# Multimedia Content on Mobile Devices : Opportunities and Challenges

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### The Basics of Mobile Services



Source: ITU, U&S Research

\*Fixed Residential & Business telephone lines

• Wireless Subscriber Growth is Still Strong through 2010



## .. With Strong Revenue Growth



Source: ITU, U&S research & estimates

\*Excludes Broadband, Data Comms & International

• ARPU is lower among the fastest growth areas



#### The handset market growth will start to slow down..

Sales Growth** (%)	18%	27%	15%	<b>9</b> %	7%	6%	5%	3%
Industry Sales** (\$Bn)*	79	101	116	125	136	144	152	157
ASP* (\$)	160	154	140	130	125	123	120	118
Units Growth (%)	21%	<b>32</b> %	27%	16%	13%	8%	8%	5%
Shipments (m)	489	645	816	943	1064	1151	1243	1308
Users (m) (End-Year)	1363	1689	2057	2346	2619	2850	3072	3285
Worldwide	2003	2004	2005	2006	2007	2008	2009	2010

Source: U&S research & estimates "Average Selling Price at \*\* ex-factory levels

"Including estimate for accessories sales

- Predictions for over 1 billion handsets with multimedia capability by end of 2008
- 5 key players Nokia, Motorola, Samsung, LG and Sony-Ericsson supply 75% of world's handsets
- Leaders release 30+ models/year
- The "40 Million handset" threshold..
- Almost 78% of the subscribers use GSM technology the trend is expected to extend to 3G as well



#### Personal Entertainment Scenario in 2008





### Evolution of Storage has a strong influence..



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## Storage will be more prevalent in clients

Units: Millions	2005	<u>2010</u>
Total WW Cellphone Sales	816m	1308m
Installed Base	2058m	3325m
'Smart Phones'	57m	327m
% Annual Sales	7%	25%
Installed Base	100m	700m
With Removable Media Slots	20m	300m+
% Annual Sales	<2%	25%
Installed Base	30m	600m+
With HDD	0	30-40m
% Sales	0	10-15%
Installed Base	0	70m

Source: Understanding & Solutions Digital Imaging Service

• Storage on Clients can be better leveraged for new applications



## How much do consumers pay for content?



- Source: U&S Digital Distribution Of Entertainment Service
- Consumer Spend on mobile content will experience strong growth
- Prediction: 150 Millions subs will receive broadcast TV on portable devices by 2010

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 Prediction : Consumers will spend upwards of \$40 Billion on mobile content (including broadcast)

# What are the likely new "killer applications"?

- Mobile Video Entertainment
  - Broadcast and downloaded
  - Time sensitive content short clips genre
  - Aggregated and personalized content
  - Time-shift on-the-go (with inexpensive storage on the phone)
- Wireless gaming
- Music (building on ring tones)
- Person-to-person video interactivity



## Technical aspects to be visited..

- Wireless capacity
  - Best effort vs. QoS capacity
  - Effect of overlay infrastructures
    - WiFi, Broadcast (DVBH, DMB, MediaFLO etc)
- Storage on the client devices
- Power performance of client devices
  - RF to applications
- Content Security
- Architecture of the distribution Infrastructure
  - Edge Caching, multicasting etc
  - Caching inside the cellular infrastructure?



## Spectrum is King!

- Desirable spectrum (below 2 GHz) is very scarce
  - 3G allocations under serve the market in terms of content distribution requirements
    - Has resulted in overlay networks to deliver wireless content
      - WiFi for local filler connectivity accomplishes microcell functionality
      - Broadcast overlays DVBH, DMB, MediaFLO
    - Quality of Service for Streaming is still a key issue
      - Short form content is less affected by QoS since reliable downloading may solve the issue
      - Unicast delivery is bandwidth inefficient
      - Support for multicasting at the edge of the radio network would be desirable
      - Ability to monitor end-to-end quality is an important technical issue that needs resolution



# Overlay Networks - Solving the BW crunch?

- WiFi Overlays are beginning to consolidate
  - Power performance of WiFi is still an issue power control on handset?
  - Need to develop applications to leverage WiFi bandwidth to enable predictive and opportunistic downloads to handsets
  - Tight coupling between WiFi and Cellular network is needed to enable seamless QoS
    - Is this a problem worth solving?
    - Should WiFi networks simply be used for data services and opportunistic download?



- Broadcast Overlays are beginning to emerge
  - DVBH, MediaFLO, DMB
  - Issues with cellular vs. broadcast coverage disparities
    - How will this affect consumer behavior?
- Operators believe broadcast TV alone will not result in very strong ARPU growth
  - Need interactive applications over cellular network
- Interactivity will require a more elaborate service delivery platform



## Mobile TV Ecosystem





## The Mobile TV Ecosystem - DVBH Example



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#### The Service Delivery Platform



#### The Storage Lever

- Cost of storage is falling faster than the cost of bandwidth
  - Power performance of storage systems will determine the race between solid state storage(Flash) and other types of media(HDD, optical etc.)
- With densities approaching 100 GB/in<sup>2</sup> (eg. holographic), prepackaging enormous amounts of catalog content may enable new service models



# Power Performance of Client Devices

- RF power is well optimized in today's receivers and will continue to evolve
- Applications on a generic back-end processor are not very power efficient
  - In 2010, expect to have 1000 Mips on a handset
    - Will need better power management
  - Encoding of video using advanced codecs will be a big challenge
    - Power efficient H.264 encoders will require dedicated silicon implementations for efficiency
  - 3D graphics rendering (for games) will be challenging



# **Rights Management Issues**

- Conditional Access System(s)
  - Today's broadcast world
- Digital Rights Management System(s)
  - Today's PC world



# **Content Distribution Architectures**

- Traditional Content Distribution Networks can bring IP content to the edge of the cellular network (at the GGSN)
  - Solutions that bring caching closer to the edge of the cellular radio network need to be developed
- Cache on the client device could be considered as part of the hierarchy
- Need to develop content distribution optimization techniques to reduce overall cost of delivery
- Emerging Peer-to-peer techniques may also have a role to play to further reduce delivery cost



## Content Owners vs. the Pipe Provider

- The "net neutrality" debate and its effects on content distribution over cellular infrastructures
  - eg. will Google be able to distribute content over a Verizon network without Verizon participating in the transaction?
- Need to develop tools to monitor fair access in the endto-end networks?



## Services in a Net-Neutral World?



# May you live in interesting times...

- Content over mobile networks is in its infancy
  - Strong opportunities, technical challenges abound
- Economic models need to be researched concurrently with technical solutions
- Tradeoffs in bandwidth, storage and power-performance needs to be constantly tuned to maximize economic value
- One of the few industries where solutions/uptake has exceeded predictions...
  - Indicative of level of interest from customers



## Discussion....

