As We May Create

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Keynote address, WINLAB Annual Review 2006
Outline

• Introduction
• Drawing on the Light Side of the Brain
• Drawing on the Dark Side of the Brain
• Summary
Introduction

The mobile networking community (current) holy grail: 4G
But what is 4G anyway?

• Historically wireless generations have been defined in terms of air interface technology, focusing on raw bandwidth

• Views of technology evolution:
  – Air interface view
  – Devices view
  – Network evolution view

• As 3G demonstrates, good wireless access technology and high raw bandwidth is no longer sufficient for business success
  – Declining ARPU for wireless carriers

• Thus for 4G it seems more appropriate to use other criteria
  – This talk presents some hypotheses for discussion
Network evolution view

~2005: Edge of PSTN/ Homogeneous RAN Type/ Disjoint Core

~2008: Edge of INTERNET/ Heterogeneous RAN/ Single all-IP Core

CS = Circuit switched
PS = Packet switched
B3G = Beyond 3G
4G is about services and applications

- Not raw data rates, wireless technology, IP networks, or devices
- But … no one knows what the killer app is
- Needed: a second waist to speed the deployment of new services (Jain, 2003)
Refrain: “What is the Killer App?”

- If you can’t answer it, redefine the question
- No one entity knows the answer
  - If I knew, I probably shouldn’t tell you
  - Today’s killer app may be tomorrow’s (or next year’s) me-too
  - No one entity can keep developing a suite of killer apps
  - The truly killer app for me may be the one that is most specialized or personalized

![Graph showing the relationship between Mass market, Applications, and Boutique with axes for Popularity, Genericity, User Willingness to Pay, and Long tail.](image-url)
First: A Bow to Vannevar Bush

Memex: A killer app ahead of its time

• "As We May Think“, Atlantic Monthly, July 1945.

Memex: "device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility."

"Wholly new forms of encyclopedias will appear, ready made with a mesh of associative trails running through them, ready to be dropped into the memex and there amplified."

• Are we there yet?
  – Not only are we there, the party is in swing …

• So what’s next ...?
  – Rely on tapping into the creativity of others’ to satisfy real or perceived needs
  – Let’s take a break from the ISO model of layering …
Maslow’s hierarchy of needs

Plenty of detractors, but a starting point …

**Real World: Maslow, 1943**

1. **PHYSIOLOGICAL**
   - (Food, clothing, shelter)

2. **SECURITY**
   - (Protection from crime, aggression)

3. **SOCIAL**
   - (Give and receive love, belongingness)

4. **SELF-ESTEEM**
   - (Earn respect and status, contribute to society)

5. **SELF-ACTUALIZATION**
   - (Develop one’s potential, creative and spiritual needs)

**Online World: Kim, 2000**

1. **ACCESS**
   - (Connectivity, obtain and maintain an online ID)

2. **SECURITY**
   - (Protection from cybercrime, privacy preservation)

3. **SOCIAL**
   - (Sense of belonging to the community and subgroups)

4. **SELF-ESTEEM**
   - (Earn respect and status, contribute to community)

5. **SELF-ACTUALIZATION**
   - (Develop skills, discover new roles and opportunities for creativity)

This talk’s focus
Drawing on the Light Side of the Brain

• The Memex was oriented towards memory: information storage, archive, access, search and retrieval

• The next step is to support creativity: generation, expression and cross-fertilization of concepts & ideas
  – In this talk we focus on creativity embodied generally in content
  – And the support of end-user creativity
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- Introduction
- Drawing on the Light Side of the Brain
  - The Fixed Web
  - The Mobile Web
- Drawing on the Dark Side of the Brain
- Summary
The Fixed Web: P&P Content Explosion

Pre-web: Content is editorially controlled by a few, consumed by many

Content created by end users, with varying levels of editorial control, that is Personal and Participatory (P&P)
Metaverse
Example: Second Life

• Metaverse = metaphysical universe
• “Not a video game but where people make things”
• Avatars decide what to wear and what vehicle to drive, go to parties, meet people, buy land,
  – build houses,
  – paint pictures,
  – make films,
  – compose music
Interesting spot for a store!

Yeah, my friend built it …
Show Me The Money

• Anshe Chung (avatar)
  – IRL: Chinese-born language teacher living near Frankfurt
  – Amassed virtual real estate and cash assets worth ~$250K
  – Buys land, develops it, resells it

• Creators have rights to their creations

Source: Business Week, 2006
Monetization

- Virtual -> Virtual: Trade in Linden dollars (L$300 = US$1)
- Real -> Virtual: Invest in avatars, real estate, films, ...
- Virtual -> Real:
  - Sell virtual artifacts
  - Sell real artifacts based on the virtual world

- 200K residents
- ~40% women
- Many age groups

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• Introduction
• Drawing on the Light Side of the Brain
  – The Fixed Web
  – The Mobile Web
     • Content creation
     • A model of content creation
• Drawing on the Dark Side of the Brain
• Summary
So … what about the mobile web?

• Mobile devices are starting to meet some of the prerequisites for creativity and rich user experience
  – Bandwidth, Storage, CPU cycles, Display resolutions
  – Multimodal UI
  – Sophisticated peripherals: GPS, contact-less IC (DoCoMo FeliCa), …

• 2.1B Mobile phones = 3.5x PCs
• Mobile phones growth = 20%, PC growth = 12% per yr
• But …Mobile web content is significantly less than fixed web

“Fully 35 percent of consumers cited poor content as the reason they don't access multimedia services, a considerable increase from just 8 percent in 2004.”

- Mobile Marketing Association, January 2006
What content are people accessing now?

- Voice Average Revenue Per User (ARPU) declining
- Data needs to, and is starting to, make up the difference
- However, actual contribution varies significantly by region
  - NTT DoCoMo: 26% of ARPU
  - Vodafone: 18%
  - Cingular 10%

- It’s not just about ringtone downloads
  - Email, Weather, Sports, Search, Maps

- Type of content users expect to access in next 12 mo*
  - Asia/Pacific:
    - Ringtones 73%, Multimedia images 56%, Music 55%, Games 49%
    - Feature films 11%
  - North America
    - Ringtones 27%, News 15%, Multimedia images 13%, Games 11%
    - Feature films 3%

*Source: LogicaCMG 6/05, quoted by MorganStanley
Challenges

• 1.1 Billion Web-capable handsets world-wide
  – 63% of all handsets*

• But
  – Low Data ARPU (outside Asia/Pacific)
  – 50% of Web-capable phones are not configured to access the Web
  – 24% have tried only once to access a Web site**

*Source: Informa, 2005
** Source: “One Web: Going Mobile”, Steve Bratt, CEO W3C, Apr 2006
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A model of mobile content creation:
1. Cross-over

- Make fixed content available in the mobile world
- Challenge: Transcoding
  - A hard, unsexy problem, that will diminish but unlikely to go away fully
  - Battery and bandwidth consumption for high-end phones
  - Legacy devices and emerging markets

Better User Experience

Fixed web content (created for fixed web)

Native full page on high-end browser and phone: pan, scroll, segment, zoom

Trans-coded: better UE

Native full page: poor UE

Mobile web access
A model of mobile content creation:

2. Direct creation

Content created for the fixed web

Native, high-end

Trans-coded

Native

Content created for the mobile web

Public (off-net)

“Walled garden” (on-net): different approaches

More open

More closed

Mobile web access

We believe in an open environment. We are not our customers' parents. Jim Ryan, VP Cingular Data*

Verizon is very particular and careful [about the content it selects], we are not interested in opening that up. – Jim Straight, VP VZW Data**

* Wireless Week, 6/15/2005
** Wireless Week, 4/1/2005
Mobile web content:
Desktop content creation

• The client diversity challenge
  – Device processor architectures (TI, Intel, …)
  – Device I/O capabilities (phone, PDA, hiptop, …)
  – OS (Mostly proprietary)
  – Development environments (Java, Brew, proprietary)
  – Multiple air interfaces (different bandwidth, latency)

  – All elements need to be taken into account – custom authoring – for acceptable user experience

• Complex ecosystem
  – Multiple players at each layer of the value chain
  – Differences in aims, philosophy, strategy
Desktop content creation

- Need tools and techniques

Mobile Sitemaps

- Allows publishers to submit sitemaps to increase coverage of mobile web pages
- Example: www.google.com/webmasters/sitemaps
Standards for content creation

• W3C Mobile Web Initiative (MWI)
  – Best practices WG
    • Encourage creation of content that renders across all devices
    • Advise on how to structure and mark-up content to ease adaptation
    • Advise on the limits of adaptation
    • Example: No table for layout, no spacers-GIFs, no frames
  – MobileOK Trustmark: Establish a set of validation tests for compliant sites
  – Device description WG: Vocabularies and reference repository creation

• New Top-Level Domain .mobi
  – Created July 2005 by an industry forum led by Nokia, Microsoft Vodafone
  – Best practices, validation tests to obtain .mobi domain

• Challenge:
  – Standards non-proliferation and consistency,
  – Standards testability and value
A model of mobile content creation:
3. Mobile user generated content (MUGC)

- Largest digital camera manufacturer: Canon, Nikon, Nokia
- Expect doubling of photo messaging in 4 yrs

Google Blogger Mobile

Moblog

*InfoTrends/CAP Ventures, 11/05
Moblog richness

- Serendipitous creation

- Moblog as social barometer
  - Infer newsworthiness of an event by number of submitted images

- Tagging: images with context
  - Location
  - Weather
  - Free text or audio
  - Maps or Google Earth

Source: http://www.makezine.com
Personal geography

“Weird Things I’ve Seen.
A map to document all the crazy things we see in everyday life…”

http://www.platial.com/jax2006
Mobile video content creation

- DoCoMo i-motion, 3G, Nov 2001
- YouTube, May 2006
- Challenges: Privacy, DRM and copyright, porn, child protection
DoCoMo i-motion

Source: NTT DoCoMo
A model of mobile content creation

**Creation**

- **Mobile created**
  - Mobile blogging, tagging, video
- **Desktop created**
  - DoCoMo i-shot, i-motion

**Packaging**

- Content created for the fixed web
  - Native, high-end
  - Trans-coded
  - Native
- Content created for the mobile web
  - Public (off-net)
  - “Walled garden” (on-net)
  - More open → More closed

**Access**

- Mobile web access
Challenge:
Monetization to motivate content creation
Or, Show me the money ... Again

- Fixed web ads 101
  - Worldwide advertising ~$250B, online ~$12.5B (5%), but fastest growth
  - Example: Basic Google AdWords model (highly simplified):

```
0. Crawl

1. Ads, Max Cost per Click (CPC)

2. Search query

3. Query, other info

4. Relevant ads

5. Auction

6. Search results, ads
```

WWW

Advertisers
**Mobile Web Monetization**

Example: Google Mobile Ads in Japan

[Ad] Identifies the ad for the user


Display URL

Click-to-call

Clicking this link brings the user to a landing page to call the advertiser directly

An advertiser can choose to link the user to a mobile website, enable click-to-call or offer both features in the ad

The title and promo line (abridged text)

Users can click on the link to initiate a call with the advertiser

Please click the link to be connected. (212)589-7868
A model of mobile content creation

**Creation**

- **Mobile created**
  - Mobile blogging, tagging, video
  - DoCoMo i-shot, i-motion
- **Desktop created**

**Packaging**

- **Content created for the fixed web**
  - Native, high-end
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- **Content created for the mobile web**
  - Native
  - Public (off-net)
  - "Walled garden" (on-net)
  - More open to More closed

**Access**

- **Mobile web access**

**Monetization**

- Direct payment: subscription, per-use etc
- Ad supported
- Supplementary services e.g. CTC
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Drawing on the Dark Side of the Brain

- Maslow’s Hierarchy Revisited
- Pornography
- Forgery
- Others
  - Environmental Impacts
  - From QoS to QoL (Quality of Life)
    - Tranquility
    - Leisure
Recall Maslow’s hierarchy of needs

Plenty of detractors, but a starting point …

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Counterpositions

• Maslow’s view of the hierarchy was somewhat deterministic: lower needs have to be satisfied before higher needs in the pyramid become relevant
• In practice, barring critical situations, some mixing of concerns at different levels is likely
• There is no doubt that in the case of the Web, and especially the Mobile Web, the lower level needs have not been fully met
Cracks in the pyramid
(And typically worse for the mobile web)

Online World: Kim, 2000

- **SELF-ACTUALIZATION** (Develop skills, discover new roles and opportunities for creativity)
- **SELF-ESTEEM** (Earn respect and status, contribute to community)
- **SOCIAL** (Sense of belonging to the community and subgroups)
- **SECURITY** (Protection from cybercrime, privacy preservation)
- **ACCESS** (Connectivity, obtain and maintain an online ID)

Issues and Challenges

- Diverse, complex ecosystem for mobile
- Limited tools, techniques and standards
- Editorial role issues for MUGC and P&P content
- Relatively smaller open source developer community
- Forgery issues
  - Abuse & asymmetry of online reputation systems (users, sensors)
  - Inclusive, porn-free, multilingual UE
- Mobile viruses and spam
- Location and context privacy
- No reliable universal ID token
  - Forgotten markets
  - Managing digital ID
  - Uncertain data costs

Forgotten markets
- Managing digital ID
- Uncertain data costs
Forgery

- Manipulation of images
  - Common on the web already
  - Active research in digital forensics to detect forgery and fraud
  - No doubt forged images will proliferate mobile web also

- But
  - Rise in camera phones can actually act as a deterrent
    - Verification by multiple images

- But again
  - Images taken by camera phones may be traceable to the owner
  - Every camera photo has a weak pattern of non-uniformity that is
    - Specific to the camera
    - Consistent from image to image
    - Invisible to the human eye
    - Can be extracted by statistical analysis of multiple images
  - Fridrich, 2006: In preliminary tests, 2,700 pictures taken by 9 digital cameras could be correlated with 100% accuracy
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    • Content creation: Approaches and Challenges
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Summary

- The next generation of mobile networks will be defined not by air interface or network protocols but by applications.
- The “killer app” is hard to predict … so rely on the creativity of users to fill real and perceived needs:
  - The fixed web is slowly maturing towards fulfilling the needs of community, self-esteem and, ultimately, creativity.
  - Fulfilling the need for creation could be the ultimate “killer app”.
- On the mobile web, exciting possibilities for content creation by the rise of richer devices, networks, applications:
  - Model of mobile content creation emerging, with a monetization feedback loop.
  - Nonetheless significant technical challenges remain at all levels of the hierarchy of needs (access, security, community, tools, standards …).
  - Possible further challenges of mobile content (forgery, privacy, …).
- Research challenges and opportunities at all layers to address these issues.
Pornography

• Large-scale study of Google mobile search site (XHTML, PDA) found that the most popular type of query was Adult: > 20%
  – Kamvar and Baluja, 2006
  – Followed by
    • Entertainment (celebrities, song lyrics), >10%
    • Internet/Telecom (ebay, gmail, ringtones), >5%
• Same study for PDA interface found Adult dropped to 6th place
• Internet study (Spink et al, 2002) found
  – Adult was <10%, and did not rank in top 3 categories
  – Adult declined by half from 1997 to 2000
  – “From e-Sex to e-Commerce”
• Mobile devices may be more personal, demographics may be different
• Mobile adult content may also be on a declining curve
  – If not, or until then, content filtering, standards and monetization may need to be considered differently for the mobile Web
Google’s Provides a Broad Array of Products to Help Users Find Information, Communicate and Collaborate
Offering Search for Mobile Phones for Over Five Years

Google builds upon and leverages the vast scale and scope of the existing infrastructure.

Google Web Search
- Access to over 8B web documents

Google Web results:
'ipod'
Results 1 - 10 of about 58,400,000.
2 iPodlounge | All Things iPod - The world’s leading iPod resource for news, reviews, forums, tips and tricks, - www.ipodlounge.com/
3 iPod Hacks :: The Latest and Greatest for Your iPod - Includes information about possible hacks, forum, news, and surveys. - www.ipodhacks.com/

Google Image Search
- Access to millions of images

Google Image results:
'ipod'
Results 1 - 3 of about 288,000.
2 apple3.jpg – www.watch.impress.co.jp/av/docs/20040720/apple.htm

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