

# D-Link Business Solutions

## Leveraging 3G Cellular Technology with Mobile Routers

White Paper  
June, 2007

### Abstract

As more cellular phone companies offer data services on their networks, consumers need to understand how “cellular data service” fits into the overall broadband picture, and how it can be enhanced and shared with add-on Wi-Fi equipment. When purchasing laptops, wireless networking peripherals and subscription plans, consumers should examine the true costs and benefits of “wireless.” They also need to think of the broadband data source in terms of delivery method – whether that’s traditional channels (DSL or Cable modems) or 3G cellular networks. This distinction is where performance and mobility issues come into play.

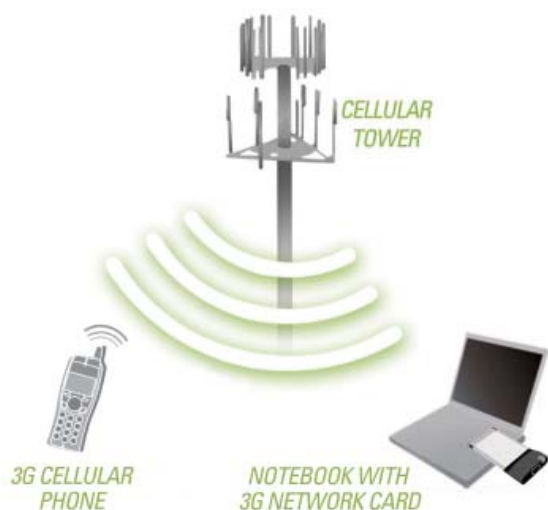
By examining these issues, consumers, small business owners and road warriors can answer questions like: Can I replace my home Wi-Fi network with a new 3G router that connects to my cellular data service plan? How does bandwidth performance compare between 3G cellular access and broadband cable or DSL service? How do 3G and traditional Wi-Fi coverage compare? What are the cost trade-offs? Can I spread out costs by sharing a cellular connection via a 3G router?

Cost, performance and coverage differences between 3G access and traditional Wi-Fi networking via broadband cable and DSL connections present choices that need a closer look. This white paper details the differences between traditional Cable/DSL broadband connections, their extension through 802.11 Wi-Fi technology and emerging 3G cellular access. We will address their performance disparities, the actual costs of each technology solution, and a new way to leverage both 3G and 802.11x networks in harmony.

## 3G Cellular and Traditional Wi-Fi Comparisons – Consider Speed, Cost and Usage

Cellular phone providers offer optional, digital data services for email, Web browsing and other Internet applications. These 3G data access packages are purchased in addition to a voice plan or as an a la carte subscription. They usually cost more than basic voice subscriptions. The plans allow users to access the Internet from their cell phone as well as from laptops or other portable devices that employ specialized modems (typically a PC card or ExpressCard\*). Some laptops are now shipping with these modems built in. Until now, users needed to purchase additional modem devices to insert into their PDAs or laptops.

### 3G CELLULAR NETWORK SETUP



#### 3G Cellular Network Setup:

*With a 3G Mobile Router, a 3G data service can be used to easily set up a secure wired and wireless LAN anywhere that cellular data coverage is available.*

3G networks are usually slower than Wi-Fi networks powered by Cable/DSL, with download and upload speeds typically ranging from 100 kilobits per second (Kbps) to 700Kbps (as opposed to 300kbps to 6MB with typical Wi-Fi Cable/DSL connections). Some systems deliver faster speeds, but 300Kbps to 700Kbps is common in metropolitan areas. We'll cover performance in more detail below.

Wi-Fi networks are simply wireless extensions of existing wired Internet connections such as Cable or DSL connections. Both 3G and DSL/cable connections can be extended with Wi-Fi equipment, by the way. Most laptops come with built-in wireless network adapters that connect to the traditional, non-3G Wi-Fi networks. PC card and ExpressCard external adapters can also be purchased as peripherals.

Examples of Wi-Fi networks include:

- “Hot spots” (e.g. Starbucks, Border’s Books, public libraries)
- Municipal wireless projects
- WiMAX
- Home wireless routers
- Airport Wi-Fi

Some Wi-Fi networks charge for access (e.g. Borders), while others are often free (e.g. municipal Wi-Fi).

Wi-Fi hot spots require that the user’s wireless network card or integrated laptop adapter be within range of the Wi-Fi router in order to maintain connectivity to the Internet. 3G networks like EV-DO (see definitions below) use cellular networks that span large geographical areas around cities and highways. Coverage is more seamless and uniform in urban and trafficked areas for this reason. The providers’ cell towers deliver the network connectivity in most of the areas where cell phone voice service is available. The two 3G technology leaders are Verizon and Cingular/AT&T. Each of these companies has rolled out 3G service to a large portion of their network coverage areas. Verizon currently has more comprehensive coverage.

#### Location Limitations

Traveling executives or service/field representatives that need constant connectivity at remote events or while in vans, limousines or on trains, are typical of the 3G consumer base. While 3G coverage is comprehensive in urban areas, the connectivity drops to “dial-up” speeds (see definition below) in transitional areas where 3G equipment has not been installed and signal coverage is weaker. 3G coverage is not reliable deep inside office buildings (due to structural limitations) and in areas where cell phone “jamming” equipment has been deployed (e.g. some movie theaters, restaurants, etc.).

With the proliferation of municipal, state and federal Wi-Fi and WiMAX (see definitions below) programs, Wi-Fi coverage has been extending rapidly in urban/suburban areas, however 3G is more ubiquitous in corridors between cities and along highways and train routes.

#### Cost Differences

Cellular networks were designed for the “mobile warrior” set, and the packages are priced anywhere from \$50 to \$80 per month\*\*, per user. Analysts speculate that cellular providers have kept prices high because 3G systems might not be able to handle a large influx of users. If numerous users started abandoning their DSL or cable modem connections in favor of 3G cards and cell access, the networks would not be able to handle the traffic.

The 3G “per user” designation is important. While DSL-based Wi-Fi systems are impacted minimally by additional users (up to a certain point), 3G cellular systems limit the number of user nodes available on each cell antennae. Once those spots are filled up, users start getting bumped off the network or refused connections. That is why 3G plans charge by the user and 3G access cards are coded for individual phone numbers. Each PC card, for instance, is coded with one finite phone number that is allowed to access the cell network. It’s not like a traditional Wi-Fi card that can connect to any available network. A DSL or cable connection with a shared Wi-Fi router costs \$15 to \$25 per month\*\*, and anyone with the right laptop, PC card and login information can connect. It’s an open system. The per-user costs come down as you approach 5, 10 and 20+ users.

Unless assisted by additional router technology (see next section), the 3G user can only connect for one session. Consumers cannot buy a bunch of generic 3G PC cards and use the same account/ phone number to connect multiple users. This is important, because intuitively consumers tend to think of PC card antennae as “open” hardware. With Wi-Fi, you might buy four or five standard PC cards or four or five laptops with integrated Wi-Fi, and you can connect to any available Wi-Fi network, without incurring charges per user. Some customers assume that multiple 3G PC cards or integrated laptops could achieve the same result. The notion is half-way true – but only because of recent technology developments.

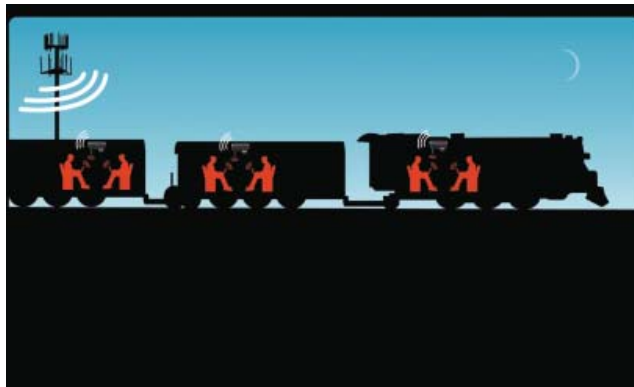
#### New 3G Router Technology Developments Enable Shared 3G

Thanks to new technology developments, 3G cellular data services can now be shared as hybrid Wi-Fi/3G access. D-Link, for instance, has launched new 3G mobile routers that take one 3G cellular signal and allow it to be shared as a 802.11g Wi-Fi network – with multiple users gaining connectivity from one wireless account. The users connect to the router with standard 802.11g network adapters. This changes things quite a bit. By connecting a 1xEV-DO Internet PC card to D-Link’s 3G Mobile Router (DIR-450), a secure Internet connection can be accessed and shared virtually anywhere within a



#### Special Events:

*With a 3G Mobile Router you can share a 3G Internet connection with your group when you are on the go for work or play.*



#### Internet Access by Commuters:

*By installing the 3G Mobile Router on a train, bus or even a boat, you can allow passengers to access the Internet and enhance their experience while commuting.*

wireless broadband network. D-Link also offers a mobile router for UMTS and HSDPA networks – the D-Link 3G Mobile Router DIR-451.

With a 3G mobile router, groups of people can create wireless networks virtually anywhere there is 3G cell service. You can even set up VPNs for private networks (like crime scenes, emergency



#### Access Private Networks:

*Government employees or corporate users can create a wireless network and provide colleagues with remote access to their secure private networks.*

response situations, financially sensitive engagements, or any instance where sensitive information is being passed around). The technology is ideal for trade shows, conventions, off-site meetings, and sporting events or concerts. Jumping from hot-spot to hot-spot is no longer an issue with this type of solution. Passengers on buses, trains and even boats can check email, use networked applications, and surf the Web while commuting. You can even bypass cellular usage billing (like minutes overage) by using Skype® or other VoIP services. Of course, with a 3G mobile router, costs can be spread out among users – which was impossible previously.

**Performance Differences**

Like DSL and cable connection speeds, 3G data rates can vary quite a bit depending on the availability and proximity to a 3G cellular tower. Generally, cellular providers report average 3G download speeds between 400 and 700Kbps.

By comparison, typical ADSL (Asynchronous Digital Subscriber Line) connections provide 1.5M downstream and 350Kbps upstream. With a 802.11n or 802.11g Wi-Fi router, those speeds are fairly consistent across the coverage range. DSL speeds vary by location due to proximity to the telephone switching installation. Cable modems typically produce even better bandwidth (generally, 6Mbps for consumer downloads and 700Kbps for uploads). Again, results vary depending on the number of cable Internet users online in a given neighborhood. Both DSL and cable modem connections can be consistently extended with Wi-Fi routers. Wi-Fi hot-spots in public and at businesses may run at faster speeds. It depends on what kinds of equipment they use and how they are set up.



**3G Mobile Network Setup:**  
Transform a 3G cellular signal into Wi-Fi for shared network and Internet connectivity.



**Emergency Response:**  
Whether you are providing relief for a natural disaster or coordinating the rescue of a lost hiker, you can quickly set up a wireless network.

Generally speaking, if a user has a good Wi-Fi connection to a DSL or cable modem source, it will usually outperform a 3G connection. For example, a 1.5Mbps DSL connection will download a 1Mb file in 5 seconds, whereas a 700Kbps 3G connection would take twice as long. The significance of this difference depends upon the application being performed. Some users use sophisticated Web applications (Rich Internet Applications – RIA) that eat up a lot of bandwidth. Others stream music, VoIP or video, and performance degrades accordingly. Typical email downloading and Web browsing usage would not see much disparity in performance, however.

**Expanding Wi-Fi Coverage, Competitive Choices**

While Wi-Fi access is limited to local “hot spots” or transmitters, WiMAX and advancing Wi-Fi “mesh” strategies are extending the networks. As local governments, private businesses, retailers, and corporate-city partnership arrangements extend networks out into urban, suburban and even rural areas, coverage is improving, seamless roaming capabilities are improving, and more people are



**Special Events:**  
Whether you are at an industry convention, off-site meeting, sporting event, or backstage at a concert, the 3G Mobile Router can keep your personnel and guests in touch with the world.

gaining access. These are ongoing trends that will continue to bring the cost of Wi-Fi access down and increase reliability and scope of coverage.

To some extent, the expansion of Wi-Fi networks will compete directly with 3G solutions. However, 3G should remain a niche solution for heavy mobile users and organizations that need to set up mobile outposts for special events or impromptu occurrences like natural disasters. 3G technology serves a very specific purpose by connecting users that are in transit or away from populated areas. As both technologies advance and consumers choose options based on their particular needs, a clearer picture of the market should materialize.

#### Wi-Fi Bandwidth Growth

Wi-Fi technology innovation continues at a fairly rapid pace. New 802.11n routers deliver extensive coverage ranges for both businesses and home users, and network performance at speeds of up to 300Mbps. The limits are being stretched rapidly. That's just the network, however. Bottlenecks will ultimately reside at the telecom connection (DSL, T1, OC-3, etc.).

Now that 3G broadband sources can connect to 802.11x networks via 3G routers, 3G becomes just another data stream source for Wi-Fi. This development is noteworthy, because consumers may confuse terminologies and mix definitions when talking about all wireless technologies (Wi-Fi, 3G, 802.11x, WiMAX, etc.).

#### Mobility, Performance and Cost Remain Core Issues

3G cellular connections are designed for mobile users that need constant connectivity. With the development of 3G routers such as the DIR-450 and DIR-451 from D-Link, 3G networking is no longer limited to a single user with a specific card. In summary, new 3G mobile router technologies are changing the way people utilize 3G technology. With the ability to share previously un-sharable 3G access, users and providers will inevitably find new ways to use 3G broadband and reduce costs by spreading around charges. This is the nature of the new networked world. Technologies advance, users adapt and markets eventually align with the best possible scenarios.

For more information about D-Link Wi-Fi and 3G solutions, please call 1-888-XSTACK1 or visit [www.dlink.com](http://www.dlink.com).

## DEFINITIONS

**Dial-Up** – An analog modem service for connecting to the Internet. For home users, dial-up was the first Internet access service available, and it is considered very slow at 56Kbps.

**3G** – This term describes wireless cellular data services that enable Web, email and similar end-user activities. The technology is the “3rd Generation” of cellular tower and receiver technology that enables faster access – downstream speeds typically range from 400Kbps up to 1Mbps. 3G mobile services exist in Europe (UMTS), North America (CDMA2000) and Japan (NTT DoCoMo). EV-DO, WCDMA and HSDPA are examples of 3G data services.

**EVDO** – (Evolution-Data Only) EV-DO is one of the 3G technology standards that increases wireless cellular data transfer rates to speeds comparable to low-end DSL service.

**HSDPA** - (High Speed Downlink Packet Access) Another 3G technology – deployed on GSM cellular systems (e.g. AT&T-Cingular and T-Mobile in the U.S.) HSDPA is an enhancement to the WCDMA technology standard.

**UMTS** - (Universal Mobile Telecommunications System) – UMTS is the 3G technology used in Europe.

**Wi-Fi** – The generic term that describes IEEE 802.11 standards for wireless networking. These include 802.11a, 802.11b, 802.11g, and 802.11n.

**WiMAX** – A IEEE 802.16 broadband standard designed to extend local Wi-Fi networks across greater distances and provide last mile connectivity to an ISP or other carrier many miles away.

\*The third generation PC Card technology from PCMCIA that supersedes the CardBus. Introduced in 2003 and designed for both desktop and mobile use, ExpressCards use USB 2.0 or a single lane PCI Express channel.  
\*\*True as of time of publishing.

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