond supplier agreements
  - Hundreds (thousands?) of small B2B exchanges
    - Bigger ones such as Ventro
- B2B exchange software companies
  - Ariba, I2, FreeMarkets, ... all now positioned as enterprise software for purchasing/supply chain
  - Commerce One split between purchasing software and e-Marketplaces
New Equities “Exchanges”

- ECN/ATS – Alternative Trading Systems
  - Flow of orders, with or without market makers
  - Exchange mechanism, matching bids and asks
- Now 40% of NASDAQ trading volume
  - Most did not exist 5 years ago
  - SEC order handling rules provided liquidity
- Expanding into NYSE stocks
- Becoming competing regulated exchanges
  - Island application to SEC
  - Archipelago/Pacific Exchange partnership

Exchange Revenues

- New equities exchanges are successful
  - However still have low revenues
  - Around $10 trillion traded on NASDAQ
    - Resulting in around $1 billion in transaction revenue to “exchanges” – .01%
- Estimates of B2B “trading” volume around $5-$7 trillion
  - If similar percentage, not a very big market
- Exchanges for benefit of members or participants who are true value providers
  - A form of public utility
Value of Intermediaries

- Enable transactions that would not have occurred (in timely manner, anonymously)
  - Brokers – proactive search for counter parties
  - Auctioneers – bring together large number of potential bidders
  - Dealers – take positions in order to get transactions done
- When high cost of waiting, these services have large potential value
  - In contrast to exchanges which are passive
  - Intermediary value lower when highly liquid

Broker-Dealer Electronic Trading

- Increase efficiency of low margin business
  - Retail web sites for individual investors
    - Can’t make money on $10 trades with human brokers, but can electronically
- Increase value of higher margin business
  - Automate handling of large institutional orders
    - Internalize matching where possible
    - Route intelligently to limit information leakage
  - Assist institutional traders and salespeople
    - Find possible counter parties given market conditions
  - Still early in the deployment of such systems
No Magic in Electronic Trading

- Enron Online
  - Make markets in various “new commodities”
  - Take positions, at least temporarily
  - Electronic trading platform for posting markets
    - Similar to trading operations of investment banks (broker-dealers) but more automated
- However very different revenue numbers
  - Reporting of trading volume versus revenue
    - Enron “revenue” more than that from largest investment banks combined
  - Spreads, commissions more accurate revenue
    - Watch out for other online sites like Priceline

Electronic Auctions

- Remove physical barriers to participation
  - For items with national/global appeal
- Lower search costs for potential bidders
  - Small number of places to look for the item
  - Tools for searching items offered
- Provide ratings of buyers and sellers
- Network effect for these benefits
  - Ebay has about 2/3 of the market
- Value much higher than for exchanges
  - 5-7% of transaction (50-70 times)
Growth of Online Auctions

- Network effects will likely lead to further mergers/closures
  - Unless auction sites cannot continue to protect against consolidators
- Growth in existing markets
  - Does main street use auction sites or alternatives such as newspaper ads?
- New markets
  - National/global appeal important
    - Limited value for real estate, used cars, etc.

Electronic Trading Summary

- Negotiation, auctions, exchanges all price discovery mechanisms
  - Not same as “dynamic pricing” by the seller
- Price discovery not appropriate to all transactions
  - Needs to be worth overhead for both parties
  - Most useful when cost not good basis for price
- Exchanges only work when two-way markets and relatively liquid commodities
- Intermediaries provide value in online trading – auctioneers, broker-dealers
Take Away Points

- Computing grows exponentially but software grows organically (slowly)
- Build a practice of software
  - Small teams, simplification, relentless focus on ship, explicit vocabulary/processes/roles
  - Flexibility of software is both benefit and curse
    - Get users early to provide real-world constraints
- Don’t try to change how people work without a truly compelling case
  - Reluctant to change, and often right
    - Removing the intermediary was in most cases a hallucination – providing hard-to-replace value