



# Connectivity Manual

Version 3.0d

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## Introduction

The BATS trading platform is housed in the SAVVIS data center in Weehawken, New Jersey. BATS also utilizes the BT Radianz data center in Nutley, New Jersey as a secondary site. Members are strongly encouraged to establish connectivity to both data centers to minimize service disruption in the event of an issue at either data center. Weehawken is the “primary” or “hot” site, with Nutley being “secondary” or “warm” – members may receive market data from Nutley, and they may connect and heartbeat with order entry systems in Nutley, but orders will be rejected until BATS declares Weehawken “down.”

The following network connectivity choices are supported by BATS:

- IPsec VPN via the Internet (only for order entry, not PITCH, FAST PITCH, DROP, or TOP market data);
- Cross-connect (i.e. for members co-located in the same datacenter);
- Extranet connectivity (e.g. BT Radianz, TNSi, Yipes, SFTI, SAVVIS); and
- Private line.

Other methods of connectivity may be possible, please contact BATS’ Network Support (913-285-7005, [noc@batstrading.com](mailto:noc@batstrading.com)) for information.

Members are responsible for choosing their telecommunications provider and arranging for connections to both BATS data centers.

## IPsec VPN

Members may connect to either data center via a Virtual Private Network (VPN) over the Internet, utilizing the IP Security Protocol (IPsec). BATS recommends utilizing a VPN to initiate connectivity to BATS while awaiting permanent private connectivity. BATS routinely uses this option for certification testing. An IPsec VPN configuration may also be maintained as a production or backup method. While a VPN may be used for production, BATS highly recommends fixed connectivity due to the inherent delays and uncertainty of data delivery when using the Internet. BATS supports the use of LAN-to-LAN IPsec VPNs and requires that the IP address of the host, as presented to BATS, be a registered address.

**Note: BATS does not offer PITCH, FAST PITCH, DROP or TOP market data feeds over VPN.**

## Cross-connect

SAVVIS, Inc. operates the primary data center where the BATS system is hosted. BT Radianz operates the secondary data center. Members interested in co-location services should contact SAVVIS or BT Radianz directly (see contact information below).

Members with their own space in the SAVVIS datacenter in Weehawken or the BT Radianz datacenter in Nutley may request an in-house cross-connect from the member’s Point of Presence (PoP) to the BATS network.

Members that are not co-located can lease co-location space in either datacenter. They can place equipment, terminate communications circuits, and establish a cross-connect to BATS in that space. This gives the maximum amount of control to the member. This option is neutral for the member and provides the greatest flexibility for the member in determining when and to whom to connect.

Cross-connection is made with copper Ethernet cabling (e.g. Cat6). In the cases where distance is too great for copper cable, BATS can support optical fiber on a case-by-case basis.

## Extranet

Members may provision connectivity to BATS via an extranet. This method is an attractive alternative when:

- the member would otherwise have to provision a long-haul private line;
- when outsourcing of network services and network management is an option; or
- when the ease and speed of turn-up are important (when both the member and BATS have an existing connection to the extranet).

BATS has established connectivity with several extranet providers, including BT Radianz, TNSi, SFTI, and SAVVIS. Contact your extranet provider to arrange connectivity to BATS, or consult the listing at the end of this document for extranet providers. Connectivity to other extranet providers is possible, and BATS is willing to connect via any open and available extranet provider, based on member demand and cooperation from the extranet provider (certain considerations apply – please contact BATS Network Support group for information).

## Member Provisioned Private Line

Members wishing to initiate a private line (or point-to-point) connection to BATS using leased lines or other network methods (e.g. Telco-provided DS-3, T-3, Metropolitan Ethernet [MetroE], etc.) are welcome. Connections other than MetroE are terminated by a member-provided and owned router or switch in the BATS datacenter space, for access to BATS by the member.

MetroE connections are preferably connected to BATS via a VLAN trunk to the provider using Gigabit Ethernet interfaces. MetroE connections may also terminate on a member-provided and owned router or switch in the BATS datacenter space, from there the standard interface to the member's equipment will be Ethernet over copper.

Contact your carrier of choice to arrange connectivity to BATS, or consult the listing at the end of this document for carrier contacts.

BATS will provide physical space, 110VAC power, and adequate environment for up to four Rack Units of member-owned equipment necessary to connect to BATS. All member equipment is placed into 2-post open relay-type racks or enclosed cabinets, and BATS requires the use of routers/switches that are rack-mountable (mid-device rack ears are required for Weehawken). All devices must be clearly labeled front and rear with the Member's name (abbreviation is acceptable) and a member-determined unique device name.

To minimize the number of power circuits and rack space requirements, BATS requires that when a member router/switch solution necessitates a DSU/CSU that the DSU/CSU be incorporated within the router/switch.

The demarcation point between the member and BATS would be the end of the member-provided Ethernet cable between their router/switch and the BATS network device. Cross-connection is made with copper Ethernet cabling (e.g. Cat6).

Do not order a circuit into either datacenter without first contacting BATS – doing so will delay your implementation. Contact BATS for information about circuit ordering details (e.g. NPA-NXX, LOA/CFA requirements, demarcation information, media and connector types, etc.). BATS will supply the in-house cross-connect of the circuit from the building's node-room / Meet-Me-room to the BATS space.

Members are encouraged to order from the LEC a standard business telephone line to be brought to a member-supplied dial modem that is connected to the router(s)/switch(es) for remote access to the equipment. BATS will supply the dial line extension from the building's node room to the BATS space.

Per policy, BATS will not control or manage the member-owned router/switch, nor perform maintenance or other actions on behalf of the member. BATS encourages members using this connectivity choice to ensure that their router(s)/switch(es) in this space are secured with strong passwords, and that those passwords are unique to the member's network devices at this location. Physical access by member representatives to the member's equipment is not possible at any time for any reason. BATS can assist, when requested, in arranging hands-on access by datacenter personnel to the member-owned network devices in the BATS cage. BATS will pass to the member any charges by SAVVIS or BT Radianz to BATS related to trouble-shooting and/or maintaining the member's equipment (after initial install).

BATS may, now and/or in the future, pass through some or all of the associated costs of circuit extension, power, space allocation, and co-location of the member's equipment to the member.

## Bandwidth Recommendations

### Market Data feeds (PITCH, FAST PITCH and TOP)

BATS recommends that members allocate a *minimum* of 25 Mb/s per uncompressed PITCH connection, 10 Mb/s per compressed FAST PITCH connection, and 10Mb/s per TOP connection. Note that these are minimum recommendations, and that the required bandwidth is cumulative (i.e. one PITCH, plus one FAST PITCH, plus one TOP would need a minimum of 45Mb/s).

During spikes in quote updates, members using less than the recommended bandwidth will experience queuing of their market data. Members using the same bandwidth to both receive quotes and transmit orders should also expect their orders to be slightly delayed. Many members will find these delays unacceptable and should provision their bandwidth to reduce these serialization delays.

The table below shows the bandwidth statistics for both the PITCH and FAST PITCH market data feeds for the busiest trading day in the first quarter of 2008 (January 23<sup>rd</sup>, 2008). The table shows the bandwidth peaks for 1, 5, 10, 30, and 60-second intervals. The statistics include 11 bytes for TCP/IP overhead per packet and do not include the data link layer overhead.

Interval Seconds	Time of Peak	Messages per Second	PITCH Peak Mb/s	FAST PITCH Peak Mb/s	# times >= 90 percent
1	15:35:18	73,114	28.86	13.00	4
5	15:37:33	51,092	20.07	9.03	4
10	15:02:40	46,980	18.45	8.35	9
30	15:02:36	41,544	16.34	7.40	7
60	15:02:09	38,561	15.16	6.86	10

BATS' FAST PITCH protocol can achieve up to 73% compression on the BATS PITCH market data stream. For the full details on FAST PITCH, see [http://www.batstrading.com/subscriber\\_resources/BATS\\_FAST\\_PITCH.pdf](http://www.batstrading.com/subscriber_resources/BATS_FAST_PITCH.pdf).

The BATS TOP feed offers up to 66% reduction in events and 84% reduction in bandwidth compared to the BATS PITCH market data feed. For the full details on TOP, see [http://www.batstrading.com/subscriber\\_resources/BATS\\_TOP\\_Specification.pdf](http://www.batstrading.com/subscriber_resources/BATS_TOP_Specification.pdf)

As the volume of trades on the BATS Exchange continues to increase, the PITCH market data feed bandwidth requirement will also continue to grow. Members will be notified of PITCH bandwidth requirements as the requirements change.

### FIX Order Entry

Bandwidth recommended for submitting orders via FIX depends on expected member order volume. If a member intends to submit orders to BATS and will not receive the PITCH quote feed, then it is possible that the member can connect with less than a T1 equivalent connection. The following table shows the maximum number of inbound orders (and/or cancels) per second that can be handled, with no buffering or delay, with different capacity connections:

Example Connection Rates			
Order Protocol	256Kb	512Kb	1.5Mb
FIX Capacity	75/sec.	150/sec.	450/sec.

## Telecommunications Providers

It is recommended that members use redundant connectivity via multiple telecommunications providers to each of the BATS datacenters.

Please note that BATS will automatically cancel all open member orders if/when communication is lost.

Some telecommunications providers are listed (alphabetically) below, this list is a summary, and is not indicative of BATS preference or recommendation, nor is it comprehensive.

<b>Company</b>	<b>Contact</b>	<b>Data Center</b>
AboveNet <a href="http://www.abovenet.com">www.abovenet.com</a>	Travis Brown (212) 803-5597 tbrown@above.net	Weehawken Nutley
A T & T <a href="http://www.business.att.com">www.business.att.com</a>	Gil Patterson (816) 275-0068 gp8728@att.com	Weehawken Nutley
BT Radianz <a href="http://www.btradianz.com">www.btradianz.com</a>	Bryan Unke 312-629-4752 <a href="mailto:bryan.unke@bt.com">bryan.unke@bt.com</a>	Weehawken Nutley
Optimum LightPath <a href="http://www.optimumlightpath.com">www.optimumlightpath.com</a>	Lee Gartstein (201) 644-9120 lgartste@cablevision.com	Weehawken Nutley
Hibernia <a href="http://www.hiberniaatlantic.com">www.hiberniaatlantic.com</a>	Andrew Hornig (212) 202-0388 ahornig@hiberniaatlantic.com	Weehawken
Level(3) Communications <a href="http://www.level3.com">www.level3.com</a>	Robert J. Howath (973) 319-7430 robert.howath@level3.com	Weehawken Nutley
NexGen Networks <a href="http://www.nexgen-net.com">www.nexgen-net.com</a>	Jeffrey Barth (800) 310-2501 jeffrey.barth@nexgen-net.com	Weehawken
NYSE Euronext Advanced Trading Solutions (SFTI) <a href="http://www.nyse.com/tradingsolutions">www.nyse.com/tradingsolutions</a>	Neil Wheatley (847) 392-6857 nwheatle@nyse.com	Weehawken Nutley
Qwest Communications <a href="http://www.qwest.com">www.qwest.com</a>	Natch Angles (913) 676-3942 ignacio.angles@qwest.com	Weehawken
RCN Business Solutions <a href="http://www.rcnbusinesssolutions.com">www.rcnbusinesssolutions.com</a>	Edward Lawson (212) 324-5052 edward.lawson@rcn.net	Weehawken Nutley
Reliance Globalcom (formerly Yipes Enterprise Services) <a href="http://www.relianceglobalcom.com">www.relianceglobalcom.com</a>	Seth Auster (212) 891-5984 sauster@relianceglobalcom.com	Weehawken Nutley
SAVVIS, Inc. <a href="http://www.savvis.net">www.savvis.net</a>	Danielle Durkin (646) 458-4044 teambats@savvis.net	Weehawken
TNSi <a href="http://www.tnsi.com">www.tnsi.com</a>	John Owens ++ 44 20 7336 1526 jowens@tnsi.com	Weehawken
Verizon Business <a href="http://verizonbusiness.com/us/">verizonbusiness.com/us/</a>	Tony Schirber (913) 339-4607 tony.schirber@verizonbusiness.com	Weehawken Nutley
Zayo Bandwidth <a href="http://www.zayo.com">www.zayo.com</a>	Bob Miskiewicz (917) 733-8059 bmiskiewicz@zayo.com	Nutley

Contact BATS Network Support for information about circuit ordering details (e.g. NPA-NXX, LOA/CFA requirements, demarcation information, etc.).

## **Data Center Contact Information**

### **SAVVIS – Weehawken, New Jersey**

Dan Diversey  
Sr. Sales Executive - Financial Markets  
(312) 214-7912  
Dan.Diversey@savvis.net

### **BT Radianz – Nutley, New Jersey**

Jhoan Checo  
DMA Solutions Specialist  
(212)303-6850  
Jhoan.Checo@bt.com