Building a Flexible & Adaptable WiMAX CSN

WiTech

Your Wireless Future
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Making Your Wireless Vision
a Reality

Executive Summary

In today's uncertain technology and market scenarios, many operators in the process of starting the deployment of a WiMAX-centered BWA network are faced with a number of critical questions. An effective answer to these questions depends also from the right implementation of the CSN component of the WiMAX Forum NRM.

Unfortunately, the WiMAX Forum NRM alone does not provide enough "reference" to build the CSN, as it leaves a number of things non completely specified (as a matter of fact, there is not a certified interoperability for the CSN).

On the other end, focusing primarily on the radio access infrastructure can also bring troubles. Too often, operators planning their network rollout focus primarily on the radio access infrastructure, leaving such things as network access control and subscriber & service management (part of the CSN) to a later stage, only to find that these quickly are the cause of major issues when they approach the commercial launch and then have to activate the first batch of real customers.

Thus, building the CSN is a critical piece of the network deployment that cannot be handled as a "Second Step" matter, nor reduced to the single question of selecting the right AAA server.

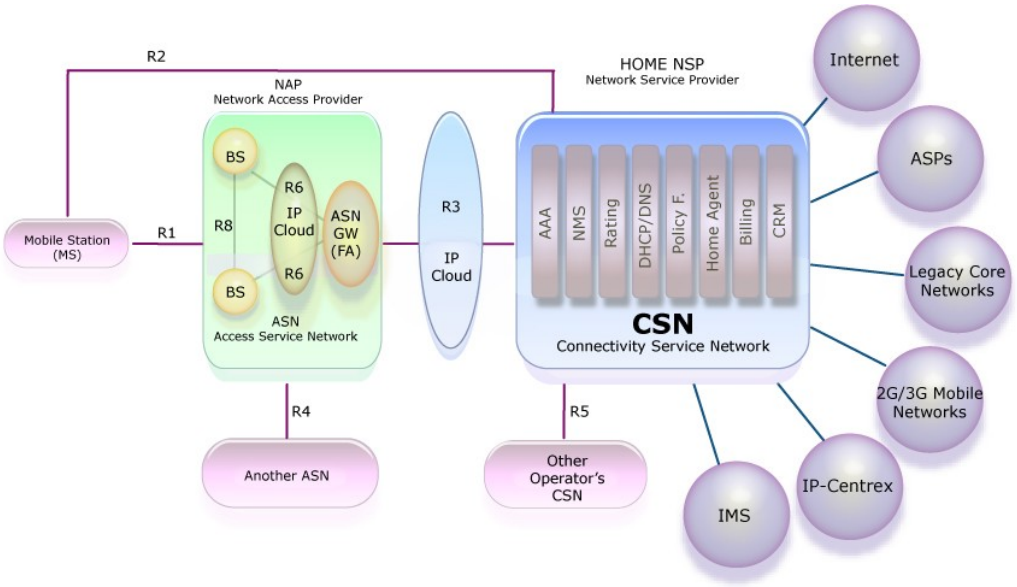
WiTech offers a Fast Deployment WiMAX CSN™ solution devised to help operator timely deploying a future-proof CSN with a stepped approach, one platform at time and taking into account the specific needs, priorities and timing of the operator. This solution quickly gets the key functionalities the operator needs to commercially launch its WiMAX network and so accelerates the never-enough shortened "time to customer". All at an affordable initial investment and a no-surprise TCO.

1 Introduction

In today's uncertain technology and market scenarios, many operators in the process of starting the deployment of a WiMAX-centered BWA network are faced with a number of critical questions, including:

- How to make the most out of reduced capital resources and budgets?
- How to plan and adapt to technological evolutions and multi-technology options?
- How to accelerate time-to-market advantages while managing regulatory constraints?
- How to differentiate service offerings with regards to QoS and value added services?

An effective answer to these questions depends also from the right implementation of the CSN component of the WiMAX Forum NRM.



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On the other end, focusing primarily on the radio access infrastructure can also bring troubles. Too often, operators planning their network rollout focus primarily on the radio access infrastructure, leaving such things as network access control and subscriber & service management (part of the CSN) to a later stage, only to find that these quickly are the cause of major issues when they approach the commercial launch and then have to activate the first batch of real customers.

Thus, building the CSN is a critical piece of the network deployment that cannot be handled as a "Second Step" matter, nor reduced to the single question of selecting the right AAA server. When building the CSN, the WiMAX operator should properly address a number of possible clear as well as hidden issues that we would recommend not to forget about, including:

- **Unproven interoperability** among the different systems, that might cause service disruption, time-to-market delays, and expensive, time-consuming integration.
- **Malfunctions at commercial launch**, that might have long-term repercussions in terms of reputation and credibility – an operator should never underestimate the power of the "word of mouth" (both positive and negative) when pushing hard to sell subscriptions in a newly-covered area.
- **Customers can be more sophisticated than expected**: even in relatively less-competitive markets, advanced subscription options and services will often be commonly requested, and they need to be managed. For example, Customers want to be able to activate service from home without technical assistance and manage their connection online. They also expect to choose between prepaid and monthly subscription options, as well as on-demand services, with the freedom to add (or remove) services like, for example, Voice over IP whenever they desire.
- **Costs can be higher than planned:** a full-featured CSN can take a big chunk of network CAPEX. For many small to mid-size WiMAX deployments, the cost of a full-featured CSN can represent a large percentage of the initial investment, that has a direct impact on the sustainability of a competitive price positioning.
- **Unexpected customer ramp-up** can take by surprise: only to see hard-chased prospects turning to competition as their requests for subscription do not get timely fulfilled through a second-class CSN.
- **Wrong level of system granularity**: deploying many separate, best-of breed systems may be too complex to build and operationally difficult to manage. The way around, deploying a monolithic, completely integrated system can lock the operator into a dead-end with reduced functionality and limited scalability.
- **Limited support for the commercial channels:** an operator can be faced, since the beginning, with the need to support different flavors of Wholesale and Retail channels, supporting multilevel business partner value chains including VNOs (Virtual Network Operators) and Master Reseller/Resellers. The business partners in the value chain might ask the operator to be supported directly on the operator's CSN platform defining their own service offerings and price lists and managing their down-stream value chain up to the end-customer. The capability to support a "White Label" Wholesale channel in this way provides the operator with a powerful channel-opener facility, giving its business partners the opportunity to rapidly offer their own brand service with a refreshingly low entry threshold.

Considering the previously mentioned issues and the other "more positive-looking" needs, a number of key requirements can be listed when deploying a CSN:

- **Flexibility:** to support different business / architectural models. In such a way that the operator can cope with the (almost inevitable) changes along the way.
- **Scalability**: to adapt to the growth of the business without writing off the system after the customer base start to grow.

- **Integrability**: to facilitate the integration with existing OSS/BSS environments.
- **"End-to-endness":** indeed there isn't only the need to manage the access network, also customers need to be managed and billed, the sooner the better. Time-to-Customer is often the first success factor.
- **Expandability**: so that new functionalities can be added / activated when needed.
- **Reliability**: to prevent the highly negative impact of service disruption on the public image (with higher churn and difficulties to attract new customers) the operator needs to deploy the CSN with the right hardware and software redundancy (let us image prepaid customers not being able to use the service because this function of the CSN is not up and running).
- **Security:** enforcing the appropriate access control policies, to prevent fraud and avoid revenue leakage.
- **Meeting regulatory requirements** is mandatory in many countries (for example, Lawful Intercept, with all the implications about tracking, storing and retrieving these type of data).

To summarize, the key challenges a WiMAX operator will likely face, highly dependant from the CSN, can be as such:

- **Making sure to go through smooth commercial launch**
  - Ensuring a great user experience since the outset
  - Having network access control and subscriber & service management ready at the first step
- **Choosing the right building blocks to guarantee a fully interoperable network**
  - Dealing well with the different business and technological aspects
  - Caring a lot about end-to-end integrability
- **Keeping ahead of competition whilst growing**
  - Planning well for future growth in subscriber and traffic, evolution in services and business models.

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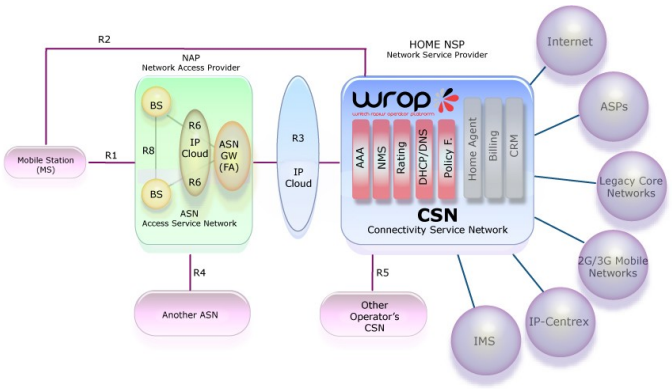
2 A fast deployment WiMAX CSN

First Step: deploying WiTech WROP|Suite

At the core of WiTech's Fast Deployment WiMAX CSN™ solution is the **WiTech WROP|CSN,** a WiMAX-fine-tuned version of the **WiTech WROP|Suite** platform**.**



This is a modular, carrier-class access & service management platform tailored to support fast moving telco operators and service providers deploying and managing broadband access networks with advanced features for subscriber and service management.

The WiTech WROP|Suite stands out for its rich feature set providing comprehensive support of different types of wireline (xDSL) and wireless (HiperLAN, WiFi Hot Spot, Fixed & Mobile WiMAX) broadband access network technologies, authentication, services (e.g., VoIP), and metering and charging (prepaid and postpaid) schemas. The WiTech WROP|Suite features also an integrated state-of-the-art NMS supporting the SNMPv1, SNMPv2c, SNMPv3 standards and capable of managing outage, event/notification, performance, etc.

Effective Support of Wholesale and Retail Business Models

With the WiTech WROP|Suite, different flavors of Wholesale (Carrier and White-Label) and Retail business models can be effectively implemented, supporting multilevel business partner value chains including VNOs and Master Reseller/Resellers. Through dedicated portals, each business partner in the value chain can define its own service offerings and price lists and manage its down-stream value chain up to the end-customer directly on the WROP|Suite platform. This provides the operator with a powerful channel-opener facility, giving its business partners the opportunity to rapidly offer their own brand service with a refreshingly low entry threshold.

Quick Service Definition and Provisioning

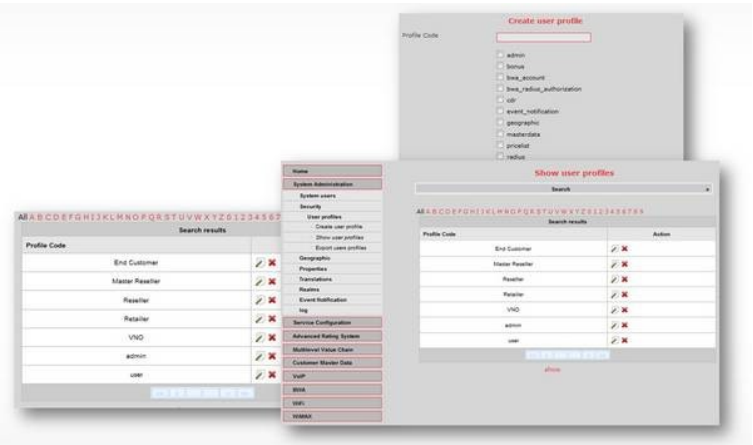
The WiTech WROP|Suite provides operators with a convenient facility for quick service definition and provisioning. Repository of pre-provisioned network resources and templates of service profiles and service levels allows one-click account activation.

Powerful Real-Time Rating

The WiTech WROP|Suite features a powerful rating engine capable of metering and charging access and service consumption in real time. Both prepaid and postpaid charging models can be implemented for a variety of service offerings with an advanced management of price lists, discount campaigns, etc.. At the core of the rating engine there is a flexible threshold-based algorithm handling absolute and relative time intervals, data traffic, geographical destinations (e.g., for VoIP over WiMAX services), fixed charges and connection set-up fees, and bonuses. The rating engine can support electronic and physical pre-paid voucher accounts. The real-time characteristics of the rating to engine can also help operators enforce effective fraud prevention and detection policies.

Easy-to-use GUI

The rich set of admin and user functionalities offered by the WiTech WROP|Suite can be easily accessed through a neatly organized GUI. In particular, key admin activities such as those for the creation of new price lists, new policy function profiles, new reports, etc., are made very easy. An integrated access control functionality manages the different operational roles profiles securely and seamlessly.



Advanced Authentication

The platform is compliant with the WiMAX Forum-specified authentication EAP protocols and other popular protocols such as UAM, PPPoE, PAP, EAP with EAP-MD5, EAP-SIM, EAP-TLS, EAP-TTLS, EAP-PEAP, and Cisco LEAP EAP sub-types.

Template-based Policy Function

A flexible template-based service profile management allows a simplified handling of WiMAX standard and vendor-specific RADIUS attributes. The WiTech WROP|Suite supports dynamic CoA and dynamic session termination.

Expedient Mediation

All metering and charging data are mediated and can be expediently exported from the platform as simplified CDRs in the most common data formats, including CSV, XML, and .xls for an easy feeding of almost every existing Billing and Invoicing system.

Convenient Reporting

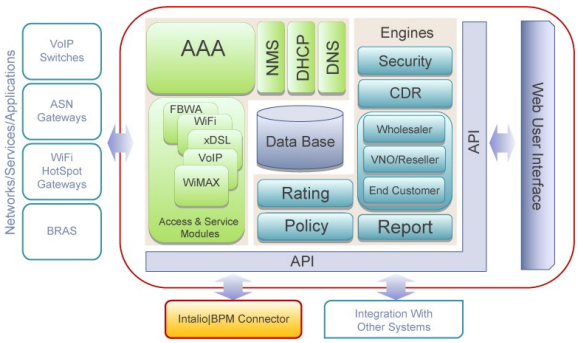
Exploiting the integrated RDBMS, a comprehensive and convenient reporting facility can provide instant system and business views, easily accessible through a number of pre-built dashboards. Additional customized dashboards can be easily added.

Compliant with Regulations

The platform meets government regulations about keeping track of data an voice traffic (according to EU Directive 2006/24/EC), with configurable levels of event logging, online log inspection, export of logs, etc.

Scalability and Reliability

The WiTech WROP|Suite is a Java-based, SOA implementation that fully leverages the Java EE 5 (Java Platform, Enterprise Edition 5) most advanced features to provide the highest levels of scalability, reliability and efficiency of use, including clustering, load balancing, and transparent failover. A full-function RADIUS/AAA server can reliably handle even the busiest networks managing authentication, authorization, accounting and service delivery. All critical operational data (security, price lists, event logs, accounts' master data and charging data, etc.) are safely stored in a central repository deployable on any standard JDBC-compliant RDBMS, including popular open source systems such as PostgreSQL and MySQL. Also the GUI is a JavaServer Faces-based, AJAX-enabled web user interface implementation deployable on any Java EE 5 certified application server.

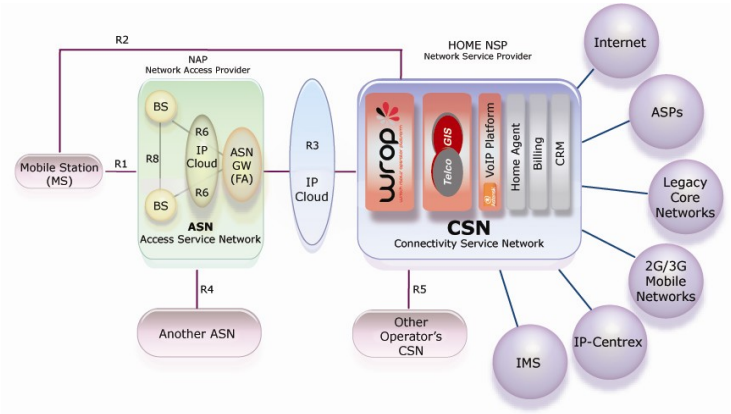


Easy Integration

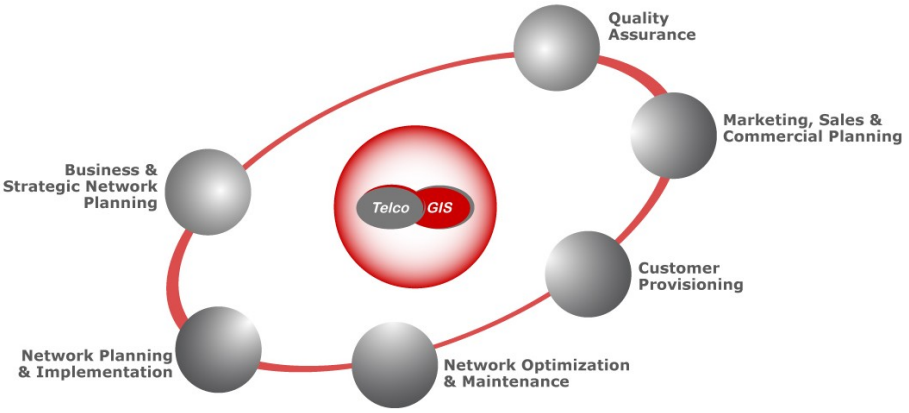
The WiTech WROP|Suite is an open system with a rich set of standard-compliant APIs (Web Services and Java RMI) enabling an easy integration into new and existing OSS/BSS environments connecting it to a variety of external systems, including Provisioning, CRM, Mediation, Billing, Invoicing, and Payment systems, SMSC, User Data Bases, Self-service Portals, etc.. The platform is also natively integrable with Sun OpenSSO Enterprise to achieve advanced, flexible and convenient security, for both the User Interface (Web Single Sign On) and the APIs. Last but not least, through its own dedicated connector developed by WiTech, the WiTech WROP|Suite platform is also natively pluggable into the Intalio|BPM - Enterprise Edition platform for the easy implementation of advanced BPM-enabled, Next-Generation OSS/BSS systems supporting the full integration, automation and control of key operational processes.

Second Step: enriching the WiMAX CSN with WiTech TelcoGIS|Suite

As a further step, enriching the CSN configuration, also the **WiTech TelcoGIS|Suite** platform and a VoIP platform (e.g., an Asterisk-based system) could be added to the configuration and connected to the WROP|Suite platform through standard Web Services.



The WiTech TelcoGIS|Suite is an integrated Web-GIS platform developed by WiTech to help telco operators and service providers to address their key operational needs. It makes available a powerful and flexible foundation to implement a number of applications and services in different areas, including business & strategic network planning, network panning & implementation, network optimization and maintenance, customer provisioning, marketing, sales & commercial planning, quality assurance. An key application provided by the TelcoGIS|Suite is the "Coverage Check", for an efficient and speedy verification of the type of coverage the customer has, before signing the contract, and for the proper choice of type of User Terminal (outdoor, indoor, indoor with windows antenna, USB dongle, etc.).

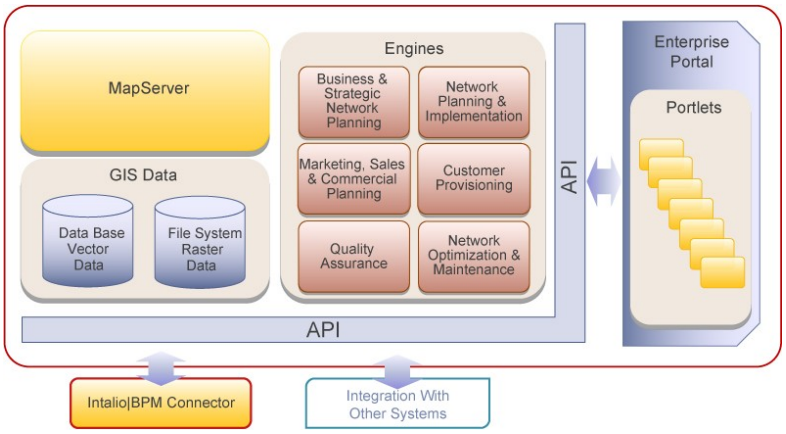


Easy-to-Use GUI

The rich set of admin and user functionalities offered by the WiTech TelcoGIS|Suite platform can be easily accessed through a neatly organized GUI. In particular, key admin activities such as import and export of raster and vector data, grouping and management of layers, dynamic spatial queries, etc. are made very easy. An integrated access control function manages the different operational roles profiles securely and seamlessly.

Scalability and Reliability

The WiTech TelcoGIS|Suite is a Java-based, SOA implementation that fully leverages the Java EE 5 most advanced features to provide the highest levels of scalability, reliability and efficiency of use, including clustering, load balancing, and transparent fail-over. All geographically-oriented data are safely stored in a integrated central repository built around the specialized PostGIS data base.

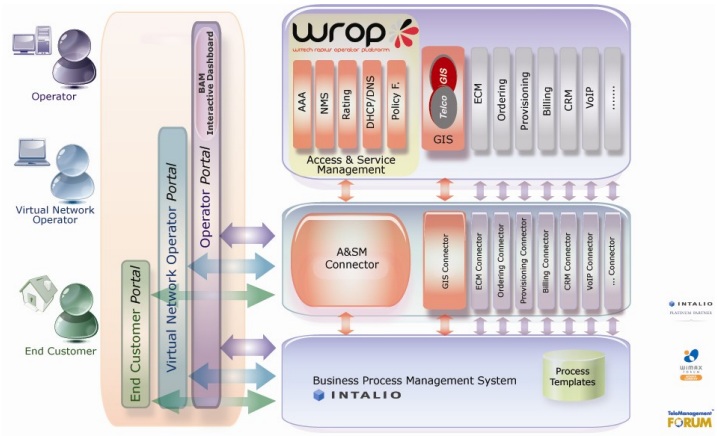


Easy Integration

The WiTech TelcoGIS|Suite is an open system with a rich set of standard-compliant APIs (Web Services and Java RMI), enabling an easy integration into new and existing OSS/BSS environments and connecting it to a variety of external systems, including Inventory, Provisioning, CRM, User Data Bases, Self-service Portals, etc.. Also the GUI is a very modular implementation built with standard Portlet technology, natively pluggable into every Liferay-based Enterprise Portal. Liferay is the world's leading open source portal platform powering portal solutions for leading enterprises around the world. Furthermore, the platform is natively integrable with Sun OpenSSO Enterprise to achieve advanced, flexible and convenient security, for both the User Interface (Web Single Sign On) and the APIs (Web Services and Java RMI). Last but not least, through its own dedicated connector developed by WiTech, like the Witech WROP|Suite, the WiTech TelcoGIS|Suite platform is also natively pluggable into the Intalio|BPM - Enterprise Edition platform for the easy implementation of advanced BPM-enabled, Next-Generation OSS/BSS systems supporting the full integration, automation and control of key operational processes.

Third step: integrating and orchestrating all WiMAX CSN systems and processes with WiTech BPM-enabled Next-Generation OSS/BSS Framework

As a third step, in a more sophisticated type of CSN configuration, all systems in and around the CSN, including existing legacy systems, and the related supporting processes can be conveniently integrated and orchestrated using the ***WiTech BPM-enabled Next-Generation OSS/BSS Framework™***.



This is a integration framework conceived by WiTech with the aim of supporting the next-generation telco operators and service providers deploying and managing their networks, allowing full integration, automation and control of key operational processes.

The WiTech BPM-enabled Next-Generation OSS/BSS Framework offers the highest level of flexibility to adapt to the specific environment of a telco operator or service provider, easily integrating, with an open-ended, loosely-coupled approach, through dedicated connectors, with the other typical OSS/BSS systems (e.g. Ordering, Provisioning, CRM, VoIP, Billing, etc.) and with specific third-party systems and legacy systems, thus preserving existing investments.

The WiTech BPM-enabled Next-Generation OSS/BSS Framework has been designed according to the TM Forum's NGOSS/eTOM guidelines, utilizing the SOA paradigm and Web Services. At the core of it there is the Intalio|BPM Enterprise Edition platform, a SOA, Web Services-based implementation.

The Intalio|BPM Enterprise Edition platform provides all the components required for the modeling, design, deployment, and management of any process. In particular, it features an advanced designer environment for process modeling and design, a powerful server run-time environment with an integrated human workflow engine, and a number of pre-built connectors, also based on Web Services, for the integration of external systems and environments (WSDL, JDBC, XForms, SMTP, POJO, JMS, LDAP, SAP, etc.).

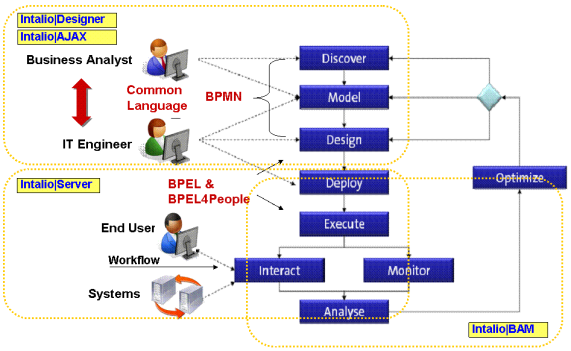
The Intalio|BPM Enterprise Edition is fully compliant with the latest relevant standards in the marketplace, including BPMN, XForms, BPEL 2.0, BPEL4People, WSDL, etc.. In particular, BPMN and BPEL today make up the most widely used BPM standards in the industry. This is important since today's telco operators and service providers need to avoid investing in proprietary solution that could take them down a technical dead end.

The Intalio|BPM Enterprise Edition basic set is made of two core components

- Intalio|Designer
- Intalio|Server,

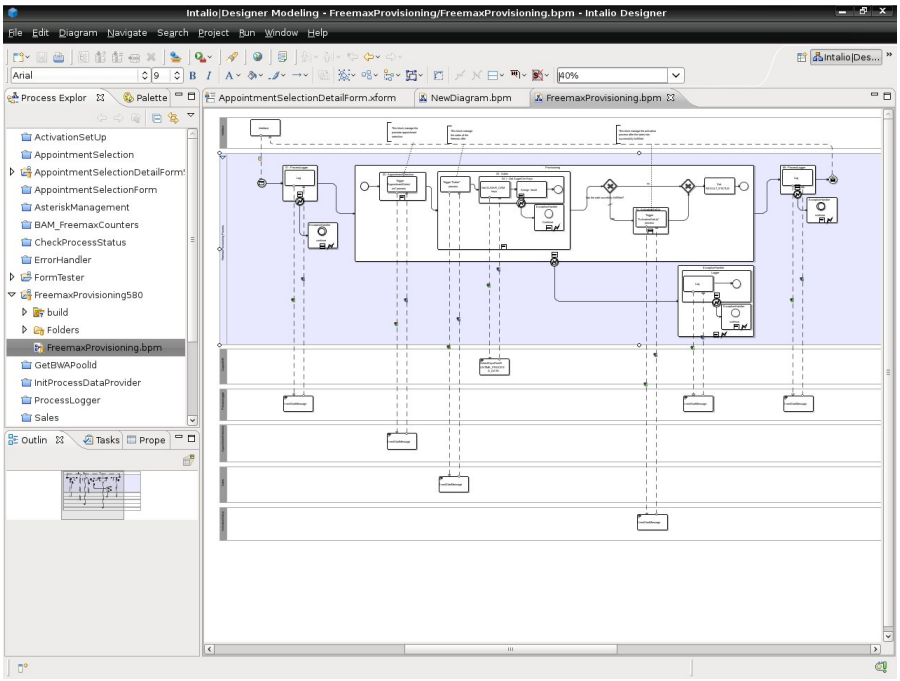
The basic set is then extended by a collection of optional modules:

- Intalio|AJAX – to develop rich user interfaces for Workflow and BAM
- Intalio|BAM – to define and track KPI in real-time for Business Activity Monitoring.
- Intalio|BRE – to increase process agility with an integrated business rules engine.
- Intalio|ECM – to manage document centric processes.
- Intalio|ESB – to integrate business processes through a Service Oriented Architecture.



The Intalio|Designer

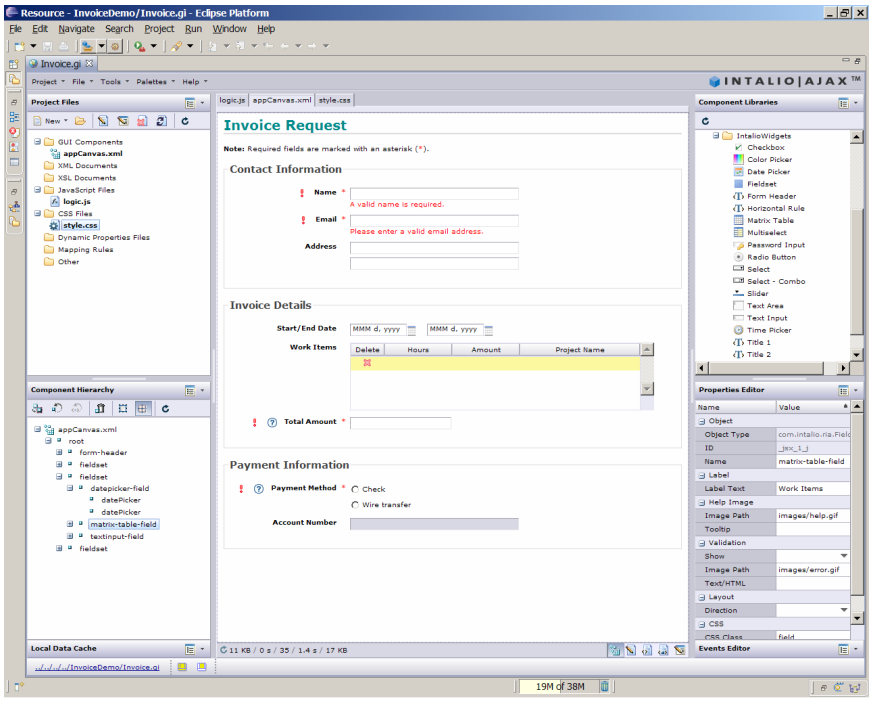
The Intalio|Designer offers a single tool that is used by business analysts, software engineers, and system administrators for supporting the modeling of business-level processes, their binding onto external systems and user interfaces, and their deployment onto Intalio|Server respectively. Intalio|Designer is the only tool currently available on the market that allows any BPMN model to be turned into fully executable BPEL processes without having to write any code ("Zero Code Process Design"). Thus, customers never need to write any code when using Intalio|Designer, for it is capable of translating any BPMN diagram into fully-executable BPEL 2.0 processes. Once a BPMN process has been modeled, bound to external systems and linked to workflow tasks — all activities performed through intuitive graphical metaphors and simple wizards — a single click validates the process, generates the code, checks for all dependencies, deploys all artifacts onto the Intalio|Server, making the process up and running in an instant.



Intalio|Designer generates all the code that is needed to support the execution of the business processes in BPEL 2.0. It also generates WSDL and XForms for the human-centric processes. Intalio|Designer embeds a Forms Designer to create forms graphically and integrate them with process models to support user tasks. The "one-click deployment"™ allows IT Engineers to directly deploy and test their processes on their development environment from the Intalio|Designer, without requiring any extra step nor configuration.

The Intalio|AJAX

The Intalio|AJAX is an IDE used for the development of real-time user interfaces. Intalio|AJAX is based on the open source version of TIBCO General Interface™. General Interface is an open source project focused on enabling rapid creation of reliable AJAX applications, components and portlets, with the look and feel of desktop graphical user interface applications. General Interface is aligned with the industry movement towards HTTP data services. Accordingly, General Interface is intended to communicate with XML, SOAP, JavaScript and other HTTP accessible services, both at a simple level, or as part of larger SOA implementation.



The Intalio|Server

Intalio|Server is a native BPEL 2.0 process server based on the J2EE architecture and certified for a wide range of hardware platforms, operating systems, application servers, and database servers. It also includes a web based management console to administrate deployed processes and monitor process execution. Intalio|Server has full transactional support including atomic scopes and automatic rollback and is designed for highly available environments through failover and load-balancing.

Intalio|Server is a native implementation of the new BPEL 2.0 standard, which added support for distributed transactions and human workflow through standard extensions. This makes the BPEL execution model suitable for large enterprise applications, but significantly more difficult for software vendors to implement. Intalio|Server relies on the ODE BPEL Compiler to translate any BPEL processes into "process bytecode" that can be natively executed. This execution model removes the need for custom Java classes generation and deployment, thereby improving performance significantly.

The Intalio|Server includes an advanced Workflow Framework for the execution of human workflow tasks. This component is based on the BPEL4People standard, and supports the definition and execution of virtually any workflow patterns. The Workflow Framework is responsible for managing the life cycle of human workflow tasks, including assignment, role to user resolution, deferred completion, delegation, and alert escalation. Custom life cycles can be modeled as BPMN processes, and the framework can be extended in order to support advanced concepts such as activity-based costing or resource allocation and utilization. The Workflow Framework's components are exposed through Java interfaces, REST interfaces, and WSDL services, which can be used for integration with end-user applications.
At runtime, the Workflow Framework provides end users with a web based task management application that is fully customizable and provides security through a global Role Based Access Control interface that supports LDAP and SSO.

The Intalio|BAM

The purpose of BAM is to provide real-time information about the status processes, activities, and transactions, through the definition of KPI, and the presentation of real-time dashboards. Intalio|BAM provides a powerful framework for the definition of KPIs and the instrumentation of processes at design time, the dynamic configuration of scalable data repositories at deployment time, the capture of events and metrics at runtime, and the presentation of dashboards in a real-time fashion. Intalio|BAM is based on a powerful Metrics Editor used to define Key Performance Indicators, a WYSIWYG Report Designer, and connectors to third-party systems in order to support the inclusion of external variables in composite metrics and KPIs. All components are tightly integrated into Intalio|Designer, while real-time dashboards can be served through Intalio|Portal or any web server, and static reports stored on Intalio|ECM. Users can also integrate third-party reporting tools that may enhance the visual representation of the information, such as Business Objects Crystal Reports.

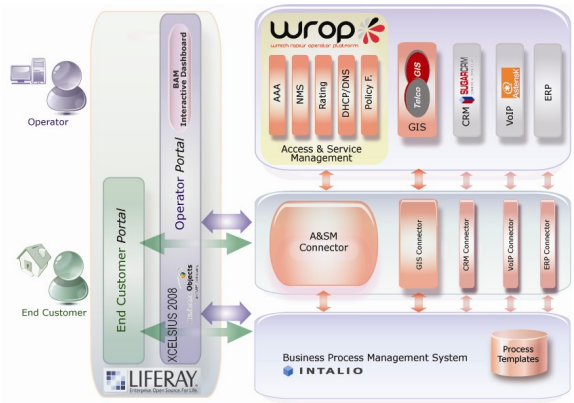
WiTech is Intalio's Platinum Partner focused on the Telco industry.

3 Reference Case

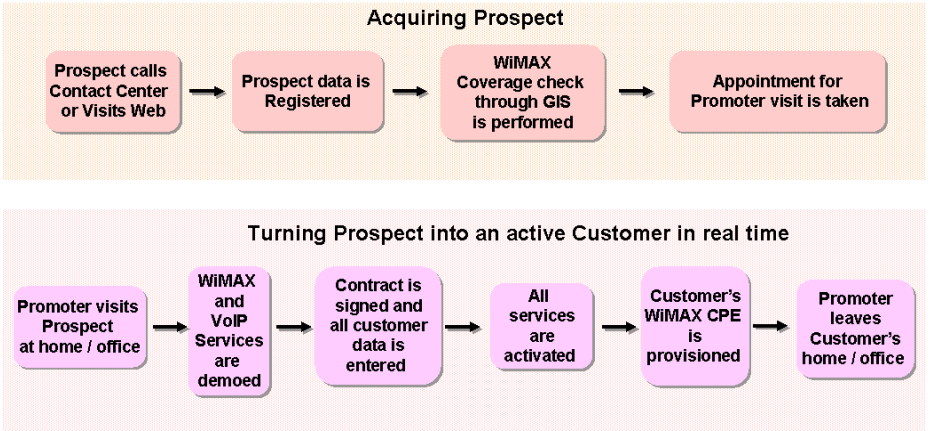
Freemax (www.freemax.net) is a recently established WiMAX operator in Italy that has adopted an innovative hybrid VNO / "infrastructured ad hoc network" operator business model. Freemax addresses the residential/soho market segment as a VNO reselling the white label offering of a major Italian Mobile WiMAX wholesaler operator in the licensed 3.5 GHz band; whilst it addresses the business market segment (mainly SMEs in industrial districts) with its own Fixed WiMAX network infrastructure operating in the 5.6 GHz unlicensed band.

WiTech has built the entire Freemax operating platform utilizing the BPM-enabled Next-Generation OSS/BSS Framework. On the Intalio|BPM Enterprise Edition platform were connected the WiTech WROP|CSN, the WiTech TelcoGIS|Suite, a SugarCRM CRM system, an Asterisk-based VoIP platform, and an ERP system from TeamSystem, a leading Italian supplier of general ledger and accounting systems. The platform has a portal-based front-end built with the Liferay Portal.

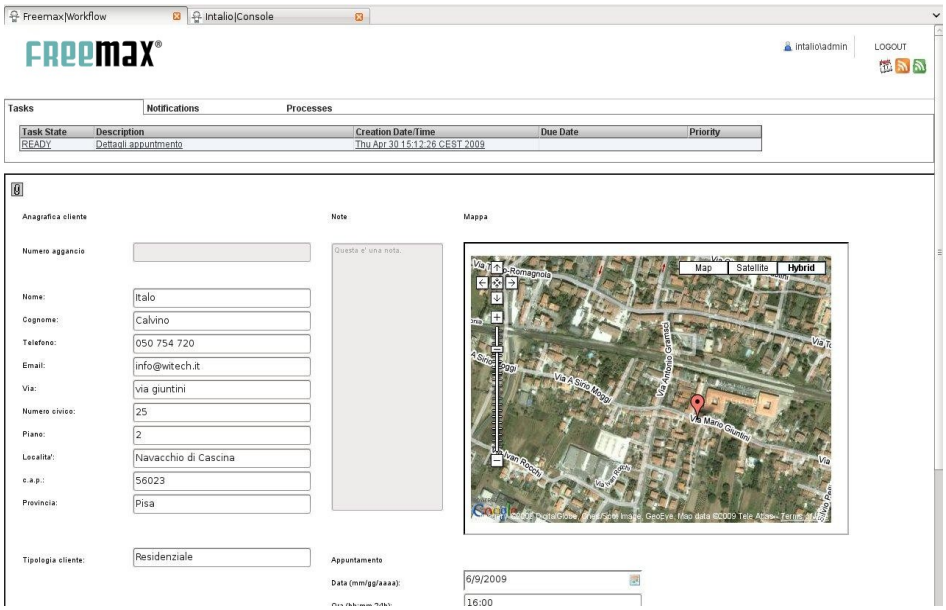
The Freemax operating platform is supporting the full automation of key processes in the FAB area.



One key process that was first automated for Freemax was the "Prospect-to-Customer" process for the residential/soho market segment, where prospects are attracted to visit the Freemax Web site or to call the Freemax contact center with focused marketing campaigns.



When a prospect gets in touch, his/her data is registered on the SugarCRM system and a coverage check is performed in real-time using the TelcoGIS|Suite platform (loaded with the necessary layer of geodata derived from the Network Radio Planning and Network Optimization activity). If the coverage check is positive, an appointment for a visit by a promoter is taken. The appointment is tentatively assigned to one of the promoters responsible for the area, who accepts it logging into the Freemax Liferay-based portal. Then the promoter visits the prospect at the fixed date bringing samples of the user terminals suggested by the coverage check.



When visiting the prospect, the promoter performs a demo of the different service bundles and when the prospect signs a contract to become a customer, the promoter completes the input of all customer's master data, choice of service bundle, payment methods, etc. accessing the Freemax Liferay-based portal. Once the data entry is completed, still through the orchestration capabilities of the Intalio|BPM system, all systems in the Freemax operating platform are aligned: the customer record on the SugarCRM is updated, the choice of services is activated on the WROP|CSN and the Asterisk-based VoIP platforms, the ERP system is loaded with the relevant customer data and, finally, also the user terminal is provisioned. By the time the promoter leaves the premises, the new customer is already accessing Internet and making phone calls through the WiMAX network.

The Freemax "Prospect-to-Customer" process was end-to-end modeled, designed and deployed using the Intalio|Designer, part of the Intalio|BPM Enterprise Edition platform.

4 Conclusions

Building the CSN is a critical piece of the network deployment that cannot be handled as a "Second Step" matter, nor reduced to the single question of selecting the right AAA server. When building the CSN, the WiMAX operator should properly address a number of possible clear as well as hidden issues, taking into account a number of key requirements.

WiTech offers a Fast Deployment WiMAX CSN™ solution devised to help operator timely deploying a future-proof CSN with a stepped approach, one platform at time and taking into account the specific needs, priorities and timing of the operator. This solution quickly gets the key functionalities the operator needs to commercially launch its WiMAX network and so accelerates the never-enough shortened "time to customer". All at an affordable initial investment and a no-surprise TCO.

Acronyms

AAA	Authentication Authorization Accounting
API	Application Programming Interface
ASN	Access Service Network
BAM	Business Activity Monitoring
BPEL	Business Process Execution Language
BI	Business Intelligence
BPM	Business Process Management
BPMN	Business Process Management Notation
BSS	Business Support System
BWA	Broadband Wireless Access
COA	Change of Authorization
CRM	Customer Relationship Management
CSN	Connectivity Services Network
EAP	Extensible Authentication Protocol
FAB	Fulfillment, Assurance, Billing
GIS	Geographic Information System
GUI	Graphical User Interface
KPI	Key Performance Indicator
IDE	Integrated Development Environment
LEAP	Lightweight Extensible Authentication Protocol
NGN	Next Generation Network
NGS	Next Generation Services
NMS	Network Monitoring System
OSS	Operation Support System
PAP	Password Authentication Protocol
PEAP	Protected Extensible Authentication Protocol
PPPoE	Point-to-Point Protocol over Ethernet
QoS	Quality Of Service
SIM	Subscriber Identity Module
SOA	Service Oriented Architecture
SSO	Single Sign-On
TCO	Total Cost of Ownership
TLS	Transport Layer Security
TTLS	Tunneled Transport Layer Security
UAM	User Access Module
VoIP	Voice Over IP
VNO	Virtual Network Operator
WiFi	Wireless Fidelity
WiMAX	Worldwide Interoperability for Microwave Access

About WiTech

WiTech, founded in 2003 as a spin-off of the University of Pisa , Italy, has become shortly one of the most interesting reality in the Next Generation Networks/Next Generation Services (NGN/NGS) scenario, with a focus on BWA (Broadband Wireless Access) and standard technologies like 3G/HSXPA, WiMAX and 4G/LTE.

In the consulting & engineering area, thanks to its in-depth expertise, WiTech provides the market with high-value services ranging from strategic consulting on investment plans to engineering services for network design and network planning.

On the solution side, the company is engaged in the development of specialized business case analysis tools, capable of performing thorough technical-economic analyses of wireless initiatives in an integrated manner, and in the development and integration of innovative BPM-enabled NGOSS/BSS (Business Process Management-enabled Next-Generation Operation Support System/Business Support System) frameworks and components, aimed at allowing more automation and better control of key telecommunications processes.

WiTech is a Regular Member of the WiMAX Forum and a Member of the TM Forum.

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