0.1 Abstract

Approach for potentially high growth services/applications on smart devices (smartphones and tablets). Theoretical foundations for high growth startups then an approach and an architecture In this innovation thesis, we argue for a pretotype architecture for thick client server systems, that serves the needs in the first phase of pretotyping and can evolve to a scalable system.

Contents

0.2 Introduction

0.2.1 Motivation

Since Amazon, one of the worlds largest online book stores, launched its Kindle e-Inc reader in 2007, the book market has undergone a big change. Millions of people are reading ebooks on different e-Ink readers, smartphones and tablets (denoted *eReaders*) [44][45][46][47][28]. In April 2011, ebooks outsold printed books at Amazon for the first time [48] - and some believe this will become true not only for Amazon, but for the industry as a whole [49][**?**]. In other words, we might be witnessing a *disruption* [53][54], a total reshaping of the book publishing industry, paving the way for great innovation opportunities.

In this *innovation thesis*[1], I was initially asked by a company to build an Android eReader application, that essentially emulates the printed book experience. With the publishing industry possibly on the verge of being disrupted, the project ambitions grew to build the seed for a potentially high growth community-driven ebook platform.

However, launching a successful high growth product takes much more than just building it. The fail rate is quite high, reaching 75% in the US for venture capital backed startup companies [1], and of all startups only 5-10% actually meet their projected goals [2]. Even established leading companies struggle to keep their position in markets that get disrupted, and often fail [4].

With limited time and resources, what strategy and processes can a startup use to increase its chances of success in a market that might be disrupted? What concequences does it have on the architecture?

0.2.2 Outline of Thesis

The first section gives the background upon which later sections are based. To be able to increase the chances of success, we need first to understand the environment in which the startup operates. We look first into the theory of *disruptive innovations* that explains how and why big market shifts happen. Next, we look into *effectuation*, a research on how expert entrepreneurs think and behave in the starting phase of a business venture. Then we look into the stages or the lifecycle an IT-startup goes through, as well as the traits of successful and unsuccessful high growth IT-startups. Then we look into a technique that can be used in the first stage, *pretotyping*, to start experimenting with an idea before investing too much effort on it, to make sure time is spent on the right idea. We conclude the section by outlining some challenges a thick client faces when implementing the pretotyping technique as well as some general architectural challenges and opportunities unique to thick clients.

The approach section builds upon the background and describes a strategy and a framework for startups, as well as a thick-client server architecture suitable for apps.

We apply the framework devised in the approach section to implement the seed for a community-driven Android ebook application as a case.

[1] *'Innovationsspeciale'* in danish, an initiative taken by Copenhaguen University in partnership with Katapult KU, Vækstforum, EU Socialfond and Next Generation, to promote student entrepreneurship and innovation as a framework of their final thesis http://katapult.ku.dk/aktiviteter/innovationsspeciale/

We conclude with results, lessons learned and further work.

0.3 Background

0.3.1 Disruptive Innovation: What is happening?

In an attempt to explain why and how some leading companies in given markets are suddenly dethroned by new players, Clayton M. Christensen proposed the *Disruptive Innovation*[2] theory [4]. This theory is interesting because it helps in shaping a strategy for startups in a market about to be disrupted.

In a given market, customers have needs, or *jobs-to-be-done* [6], addressed by a process, service or product (subsequently *product* for short) [8]. Customers value a product's performance along different characteristics, some of which are *drivers*, i.e. the most important when selecting a product. For a given driver, different customers have different sophistication levels. Customers at the *low-end* can be satisfied with less sophistication and performance, while customers at the *high-end* are interested in more performance [4].

For example, a low-end customer for gaming might be satisfied with a computing device with an average performance (CPU, memory, graphics card etc.), while a high-end customer might want top performance and looks up for the next performance improvements.

Usually, profit margins, the percentage of profit out of the total sale, are higher at the high-end of the market than the low-end, thus making it more attractive. To stay competitive, companies continuously make *sustaining innovations* to improve their products, enabling them to serve more and more of the high-end customer needs. For example, a more performant graphics cards. This is depicted in Figure 1.

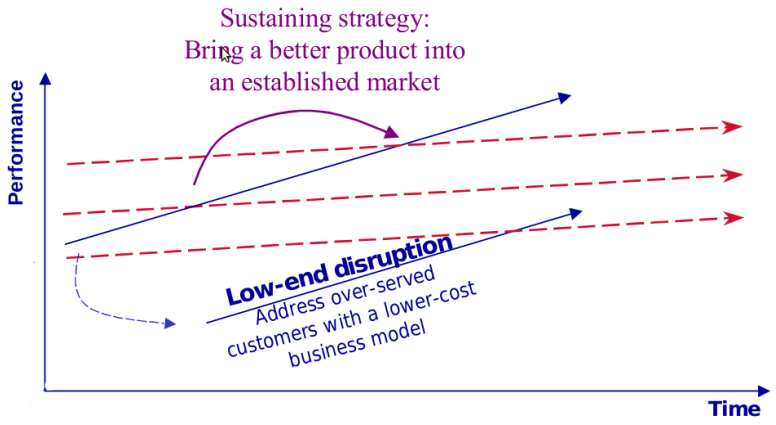

Figure 1: The Disruptive Innovation Model (source: [4])

The upper blue arrow represents the product performance growth over time. The sustaining innovations improve the product's "attributes most valued by the industry's mainstream customers" [4], i.e. the drivers.

[2]It was first named disruptive technology but then renamed to innovation due to the fact that technology in and by itself does not disrupt the market, but the innovation is rather the use of it in an innovative business model [9].

However, according to the disruptive innovation theory, the pace at which companies improve their products by sustaining innovations is faster than the growth of customer sophistication - the ability to utilise or absorb improvements. This is illustrated by the stippled red lines in figure 1. For example, a graphics card performance improvements beyond what is sufficient to play less demanding games does not effect low-end or casual gamers.

Over time, more and more customers become *overserved*. The product becomes more complex and costly without valuable leverage for most customers. Despite this trend, the established company tend to continue doing what it has been optimized over the years to do: sustaining innovations. The company has built internal and external structures that are optimized for competing in the high-end market, including its vision, processes, policies, assets, valued competencies, corporate culture [8], as well as its *value networks* [**?**]. A value network is "the collection of upstream suppliers, downstream channels to market, and ancillary providers that support a common business model within an industry." [**?**]. That is, all its relationships and integrated processes with partners within the market. This solidifies its position in the current market against any new entrant (e.i. startups), but at the same time makes it vulnerable for changes in the market, including changes in the priority of the dominant drivers.

This opens the door for *disruptive innovations*, typically done by new entrants (i.e. startups) into the market with a new business model that can change the market significantly.

There are two types of disruptions, *low-end* and *new-market disruptions*, depending on the initial target customers.

In low-end disruptions, an entrant company starts by offering a product that is good *enough* to the existing low-end market in regard to the dominant driver, using a business model that enables profits at lower prices. Furthermore, the product might be better in regard to other characteristics as simplicity and convenience [4] making it a better choice. This is illustrated by the lower blue arrow in figure 1.

The disruptor company is built around a new business model better suited for the low-end, which gives it the advantage. Instead of fighting back, the established company tend to abandon the unattractive low-end and focus on the more attractive high-end market, where it has a competitive advantage. In the short term, this is more profitable, "feels good" and makes "perfect sense" [4]. Thus, the established companies ignore the eminent threat. However, as the disruptor begins its own cycle of sustaining innovations, it gradually improves the product in regard of the dominant driver and builds its value network to serve more needs in the high-end, thereby pushing the established companies upward in the market. This continues until the bulk of customers are attracted to the new entrant company, thereby disrupting the market. Because the bulk of the customers are usually concentrated in the middle of the sophistication scale, when the disruptor matures enough for the mainstream customers this results in a relatively quick and sudden market change. The old companies are either reduced to the high-end niche or disappear completely.

On the other hand, in a new-market disruption, the disruptor starts by offering typically a simpler, more convenient product to *nonconsumers*. Nonconsumers are persons that previously either could not afford or did not have the skills to use the products in the established market. Thus, the new entrant

company competes against "non-consumption", by offering a product to a whole new population that have no alternative. This type of disruption is the most frequent [5] and advisable for new players [6].
This is illustrated in figure 2 by a new (green) plan.

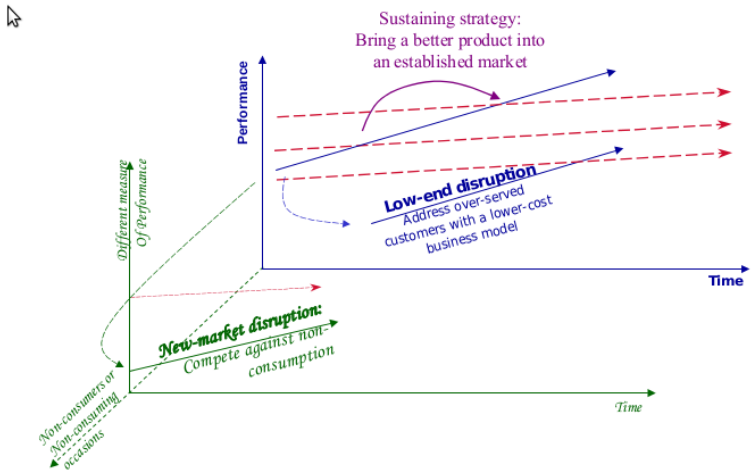

Figure 2: The Two Disruptive Innovation Models (source: [4])

Initially, the product is not sophisticated enough for the existing customers in the old market, and the performance is perceived differently in the new market (along other drivers). However, as in the case of low-end disruptions, the product improves gradually and eventually pulls customers from the old to the new market. This happens because the new player improved its product against the old drivers, a shift happened in the priorities of drivers or the old drivers became obsolete in the old market.

Employing disruptive strategies, both low-end, new-market or a combination, many companies accross different industries have successfully overtaken markets [4]. For instance, when the Apple II computer was launched, it was too basic for the financial and engineering applications that used to be handled by minicomputers. Apple II was sold as "children's toy" thereby creating a whole new market that previously did not exist. As personal computers improved, they disrupted the minicomputer market [5].

Most successful disruptions have three enablers: a simplifying technology (makes it simpler and/or more convenient to do a job), a business model innovation (new definition of who the customers are, what is the value proposition, key processes and resources, and a profit formula [12]), and a new disruptive value network [15]. A disruptor rarely disrupts the market alone, but an entire new value network arises that replaces the old one [6][15].
A disruptor rarely disrupts the market alone, in that to efficiently replace the established market, a whole new network needs to arise [6][15].

IGNORE THE REST OF THIS THESIS - WHAT FOLLOWS ARE JUST

NOTES

Notes: Some researchers disagree/add:

First [9] — "Because they are disruptive to both consumers and producers, these innovations are rarely driven by demand. Instead, they result from a supply–push process originating from those responsible for developing new technologies (Markides and Geroski, 2005)." [9]

many small firms, only few survive: the dominant design. But success: "... involves making heavy investments in exploiting scale economies, traveling down learning curves, developing strong brands, and controlling the channels of distribution to the mass market."

Established: buy-up! "established companies should not even attempt to create such in- novations but should leave the task of creating these kinds of markets to small, start-up firms that have the requisite skills and attitudes to succeed at this game. Established firms should, instead, concentrate on what they are good at—consolidating young markets into big, mass markets." [9] –

Second [**?**]

High-end disruption also occurs, for example cellular phones costed more, still bad performance in sound. But they are still low-end in sound quality!

0.3.2 Expert Entrepreneurs Effectuation

In order to explain how entrepreneurs create new firms, Saras D. Sarasvathy proposed a new decision model [29], *effectuation*, which she later established empirically by a series of experiments [**?**]. 27 expert[3] entrepreneurs and 37 students (i.e. novice entrepreneurs) were given the task of creating a company from scratch.

Most students based their decisions on *causal reasoning*. They proceed analytically with market research and competitor analysis to identify potential target customers from a predetermined market, and estimate expected returns. With a fixed goal (i.e. *effect*) the students proceed then analytically to find the optimal sequence of events and the means necessary to *cause* the effect. The implicit assumptions are that the market already "exist[s] independent of the firm", the future is predictable (plan to achieve a future effect and return by a known series of events), and that any risk threatening the plan is bad and should be avoided.

Most experts, on the other hand, used an almost *reversal* decision-model, called *effectual*, illustrated in figure 3.

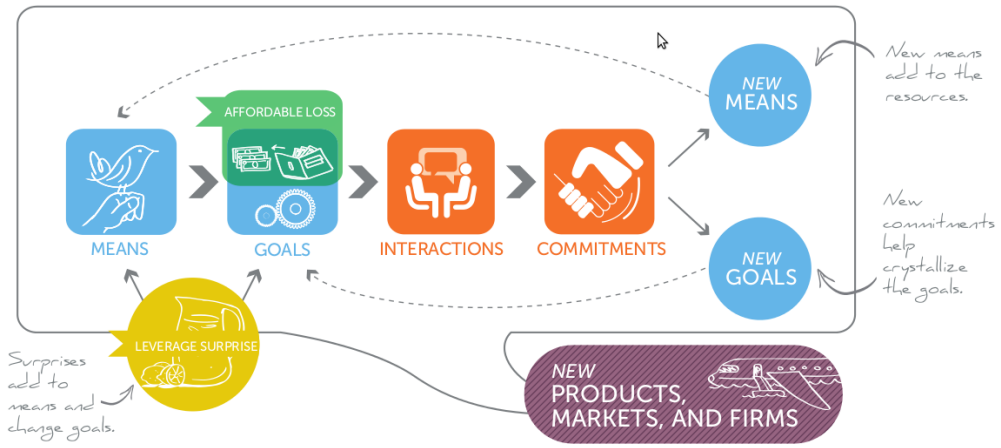

Figure 3: The Effectual Cycle (source: [34])

With no rigidly fixed goal but only an aspiration, the experts ignore market research and competition. Instead, they start immediately with what they can do with the means they have and can afford to lose, thereby minimizing the risks. They do not predict if, but ensure there is demand for the product as quickly as possible. Starting from what and whom they know, they interact with people in their network and gradually aquire concrete customers and get commitments to the venture from partners. This fruitful interaction increases the means available, and possibly results in partners and customers influencing the flexible goals. This process is repeated iteratively, crystallizing the goals and increasing the network, until the experts end up by *creating* a new market. There is no need in predicting the future, since the expert entrepreneurs shape

[3] An expert entrepreneur in this study is a person who started one or more companies that have a value from 200 million to 6.5 billion USD

it together with partners and customers. If the unexpected happens, the experts take it as a hint of a possible opportunity and would try to adjust the path to take advantage of it instead of sticking to a rigid plan.

There are five principles that govern the effectual decision-model:

1. Bird in hand: experts start with their means (who I am: traits, tastes and abilities; what I know: education, training, expertise, and experience; and whom I know: social and professional networks) [31] and imagine possibilities they can pursue. That is, their choices reflect their personality, knowledge and network instead of rational analysis and prediction
2. Affordable loss: At each step, their efforts and choices are guided by what they can afford to lose, not by a projected future revenue
3. Patchwork Quilt: experts co-create a market with committed partners, spreading the risk, aquiring new means and crystallizing the goals
4. Lemonade: bad surprises give an opportunity to learn and give useful clues while creating the market
5. Pilot-in-the-plane: "the future is neither found nor predicted", but rather made and controlled

Although the goal is not fixed, "at any given moment, there is always a meaningful picture that keeps the team together, a compelling story that brings in more stakeholders ..." [31].

Experts prefer effectuation, but recognize both causal and effectual reasoning as important, each in the appropriate context [29][30]. In fact, both can be used simultaneously [35][38]. For example, an entrepreneur can use a means-driven approach but still try to predict outcomes if the knowledge available permits to do so reasonably, or build partnerships while safeguarding intellectual property and being fully aware of competition when it makes sense [38].

In situations with high uncertainty, e.g. in a startup phase when commertializing an innovation, effectuation is particularly useful [29]. It helps reduce the costs of failure [33], in fact, "failing is an integral part of venturing well" [30] by early validation that keeps failures relatively small and an opportunity to learn [32][30]. Most importantly, effectuation helps to bring people (early customers, partners) on board [35], so much so that "system builder" has been proposed as a more descriptive name than "entrepreneur", to reflect the importance of a systemic approach [36], i.e. bringing different parts and means together in a coherent network.

In a situation where knowledge permits a reasonable level of prediction, a more causal approach would be appropriate [32]. For example, as a market begin to emerge and a product or business model begins to work [32]. In fact, a causal approach is necessary for scaling (expanding) the business after the business model has been validated [35].

Link to disruptive innovation

Despite that research linking disruptive innovation and effectuation is minimal [51], there seems to be an obvious overlap. As seen in the previous chapter,

Christensen advices to start disrupting a market by creating a new market, and disruptions rarely occur without a creation of a whole new value network that can disrupt the old. Effectuation is especially helpful in creating new markets and building partnerships.

There is high uncertainty when creating a new market, that makes it unknowable what product design/features for what customer/partners would work [37]. Examples of *exaptation*, the successful use of innovations in markets they were not intended for when first developed, are numerous [51].
Exploratory (or experimental) approaches have been proposed to test different permutations of product features early on to different customers until a match is found with a viable business model [51][37]. Despite the uncertainty, *Business Development*, an effectual exploratory approach proposed specifically for disruptive innovations, combines some causal aspects as market analysis to identify potential partners and customer segments to explore. In particular, it encourages the engagement and exploration of potential partners, e.g. distribution channels, in the early phase in a systematic way [37].

In addition to iteratively assessing different features permutations with customers in real life settings, opening a direct channel to tap into user ideas, for example an online platform, can be a fruitful initiative to generate disruptive innovations [51].

0.3.3 Startup Challenge: Consistency

With the aim of understanding what makes startups succeed or fail, the team behind the Genome project processed data from more than 3200 "internet startups" to identify commonalities between successful startups.

Startups are described as

> *"temporary organizations designed to scale into large companies. Early stage startups are designed to search for product/market fit under conditions of extreme uncertainty. Late stage startups are designed to search for a repeatable and scalable business model and then scale into large companies designed to execute under conditions of high certainty."* [42]

That is, a startup's primary mission is to learn and discover a product that fits the needs of a (new) market, that can be met profitably in a repeatable and scalable way. A high growth startup goes typically through a lifecycle [42] described below

Startup Lifecycle

A high growth startup goes through 4 stages until it reaches "scale", as shown in table 1:

In the first stage, the startup discovers the . Then validating that it users consistently use/buy the product, makes sense.

"a developmental organism that evolves along 5 interdependent dimensions: Customer, Product, Team, Business Model and Financials." [42]

Stage	Purpose	Events	Time
Discovery	Validating the problem and whether anybody would hypothetically be interested in the solution.	Founding team formed, customer interviews, value proposition is found, minimally viable products are created, team joins an accelerator or incubator, Friends and Family financing round, first mentors and advisors come on board.	5-7 months
Validation	Early validation that people are interested in the product through the exchange of money or attention.	refinement of core features, initial user growth, metrics and analytics implementation, seed funding, first key hires, pivots (if necessary), first paying customers, product market fit.	3-5 months
Efficiency	Refining business model and improving the efficiency of customer acquisition process. Startups should be able to efficiently acquire customers in order to avoid scaling with a leaky bucket.	value proposition refined, user experienced overhauled, conversion funnel optimized, viral growth achieved, repeatable sales process and/or scalable customer acquisition channels found.	5-6 months
Scale	Startups step on the gas pedal and try to drive growth very aggressively.	Large A Round, massive customer acquisition, back-end scalability improvements, first executive hires, process implementation, establishment of departments.	7-9 months

Table 1: Startup lifecycle (Source: adapted from [41])

1. Forget products/market segments, it is all about jobs-to-be-done: the roots why people "hire" a product [12] Note: Effectuation: people do not use time on market research - they create the market!

2. "People don't want a quarter-inch drill—they want a quarter-inch hole."

3. Established or big companies are adviced to create a separate startup like unit.

A startup anology that works well, is organ development in early stages. Need to grow harmoneously between all dimensions of startup, until it reaches a final shape; And find itself/identity to form and adapt to how to serve a specific need/market-to-be. Then it can grow on this foundation.

According to Genome types, Padness is "The Social Transformer / Type 1N" (social reading/studying)

- Clayton: understanding jobs to be done is the starting point, build everything upon it [12]

So, as Disruptive Innovation sais about jobtobedone and forge the whole based upon, organ has to form itself. Ok

Findings: "Startups need 2-3 times longer to validate their market than most founders expect. This underestimation creates the pressure to scale prematurely"

"Startups are temporary organizations designed to scale into large companies. Early stage startups are designed to search for product/market fit under conditions of extreme uncertainty. Late stage startups are designed to search for a repeatable and scalable business model and then scale into large companies designed to execute under conditions of high certainty."

The Organic Startup How should IT-startups do it? Jobs-to-be-done is discovered and startup builds around it and a business model, and grow organically to be a grown up company. A balance excercice between all aspects of the startup

— "I believe the missing piece from the DNA in the founding teams of Transformational Companies is now the Domain Expert, who has deep insight into the industry they are trying to disrupt. " `http://blog.startupcompass.co/reversing-the-decline-in-transformational-ide`

Genome, orig. report "Technical teams did very well with Type 1 (The Automizer) startups and didnot do very well with Type 1N (The Social Transformer) startups"

0.3.4 Pretotyping

Matches great, and the Agile movement/Lean startup Early stage: pretotyping find the job(s) to be done
Interpretation: shorten the speculative phase and back it up with user data

1. iteration,

2. AB test, Google made millions of $ on changing link blue color shades to figure best.

3. data collection,

4. metrics,
5. one or more projects
6. Continuous deployment
7. First disable caching, to get most hits, then enable if necessary

Small AB tests, too much to require users to install and reinstall different Early stage development: Minimum Viable Product pretotyping - What pretotyping is — beware vanila metrics, i.e. user growth if no revenue stream. - beta, alpha - AB/split test - Requires Quick development/deployment

Challenges of pretotyping on thick clients

— http://hbswk.hbs.edu/item/6659.html Tom Eisenmann, a professor in the Entrepreneurial Management Unit at Harvard Business School.

"Lean startups don't try to scale up the business until they have product market fit [PMF], a magical event—more easily recognized in retrospect than in the moment—when they finally have a solution that matches the problem" —-

To be Quick is fine, but needs flexibility to change. However, backward compatibility imposed, delays might incur etc. Needs to reverse quick bad decisions. Keep control over architecture (well behaved clients). * Challenges of thick client pretotyping - Client distribution out of control: external distributor. Sometimes restrictions/rejection, delays in distributing update etc. - unflexible for pretotyping practice (cons) - For example if one makes a quick pretotype with heavy polling, then it shows to be too much, not possible to easily retire the client. not easy AB test: no full control over installs. - In beginning, important to convey a good image and make to be a "sticky" app in the users mind. Before that, don't annoy/expect user with too many re-installs - Forced external API Design (cons but make it advantage - prepare platform API, and possible easier partnership) API deprecation, reverse wrong design: keep control over system - Architecture: Cost and difficulty when time passes, for website, even more when no control over a component in the architecture: change in Design –costs(++)– ¿ Impl. scala+perf. most difficult to adjust. Anecdote: Amazon split server for Christmas season. Might have had significant concequences. performance, scalability and reliability (advantage thick client computation available)

Communication with users AB test

public API trend, and platform a good way to go

A public API is a way to build an eco system around a product/service, it is a trend and should be envisaged. However, API's as stars in the universe, inchangeable and will be wrong first time. Prepare for evolution, deprecation. So, my own note: use it internally before public, eat you own food.

0.3.5 Architecture

Although probability low, and many focus on scalability too early, bad if chance goes away and we are here for high growth systems anyway. So, make lightweight

decisions that keep my system open for scalable solutions in the future with relatively small price.

Keep all possibilities open, open evolvable architecture for different loads.

1. Design costs less, after costs more...
2. Scalability and performance are most difficult to add as an afterthought
3. An architecture that both satisfies the needs of the pretotype in early stage, but can evolve into a scalable solution
4. QRCS read-write separation

Client loadbalancing. Cloud more expensive than own. Cloud not good at scalability; cannot optimize (commodity), [not near CPU, LMAX architecture,...]. Plus, cost saving in beginning important. Investment postponed, but success needs most of hardware investment, so best: Client load balancing, hybrid cloud-hosting.

0.4 Approach

A (3osarat) resume is to: - start from what one have: I am arab, student, know educators and publishing houses in arab world, have access to copyright free books - niche good, focus. - build basic seed add what opens different types of partnerships: investors (collect data, but disable if too much), authors (feedback), self-authors (+corrections), schools (teacher¡-¿students¡-¿students), publishers (correction, usage stats), software houses cooperation.

— in the light of education disruption

- make lightweight architecture (remote control, API Design, scalability if it comes) – separate client from server, enable each to evolve – separate backend by two dimensions: 1) services, 2) read-write - launch then look for partnerships with concrete product and user numbers (more credibility with product in hand) - Hold eye on growth: if scale, move to arch, otherwise optimize user experience, user retention, feedback loops etc. until it takes off. - continuous integration/deployment, test. However, might be too complicated if simple backend, introduce when necessary.

0.5 Case

0.5.1 Use cases

1. Easy corrections
2. Class mate and group reading
3. Asking clarifications from author
4. Author understanding of book unclear passages, reading patterns etc. to improve book
5. Author More data about how book is read, time spent etc.

IDEAs: - ebooks that change depending on type of user learning preferences (?) - MEAP/Manning: books dev-loop and sold. What about more dynamic, realtime feedback loop?

Disruption in Education, paper: ————————————

" The CDs often were left in their jackets and the Web sites were rarely visited. Had the publishers observed stu- dents, they would have found that what students really do is wait until the last minute to read their textbooks. What they really need is a way to help them learn quickly right before an exam and the ability to ********** share class notes online. **********"

— http://www.educause.edu/ero/article/role-disruptive-technology-future-higher-educational

"Terry Anderson12 pointed to the importance of placing the student at the center of the learning experience, as have others. That means a greater focus on student-generated content, students' use of collaboration and sharing tools such as Web 2.0 applications, and modular tutoring."

"... automated instruction, self-publishing, and peer-to-peer networking."

0.5.2 Applying disruption approach

A successful disruption of print books can reach far beyond the publishing industry.

Textbooks are a cornerstone in the education system, and its creation and distribution is the first activity in the chain of activities that together constitute the public education's *value network* [6]. A *value network* comprises all activities by different partners, suppliers and channels that together serve particular customers.

The US education system is becoming too expensive [13]. With continuously increasing tuition fees [11][13] and student debt reaching a staggering 1 trillion USD in the US [14], the education market is in need of more affordable alternatives. Combined with a fundamental mismatch between the unique individual student learning preferences and the increased standardized of education [6][55], the education industry is itself ready for disruption [6][13].

Indeed, the disruption might already have started. In recent years, online course enrollment in the US has increased "substantially faster than overall higher education enrollments" [17]. Specifically, online enrollments growth rate has been more than ten times the growth rate of overall higher education enrollments in the fall 2010. 31 percent of all higher education students take at least one course online, and 67 percent of academic leaders rated the learning outcomes "as the same or superior to those in face-to-face" [17]. Clayton M. Christensen, a leading expert in disruptive innovation theory, predicts that by 2019, fifty percent of all high school courses will be delivered online [6].

However, a disruptive online education, or more generally computer-based learning, is not a mere replication of the monolithic "bricks and mortar" education online [6]. Despite heavy investment in computer systems, previous attempts have largely failed to deliver significant improvements, because the technology has been co-opted to the existing teaching model, serving existing students [6]. Instead, to be successful, a new student-centric teaching model ducational system about using a new tool to deliver the same monolithic experience, but rather There are interesting innovations in online education, includ-

ing Coursera's Massive Open Online Courses (MOOC), some of which and khan translated to more than 50+ languages. It is appealing to an international audience (not just the US). Education is competitiveness, With a global education spending of 4 trillions USD per year predicted to double by 2020 to 8 trillions USD... In this innovation thesis, I am initially asked by a startup to build an eReader application for Android. With this fast paced ebook and educational market, ambitions quickly got higher - eReaders are more than books. Not only digitize the reader. Interconnected, powerful devices. However, startups fail, and even established companies.

So, need learn big picture, deduce requirements for process and architecture.

Many educational startups emerged in recent years [18][19], as well as big players like Apple, Intel, Google and Microsoft battling for the education market. The estimated global spending on education is about 4 trillion USD, projected to grow to 8 trillions USD by 2020.

Massive Open Online Courses (MOOC), courses with large scale student participation from few thousands to hundreds of thousands of participant in a given course.

Nation competitiveness. But not standardized, customized, user sharing etc.

Findings applied to education (Note: IT disrupting education, not only iPads. But iPads/eReaders disrupting books -¿ disrupting textbooks used in education?)

1. Traditional way of education is too inflexible, standardized, students run in batches, subjects and departments are silos
2. People learn differently, different paces, different interests and capabilities
3. Learning best by creating and engagement two-ways or peer-to-peer, not one-way-hearing [3]
4. Creativity comes at cross-roads of different disciplines
5. " ...schools.. online learning programs failed simply because they tried "to provide traditional courses in a nontraditional manner.""
6. " Attempting to market an inferior product to their most demanding customers was, predictably, a recipe for failure"
7. "...problem was that they were still competing against consumption."
8. is ready for disruption

——— Rita Kop, "Web 2.0 Technologies: Disruptive or Liberating for Adult Education?" Adult Education Research Conference 2008, St. Louis, Missouri, June 5–7, 2008.

Students need to create content, get it validated by peer (Tayeb: voting?) and expert feedback. Free to construct, but get validated instead of one-way-hearing. Maybe not fully understand until validating ones own thoughts? Get knowledge from different sources, no time/space limits. Chaos, creativity.

"... people take ownership of the learning process, rather than institutions controlling their education"

"... they preferred the online mode of study, which is flexible and available at the time and place to suit them and fitting in with their lifestyles better than

face to face teaching, [but] they required a lot more nurturing than anticipated. ” ———

conclusion:? Courses with lots of books, deep
Non-consumers(non-students): Books, ”randomly chosen”, by topic, on your own.
Offer: Package mini courses with the books in one package, peer-to-peer.!
But how do expert do it?

Applying effectuation (remove?)

Apply

1. Pilot in the plane: ”the future is neither found nor predicted”, but rather controlled

2. Bird in hand: apply:(arabic books, understand language and culture, network; P.inc servers) - and find and do what is doable.

3. Affordable loss: my time for thesis, P.inc: limited funds for Amazon, Google play etc.

4. Partnership: (now move to k12 with iqra school instead of university-wish-to-be)

5. Leverage surprises: Use uncertainty to own benefit, investors doubted: further develop concept etc.

0.5.3 Why/strategy

Arabic Niche, Low cmompetition, hope for higher interaction iOS success, demand for android

0.5.4 Possible paths and what should be done in each case

If high growth, move to scalable If low growth, work on customer aquisition and retention Enhance existing functionality Add functionality

0.5.5 What happened

Pretotype with HTML5 (titanium), made book scanner. However too slow. Some big companies that used it, moved away from it.

In beginning, a thought of developing API, let existing iOS app be enhanced with interaction to get feedback quickly, start immediate iteration However, problems with external devs, genome sais it! Dropped and moved to android

Web (minimum), failed, parked Android: basic has to be in place, pretotype only on new extra features. Challenge

Need fast desicion, product owner present or autonomy. Authority to decide

Implementation

Arabic

Arabic letters different forms. Needs reshape. Had an open source starting point, but had bugs for some letters, and no "tashkeel". Bug long lines, sometimes letters inversed. Need to estimate line length and cut.

Search: trade off, between size, speed and batteri. Chose speed and batteri - space can be purchased. word reshaped before indexed - remove tashkeel.

Log analysis

1. Although arguably less user friendly, number of user contents available per page is not available. Interested users would click on it, so we register interest even if most books have no annotations in the beginnning. Not enough resources to enter/sponsor/encourage initial user content.
2. various books different interests, too scattered user annotations. To get momentum, needs focus user groups, for example cooperate on particular course and get students to interact with each other and teacher through app to add content. Otherwise, users are disappointed.
3. Remarked same users click on different pages from same book, guess frustrating, especially when most have no content, so made change added different categories: page, chapter and book.
4. Quite few users attempted repeatedly to login but failed, even after successful registration with arabic names. A bug hindered UTF8 usernames from client side. Was too cumbersome to fix with time limit. Others tried with email. Quick fix was to send message, meanwhile made stricter client validation: no arabic, no email.
5. Quite few failed registration because of weak password. The numbers were quite significant, and turned out they used numbers only password. Restriction was removed.
6. In general, we need a much easier user account creation and login process, possibly with auto picking user (Google) email if available and generating a password so user only needs to approve.

0.5.6 Requirement and architecture

Prepare for scalability, even not implementing:

1. Avoid bottleneck on id generator
2. Shard-able ID creation, one per book well defined algorithm
3. Scalability and performance are most difficult to add as an afterthought
4. An architecture that both satisfies the needs of the pretotype in early stage, but can evolve into a scalable solution

0.6 Conclusion

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