

Cisco Virtual Office over WiMAX in India

Cisco and ISP prove viability of home-office solution over last-mile wireless broadband connection.

In early 2007 Cisco IT successfully deployed the first remote-access Cisco Virtual Office solution localized for India over DSL and cable broadband connections. Cisco has now proven the home-office solution over WiMAX in the last mile by conducting a pilot with select users in India. For the pilot, Cisco teamed up with ISP Tata Communications Limited (Tata), who provided a WiMAX wireless broadband Internet-based service as an additional component of Cisco IT's solution for offering stable, reliable remote access.

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Dinesh Kavuru, IT Engineer
Global Extranet Services, Cisco

The Cisco Virtual Office solution combines a Cisco 800 Series Integrated Services Router with a high-speed broadband connection, a 7900 Series Cisco Unified IP Phone, Cisco Unified Video Advantage software, and a Cisco VT Camera at the employee's home. The Cisco IOS Software-based router provides hardware IP Security (IPSec), Triple Data Encryption Standard (3DES) encryption, and enhanced security features. “Zero-touch” provisioning automates the configuration process, nearly eliminating all the time and effort previously spent by network technicians and simplifying the installation process for end users.

Validating the Cisco Virtual Office solution over broadband wireless provides a viable last-mile alternative for employees at locations not served by a stable wired broadband connection or a land-based DSL. This proof of concept also arms Cisco IT with knowledge that can be applied to Cisco Virtual Office WiMAX deployments in other emerging markets. Customers with presence in India can leverage Cisco IT's experience to help support similar enterprise-class, work-from-home needs.

The Cisco Virtual Office WiMAX Service

The stability and robustness of the last mile is a critical prerequisite to ensure that Cisco Virtual Office functions properly. In the initial pilot, Cisco IT successfully deployed Cisco Virtual Office over DSL and cable in India, localizing the solution to overcome service availability and technical infrastructure issues prevalent in the region. (For details on the initial deployment, see the case study at www.cisco.com/web/about/ciscoit/work/security/cisco_virtual_office_india_web.html.)

However, Cisco IT was receiving several trouble tickets related to the performance of the solution at employees' homes. Two main concerns emerged: power and ISP landline instability.

Cisco IT overcame the power issue by mandating that every Cisco Virtual Office installation in India includes backup uninterruptible power supply (UPS) in the user's home. To address the ISP instability, Cisco IT tweaked an in-house tool, the Cisco IOS IP SLA, to monitor performance of the ISP connection at the user's home. A DMAIC (define, measure, analyze, improve, and control) approach was also used to identify and eliminate dead ends.

While users mistook the underlying infrastructure instability as a problem with the Cisco Virtual Office solution, a root cause analysis using IP SLA established that instability of the land-based ISP line was the primary factor. Cisco IT approached various service providers to explore alternatives to the land-based ISP line instability. Tata recommended WiMAX. Cisco IT chose to explore the WiMAX

technology and initiated a pilot to validate the Cisco Virtual Office solution over a wireless broadband service.

Cisco teamed up with Tata to provide a WiMAX service that met service-level agreements (SLAs) crucial for Cisco Virtual Office performance. This service was customized by Tata to meet the technical specifications provided by Cisco IT.

Cisco and Tata discussed and agreed on the bandwidth, quality of service (QoS), and other service characteristics that would be provisioned in the pilot environment. The service parameters required for optimal Cisco Virtual Office deployment and performance are:

- Dedicated symmetric 768-Kbps upload and download speeds provisioned from the Cisco employee's home (customer premises equipment or CPE) to Tata's Internet point of presence (POP)
- QoS at the transmission layer from the home antenna to the ISP base transceiver station (BTS)
- A static public IP address provisioned for each connection (Cisco Virtual Office also works on a Dynamic Host Configuration Protocol address assignment)
- Multi-Router Traffic Grapher (MRTG) monitoring tool used by Tata for traffic trending on all its circuits

No changes to Cisco's back-end infrastructure were required during the month-long pilot. The Cisco Virtual Office 800 Series Router needed a one-time configuration to enable the static IP assignment.

The implementation comprises:

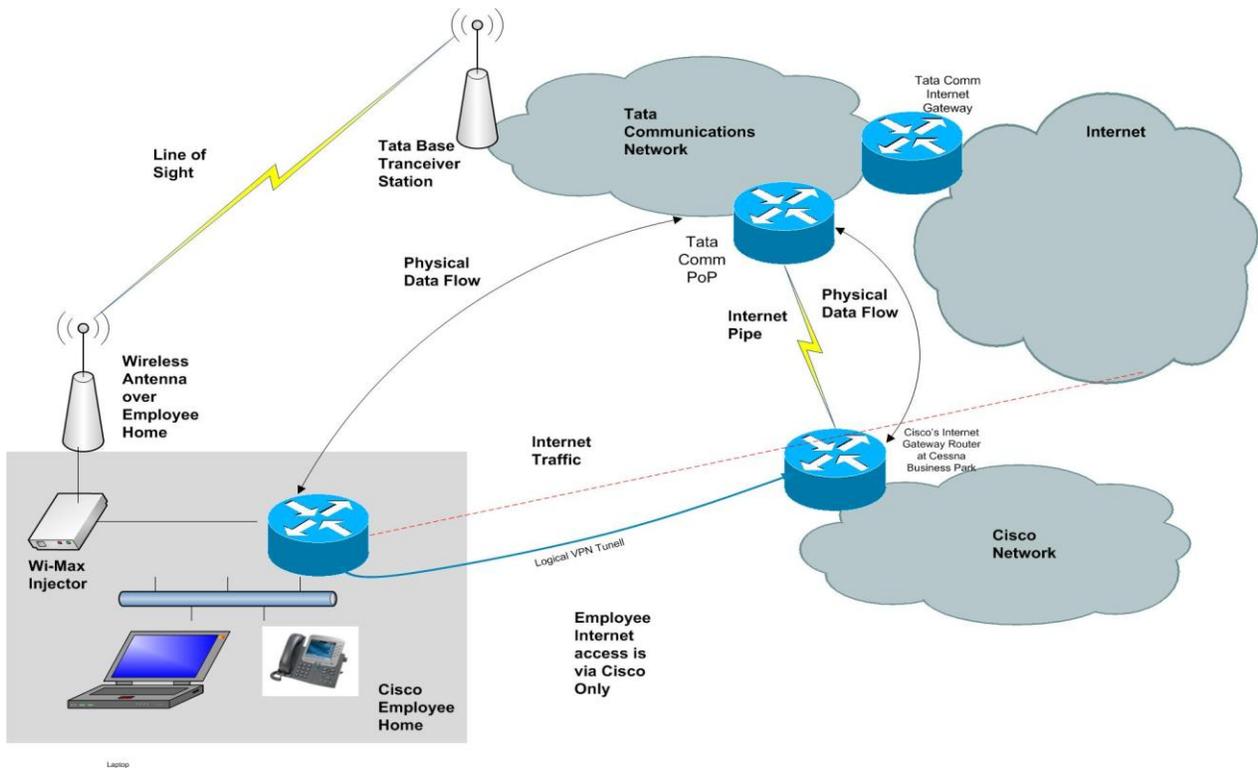
- The employee's home equipped with Cisco Virtual Office gear
- An antenna installed on the roof of the employee's home, with direct line of sight (LOS) toward Tata's BTS (see Figure 1)

The BTS connects to the Internet backbone via the provider's infrastructure where Tata switches between various sectors of the WiMAX spectrum in the 3.3 GHz band licensed for the ISP's use. The link terminates at the CPE.

On the building rooftop, the ISP installed an antenna on top of a pipe 2 to 3 meters high (height varies depending on the provider's line of sight) with a cable drop into an IEEE 802.3af injector, from which the user plugs into the home-based Cisco 800 Series LAN router via Ethernet.

"Precise alignment of the antenna is essential to ensure service quality and good signal strength," says Akshai Mallappa, program manager, IT Vendor Management Services, Cisco.

Figure 1 Cisco Virtual Office / Tata Enterprise-Class WiMAX Solution



Other requirements of the Cisco Virtual Office / Tata enterprise-class WiMAX solution include:

- Internet service offered by Tata at 1:1 bandwidth contention ratio
- Service latency commitment from the Cisco employee's home to Tata's Internet POP only
- Cisco's use of Dynamic Multipoint VPN or DMVPN technology (IPSec+NHRP+mGRE) between the Cisco Virtual Office router and enterprise secure data gateways at the Cisco Bangalore campus headquarters
- Data, voice, and video traffic on the link transferred over IP; no time-division multiplexing (TDM)
- A high-bandwidth Internet link from Cisco's Bangalore campus to Tata's Internet POP, which handles all data traffic between the employee's home and the Cisco enterprise network
- No Cisco call center business conducted on the ISP links

The Users Speak

For the proof of concept, Cisco IT assessed performance and network parameters such as latency, jitter, packet loss, download and upload speeds, connection stability and recovery, and data, voice, and video quality of the Cisco Virtual Office solution over WiMAX.

Table 1 summarizes the primary user observations and usage results observed from the Cisco Virtual Office over WiMAX pilot in India.

Table 1 Cisco Virtual Office WiMAX Pilot: User Observations and Usage

	Pilot Test Case	User Observations and Usage Results
Data	File transfer Outlook, instant messaging, WebEx, browsing, etc.	Good transfer speed ~450+ Kbps; variations of 50 to 90% of peak values in both upload and download speeds at different intervals Good application response Data usage stable; data drops not an issue
Voice	Audio conference (WebEx) 1:1 VoIP calls + 1:many (between home and office and other remote locations)	Good voice quality overall - Average Mean Opinion Score (MOS) ~ 4 to 5 - Average jitter <30 ms - VoIP quality sometimes compromised during data downloads but not compromised during data uploads or video usage Few voice drops initially but resolved after sector changes by ISP
Video	Cisco Unified Video Advantage YouTube and videos on the Cisco intranet WebEx	Better video streaming Good quality (improved user experience over pilot period); quality mostly same "as in the office" Video used primarily with WebEx conferencing
Solution over WiMAX Usage	Cisco Virtual Office solution over WiMAX used between 4 to 8 hours per day	ISP link flapping not an issue with wireless broadband connectivity Blizzard connectivity excellent Cisco Virtual Office solution recovered consistently after power failures

"The quality of data, voice, and video connectivity over the Tata WiMAX ISP solution definitely met or exceeded our expectations going into the pilot," says Dinesh Kavuru, IT engineer, Global Extranet Services, Cisco.

Overall Recommendations

Cisco IT's pilot proved that WiMAX is a credible alternative to traditional land-based DSL, especially in areas with known landline stability issues. Moreover, the pilot confirmed the stability of Cisco Virtual Office over Tata's WiMAX in the last mile, validating its suitability as an enterprise-class WiMAX service. Based on the data, voice, and video quality and overall user satisfaction with the pilot in India, Cisco IT recommends the Tata WiMAX service for use with Cisco Virtual Office.

“From a technical standpoint, service availability and quality in particular, we assessed Tata’s WiMAX solution to be more robust and predictable than retail WiMAX service,” says Kavuru. “Service parameters such as QoS for transmission between the home and base station and committed bandwidth of 768 Kbps made a significant impact.”

Caveats

To other enterprises, Cisco IT recommends that they ensure the ISP can provide good line of sight to the antenna on top of the employee’s home. Pricing is also a consideration. Pricing of the Tata WiMAX service is comparatively higher than standard DSL Internet service; however, the price could go down if the user base increases based on economies of scale.

“It is expected that an enterprise-class service will come at a higher price than retail service,” says Mallappa. “To justify the cost difference, we need to assess the quality impact of the enterprise-class service against the performance of a corresponding retail WiMAX service.”

Who will use the Cisco Virtual Office solution over WiMAX service? Cisco IT is targeting it for employees at locations that do not have cable or wired broadband (DSL) connectivity from a service provider, or employees in areas where the existing DSL performance is suboptimal.



Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV
Amsterdam, The Netherlands

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