

# Telecom Italia Packet Voice Migration: A Case Study

## Executive Summary

*In 1904, Italy's first long-distance telephone call was made between the cities of Milan and Monza, giving one of Europe's most voluble people a new way to communicate. Now, a hundred years later, Italy's largest operator is poised to attain an equally important milestone, not only in the history of Italian telecommunications, but for the industry as a whole.*

*Telecom Italia, Europe's fourth largest telco, is the first major operator to undertake a wide-scale migration to a converged infrastructure. By 2006, a single national network will handle all the voice, data, and eventually video traffic generated across Telecom Italia's 27 million fixed subscriber lines in Italy and across its pan-European backbone, as Exhibit 1 details.*

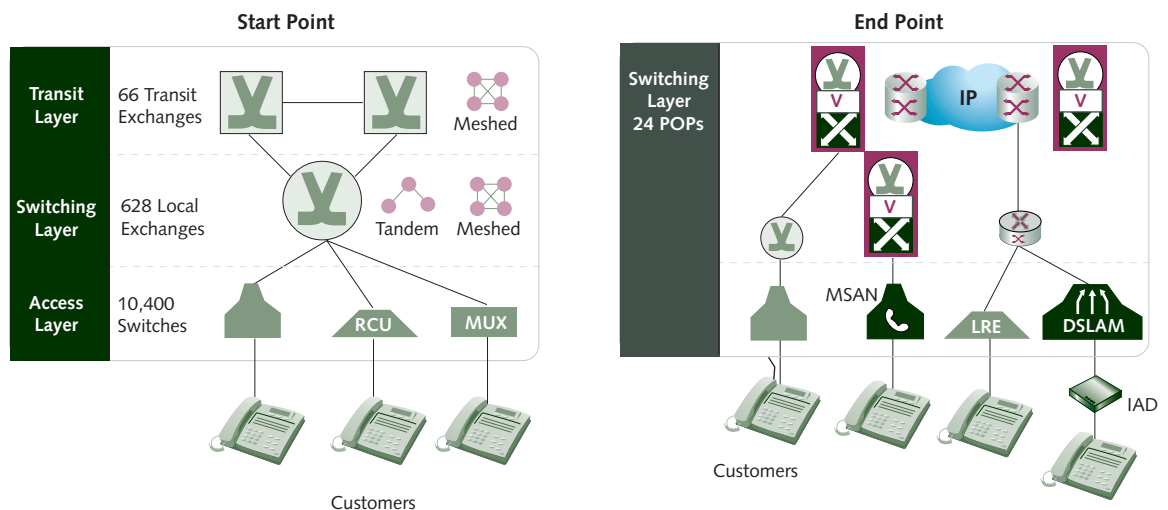
*Although Yankee Group research indicates that almost 40 percent of Europe's operators will also launch major packet voice migration plans within the next two years, Telecom Italia's progress is the most advanced. Indeed, Telecom Italia has already slashed 30 percent of its operational expenses in 2003 through its initial packet-voice implementation, prompting the company to accelerate its rollout plans. This report investigates the drivers and expected benefits fuelling Telecom Italia's network transformation*

THE YANKEE GROUP REPORT

### Exhibit 1

### Telecom Italia Voice Network Evolution 2001-2006

Source: The Yankee Group and Telecom Italia, 2003



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## I. Introduction

### A Challenging Market Environment

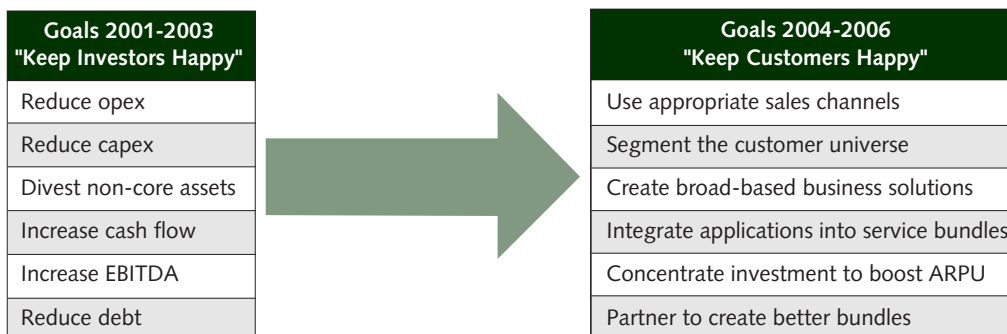
The decision to overhaul and replace Telecom Italia's national circuit-switched voice infrastructure can be viewed as an evolutionary process. It is also tightly linked to changing priorities in current operator strategies. Since 2000, operators' strategic priorities have moved from inward-focused imperatives such as reducing expenses, to outward-focused drivers aimed at retaining and expanding customer bases that are increasingly demanding (see Exhibit 2).

As one of only six fully privatised former monopoly operators in Europe, Telecom Italia is unable to take its dominant position in the Italian market for granted. Small, nimble competitors are attacking the company not only in the newer area of broadband communications, but also in the heartland of fixed voice, where the bulk of its €30.4 billion (\$35.2 billion) annual revenue is still generated.

#### Exhibit 2

#### Operators' Strategic Priorities Are Changing

Source: *The Yankee Group, 2003*



Competitive pricing and saturation of Italy's consumer and business voice market mean that traditional sources of revenue are at a standstill. At the same time, Telecom Italia has carved out a dominant position in the provision of innovative broadband packages: Between the first quarter of 2002 and the first quarter of 2003, the number of Telecom Italia DSL connections soared by 126 percent in the consumer sector, and 117 percent in the business sector, representing a significant new revenue stream. The principal challenge facing Telecom Italia, meanwhile, is to ensure these two divergent revenue trends balance out in its favor. It must also keep its customers happy, and do it with fewer resources.

## Migration Triggers and Perceptions

Telecom Italia is convinced that network transformation can help resolve its critical business concerns (see Exhibit 3). However, the decision to proceed happened because of a number of related factors:

- **Internal cohesion**, which meant there is common agreement between the marketing and engineering departments that the next strategic step had to be convergence.
- **Potential for an expanded customer universe**, which referred to the belief that new services enabled through convergence would stimulate subscriber growth.
- **Potential for greater customer stickiness**, which encompassed the belief that new services would boost loyalty and increase customer lifetime value.

### Exhibit 3

#### Telecom Italia's Business Drivers and Benefits

Source: *The Yankee Group, 2003*

##### Telecom Italia Wireline Mission Statement

**"To become the best-in-class wireline operator through customer care excellence, product innovation, leadership in technology, top efficiency/effectiveness, fast and entrepreneurial organization"**

##### Business Drivers for Voice over IP Migration

- Stalled growth in switched access revenue
- Cost and complexity of managing multiple legacy networks
- Need to reduce operational expenses
- Pressure to launch new services to keep ahead of competition
- New subscriber growth must be principal trigger for network investment

##### Business Benefits of Voice over IP Migration

- Achieved a 30 percent reduction of 2003 operating expenses
- Projecting a 40 percent reduction of 2004 operating expenses, dropping to 60 percent in 2005
- Projecting 50 percent reduction in long-term capex, compared to Class 4 switch costs

- **Neutral to positive risk scenario**, which was the conviction that maintaining the status quo (from the perspective of service portfolio and network infrastructure) could impair achievement of business objectives;
- **Potential for trickle-effect cost reduction**, which was the belief that new infrastructure would trigger tangible and intangible savings at various levels throughout the organisation—not just at a technology level.

## II. Project Genesis

Telecom Italia's national Voice over IP migration project grew out of several earlier initiatives to reduce network complexity, as well as long-term relationships with both the equipment supplier Cisco Systems Inc., and the network integrator Italtel, itself a former division of the Italian operator.

In 1996, Telecom Italia announced that it had chosen Cisco to implement a national Asynchronous Transfer Mode (ATM) network, with the aim to deliver various data communications services across a single network platform. The integration of voice, although mentioned in passing as a potential target for integration, was of secondary interest at the time. Nevertheless, Telecom Italia's purchase of 250 Cisco IGX switches and 50 Cisco AS5200 access servers was viewed as Europe's largest integrated network equipment deal. A seed had been planted.

Commitment to voice and data convergence came to the fore in 1997, when Telecom Italia decided to converge its pan-European network. This first project served as proving ground for the more complex task of migrating Telecom Italia's national voice infrastructure. For the company's international network, the economic benefits of running a converged network were undeniable just from the sheer cost of buying and maintaining major voice and data transmission links outside Italy.

It is interesting to note that from 1996 to the present day, Telecom Italia underwent dramatic and fundamental changes in ownership and structure. Yet, despite the changes in its executive management team, Telecom Italia's business case for convergence—and the support to execute the more financially draining national network project—did not waver.

## III. Network Migration Status

Telecom Italia plans a dramatic cut in the number of connections operated on its national voice transit network from more than 1,100 to only 24.

Previously, maintaining its SDH-based national voice transit network meant that Telecom Italia had to complete thousands of tests and measurements to maintain the network at a decent level of performance. From 66 transit POPs and 628 local exchanges, Telecom Italia will downsize to only 24 PoPs. Currently, to provide resilience, the operator's 10,400 national access nodes are each linked to two PoPs.

The new plan will require a fundamental architectural shift from a highly meshed infrastructure with complex built-in redundancy to a streamlined hub-and-spoke configuration. The replacement of Telecom Italia's Class IV and Class V switches with a Cisco-Italtel VoIP softswitch-based solution, and the installation of MPLS Traffic Engineering tunnels between different PoPs, based on a IP optical converged network that is to handle all voice and data traffic are currently under way.

## Running Parallel Networks Reduces Risk

A major issue was how to start the migration from Time-Division Multiplexing to IP. Italtel designed some tools that allow co-existence of both worlds, which eliminates overnight handover and extra staffing expense. All existing features plus new IP-based features would be available to all users and, more importantly, to the operator.

As a result, Telecom Italia is operating its TDM circuit-based telephone network (PSTN) and the VoIP national network in parallel, using the Italtel hybrid softswitch to ensure co-existence and interoperability of the two worlds as the migration proceeds. The plan is to phase out the Class IV switches by the end of 2003. Telecom Italia has chosen the Cisco-Italtel Class V replacement solution, but still needs to decide when to implement it, depending on local user characteristics and traffic profile. Telecom Italia is discussing several options, including retaining TDM, running pure IP with special subscribers over Ethernet or ADSL using a home access gateway (HAG) or using an access gateway converting voice over IP directly at the access gateway (i.e., Digital Loop Carrier) level.

Telecom Italia opened its first MPLS-based multi-service PoPs in Milan and Rome in the summer of 2002; by October 2002 all calls between both cities were handled across the new infrastructure, as Exhibit 4 details. Today, all of its network PoPs are interlinked

### Exhibit 4

#### Telecom Italia Project Milestones

Source: *The Yankee Group, 2003*

January 1997	<ul style="list-style-type: none"> <li>- Telecom Italia project planning begins for implementation of converged pan-European backbone, working with Cisco Systems</li> </ul>
January 1998	<ul style="list-style-type: none"> <li>- Liberalisation of European telecom market</li> <li>- European Commission rules that IP telephony is too immature for regulatory oversight</li> </ul>
January 1999	<ul style="list-style-type: none"> <li>- Telecom Italia pan-European backbone project implementation begins</li> <li>- All local exchanges in Italy now fully digital</li> </ul>
July 2000	<ul style="list-style-type: none"> <li>- Italtel demerger from Telecom Italia. Cisco Systems picks up 19 percent stake in Italtel, Telecom Italia's former telecoms equipment and integration arm</li> <li>- Telecom Italia and Cisco Systems alliance announced to focus on developing IP convergence, DSL and mobile solutions</li> </ul>
December 2000	<ul style="list-style-type: none"> <li>- First implementation of converged pan-European backbone</li> </ul>
June 2001	<ul style="list-style-type: none"> <li>- Telecom Italia announces rollout of its second-generation converged national network with partners Cisco and Italtel</li> <li>- The optical packet backbone will support voice, IP and video services delivered across Telecom Italia's national fixed telephony network</li> </ul>
October 2002	<ul style="list-style-type: none"> <li>- Telecom Italia announces that all calls routed between Rome and Milan, and 50 percent of Telecom Italia's international calls, now run over a converged multi-service IP network supplied by Cisco Systems and installed by Italtel</li> <li>- This represents more than 3 billion voice minutes</li> <li>- The European Commission sets out new electronic communications regulatory framework. Distinctions between voice telephony and other telephone services will be removed, which could theoretically extend regulation to VoIP services</li> </ul>
April 2003	<ul style="list-style-type: none"> <li>- Telecom Italia announces that it is accelerating migration plans by a year, and expects to complete full network migration by the end of March 2004</li> <li>- 17 billion voice minutes currently transiting across the new converged network</li> </ul>

using IP. Each existing PoP employs some time-division multiplexing (TDM), a Cisco media gateway translating calls from TDM into IP, and an IP edge router linking the PoP to the MPLS backbone. In addition, TDM-based links still exist between Telecom Italia POPs and other licensed operators.

In practice, Telecom Italia has found it difficult to justify the immediate replacement of its Class IV infrastructure. These switches were only installed in the mid-1990s and their cost is still not fully written off. Nevertheless, Telecom Italia has taken a longer view of the anticipated savings that a converged infrastructure will bring. By employing a depreciation cycle of 15 years, Telecom Italia anticipates capex reduction in excess of 50 percent when all transmission and switching gear is factored.

Current and anticipated operational cost savings compared against maintaining the Class IV network are equally compelling. These savings will escalate to 60 percent in 2005, but already Telecom Italia is stating 20 percent savings through what has been installed in 2003.

Fuelled by such existing and project savings, between October 2003 and March 2004, Telecom Italia will replace all TDM links to other Italian fixed and mobile operators. Notably, this migration is a year ahead of Telecom Italia's initial project plan.

## A Note of Caution

One of Telecom Italia's biggest problems has been dealing with all of the legacy networks, services and implementations. Moving voice over IP on its own has proven a simple enough issue. However, the need to have voice over IP work with fax and older modem services brings problems of implementation and co-existence.

With VoIP there is no synchronous link available. As a result, non-voice applications that require synchronous transmission (such as point-of-sale terminals, fax machines and modems) in the network could be affected if the IP converged network is not fine tuned.

In practice, it has taken time to adjust to new ways of traffic engineering. From the standard measure of Erlangs in a TDM environment, Telecom Italia has had to work at MPLS level to reduce delay and jitter.

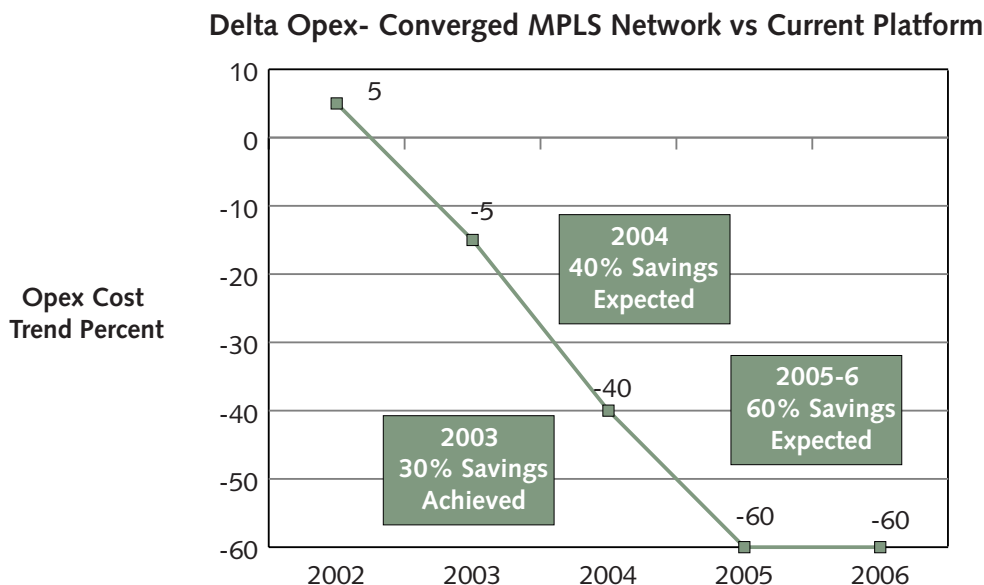
A critical element in reducing delay and jitter is distinguishing between voice and data traffic. If the traffic is voice, the network uses compressed wave (which is obviously not for data). This is easy to detect when a standard modem is used. However, many modems used for data are not standard, so Telecom Italia has had to design a call-separation process. One major Telecom Italia customer used a proprietary modem to connect branches to the central data room. Telecom Italia has to install calling line identification at the centre to distinguish between call types. Italtel has installed a number of filters and automatic detection of call types is now possible.

## IV. Benefits of Convergence

- **Operational costs reductions cascade throughout the business over time.** Telecom Italia is already seeing a cost reduction of 30 percent in 2003. However, these savings are expected to escalate to 40 percent in 2004, and 60 percent in 2005 and beyond. See Exhibit 5 for evolution of opex. As the following points discuss, savings cascade through different areas of the organisation over time—from management and maintenance to staffing—and become more sizeable in aggregate.

## Exhibit 5 Incremental Cost Reduction over Time

Source: Telecom Italia, 2003



- Voice becomes a marginal cost on a converged network.** Telecom Italia ran its SDH-based national transmission network on a large number of E1 (2Mbps) circuits. The new converged MPLS-based optical backbone network employs dense wave division multiplexing (DWDM) using 2.5Gbps wavelengths. Despite avowedly high up-front expenses incurred in commissioning the MPLS-based optical network, Telecom Italia found that this converged network could support both data and voice at minimal incremental cost. Capex per trunk is also less than the TDM network because it is based on STM-1 (155Mbps) and not E1 interfaces, providing better statistical use of resources with large quantities of multiplexed traffic.
- Simplified management of traffic fluctuations brings 10 percent operational cost reduction.** During peak traffic hours, traffic volumes can vary substantially by direction and connection type, such as the volume of mobile calls made from the beach during the summer. Traffic balance is difficult with multiple links to POPs. With a single link from any PoP, it is a much simpler procedure, and with all traffic together linked together, operational savings in excess of 10 percent are possible.
- Convergence means operators only need to maintain a single management centre.** At Telecom Italia, a unified team now runs the DWDM network with greater efficiency and at lower cost, replacing separate voice and data teams and what were also regional management and engineering functions. In addition, Telecom Italia now runs a single engineering centre.

- **Superior voice compression allows up to 40 percent reduction in bandwidth used.** Telecom Italia now employs voice compression at 40Kbps instead of 64Kbps to reduce required bandwidth with consequent operational savings. Associated Wave signaling is also used. In the old architecture, Telecom Italia needed roughly 4,000 SS7 links.
- **Implementing VOIP in a Class V environment is transparent to customers.** The parallel network operation and network replacement process is not evident to customers. However, once it is achieved it should allow customers to access a broader service portfolio.

## V. Lessons Learned

Telecom Italia, Cisco and Italtel can congratulate themselves for a job that is going well. But what about the next guy? There is no doubt that Telecom Italia's current success is a result of a committed management, not just good technology. In other words, the three principals had the will to not let the project fail.

So what can other operators do to ensure that they are at the leading, not the bleeding edge when their turn comes? We provide the following recommendations:

- **Conduct a thorough audit, not only of equipment, but also all services offered and associated network traffic mix.** Time dedicated to identifying traffic types coming over the network and traffic patterns is well spent. Understanding traffic mix is part of the fine-tuning necessary for optimal design of the converged network infrastructure.
- **Take time to build a common understanding of standards and legacy protocols used, particularly local flavours.** Inevitably, each operator's network has unique features, even in the usage of industry standards; suppliers must be equipped to handle individual differences, including special users and special protocols. Expect problems of implementation and coexistence in well-established multi-vendor networks.
- **Operating a temporary parallel infrastructure is a cost worth incurring.** The cost of running a parallel infrastructure should be balanced against the knowledge gained in seeing how both networks operate, and the benefits in making transition seamless to customers.
- **Rethink the billing function; you must support session-based billing scenarios.** Next-generation converged services will be highly personalised and session-based, requiring operators to handle flexible billing that varies over time according to user and service.
- **Choose partners with demonstrable integration skills.** Integration of both front and back-office systems will determine the success of a migration project. Operators need support from companies with strong systems integration skills.

- **Don't leave OSS issues until last** The OSS aspect of service and infrastructure development is equally as critical as the infrastructure component. Telecom Italia recognised that the converged platform would have to streamline the stovepipe approach of former OSS systems. The efficiencies innate within a single coherent OSS system would also pass on benefits in terms of service delivery and the life cycle of new services being brought into the marketplace. The move to a streamlined customer facing set of OSS processes is critical to the future success of telecoms services.

## VI. Further Reading

### Yankee Group Reports

*After the Deluge, Incumbents Must Lose Telco Tag and Focus on Customers, Not Products*, Telecommunications Strategies Europe, August 2003

*Hosted IP Telephony Will Help Providers Reduce Churn and Build Customer Loyalty*, Communications Network Infrastructure, March 2003

*VoIP Peering: Bridging the Gap Between Public and Private Networks*, Communications Network Infrastructure, May 2002

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