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Broadband Attributes of Wireless IP Network - Technology Case Study

RTX powers Atlas Telecom wireless and broadband services.

Case Study: Atlas Telecom uses RTX's wireless IP network devices to make the most out of their network equipment investment

Executive Summary

Customer: Atlas Telecom Network, Romania

Industry: IT/Telecommunications

Business Challenge:

- Migrate its small traditional network system to an advanced wireless IP Network in order to support graceful increase in customer base and improve network availability.
- Maintain operation cost while managing increasing customer growth and service demands
- Reduce bandwidth constraints at network edge.

Network Solution:
Deploy complete suite of RTX wireless IP network solution that supports broadband data access and seamless VoIP sessions/calls

Business Results:

- Brand new network that replaces old network, halves network complexity and reduces network management burden
- Reduces new service implementation costs
- Increase bandwidth, eliminates congestion, and improves network security with minimal capital investments
- ATN can now offer seamless wireless voice via VoIP and DECT and Wireless Broadband access via IEEE 802.11g

Business Challenge

Atlas Telecom Network (ATN) is one of the biggest telecommunication companies in Romania. Its mission is to provide an alternative integrated voice and data communications services at reasonable cost.

ATN's engineers are responsible for running and maintaining the network infrastructure as well as planning the best use of current and future network resources.
Three years ago, ATN replaced its aging network devices with RTX's cost effective and highly scalable wireless IP network to provide broadband data access and seamless VoIP telephony services. ATN old network devices was based on a system that only served limited geographical areas, call centers and Hotels. Further, it lacked the flexibility for network expansion at a reasonable investment.

Over the years, there have been a significant city and urban growth within Romania. ATN needed a way to support "hungry" customers in these high growth cities. This was noted by P. S. Tripa, president of ATN for Eastern Europe, "….in the fastest growing metropolitan areas in the country … there is an increasing demand for efficient and reliable broadband internet and telephony services" [1].
Therefore it became necessary to migrate to a brand new wireless IP network that makes use of the latest industry technology.

The new network was also to satisfy the following goals:

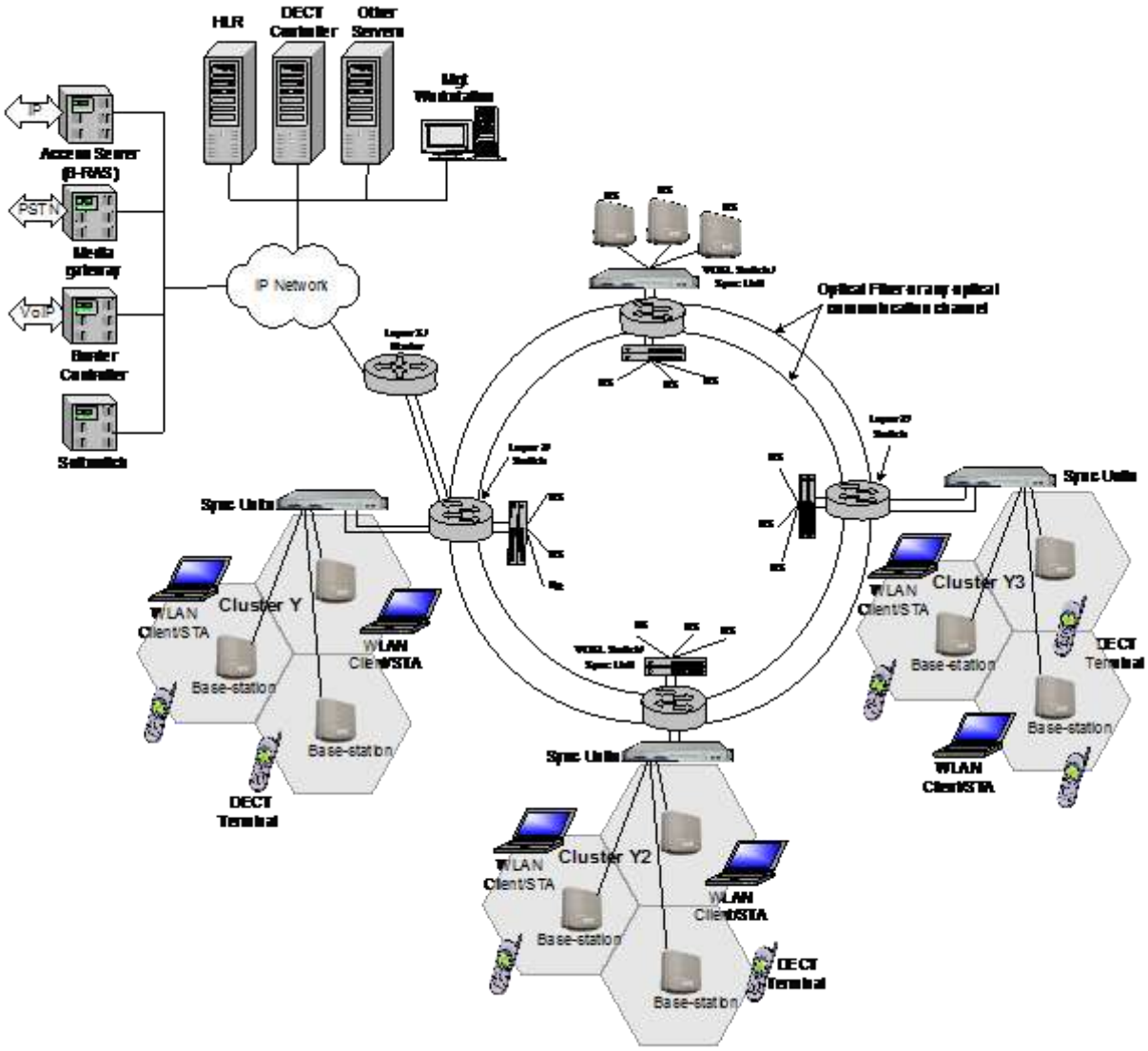
- Support graceful increase in customer base and improve network availability.
- Maintain operation cost while managing increasing customer growth and service demands
- Reduce bandwidth constraints in order to provide broadband data services and low cost VoIP calls.

Network Solution

The network system from RTX to ATN is a full wireless IP solution integrated with technologies such as DECT for high quality voice telephony, Wi-Fi for the wireless data communications, and Voice over IP (VoIP) that allows the ATN to provide a high number of premium telephony features to residential and business consumers.

Network Topology

ATN network setup is the interconnection between Base-stations, VDSL switches, Sync units, Repeaters, portable parts, etc, in an IP network. The back-bone of the network is ring topology within which Layer 2 switches are interconnected by optical fibers.
The Ring topology has a centralized monitoring, and maintenance system. The choice of this topology is because ring network have tolerant response to faults due to the improvement of redundancy paths within the network.



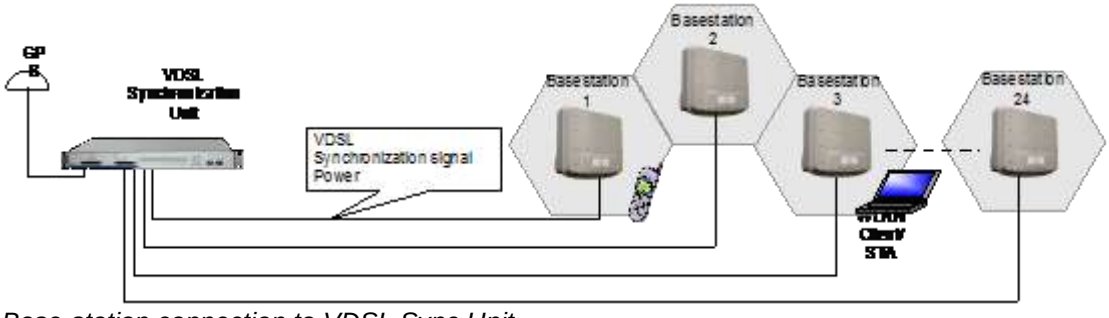
Ring Topology

Hardware setup

ATN's wireless IP network hardware setup is deployed under two customer situations:

1) Urban Mass Deployment

In this deployment, the IP network is connected to the Base-station via VDSL modem and VDSL Sync Units.

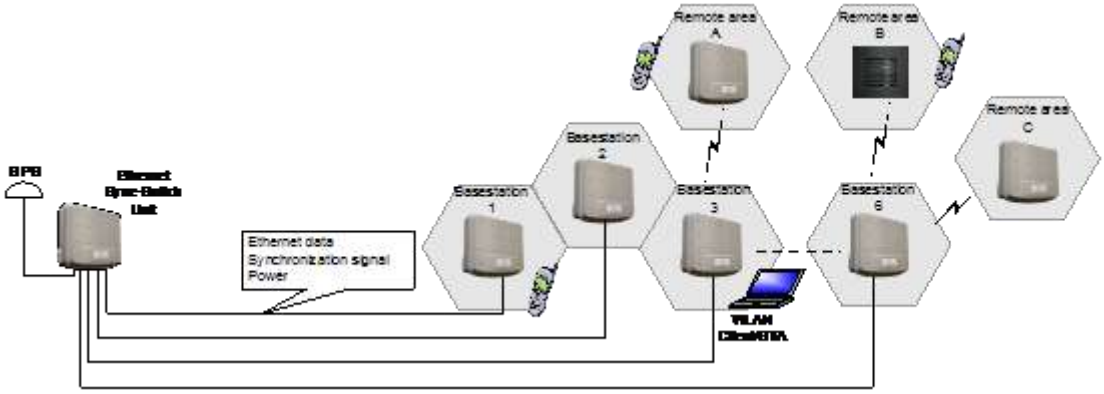


Base-station connection to VDSL Sync Unit

Each VDSL Sync Unit is stackable up to 10 units in the rack; each unit connects up to 24 Base-stations. The Base-stations are mounted on Lamp poles so that each Base-station is separated from each other by 300m. The coverage is extended to 800m using Repeaters that is installed up to 1.5km from the Base-station.

2) Rural/Suburban deployment

In rural or suburban areas of ATN's wireless IP network, a configuration of up to 6 Base-station is mounted on a tower. Each Base-station is connected to the network via Ethernet Sync-Switch Units which provide data, power and synchronization signals over a standard CAT-5 cable. The cable length can be up to 100m. Furthermore, radio coverage is extended to remote villages and towns by Outdoor Repeaters.



Extended radio coverage to Rural areas/remote villages by Outdoor Repeaters

In both deployment situations, the Base-station antenna mechanism is based on space diversity feature which improves coverage. The base-stations uses complete DECT MAC protocol layer and IP media stream audio encoding feature to provide up to 11 simultaneous calls.

ATN were pleased with how the Base-station also supports up to 16 WLAN stations/clients implemented with 802.11g, WPA security and network access control specifications.

Software setup: Network Monitoring and Management

ATN's network server environment is installed as a centralized system. Server tasks are distributed on Linux servers sharing processing load and for adding system redundancy in order to handle network failures.
The 3 main server types hosted for the network include IP DECT/WLAN controllers, HLR database servers and Management servers.

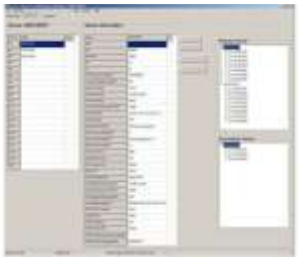
IP DECT/WLAN HLR Interface

IP DECT/WLAN Controller

The former two are essential for maintaining wireless IP network services. The HLR is duplicated on 2 servers both of which respond to subscriber lookup requests. In addition, the HLR Terminal Database is based on an Oracle Database and data are stored on SAN. For backup purposes, the HLR is also hosted on Tivoli Management running Windows Blade servers. Each IP DECT/WLAN controllers is hosted to a primary Debian based Linux server to serve a maximum of 4000 Base-stations.

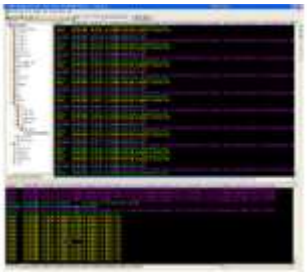
The management servers consist of these softwares: IP DECT/WLAN Configuration, and Terminal Manager (including 3rd party SNMP Manager). These softwares are installed on one or multiple MS Windows server platforms.

ATN were also pleased to find out that Management servers can monitor and manage the network in detail. Each Base-station status can be checked, even down to antenna status, traffic statistics and traffic log pattern. Each Repeater and each Subscriber Terminal can be monitored over the air from a centralized office.



IP DECT/WLAN Configuration Manager

IP DECT/WLAN Terminal Manager



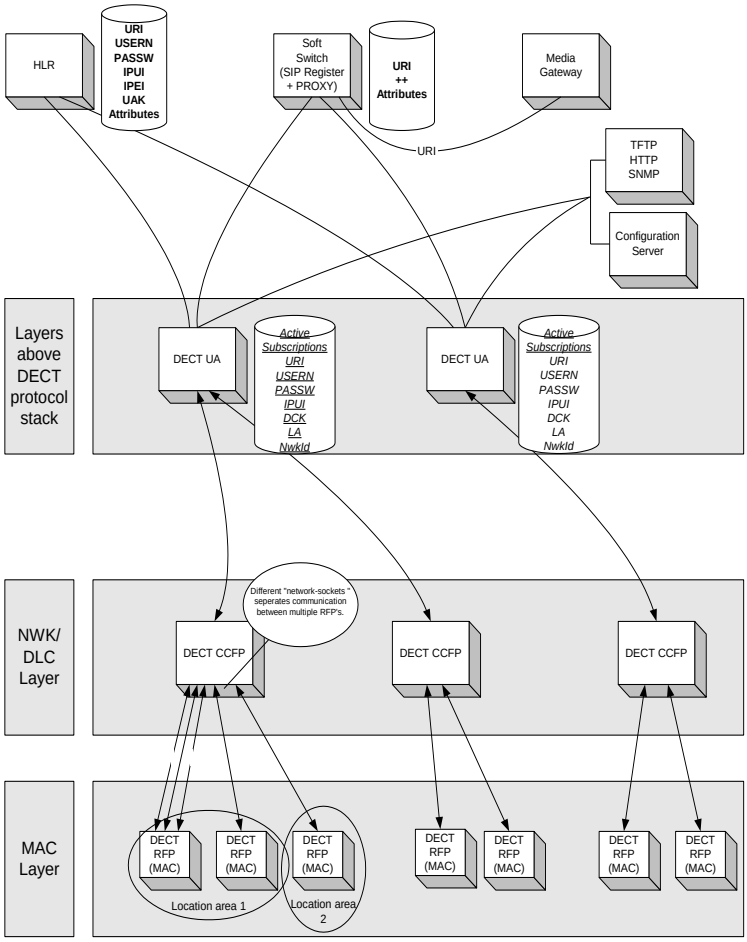
3rd Party SNMP Manager

Further, new software can be uploaded to all system elements from the centralized office on an individual basis. This includes Subscriber Handsets where the latest software is downloaded over the air (OTA).

Network Architecture

The wireless IP network devices and components are implemented across different layers. This makes it possible for the system to inter-operate with different networks thereby simplifying and standardizing operations.

Some major components in the network architecture include RFP, CCFP, and UA. The UA controls the DECT-SIP interaction, call processing, active subscription database, mobility management and system management procedures. The CCFP consists of DECT networking and data link control stack that controls a group of Base-stations, which form one or more DECT traffic area.



Simplified version of wireless IP network architecture

Network Scalability and Bandwidth Provisioning

ATN realized that the architecture of the RTX Wireless IP Network System allows expansion up into millions of subscribers by just adding Base-stations and increasing server capacity while increasing network throughput under increased network load.

And this expansion can be handled without complex frequency planning, since the radio access is based on “Dynamic Frequency Allocation” mechanism. The subscriber terminals in each area automatically ensure the optimum use of the frequency range.
It is in this matter Mr. Tripa remarks that “The (wireless IP network) utilizes what is known as a ‘shared spectrum’ or … an agreed frequency range, and has huge capacity compared to … a standard mobile GSM network. In fact, (the network) is ideally suited for dense areas of population – comfortably handling up to 100,000 users per sq. km (by comparison GSM allows only 2000 users per sq. km). Add to this the fact that such a system, operating over this frequency, does not need a license and it is clear that this economic argument could be compelling.” [2]

Standardization

The wireless IP network supports industry proven specifications and standards. Some of these standards are summarized below:

ETSI:
All DECT drafts, EN 300 175 (1-8), etc.

IEEE: specification and Drafts documents of 802.11

IETF: RFC's and Drafts for IP architecture, SIP, etc

ITU-T: Recommendations; for e.g.
G standards, G.711, G.729a/b, etc.;
H-standards, H.323, etc.;
X.680 i.e. ASN.1 for rtxMIB, etc..

Details

Features	Specifications and standards
DECT	Compliant with ETSI standard EN 300 175 part 1-8 Generic Access Profile (GAP) , CLIP Network information, System Time/Date Enhanced location registration Emergency call, Flash dialing, Pre and post dialing Audio encoding: ADPCM or PCM Over air terminal maintenance, including OTA firmware load Supported timeslots: full, double MAC connection types: basic, advanced Encryption: DSC; Authentication: DSAA Timing Advance Regional settings (DECT / DECT6.0 / LATAM)
IP Network	TCP, UDP, VLAN, FTP, TFTP, HTTP SSH, DHCP, DNS, SNMP, ICMP Ethernet IEEE 802.3, VDSL, DNIC
Management & Monitoring	SNMPv2 and above RFC 1908/3411 SNMP parameter monitoring & event notifications HTTP, SSH Proprietary TCP connections Extensive event logging
RTP	RFC 3550/3551 Offer / answer Codec: G711a, G711u, G726, G729a/b (optional) PLC No support for NAT

SMS	SIP MESSAGE (no submission/delivery reports) Proprietary protocol to SMS gateway (HTTP based) EN 300 757-103 1
SIP v2.0	RFC 3261 *SIP: Session Initiation Protocol* RFC 3262 *Reliability of Provisional Responses in the Session Initiation Protocol (SIP)* RFC 3263 *Session Initiation Protocol (SIP): Location SIP Servers* RFC 3264 *Offer/Answer Model with Session Description Protocol (SDP)* RFC 3311 *Session Initiation Protocol (SIP) UPDATE Method* RFC 3842 *A Message Summary and Message Waiting Indication Event Package for the Session Initiation Protocol* RFC 4028 *Session Timers in the Session Initiation Protocol (SIP)* RFC 2976 *SIP INFO Method* RFC 2327 *SDP: Session Description Protocol* RFC 2617 *HTTP Authentication: Basic and Digest Access Authentication* Caller ID (name and number) is supported No REFER or transfer or other applications level features
Wireless LAN	Multiple SSID Multiple concurrent clients Access Control (MAC address limitations) IEEE 802.11g Dynamic and static frequency selection Antenna diversity Regional settings WPA (subset of IEEE802.11i with WPA-PSK as optional), WEP Optional no security RADIUS server authentication

Business Benefits

ATN wireless IP network environment whether the Base-station or Sync Unit, etc, relies on proven technology such as DECT and WLAN. The results obtained in deployment of this network are significant:

- Very fast roll-out of ATN's voice and data services to the urban and rural consumers since it is simple and easy to deploy. Mr. Tripa comments that "... apart from crippling license fees, the most expensive and difficult part of establishing any fixed line telecoms network is the last mile through to the customer. The (wireless IP network), ... solves this problem by linking end-users to the network without the need for localized fixed line connections – instead, transmitting digital signals to handsets from local base stations to the home or office" [2].
- Wide network coverage - Several Romanian cities have been covered successfully. Based on this success, plans are in the final stages to extend wireless broadband coverage to the additional cities. ATN has successfully tested

and deployed the solution to tier-1 operators in other countries for e.g. Hungary. In fact, Mr. Tripa reports that "we believe that the (wireless IP network system from RTX) ... developed for Romania has ... become a classic model for telecoms networks in developing countries. Indeed, we are also deploying the same system in neighboring Hungary, and we are also looking for other countries in Eastern Europe which could benefit from the same sort of system...." [2].

Product List:
Software
Home Location Register (HLR)
IP DECT/WLAN Configuration Manager
IP DECT/WLAN Terminal Manager
IP DECT/WLAN Controller
Hardware
VDSL Sync Unit,
Ethernet Sync-Switch Unit
Base-stations
Outdoor Repeaters
Deployment Kit.
Standard Handset to High-End Handsets

- A highly scalable wireless IP network that uses the same physical IP connection both DECT and WLAN traffic which reduces network complexity and eliminates congestion. Further, the server software module of the wireless IP network streamlines operations and simplifies management, and troubleshooting of network failures because everything runs on consistent protocols.
- Improves network security - In the wireless IP network, the DECT network is completely separated from the WLAN network so that the security control at the network edge includes two different VLAN used to provide guaranteed QoS and separate audio streams from WLAN traffic. In addition, ATN can implement different security policies or control so that attempted breaches are stopped at source.
- Reduces service implementation - wireless IP network offers value because ATN is able to add new services (value added services) without having to re-configure the whole network each time.
- Improves network availability - Redundant system architecture and links within the network serves as a backup facility that transforms network recovery from noticeable minutes of old network downtime to transparent sub-second recovery.

Mr. Tripa says “With …. industry-leading partners (such as RTX Telecom) …ATN is well positioned and has the technology to offer consumers a differentiated and enhanced communications experience …." [1].

Glossary

AP	Access Point
CCFP	Cluster Control Fixed Part
DECT	Digital Enhanced Cordless Telecommunications
DHCP	Dynamic Host Configuration Server
DNIC	Data Network Identification Code
DNS	Domain Name Server
FTP	File Transfer Protocol
GAP	Generic Access Profile
GPS	Global Positioning System
HLR	Home Location Register

IP	Internet Protocol
IPUI	International Portable User Identity
OTA	Over-The-Air (firmware load)
PSK	Pre-Shared Key
RADIUS	Remote Authentication Dial In User Service
RTP	Real time Transport Protocol
SIP	Session Initiation Protocol
SMS	Short Message Service
SNMP	Simple Network Management Protocol
SSID	Service Set IDentifier
TCP	Transmission Control Protocol
TFTP	Trivial File Transfer Protocol
UA	User Agent
UDP	User Datagram Protocol
URI	Uniform Resource Identifier
VDSL	Very High Speed Digital Subscriber Line
VLAN	Virtual LAN
WEP	Wired Equivalent Privacy
WLAN	Wireless Local Area Network
WPA	Wi-Fi Protected Access

Reference(s)

[1] Press Release, “Atlas Telecom Launches Operations In Timisoara And Offers The First Metropolitan Wireless Broadband Network In Eastern Europe”, June 2006, http://www.atlasgroup.bm/News/NewsDetail.asp?ID=72 (Last accessed 17/Aug/2007)

[2] P. Tripa, "A new way forward", Public Service Review: European Union, Issue 7, pp 68-9, Spring 2004, http://www.publicservice.co.uk/pdf/europe/spring2004/EU7%20Pompiliu%20Tripa%20ATL.pdf (Last accessed: 20/Aug/2007)

For More Information

RTX has helped Tele-operators; and Hosted PBX service providers roll out scalable wireless IP network to their consumers while holding down operating costs. To learn more about how RTX wireless IP network can help your organization or community, contact our regional representative or visit http://www.rtx.dk

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This customer story is based on information provided by ATN and describes how it benefits from the deployment of RTX products. Many factors may have contributed to the results and benefits described. RTX does not guarantee comparable results elsewhere.
