

CLOUDTRAX QUICK START GUIDE

CloudTrax network planning guide

CloudTrax is a free cloud-based network controller that helps you build, manage and monitor your wireless networks from anywhere in the world. This guide will help you plan a network.



CloudTrax network planning guide

Overview: what we're doing

This guide is intended to help you plan a cloud-managed wireless mesh network with CloudTrax. CloudTrax is a free cloud-based network controller that makes it easy for anyone to build, manage and monitor wireless networks from anywhere in the world.

CloudTrax is the ideal solution to quickly and easily extend wireless coverage throughout a hotel, apartment, office, neighborhood, village, coffee shop, shopping mall, campground, marina and just about anywhere else—often without any additional Ethernet cabling.

This guide will discuss:

1. Basic terminology
2. CloudTrax's approach to wireless
3. Key elements of building a strong wireless network
 - a. Bandwidth and your ISP
 - b. Choosing the right nodes
 - c. Determining the placement and number of nodes needed
 - d. Determining the location for your gateways
5. Additional tips

This guide is not intended to cover every aspect of CloudTrax. To learn more, download the *CloudTrax Quick Start Guide: Creating Your First CloudTrax Network* at www.cloudtrax.com/docs/quick_start_guide.pdf.

Basic terminology

We'll make this process as easy and nontechnical as possible. Here are a few key words that will help.

Network: A group of computers or devices that can talk to each other (in our case, wirelessly).

Bandwidth: The amount of capacity available to transfer data—such as web sites, social media, voice calls or streaming video—over a network. This is measured in megabits/second, or Mbps.

Gateway: A CloudTrax-compatible router that is connected to the Internet (usually through a DSL, cable, or LAN).

Repeater: A CloudTrax-compatible router that is not connected to the Internet that repeats the signals from local computers and other nodes to the gateway.

Node: A generic name for a CloudTrax-compatible router which can be either a Gateway or a Repeater.

All CloudTrax devices configure themselves: they become gateways or repeaters depending on if they are hard-wired to the Internet or not.



CloudTrax's approach to wireless

CloudTrax (and this document) grew out of experiences deploying networks for hotels and apartments. We had several requirements for each network:

- It must be affordable.
- It must not require any configuration and be installable by employees, property managers or residents with no training.
- It must be manageable by non-trained property managers.
- It must provide a good signal indoors without additional equipment.
- It must be able to let people know when there is a problem (such as being unplugged).

These requirements can be applied to essentially any wireless network, anywhere. By managing the network through the cloud, much of the cost, expertise and equipment typically required to build a network is eliminated. In addition, features typically available only on enterprise-class systems are provided at no extra charge. No configuration is required on the access points themselves: all changes are done using the cloud controller.

Using CloudTrax-compatible equipment and the CloudTrax cloud controller, anyone can:

- Extend wireless coverage without running additional cables
- Utilize two SSID's (or "networks"), typically one public, one private
- Limit bandwidth up and down, per user
- Display splash pages (the splash page is fully editable via an HTML/WYSIWYG editor)
- Set up user authentication and credit card payment (PayPal)
- Set up and change the network passwords
- Redirect users to any web page on login
- Prevent public users from accessing the wired or private network
- And much more

With CloudTrax, it only takes a few key elements to build a strong wireless network. We'll discuss each of them here.

Bandwidth and your ISP

CloudTrax requires one (or more) incoming Internet connections to feed the network. If you are not using an existing office LAN, this will usually this will be a DSL, cable or LAN connection.

When choosing an Internet service provider (ISP), consider what you'll need for bandwidth—both download and upload. Your needs will vary depending on the type of network, how many simultaneous users you have, and what they are doing.

We've included a few common online activities and the minimum bandwidth required for each of them on the right. The highest demand for bandwidth comes from streaming video services such as Netflix and YouTube, video chat services such as Skype and FaceTime, and automatic

Bandwidth requirements

| | Down | Up (Mbps) |
|------------|------|-----------|
| VoIP | 0.1 | 0.1 |
| Browsing | 0.5 | 0.1 |
| Email | 0.5 | 0.5 |
| YouTube | 0.7 | 0.1 |
| Skype HD | 1.5 | 1.5 |
| Netflix HD | 3.8 | 0.1 |

backup systems such as DropBox.

While any network should be able to handle a high number of users simply browsing the web, just a few users sharing files or streaming video can quickly use up all available bandwidth. CloudTrax helps to manage this by setting per-user download and upload limits, as well as providing the ability to block individual users.

Even with the management capability of CloudTrax, the more bandwidth you have available on your network, the better the experience will be for the network users.

Choosing the right nodes

CloudTrax supports two device families—the MR500 and OM1P/OM2P—that excel in very different environments.

The OM1P (802.11g) and OM2P (802.11n) are designed to penetrate the walls in hotels and apartment buildings and have an option for a rugged outdoor housing, making it ideal for marinas and outdoor areas, and an indoor wallplug enclosure to hide the router and power supply for clean retrofit installations.

The MR500, on the other hand, excels in high-bandwidth environments such as hotel lobbies, shopping malls and conference centers, but does not provide the wall penetration or range of the OM1P/OM2P.

Take a look at where the CloudTrax compatible devices are best utilized below:

| Application | MR500 | OM1P & OM2P |
|--|-------|-------------|
| School | ✓ | |
| Business | ✓ | |
| Hotel (rooms/hallways) | | ✓ |
| Hotel (lobby/conference) | ✓ | |
| Apartments | | ✓ |
| Warehouse | ✓ | |
| Marinas (require outdoor housing) | | ✓ |
| Homes (small or large rooms) | ✓ | |
| Homes (large or with many small rooms) | | ✓ |



Top: OM1P (left) and OM2P
Middle: Indoor enclosure (left) and outdoor enclosure
Below: MR500



Determining the placement and number of nodes needed

The number of nodes you require depends on four factors:

1. The size of the area you need to cover.
2. How many walls and floors you need to penetrate.
3. The material of the walls and floors you need to penetrate.
4. The amount of interference in your environment.

While every installation is different and the number of nodes you need will vary greatly with the factors above, in general, you shouldn't exceed these parameters:

| Device | Indoor range | Outdoor range | Max walls to penetrate |
|--------|--------------|---------------|------------------------|
| MR500 | 50' | 300' | 1 |
| OM1P | 50-100' | 400' | 2-3 |
| OM2P | 50-150' | 600' | 3-4 |

In CloudTrax, you'll be able to see the speed of each device and signal strength between devices (both of which decrease over distance and through walls and floors). Look for a signal strength (or "RSSI") of at least 17, where 20+ is desirable. You can add, remove, or reposition nodes as needed at any time.

For large installs, test your environment with CloudTrax and two or three nodes before buying all of the nodes. You'll be able to see the range and how many walls and floors you can expect to transmit through in your specific environment. Nodes transmit in a spherical pattern—up, down and side to side—so there's no need to "aim" signals.

Here are some guidelines to help plan how many nodes are needed for your installation.

Hotels and apartments: You will typically need one node for every 3-6 hotel rooms or apartments. This will vary depending upon the type of construction and layout. If you are in a single-story, single-row concrete/brick/stone build, you may need one node in every second or third unit. For wood frame multistory buildings with interior hallways and small rooms, one node for every six or seven rooms may be sufficient if placed in a central hallway.

When installing multistory buildings, we recommend placing units on every second floor for both concrete and wood buildings. Copper ceilings, steel plating, cement and adobe-type materials may limit (and even eliminate) signal transmission between floors.

Coffee shops and restaurants: One well-placed node can usually cover an entire coffee shop. For restaurants or large coffee shops, you may need two or three nodes, especially if you want to cover outdoor seating areas.

Residential neighborhoods: In residential neighborhoods, we recommend that each house have at least one node. And if the houses are especially large, you can add multiple nodes to the house to provide excellent coverage in every room. Wherever possible, place nodes near windows or exterior walls with a direct line of sight to the nodes in other houses.

Quick Tip: Let CloudTrax do the work

For large installs, test your environment with CloudTrax and two or three nodes. You'll be able to see the range and how many walls and floors you can expect to transmit through.

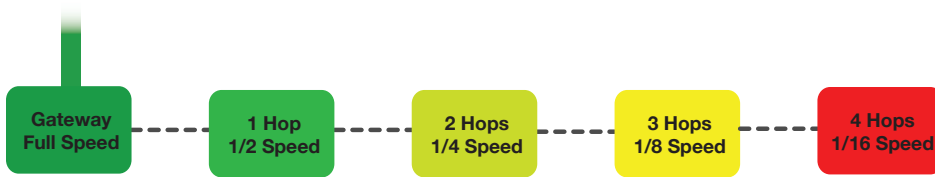
Nodes: indoors or out?

With the advent of low cost mesh technology, network design is literally turning "outside-in." Here are some benefits of installing your nodes indoors:

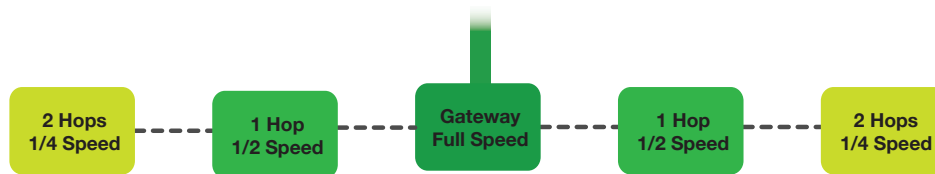
- It is much less expensive to install inside rather than outside
- Outdoor nodes often require an electrician to install power
- Outdoor nodes often involve getting up on ladders or rooftops
- Outdoor nodes require installation of long Ethernet cables
- Outdoor nodes can be unsightly and often violate apartment/condo CC&Rs
- Outdoor nodes take your strongest signals outdoors, the opposite of what you generally want

Determining a location for your gateway(s)

Users on mesh networks will lose half of their maximum speed for every hop they are away from a gateway. Therefore, you want to place the gateway(s) as central to the area you want to cover as possible. As you can see below, forcing traffic through too many hops quickly leads to very slow network speeds.



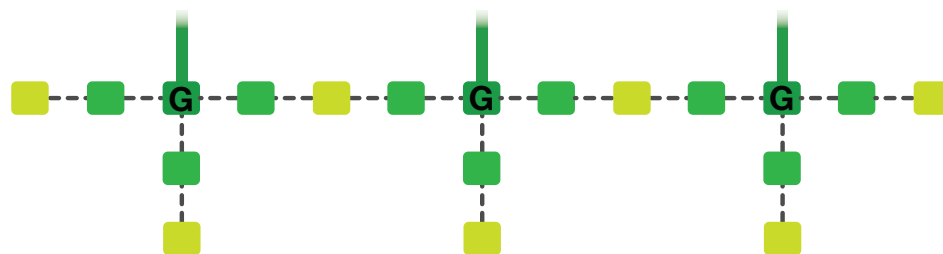
By moving the gateway from one end to the center, as shown below, you can improve the maximum potential speed on the outer reaches of the network by a multiple of four.



If most of your repeaters have a direct (or single “hop”) connection to the gateway, speed is maximized. The easiest way to accomplish this is to put your DSL/cable/fibre connection as close to the middle of the area you want to cover as possible.

Scaling your network

CloudTrax networks are highly scalable. To build large-scale networks, simply repeat the model above as needed by adding additional gateways and repeaters. There is virtually no limit to the number of gateways and repeaters you can have on a single network (although we recommend 100 or fewer nodes for readability of reports). Larger networks can simply be broken up into discreet zones under the same login.



There are two primary ways to add additional gateways: you can have multiple DSL's (cable modems, etc.) or have a switch with Ethernet cables, both distributing gateways evenly through your network.

The advantage of multiple DSL's feeding your network is twofold. First, you avoid running any Ethernet cabling. Second, you have a built-in failover: if one DSL were to go down, your network will switch-over to the other DSL(s) keeping your network up, if a bit slower. However, there is typically a higher ongoing cost to providing multiple low-speed DSL's compared to one high-speed DSL.

With a switch running Ethernet to multiple gateways, you have a one-time investment but a reduced on-going cost because you are only paying for one DSL connection.

Quick Tip: Using RSSI to position nodes

From the Network Status screen in CloudTrax, click on any node to see its name, throughput and connection to other nodes.

All of your nodes should have an RSSI of at least 17 (preferably 20+) to one or more nodes. If not, try repositioning them closer or add more nodes.

Additional tips

Here are some additional network planning suggestions:

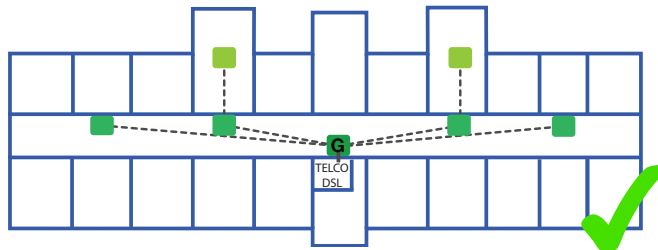
1. Have the edges of the signals from nodes overlap so that each node can talk to at least one (and preferably two) other nodes, with good signal quality.
2. Don't under install. Having redundancy built into the network by having extra nodes allows CloudTrax's self-healing, self-configuring mesh protocol to keep users connected and minimize outages.
3. To avoid bottlenecks, don't have more than ten (we recommend no more than five) repeaters running off of any one gateway.

4. Think vertically in multistory buildings. If you have two or three floors to cover, place the nodes on the second floor. This keeps them centered between the floors where they can provide coverage both above and below. You get all of the coverage with half of the nodes.

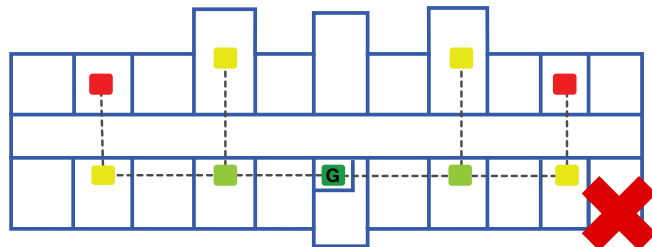


5. Use straight lines when broadcasting through walls and floors. The less material the wireless signal needs to penetrate, the stronger the signal will be.

6. If you are installing in an apartment complex or hotel with internal hallways, consider placing most nodes in the hallways. As this is common space, you'll have access to them without disturbing residents.



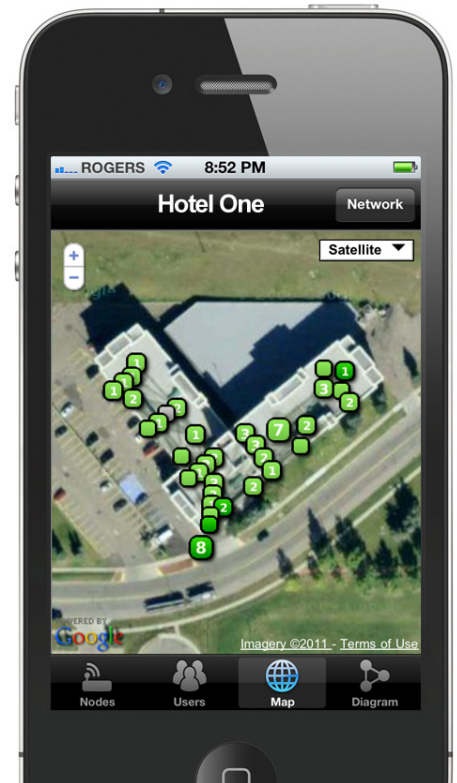
Secondly, placing the nodes down a long corridor means they can all see each other without having to go through as many walls. This



maximizes the signal between the routers and minimizes potential "hops" and low signal quality that will slow down the network. Add additional nodes as needed (typically in larger units) to boost signals in specific areas.

7. If there is no power outlet where you want to place a node, you can power it through an Ethernet cable (power over Ethernet, or POE). Any CloudTrax compatible device can be powered through passive POE. Note that they do not support POE switches and will be damaged by connecting them to a poe switch without the appropriate adapter.

8. Consider using the indoor and outdoor cases for the OM1P and OM2P. The cases are designed to blend in to the environment, minimizing theft and tampering.



**Monitor your network...
from anywhere.**

The CloudTrax apps let you monitor your network from your iPhone™ or Android™ device.

Need additional help?

To learn more about the features within CloudTrax, download the *CloudTrax Quick Start Guide* at www.cloudtrax.com/docs/quick_start_guide.pdf.

To learn more about CloudTrax's splash page feature, download the *Using the Splash Page Editor Guide* at www.cloudtrax.com/docs/using_the_splash_page_editor.pdf

To learn more about CloudTrax's vouchers feature, download the *Using Vouchers in CloudTrax Guide* at www.cloudtrax.com/docs/using_vouchers_in_cloudtrax.pdf.

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