



## Connecting Multiple LAN-Cell's in Tandem

### Technote LCTN0019

Proxicast, LLC  
312 Sunnyfield Drive  
Suite 200  
Glenshaw, PA 15116

1-877-77PROXI  
1-877-777-7694  
1-412-213-2477

Fax:  
1-412-492-9386

E-Mail:  
[support@proxicast.com](mailto:support@proxicast.com)

Internet:  
[www.proxicast.com](http://www.proxicast.com)

© Copyright 2005-2010, Proxicast LLC. All rights reserved.

Proxicast is a registered trademark and LAN-Cell, and LAN-Cell Mobile Gateway are trademarks of Proxicast LLC. All other trademarks mentioned herein are the property of their respective owners.

## This TechNote applies to LAN-Cell models:

### LAN-Cell 2:

LC2-411 (firmware 4.02 or later)

### CDMA:

1xMG-401  
1xMG-401S

### GSM:

GPRS-401

**Minimum LAN-Cell Firmware Revision:** 3.62(XF2).

## Note for Original LAN-Cell Model (1xMG & GPRS) Users:

The WAN Fail-Over & Traffic Redirect screens in the original LAN-Cell's Web GUI differ slightly from the examples in this TechNote. See the LAN-Cell's *User Guide* for more information on WAN Fail-Over & Traffic Redirect configuration.

## Document Revision History:

| Date             | Comments        |
|------------------|-----------------|
| February 8, 2010 | Initial Release |

## **Introduction**

Multiple LAN-Cell's can be connected together to provide fail-over to a different cellular modem (or cellular service provider) and/or to provide higher capacity for bandwidth intensive applications (such as remote security video). There are several techniques for interconnecting LAN-Cell's that are appropriate under different conditions.

### **1. WAN Fail-Over**

WAN Fail-Over is the LAN-Cell's method of monitoring its internal WAN interfaces (Ethernet wired WAN port, Cellular 3G modem WAN port, and Dial-Backup serial port) and sending packets to the highest priority interface that is operational. Use this configuration when:

- A redundant cellular connection is required
- A wired Ethernet WAN connection is not in use
- The backup cellular connection will be used only when the primary connection is down

### **2. Load Balancing with WAN Fail-Over**

Both LAN-Cell's in a WAN Fail-Over topology can provide simultaneous Internet connections, increasing the overall bandwidth available. Use this configuration when:

- Additional bandwidth or data budget allocation is required
- Cellular service for both carriers is available most of the time
- A wired Ethernet WAN connection is not in use on the primary LAN-Cell

### **3. Parallel LAN-Cell's with WAN Fail-Over**

Each of the LAN-Cell's in a WAN Fail-Over topology can be configured to act as independent Internet gateways, servicing a subset of clients, while still offering fail-over to the other device in the event of a loss of connectivity. Use this configuration when:

- LAN devices can easily be segregated to different gateways / subnets
- Cellular service for both carriers is available most of the time
- A wired Ethernet WAN connection is not in use on either LAN-Cell

### **4. Traffic Redirect**

Traffic Redirect is a technique the LAN-Cell uses to re-route WAN-bound traffic to a different LAN subnet that contains another WAN gateway device (e.g. another LAN-Cell). Use this configuration when:

- A redundant cellular connection is required
- A wired Ethernet WAN connection is in use on the primary LAN-Cell

### **5. Parallel LAN-Cell's with Traffic Redirect**

Each of the LAN-Cell's in a Traffic Redirect topology can be configured to act as independent Internet gateways, servicing a subset of clients, while still offering fail-over to the other device in the event of a loss of connectivity. Use this configuration when:

- LAN devices can easily be segregated to different gateways / subnets
- Cellular service for both carriers is available most of the time
- A wired Ethernet WAN connection is in use on either or both LAN-Cell's

This TechNote illustrates examples of each method of interconnecting two LAN-Cell's. The reader is assumed to be familiar with configuring the LAN-Cell for accessing cellular networks and other basic setup parameters. See the *LAN-Cell User's Guide* for more information. Also refer to TechNote *LCTN0011 WAN Fail-Over and Traffic Redirect*.

## Example 1: WAN Fail-Over To An Alternate Cellular Network

Each of the LAN-Cell's WAN interfaces (wired Ethernet, Cellular, Traffic Redirect and Dial-Backup) is assigned a relative routing priority. The LAN-Cell uses these values to determine the interface to which packets are routed. When configured to WAN Fail-Over mode, the LAN-Cell will attempt to use the next lowest priority interface as higher priority interfaces become unavailable.

In the example shown in Figure 1, LAN-Cell "V" is the "primary" gateway, providing Internet connectivity over the Verizon Wireless network to LAN-attached devices. LAN-Cell "A" being used in stand-by mode to provide redundant 3G Internet connectivity over the AT&T Wireless network should LAN-Cell V lose its connection to Verizon Wireless.

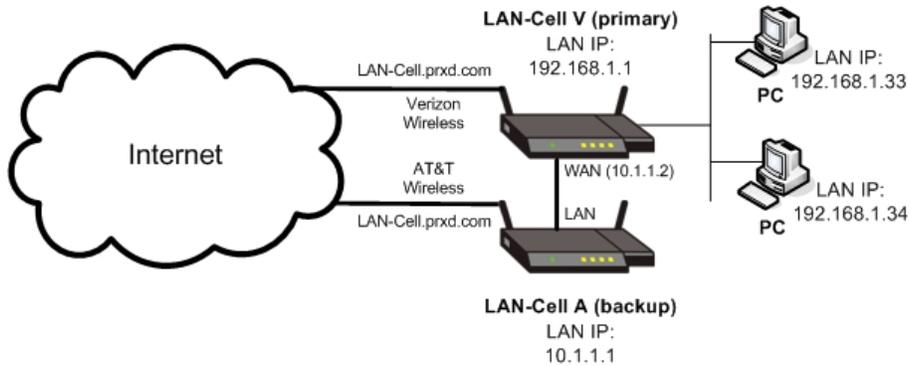


Figure 1: Example WAN Fail-Over Network Topology

Figure 1 shows that LAN-Cell V's Ethernet WAN port is connected via an Ethernet cable to one of LAN-Cell A's four LAN ports.

Before interconnecting the LAN-Cell's, each must be configured independently for access to their respective cellular network. Also, in this configuration, LAN-Cell V and LAN-Cell A must be on different subnets. In the example, LAN-Cell V's subnet is 192.168.1.0/255.255.255.0 and LAN-Cell A's subnet is 10.1.1.0/255.255.255.0.

### LAN-Cell V Configuration

LAN Parameters:

LAN-Cell V is using the default LAN parameters: LAN-Cell IP address = 192.168.1.1; DHCP Server Enabled.

WAN General Parameters:

The **Operation Mode** should be set to Active/Passive with Fall Back enabled. The **Route Priority** of the Cellular Interface must be set to 1 and the WAN interface must be set to 2 (Figure 2).

**WAN**

General | **WAN** | Cellular | Traffic Redirect | Dial Backup

**Operation Mode**

Active/Passive (Fail Over) Mode  
 Fall Back to Primary WAN When Possible  
 Active/Active Mode  
 Load Balancing Algorithm: None

**Route Priority**

|                  |                   |    |                         |
|------------------|-------------------|----|-------------------------|
| WAN              | Priority (metric) | 2  | 1(Highest) ~ 15(Lowest) |
| Cellular         | Priority (metric) | 1  | 1(Highest) ~ 15(Lowest) |
| Traffic Redirect | Priority (metric) | 14 | 1(Highest) ~ 15(Lowest) |
| Dial Backup      | Priority (metric) | 15 | 1(Highest) ~ 15(Lowest) |

**Connectivity Check**

Check Period: 5 (5 ~ 3600 (Seconds))  
 Check Timeout: 3 (1 ~ 10 (Seconds))  
 Check Fail Tolerance: 3 (1 ~ 10 (Successive Checks))

Check WAN Connectivity  
 Ping Default Gateway (0.0.0.0)  
 Ping this Address (www.proxicast.com)

Check Cellular Connectivity  
 Ping Default Gateway (66.174.161.64)  
 Ping this Address (www.proxicast.com)

Figure 2: LAN-Cell V's WAN General Parameters

WAN IP Parameters:

The **WAN IP Address** for LAN-Cell V is set to an address in LAN-Cell A's subnet. The **Gateway IP Address** is the LAN IP address of LAN-Cell A (Figure 3). For the example configuration, 10.1.1.2 is used as LAN-Cell V's static WAN IP address.

**WAN**

General | **WAN** | Cellular | Traffic Redirect | Dial Backup

**ISP Parameters for Internet Access**

Encapsulation: Ethernet  
 Service Type: Standard

**WAN IP Address Assignment**

Get Automatically from ISP  
 Use Fixed IP Address

My WAN IP Address: 10 . 1 . 1 . 2  
 My WAN IP Subnet Mask: 255 . 255 . 255 . 0  
 Gateway IP Address: 10 . 1 . 1 . 1

Figure 3: LAN-Cell V's WAN Interface Parameters

DNS Parameters:

Add a **Name Server Record** (ADVANCED>DNS) on LAN-Cell V to use the LAN IP address of LAN-Cell A (10.1.1.1) as its Name Server (Figure 4). The LAN-Cell is a caching DNS-relay server and will forward DNS requests to the proper ISP based on the currently active interface.

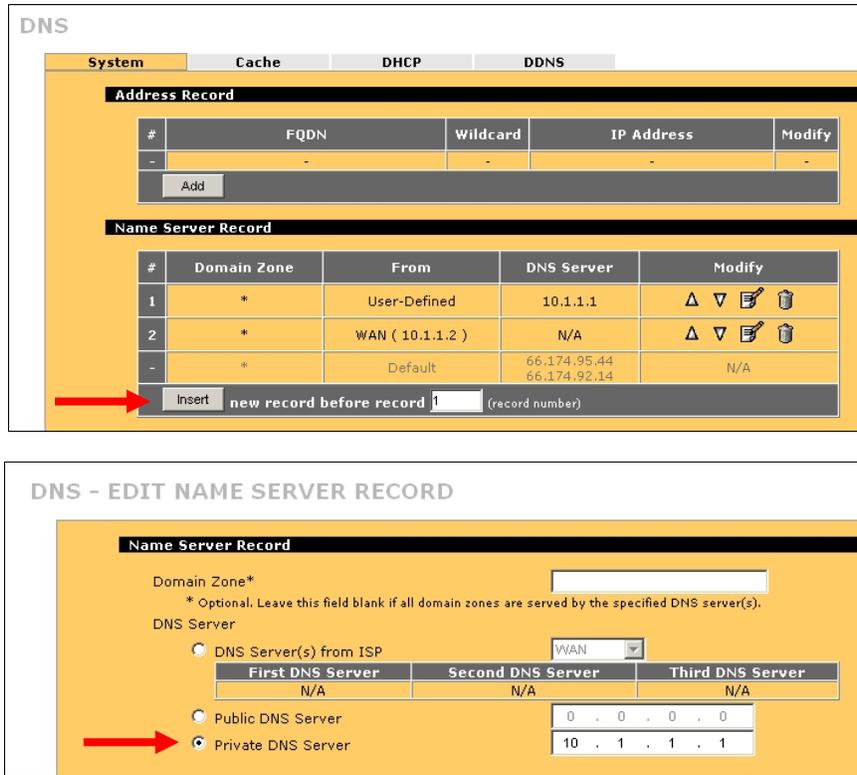


Figure 4: Adding a DNS Server

If devices connected to LAN-Cell V must be accessed remotely from the Internet, add a **Dynamic DNS** entry for LAN-Cell V as shown in Figure 5 (see TechNote LCTN0016 Configuring Dynamic DNS). Create a DDNS host name even if the LAN-Cell's have static IP addresses so that the active device can be accessed by a single host name.

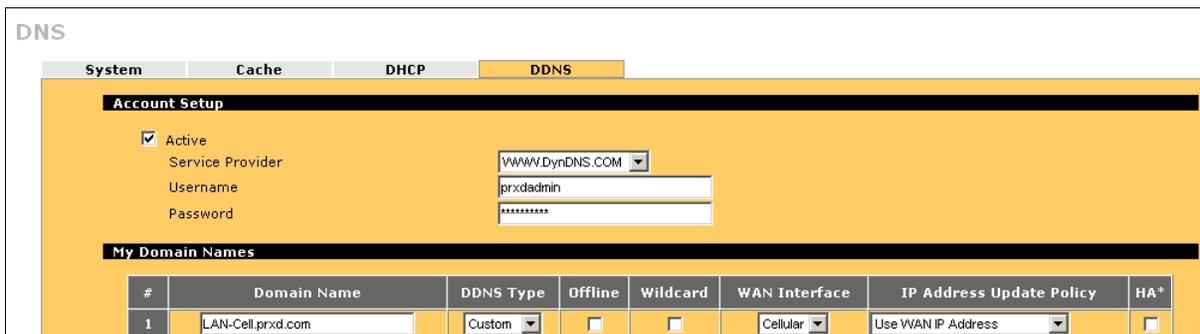
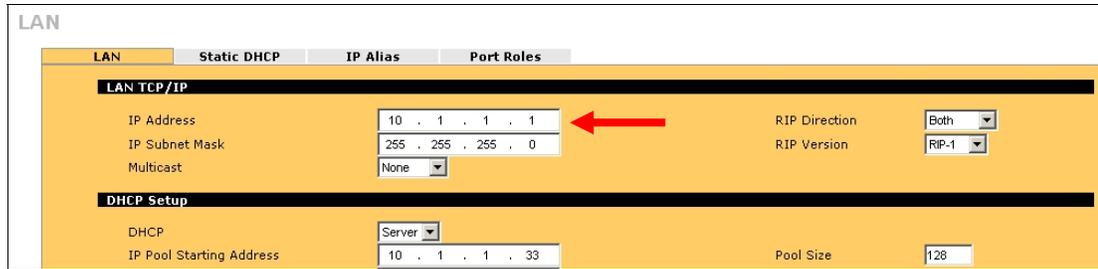


Figure 5: Defining a Dynamic DNS Host Name

**LAN-Cell A Configuration**

LAN Parameters:

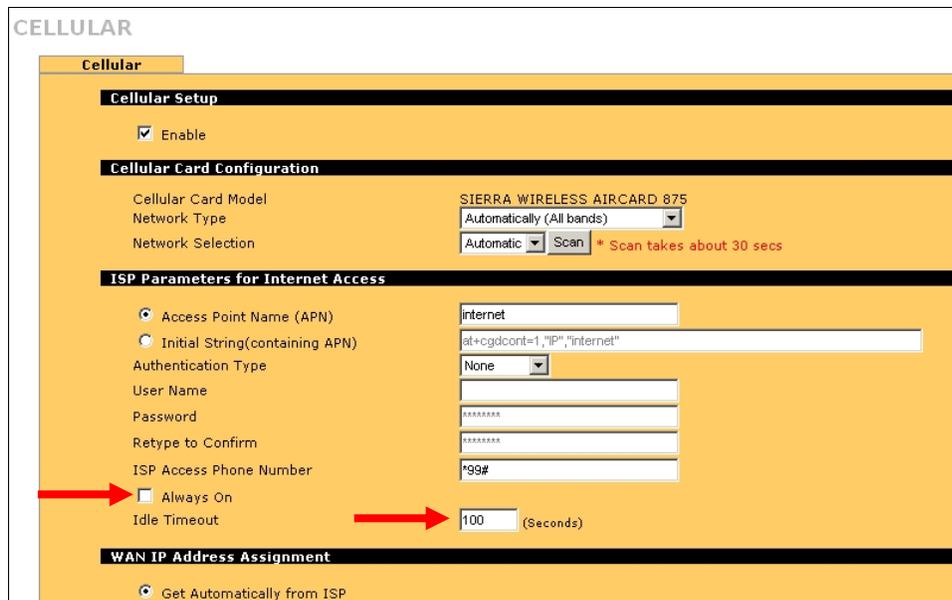
LAN-Cell A's **LAN IP Address** must be changed to be in a different subnet than LAN-Cell V. In the example, LAN-Cell A is set to: LAN-Cell IP address = 10.1.1.1 (Figure 6).



**Figure 6: Changing LAN-Cell A's LAN IP Address**

Cellular Parameters:

Configure LAN-Cell A's **Cellular** interface to be "dial-on-demand" by removing the **Always On** checkbox and setting a non-zero **Idle Timeout** value (Figure 7). This allows the LAN-Cell's DDNS client to properly update the DNS values when LAN-Cell A's cellular IP address changes.



**Figure 7: Dial-on-Demand Cellular Connection**

Firewall:

The Firewall on LAN-Cell A can be disabled (Figure 8). LAN-Cell V will be used to manage all Firewall rules.

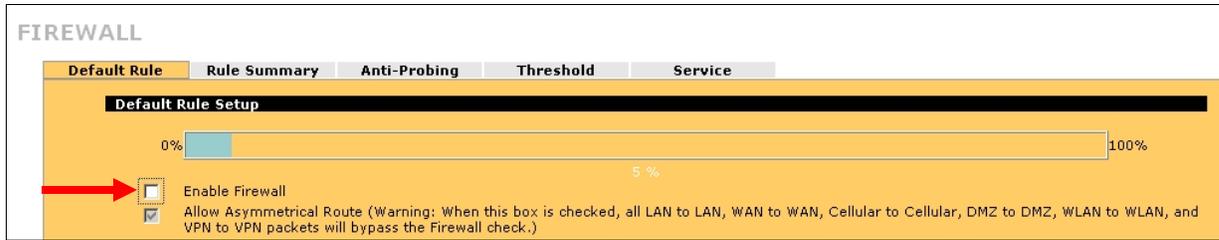


Figure 8: Disabling the LAN-Cell's Firewall

DNS Parameters:

To remotely access devices connected to LAN-Cell V from the Internet, add a Dynamic DNS entry. Use the same host name entered for LAN-Cell V (see Figure 5).

NAT Parameters:

To remotely access devices connected to LAN-Cell V from the Internet, enter LAN-Cell V's static WAN IP address as the Default Server (Figure 9).

To manage LAN-Cell A from the Internet, add **Port Forwarding** and **Port Translation** rules for each of the LAN-Cell's Remote Management ports, with LAN-Cell A's LAN IP address as the target **Server IP Address**. For maximum flexibility, define different Remote Management port numbers on each LAN-Cell. For example use 80 and 8080 for HTTP, 23 and 8023 for Telnet, etc. By using Port Translation, you do not have to change the LAN-Cell's actual Remote Management Ports.

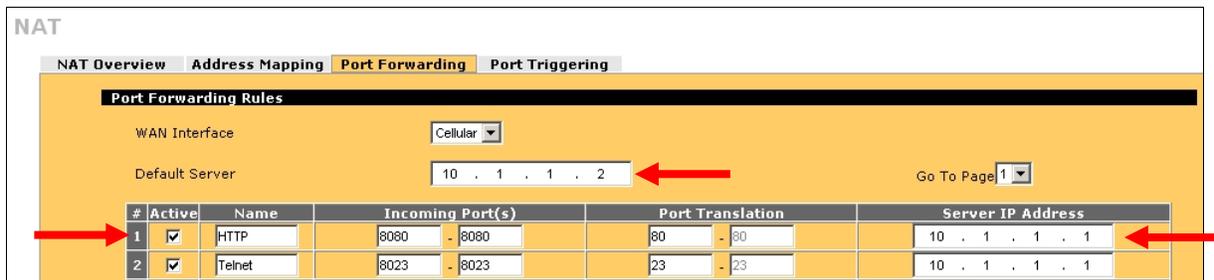


Figure 9: Default Server, Port Forwarding & Port Translation

Usage Notes

- Configure LAN-Cell V with any other required application parameters (e.g. Firewall, VPN, NAT/Port-Forwarding settings). Note that in some instances, such as NAT/Port-Forwarding, you must create “parallel” rules for both the Cellular and WAN interfaces.
- Configure each LAN-Cell independently before interconnecting them. Once complete, connect an Ethernet cable from LAN-Cell V's WAN port to one of the four LAN ports on LAN-Cell A.
- Consider using the **WAN Connectivity Check** on both the WAN and Cellular interfaces (Figure 2) The WAN IP and Cellular IP address to check should be the same host. We recommend a well-known, highly available host such as a name-server or some other host over which you have control (e.g. web server, mail server, etc) and which responds to ICMP (ping) requests. Also, increase the **Log Consolidation Period** to 300 seconds to prevent the log from quickly filling up with Ping Check failure messages on in the inactive interface (Figure 10).

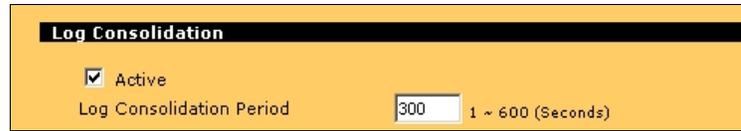


Figure 10: Log Consolidation Period

- Depending on the **WAN Connectivity Check** settings, fail-over may take several seconds to several minutes. Use lower parameter values for faster fail-over but less tolerance of temporary primary cellular connection losses.
- To make inbound remote connections to the primary LAN-Cell, both cellular providers must allow inbound connections.
- The Cell-Sentry feature of each can be used LAN-Cell to monitor the amount of data sent/received over each cellular connection.
- The “backup” LAN-Cell can be on the same cellular network as the “primary” network, however, this only protects against failure of the primary 3G modem.
- Locate the respective cellular antennas at least several feet apart to minimize interference.
- Advantages of this approach:
  - Simplest configuration of each LAN-Cell
  - All security and application parameters are configured on the primary LAN-Cell
  - Can be extended to additional cellular networks by connecting LAN-Cell A's WAN to a third LAN-Cell
- Disadvantages of this approach:
  - All traffic sent through only 1 cellular connection at a time

## Testing WAN Fail-Over

WAN Fail-Over can be easily tested by disabling the Cellular interface on LAN-Cell V. Uncheck the **Enabled** option on the Cellular WAN page. Test Internet connectivity by pinging some Internet IP address or going to a remote web page. Re-enabling the primary Cellular interface will cause the traffic to resume through LAN-Cell V's Internet connection once its data session is fully established.

## Example 2: Load Balancing with WAN Fail-Over

The WAN Fail-Over configuration can be modified so outbound traffic is split between the two LAN-Cell's based on several different criteria. Several changes in each LAN-Cell's configuration are necessary:

- Configure the LAN-Cell's as in Example 1, but set LAN-Cell V's **Operation Mode** to Active/Active and select a **Load Balancing Algorithm** that fits your application requirements. See the *LAN-Cell User's Guide* for more information on Load Balancing Algorithms.
- Configure LAN-Cell A's **Cellular Connection** to be "Always On" rather than "Dial-on-Demand".
- Change the **Dynamic DNS** host name for LAN-Cell A to a different value than the one used on LAN-Cell V.

Now, outbound traffic will make use of both cellular connections, increasing the overall bandwidth available. In the event that LAN-Cell V loses its cellular connection, all traffic will be routed through LAN-Cell A.

### Usage Notes

- In addition to the **Load Balancing Algorithm**, the LAN-Cell 2's **Policy Routing** feature can be used to direct specific types of traffic over specific interfaces. For example, video traffic can be forced over the highest bandwidth connection, while telemetry data is sent over the lowest bandwidth connection. See the *LAN-Cell User's Guide* for information on configuring Policy Routing.
- The Cell-Sentry feature of each can be used LAN-Cell to monitor the amount of data sent/received over each cellular connection.
- Advantages of this approach:
  - Maximizes the use of cellular bandwidth and data volume allocations available from both connections
  - All security and application parameters are configured on the primary LAN-Cell
  - Fail-over is essentially instantaneous since both the cellular and WAN connections are always active on the primary LAN-Cell
  - Can be extended to additional cellular networks by connecting LAN-Cell A's WAN to a third LAN-Cell
- Disadvantages of this approach:
  - More difficult to troubleshoot application issues since IP packets have multiple pathways to the Internet at all times
  - Different Dynamic DNS host names (or IP addresses) must be used to make inbound connections over the different cellular networks.

### Example 3: Parallel LAN-Cell's with WAN Fail-Over

Instead of using Load Balancing and Policy Routing, LAN-attached devices can be divided between the two LAN-Cell's to create two independent cellular gateways, each service a subset of devices. The LAN-Cell's can each serve as a backup to the other, creating a highly redundant solution.

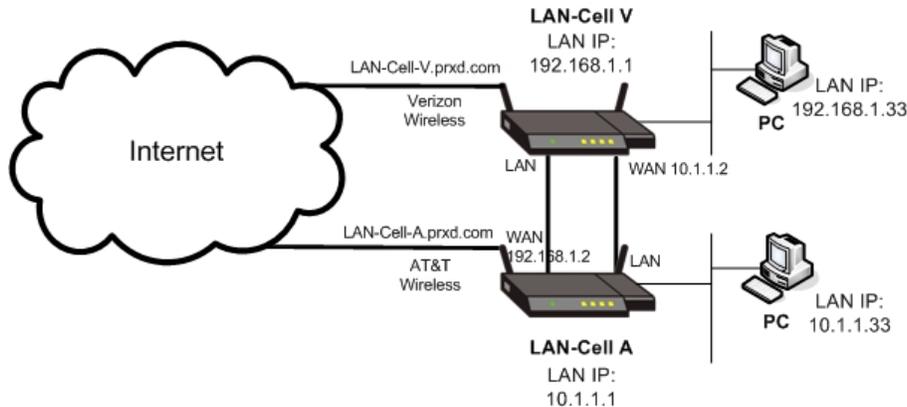


Figure 11: Parallel LAN-Cell's with Dual Fail-Over

- Configure each LAN-Cell as described in Example 1 (WAN Fail-Over), but set the **LAN IP Address** of each LAN-Cell so that it is in a different subnet.
- Make sure that Cellular is the first **Route Priority** on each LAN-Cell and the **Operation Mode** is Active/Passive with Automatic Fall-Back selected.
- Add LAN-Cell V's IP address as a new **Name Server Record** on LAN-Cell A.
- Connect an Ethernet cable from the WAN port of LAN-Cell V to a LAN port of LAN-Cell A. Also connect an Ethernet cable from the WAN port of LAN-Cell A to a LAN port on LAN-Cell V.

### Usage Notes

- DHCP-enabled LAN devices may receive an IP address from either LAN-Cell since all devices are on the same physical Ethernet segment. To assign LAN devices to specific LAN-Cell's, use the Static DHCP feature (**LAN>Static DHCP**) to map Ethernet MAC addresses to specific IP addresses, configure LAN devices to contact a specific DHCP server, or use static IP assignments for LAN devices.
- The Cell-Sentry feature of each can be used LAN-Cell to monitor the amount of data sent/received over each cellular connection.
- Advantages of this approach:
  - Maximizes the use of cellular bandwidth and data volume allocations available from both connections
  - Internet connectivity is available even in the event of a total failure of 1 LAN-Cell
- Disadvantages of this approach:
  - Each LAN-Cell must be configured for security and application requirements
  - LAN devices cannot communicate directly to devices on the other LAN subnet
  - Different Dynamic DNS host names (or IP addresses) must be used to make inbound connections over the different cellular networks.
  - Limited to 2 cellular connections

## Example 4: Traffic Redirect

The LAN-Cell also supports a “virtual” WAN interface called Traffic Redirect. By indicating the IP address of a backup LAN-Cell, the primary LAN-Cell will forward all packets to the backup LAN-Cell whenever the primary has no WAN or Cellular connection. In this configuration, the “backup” LAN-Cell provides fail-over for both the wired WAN and cellular connections on the “primary” LAN-Cell.

In this example, the LAN-Cell V is connected to LAN-Cell A on the same physical Ethernet network.

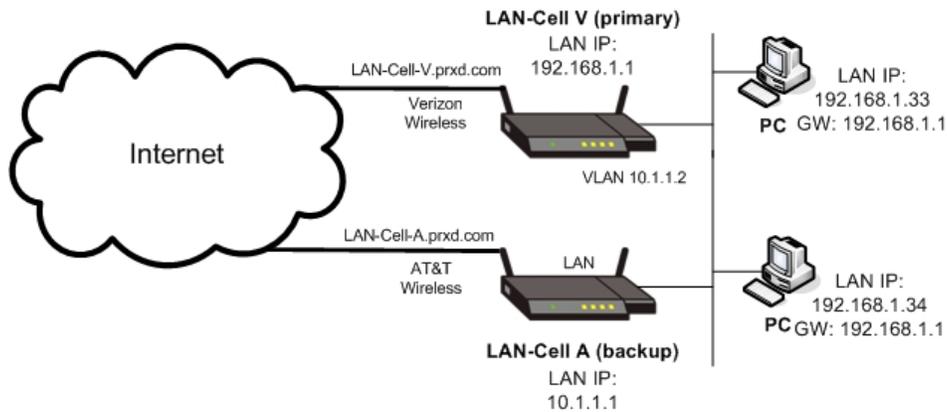


Figure 12: Example Traffic Redirect Network Topology

### LAN-Cell V Configuration

LAN Parameters:

LAN-Cell V is using the default LAN parameters: LAN-Cell IP address = 192.168.1.1; DHCP Server Enabled.

On the **NETWORK>LAN>IP ALIAS** tab, enter a unique IP address that is part of LAN-Cell A's subnet. Do not enter the backup LAN-Cell's address here. In the example, the IP Alias Address is set to 10.1.1.2. Also enable RIP in both directions (Figure 13).

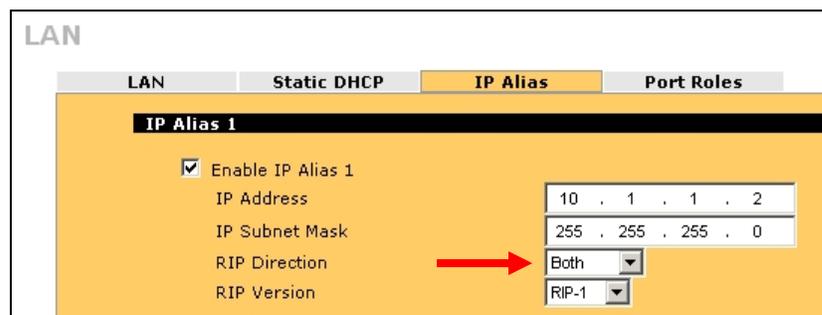


Figure 13: IP Alias on LAN-Cell V

WAN Parameters:

Configure the primary LAN-Cell for its normal WAN/Cellular operation. We also recommend using the **WAN Connectivity Check** on both the WAN (if used) and Cellular interfaces.

On the **WAN>Traffic Redirect** tab, enable the feature and enter the LAN IP address of the backup LAN-Cell A (Figure 14). This will automatically enable WAN Continuity Check for the backup LAN-Cell.

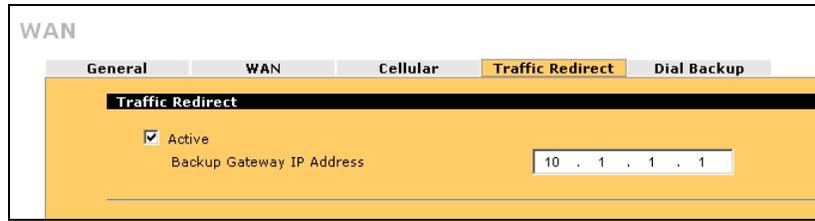


Figure 14: Traffic Redirect on LAN-Cell V

DNS Parameters:

Add a **Name Server Record** (ADVANCED>DNS) on LAN-Cell V to use the LAN IP address of LAN-Cell A (10.1.1.1) as its Name Server (See Figure 4). The LAN-Cell is a caching DNS-relay server and will forward DNS requests to the proper ISP based on the currently active interface.

**LAN-Cell A Configuration**

LAN Parameters:

Set the LAN IP address to a different subnet than LAN-Cell V (10.1.1.1 in the example).

Disable LAN-Cell A's **DHCP Server** to ensure that DHCP-enabled devices on the LAN receive an IP Address from LAN-Cell V only (Figure 15).

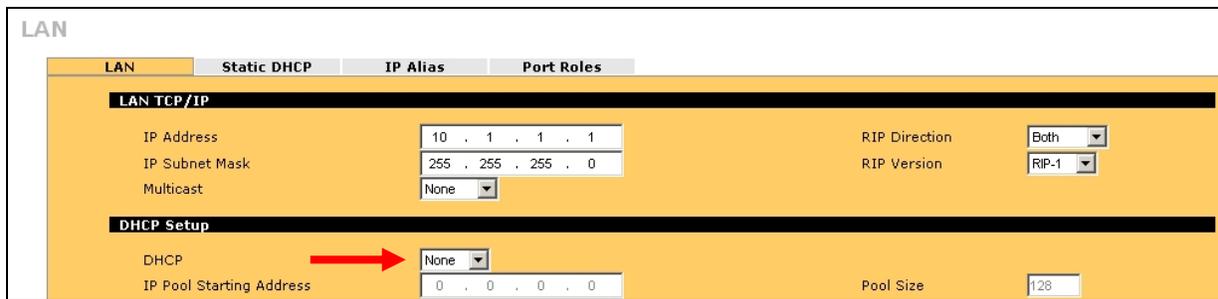


Figure 15: LAN-Cell A LAN Parameters

**Usage Notes**

- Configure each LAN-Cell independently before interconnecting them. Once complete, connect an Ethernet cable from a LAN port on LAN-Cell V's to one of the four LAN ports on LAN-Cell A.
- LAN-Cell V and LAN-Cell A must be on different IP subnets but on the same physical network. This is achieved by using the IP Alias (VLAN) feature of the LAN-Cell.
- LAN client devices should set the "primary" LAN-Cell as their default gateway. The Traffic Redirect function will route the packets to the backup LAN-Cell with no configuration changes necessary on the client devices.
- Traffic Redirect works when either the wired WAN, Cellular WAN or both are configured on the primary LAN-Cell.
- The routing priority of Traffic Redirect must be lower than the WAN and Cellular interfaces.
- Configure all necessary security and application parameters on LAN-Cell V.

- There is additional information on the Traffic Redirect and IP Alias configuration parameters in the *LAN-Cell User's Guide*.
- Advantages of this approach:
  - Enables wired Ethernet WAN and Dial-Backup WAN connections on the primary LAN-Cell while still offering fail-over a secondary cellular connection
  - All security and application parameters are configured on the primary LAN-Cell
  - Can be extended to additional cellular networks by connecting LAN-Cell A's to a third LAN-Cell
- Disadvantages of this approach:
  - All traffic sent through only 1 cellular connection at a time
  - Different Dynamic DNS host names (or IP addresses) must be used to make inbound connections over the different cellular networks.

## **Testing Traffic Redirect**

You can easily test the Traffic Redirect feature by removing LAN-Cell V's WAN cable (if used) or by changing the Cellular 3G card's configuration such that it cannot make a connection (e.g. change the ISP Access Phone number on the **WIRELESS>CELLULAR** screen). Failing over to the Traffic Redirect device may take several seconds.

**Note:** You cannot test Traffic Redirect by disabling the Cellular interface. The Traffic Redirect function is managed by the interface software – the WAN/Cellular interfaces must be enabled but not able to route traffic for the Traffic Redirect feature to work.

## Example 5: Parallel LAN-Cell's with Traffic Redirect

Similar to Example 3, two LAN-Cell's can be used in parallel to create two independent cellular gateways, while defining the other LAN-Cell as a Traffic Redirect target.

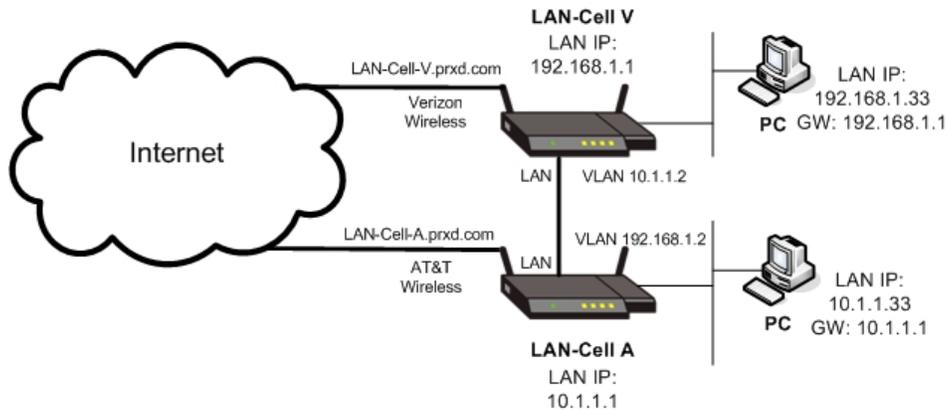


Figure 16: Parallel LAN-Cell's with Traffic Redirect

### LAN-Cell V Configuration

Configure LAN-Cell V as described in Example 4 (Traffic Redirect).

### LAN-Cell A Configuration

LAN Parameters:

Set the LAN IP address to a different subnet than LAN-Cell V (10.1.1.1 in the example).

Enable LAN-Cell A's **DHCP Server**, excluding the IP Alias address assigned to LAN-Cell V in the DHCP address pool.

Create a LAN **IP Alias** that is in LAN-Cell V's subnet and enable **RIP** in both directions (Figure 17). In the example configuration, the IP Alias is 192.168.1.2.

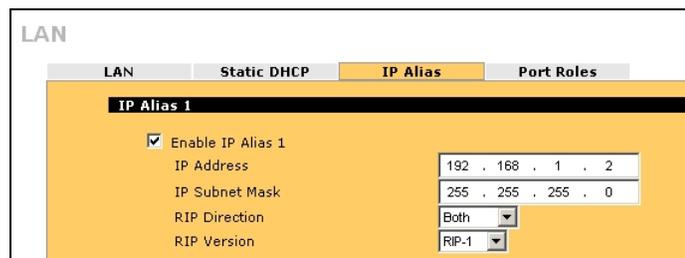


Figure 17: IP Alias on LAN-Cell A

DNS Parameters:

Add a **Name Server Record** (ADVANCED>DNS) on LAN-Cell A to use the LAN IP address of LAN-Cell V (192.168.1.1) as its Name Server (See Figure 4). The LAN-Cell is a caching DNS-relay server and will forward DNS requests to the proper ISP based on the currently active interface.

## Usage Notes

- DHCP-enabled LAN devices may receive an IP address from either LAN-Cell since all devices are on the same physical Ethernet segment. To assign LAN devices to specific LAN-Cell's, use the Static DHCP feature (**LAN>Static DHCP**) to map Ethernet MAC addresses to specific IP addresses, configure LAN devices to contact a specific DHCP server, or use static IP assignments for LAN devices.
- In the event that either LAN-Cell loses its cellular connection, traffic will be routed to the other LAN-Cell and on to the Internet.
- Each LAN-Cell must be in a different subnet.
- The Cell-Sentry feature of each can be used LAN-Cell to monitor the amount of data sent/received over each cellular connection.
- Advantages of this approach:
  - Maximizes the use of cellular bandwidth and data volume allocations available from both connections
  - Enables wired Ethernet WAN and Dial-Backup WAN connections on both LAN-Cells while offering fail-over to a secondary cellular connection for both devices
  - Internet connectivity is available even in the event of a total failure of 1 LAN-Cell
- Disadvantages of this approach:
  - Each LAN-Cell must be configured for security and application requirements
  - LAN devices cannot communicate directly to devices on the other LAN subnet
  - Different Dynamic DNS host names (or IP addresses) must be used to make inbound connections over the different cellular networks
  - Limited to 2 cellular connections

## Frequently Asked Questions

**Q: Does the LAN-Cell support “bonding” of cellular connections?**

A: No. Cellular data connections cannot be bonded in the traditional sense that multiple independent channels are combined to create a single higher bandwidth “virtual” connection (such as with ISDN). This is because true channel bonding (also known as MultiLink) requires both ends of a connection to participate in the bond. Most cellular carriers do not currently offer this feature.

By using the Load Balancing or Parallel LAN-Cell configurations described in this TechNote, you can increase the overall cellular bandwidth available to client devices. However, any single data stream will be limited by the fastest available single connection.

**Q: Can each LAN-Cell be on the same cellular network?**

A: Yes. The examples shown in this TechNote are independent of the cellular network accessed by each device. Example 2 (Load Balancing) is the most common configuration when both LAN-Cell's use the same cellular network. Example 1 (WAN Fail-Over) is the most common configuration when the cellular networks are different.

**Q: Which configuration provides the most reliability?**

A: The parallel configurations (Fail-Over or Traffic Redirect) offer the most resilient Internet connection since service is still available in the event of a complete hardware failure of one LAN-Cell. However, they are the most complex to configure and do not allow remote access to all LAN devices using a single Dynamic DNS name.

###