

Looking Ahead to 4G

Potential Impact on the Wireless Landscape and Value Chain

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Evolution of Wireless Networks

Wireless Services and Technologies are evolving in three waves

1 & 2G Network (1995 -...)

Capacity Focus

Business Drivers

- Voice network capacity
- Rapid subscriber growth
- Intro data services
- Reduce fraud and cloning
- Global Roaming
- Device Variety

Technology Drivers

- Analog to Digital Shift
- Support Exponential Growth
- Maximize Spectrum Use
- Authentication
- SIM Cards
- Enable Text Messaging
- WAP and Packet Data

3G Networks (2006 -...)

Cost Focus

- Increasing MOUs
- Big “Bucket” Plans
- Look to differentiate with data
- Improving applications & devices
- Enterprise lead usage
- Experimentation with video

- Spectrum Efficiency
- Increase Voice Capacity
- Support Voice “Big Buckets”
- Optimize by Separate Data
- IP Intersects Wireless
- Multi-band
- Devices become smarter

4G Networks (2008 -...)

Strategy Focus

- Voice as an application
- Wireless Broadband
- Service Differentiation
- Video enablement
- Embedded Wireless
- Quad Play; Convergence

- Wide Channels
- All IP
- Services Flexibility (IMS)
- Convergence
- Capacity Ahead of Demand
- App Specific Devices
- Multi-Mode/Multi-Band

The 4Ps of 4G: What Defines 4G?

4G is about more than just speed. 4G technologies will provide broadband *Pipes* over standard Internet *Protocols* to deliver *Personalized* services in a *Pervasive* manner



4G Characteristics

- Enable broadband speed
- High tonnage capacity
- Cost efficient architecture
- Spectral efficiency
- Low latency, reliable transmission

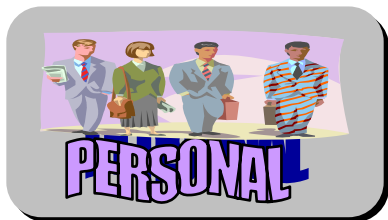
4G Opportunities

- Primary and secondary Internet access service
- Higher quality and more cost effective deliver of heavy content such as music and video
- New communications services such as video calling and conferencing



- Support full IP data applications and services
- Interface with public and private networks without requiring changes to protocol, settings, devices, or content
- Technologies converging on OFDM and MIMO

- Easier to offer customers integrated products with consistent user experiences
- Enables more rapid and flexible service creation, reducing time to market



- Allow for user personalization of presentation, filtering, and accessibility (mass customization)
- Service profile and policies remain consistent and follow the user regardless of access network

- Differentiation and churn reduction through new personalization features
- Increased ability to offer applications and services that customers want, when they want it



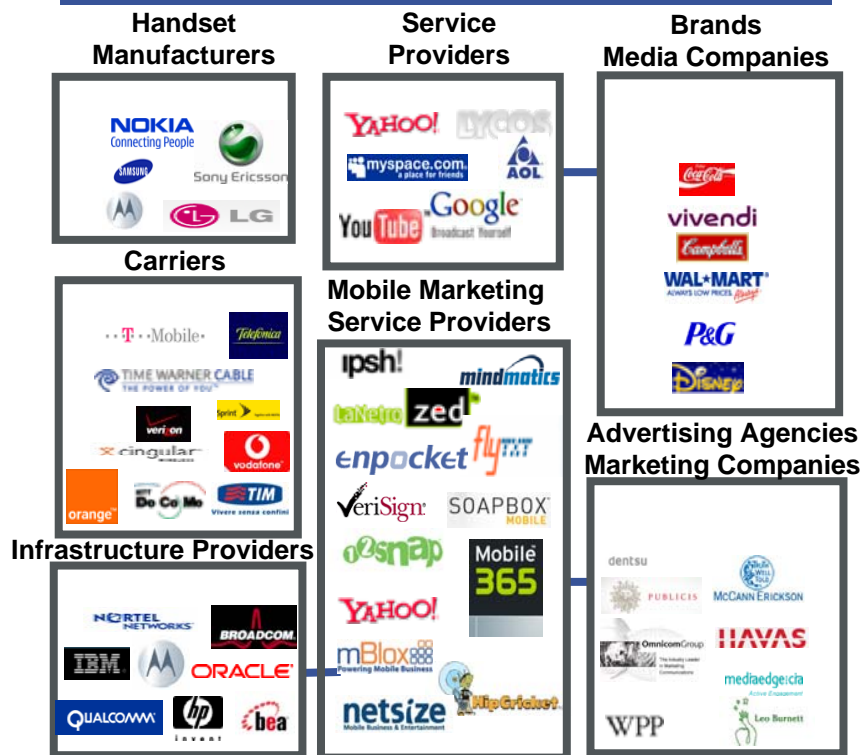
- Fixed, Nomadic, and Mobile Capability
- Multiple discrete and integrated devices
- Everything becomes "wirelessly enabled"; not just "cell phones" anymore
- Always connected. Always "on"

- Offer customers increased connectivity and simplicity
- Open new markets, previously unavailable to service providers

What is Different with 4G Versus the Past

Wireless broadband comes with a much greater degree of complexity and uncertainty.

Complex Ecosystem



New Challenges

- **Spectrum Acquisition:** Spectrum allocations are much more inconsistent and fragmented leading to concerns of worldwide harmonization. Also, optimizing the specific amount and value for spectrum is a significant challenge
- **Technology Selection and Deployment:** While Sprint's announcement has generated momentum around WiMAX, evolution paths have become more complex rather than more clear
- **Geographic Significance:** Primary drivers for 2G and 3G have come from Western Countries particularly Europe and US. 4G may be primarily driven by Asia and Latin America
- **Business Strategy and Services:** Services adoption much more uncertain...Build and WILL They Come...Opportunity for wireless triple and quadruple play could be realized pushing wireless further into traditional wireline markets
- **Financial Markets and Returns:** Financial Markets more Pragmatic than Enthusiastic – returns must be generated on businesses beyond voice

Spectrum: Specific Regulatory Trends

Global spectrum regulation to support 4G is very fragmented with many competing forces and the ultimate direction unclear. Lack of harmonization will decrease economies of scale.

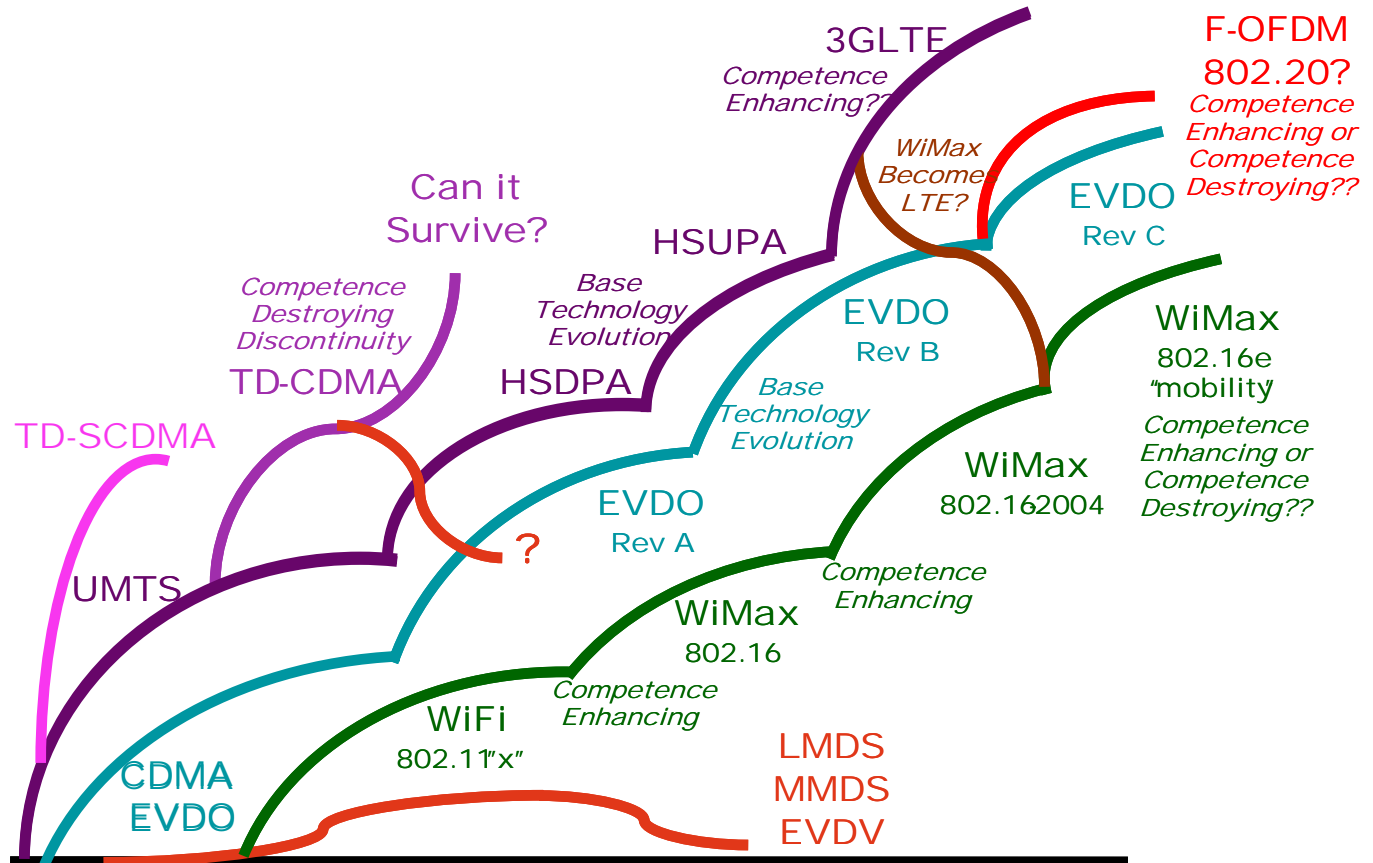
North America (1.7/2.1, 2.3, 2.5, 5.x Ghz)
APAC (1.9, 2.3, 2.5, 3.3, 3.5 & 5.8Ghz)
Fragmented evolution with many different countries at varying points of licensing and deployment
<ul style="list-style-type: none">• India just announced shortlist of frequencies for Broadband like WiMax 2.5, 3.4, 2.3 and significantly 700MHz• Korea using WiBro which is expected to be very close to the 802.16e standard• China will likely issue 3G licenses in early 2007; with 4G will they attempt unique OFDM variant akin to TD-SCDMA?• WiMAX trials in 13 APAC countries• Japan WiMAX trials at DoCoMo & KDDI: Hedge strategy?
spectrum to be used for WiMAX type technology as protection of their major investment in 3G spectrum

Broadband - The New Technology War “Wireless War II”

Sprint fired the opening shot by selecting WiMAX, but the battle has just begun. There now is tremendous uncertainty with regards to 4G technology selection, but global demand will drive technology paths more than in the past which was more standards-based (i.e., GSM).

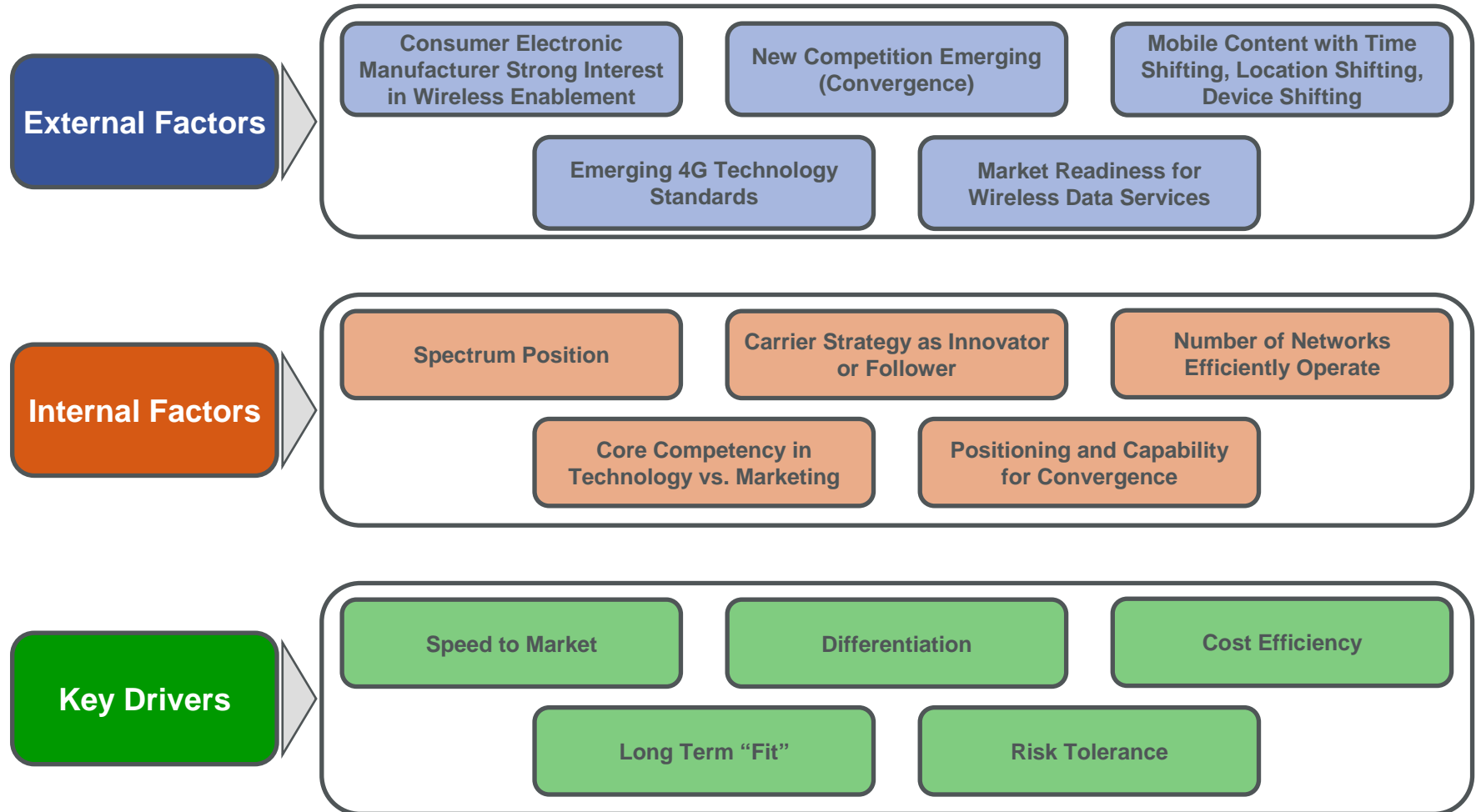
What History Has Shown

- Those organizations that initiate major technological innovations have *higher growth rates* than other firms in their industry
- While dominant technologies cannot be known in advance, those firms that recognize and quickly adopt a technological breakthrough grow more rapidly than others....*there is a first mover advantage*



Technology Decision Larger Context

More than ever, the “technology” decision is becoming more of a strategy decision impacted by various environmental factors outside of technology performance



Challenges for WiMax

WiMax faces some major hurdles on the way to delivering on its future promise

Intellectual Property Rights (IPR)

WiFi enjoyed relatively fast growth and cost reduction in part due to limited enforcement of technology patents by major players. Does not appear that the same will be true for WiMax. Cooperation of Intel/Motorola Samsung control 34% of OFDM patents granted and 59% of total patents pending compared with Qualcomm with 16% granted and 7% pending.

Chipset Cost and Proliferation

essentially non- devices adopt d to other mass control?

Battery Life

be deployed in n issues.

Break Traditional Growth Curves

rs; HSPA 5 mass not ss sooner?

Viable Carrier Value Chain

m in the position or just being a pipe with all the real value in content providers? Carriers will have to emphasize value of customer distribution, along with ability to enhance distribution. Same time will need to be comfortable with on and off portal models. Ultimate goal could be to enable user generated data bringing full circle to voice type model.

Company	Patents Granted	Patents Filed
Motorola/ Intel/ Samsung	34%	59%
Qualcomm (includes Flarion)	16%	7%
Ericsson	13%	2%
Lucent	17%	2%
All Others	20%	30%

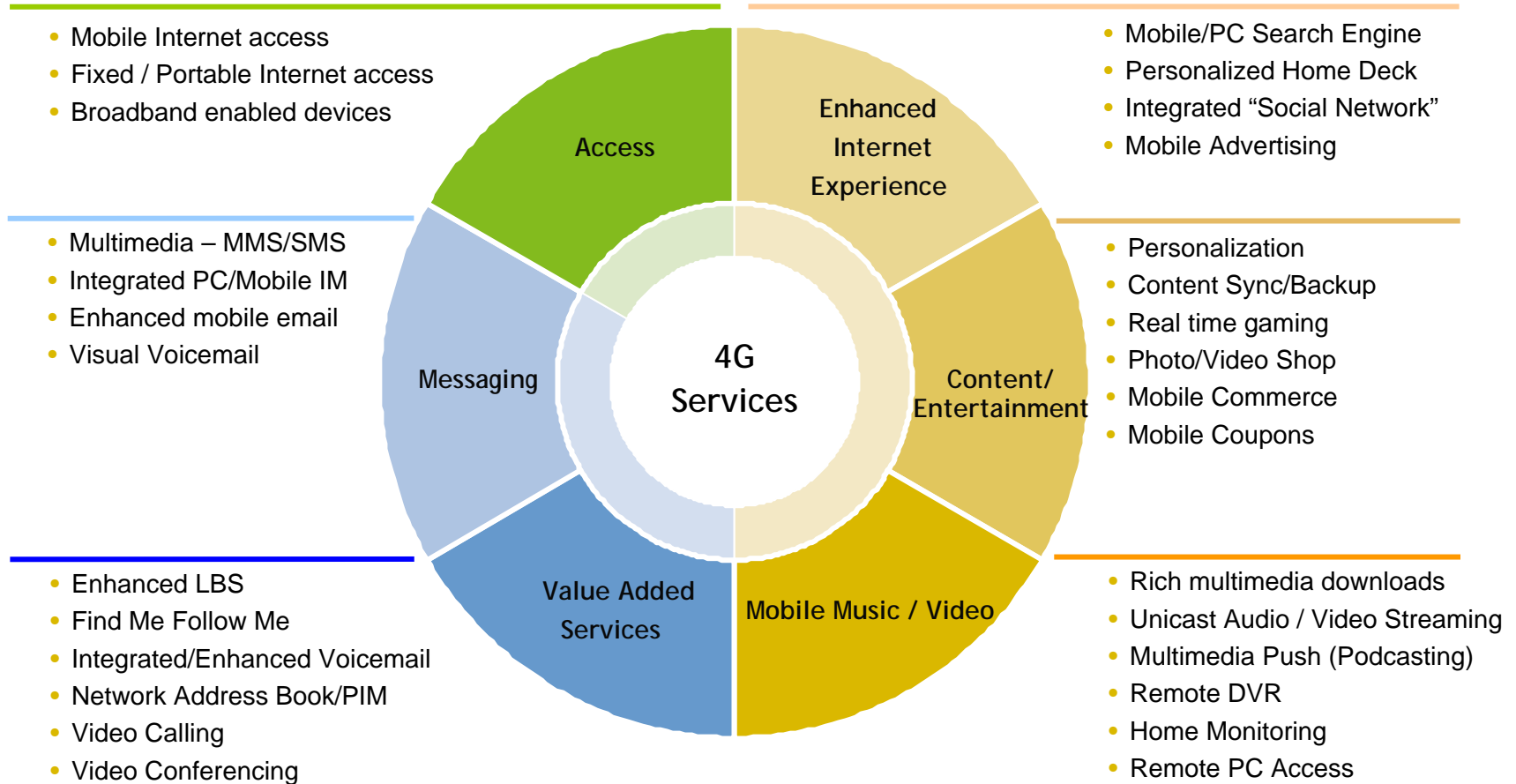
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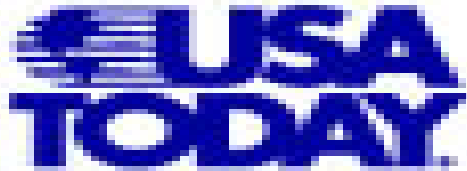
II. 4G Services and Value Chain

Potential Next Generation Services

4G can enhance and / or enable a range of wireless services leveraging a broad spectrum of devices



Personalization becoming more of a key trend



Musicians put ne

the CD to boo

Monday, June 12, 2006

THE WALL STREET JOURNAL.



Google's tv eavesdropping plan

Beck: *The Information* comes with stickers to customize the CD. "This is the only CD in the music world," Beck says.

Offers \$1M Prize For

Better Movie Recommendations

ONES NEWSWIRES
June 2, 2006 12:39 a.m.



For a peek at what's cooking behind Google's research lab doors, check out [this plan](#) to get your computer to listen in to what you're watching on tv. By using its microphone to listen in and then connecting to an online database it could identify the show, and how far through you are.

The next step is where it gets interesting. One application would be to automatically set up a chatroom for everyone watching the same thing at once - like a virtual tv couch. I think Google's bigger interest is in using this for advertising though, since it would be hard to make money from otherwise.

"[C]ontent providers or advertisers might bid for specific television segments", the paper says. Your computer might browse to your local video store when a film trailer was on, or show you where to buy a film star's outfit when they appear on a chat show.

(AP)--Online DVD rental pioneer wants recommendations on how to recommendation system so badly \$1 million reward as an incentive. in a contest scheduled to begin of Netflix's effort to sharpen its as it continues a bitter duel with and prepares for an anticipated is that make it easier to download to computer hard drives.

Develop a better way to decipher consumer tastes, adding DVD service will become even more useful subscribers and attract new customers. software program must improve upon the DVD movie-recommendation system by at least 10%. The differences will be tracked by a program that quantifies how well the systems predict which movies will be liked or disliked by a profiled consumer.

Additionally, BNL is inviting fans to download multitracks for five songs from its website to enable remixing and re-editing. The band will select the best versions for release next year. Such innovations reflect an effort to excite bin browsers and cyber-shoppers alike and are worth "a good college try," says *Billboard* director of charts. "Obviously, people are still trying to figure out what the new directions will be. We're at a point where one foot is heading down a new path, but the business is still weighted in album sales."

New Opportunities in Embedded Devices

Potential for embedded devices in all forms of consumer products to significantly expand the market for wireless services and change the traditional market dimensions of subscription and value chain

MP3 Players



Handheld Games



Laptop Computers



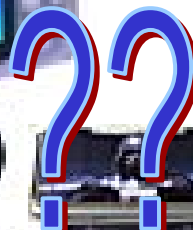
Cameras



Personal Digital Assistants



What's Next



The Carrier Value Chain Position

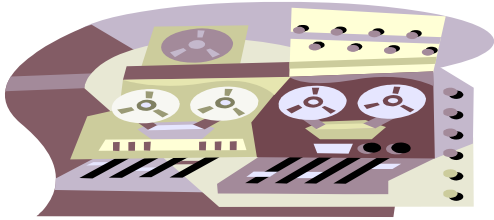
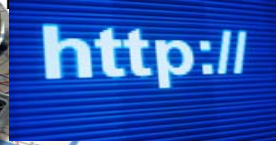


Carrier Position in the Content Market

Content Provider



Content Provider Location Info



Carrier Data Center

Key Trend - User Generated Content

Personal Sharing



Video Sharing



Broadcast Yourself



Photo Sharing



