IP Core Expertise From WireIE

Leveraging the IP Network Core to Enrich Broadband Access

Growth in the adoption of broadband network access is expected to continue on a worldwide basis for the next several years. Whether its wireline or broadband wireless access, inherent in this trend is the opportunity to leverage the power, flexibility and cost efficiency of an IP network core. An IP core opens the door to a vast and varied array of new and enhanced services.

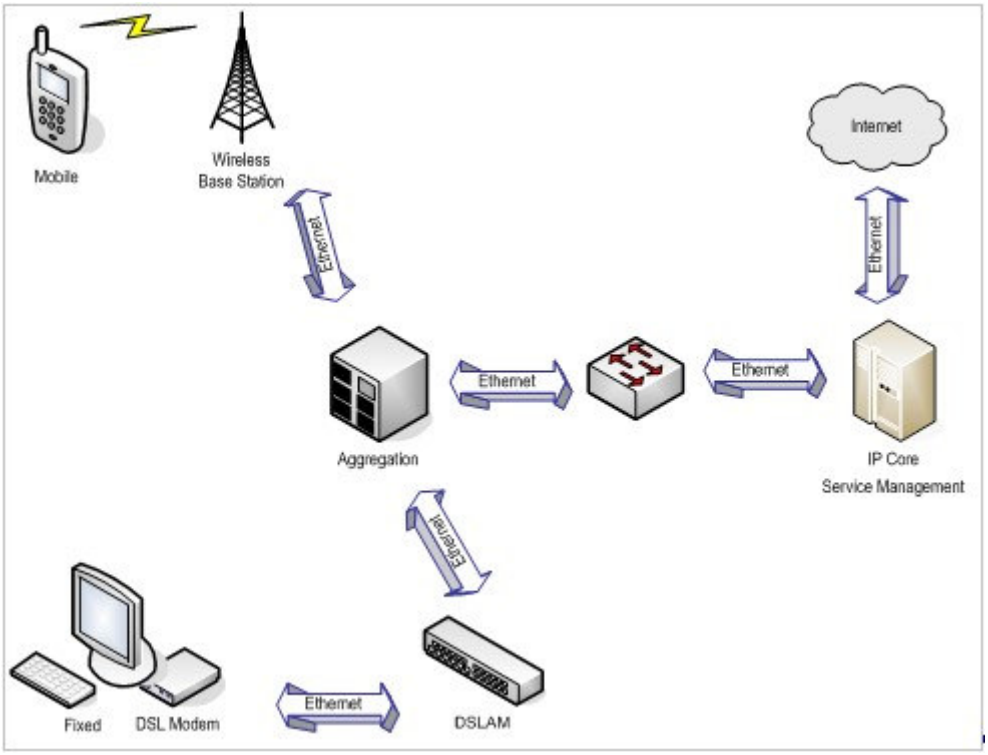
Core Network Support for Broadband Access: The IP Advantage

Circuit-switched legacy networks are rapidly converging with or being supplanted by IP core networks, opening users to a limitless array of applications and services via broadband connections. 'Always on' connectivity has become a consumer expectation and a fundamental characteristic of emerging broadband technology. In parallel, devices are becoming more powerful and more varied as users continue to assert their expectation of multiplatform support for their favorite applications. Consumers also want the quality of their rich broadband wireline connection to be available to them wirelessly, and with mobility. Three fundamental service categories emerge from the opportunity afforded by an all-IP network:

- Traditional voice
- Data services – *conventional* web interaction supported by a browser
- Multimedia, gaming etc. (applications requiring high network bandwidth, data-intensive coding and decoding. E.g.: HDTV)

Business requirements such as multilevel SLA VPNs also remain prevalent in the service mix.

As bandwidth demand increases, user expectation to pay less per unit bandwidth prevails. This cost/revenue inversion creates a dilemma for the operator. The solution lies in the design of the core network.



HIGH LEVEL TOPOLOGY

First mile shows connection of end-user devices to access network resources (both wireline and wireless). The second mile aggregates disparate access elements into a unified IP path back to the network core. At the core, services are managed including voice call management and the provision of multimedia. While Ethernet is depicted as the common mode of connectivity, legacy methods such as ATM and SDH are not uncommon. Media can be fiber, copper, microwave or radio frequency.

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WireIE prides itself on designing access-to-core network solutions which exceed client expectations. Our best-in-class RF design expertise, combined with our depth in core network design, ensure a cost-effective, high performance solution – regardless of whether the objective is an all IP network core, or hybrid solution.

Broadband Wireless access technologies continue to evolve and mature. 3GPP[1] air interface technologies such as HSPDA are offering consumers peak downlink data rates of 7.2 Mbps. Fourth generation technologies such as WiMAX offer up to 40 Mbps[2].

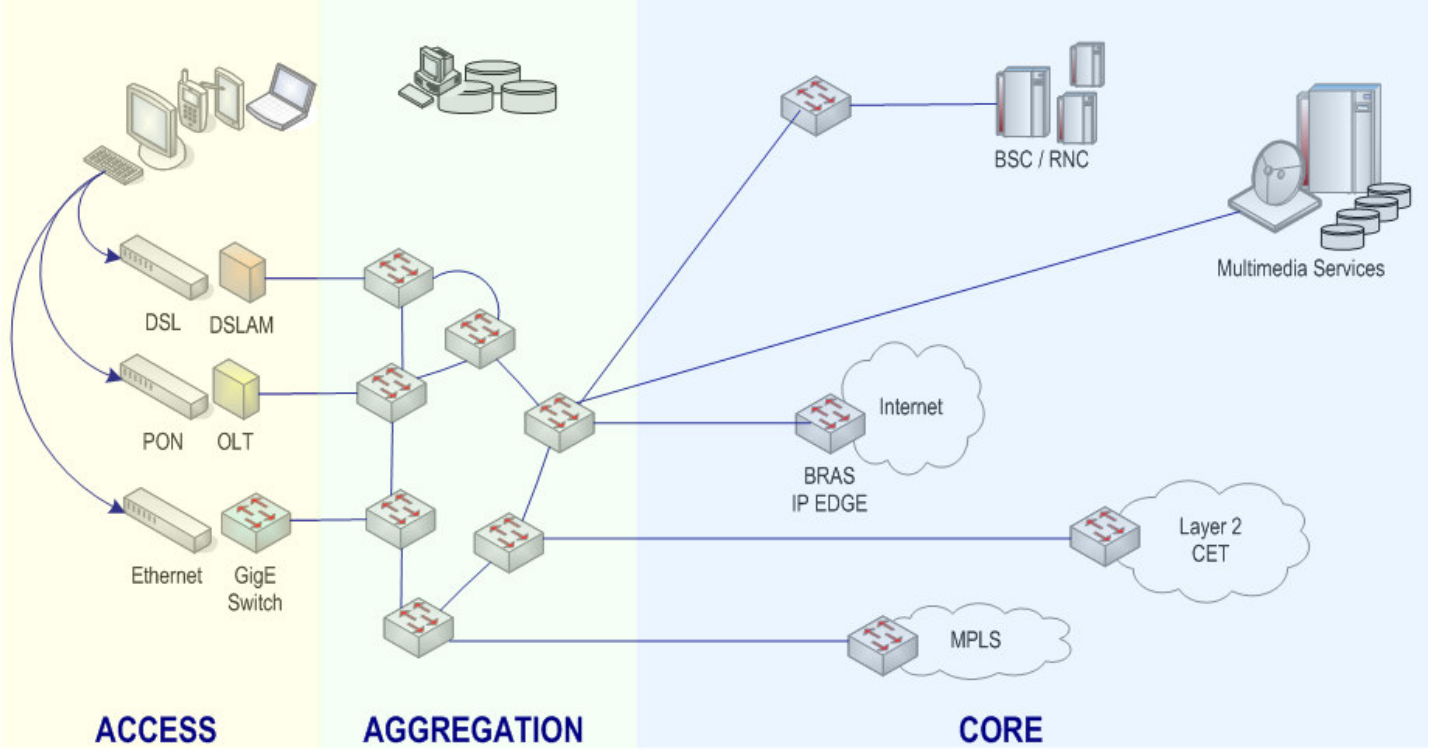
Wireless Broadband Access Technologies

Mode	Downlink Data Rate	Uplink Data Rate
HSDPA (HSPA Evolved)[3]	42 Mbps	11 Mbps
WiMAX[4]	40 Mbps	40 Mbps
LTE[5]	100 Mbps/20 MHz (target)	50 Mbps/20 MHz (target)

These rates force a complete rethink of backhaul and core network design. Traditional channelized time-division (TDM) transport such as T1 and E1 are inadequate from a capacity perspective and lack the flexibility of an IP based environment. While suitable for legacy voice and low to moderate data rates, the demands created by today's large bandwidth access opportunities force a new approach to backhauling, in addition to design at the network core.

IP based backhauling using Ethernet or Passive Optical Networks (PAN) support higher data rates at a significantly lower cost per bit. Today's microwave and optical terminal technologies provide sufficient capacity and offer interfaces for Ethernet exclusively, or a hybrid where legacy T1 or E1 transport can be statistically multiplexed along with IP traffic.

[1] 3rd Generation Partnership Project
[2] Assumption: Peak bit rate, Single User, Time Division Duplex (TDD), 10 MHz bandwidth.
[3] High-Speed Downlink Packet Access
[4] Worldwide Interoperability for Microwave Access
[5] Long Term Evolution



CORE NETWORK

User access is provided through traditional means such as Digital Subscriber Line (DSL), Passive Optical Network (PON) and Ethernet. IP based, metro-wide aggregation is fundamental in providing connectivity between users and the vast array of rich services found in the network core. The IP core can contain elements such as Base Station Controllers (BSC) / Radio Network Controllers (RNC) to support wireless sessions backhauled via IP to the base station. Voice sessions are managed by softswitching/MPLS, while IMS manages multimedia experiences. For next generation networks, Carrier Ethernet Transport (CET) offers a scalable, cost effective approach to offering new, high bandwidth services over optical transport with guaranteed SLAs.

Numerous access nodes can be supported by relatively few IP based edge routers. With Ethernet as the standardized aggregation method, interconnection of network nodes is straightforward. From there, tunnels can be created to support specific configurations such as VLANs (Virtual Local Area Networks). Multi Protocol Label Switching[6] (MPLS) is also available to support networks where circuit switching for legacy services remains a requirement.

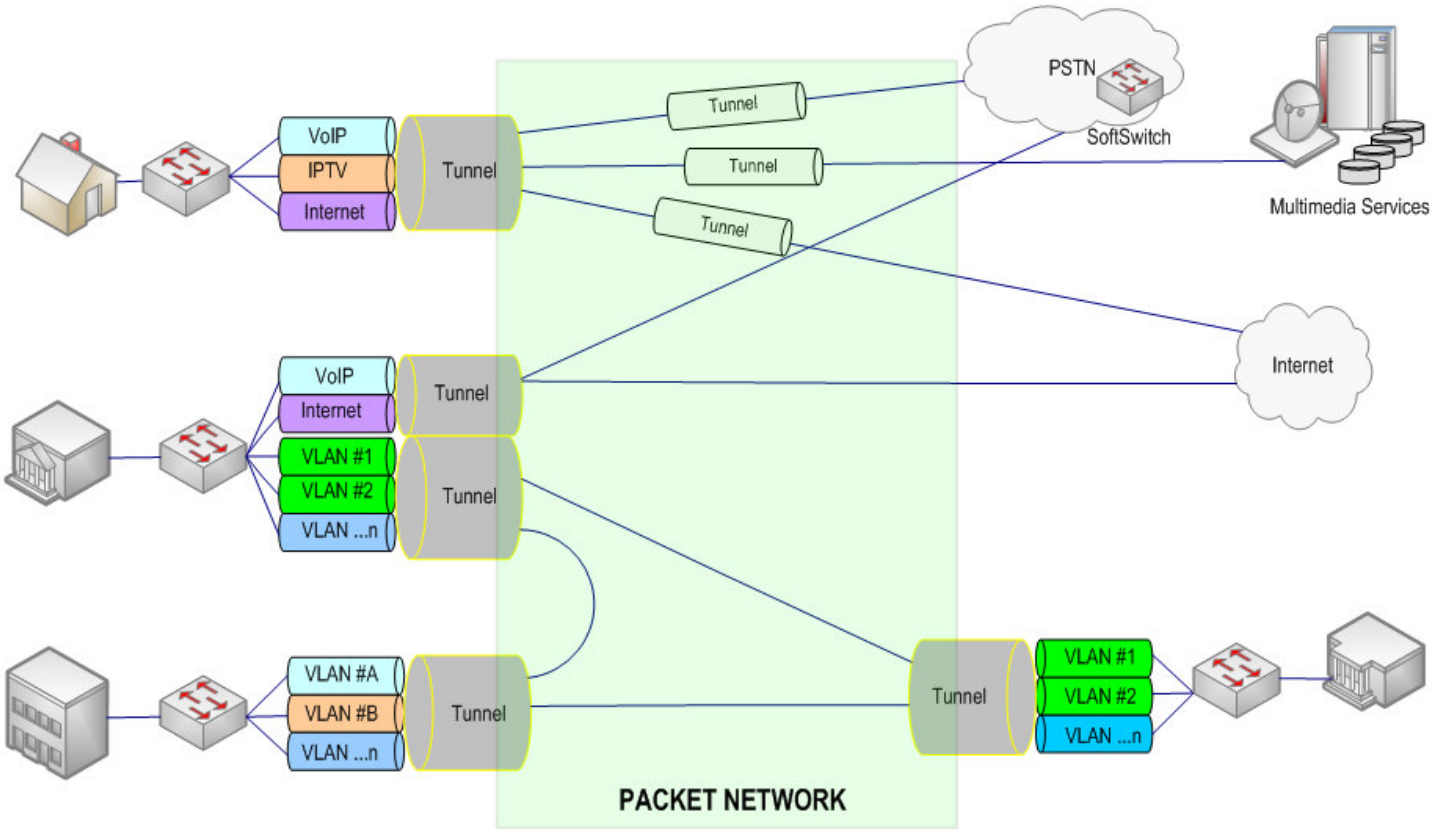
By its very nature, the network now promotes deployment of IP Multimedia Subsystem (IMS) in the core – leading the way to a converged network with a broad array of unified services including VoIP and video can be supported on various subscriber platforms.

[6] MPLS operates in between Layer 2 (data link layer) and Layer 3 (network layer) of the OSI model. It is often referred to as a "Layer 2.5" protocol. It is designed to provide a unified datagram service for both circuit-switched and packet-switched users within the same network environment.

Wireline & Cable Access Technologies

Mode	Symmetry	Maximum Loop Length	Downlink Data Rate
SHDSL.bis (ITU-T G.991.2)[7]	Symmetric	5 km	2.3 Mbps
ADSL2 (ITU G992.3)	Asymmetric	5 km	=/< 12 Mbps
ADSL2+ (ITU G.992.5)	Asymmetric	3 km[8]	=/< 24 Mbps
VDSL2 (ITU-T G.993.2)	Either	< 2km	20-100 Mbps
VDSL2 with DSM L3[9]	Either	=/< 1 km	60-200 Mbps
DOCSIS 2.0	Asymmetric	42.88 Mbps	30.72 Mbps
DOCSIS 3.0 (4 channel)	Asymmetric	171.52 Mbps	122.88 Mbps

IP Tunneling For Security & Quality of Service



IP TUNNELS ALLOW FOR VLANs & Asserting QOS

Inherent in an IP network is the opportunity to create virtual Local Area Networks (VLANs). The operator can also set Quality of Service (QOS) levels on a service-by-service basis.

[7] Single pair High Speed DSL
[8] Throttles down to ADSL2 past 3 km
[9] In order to achieve best data rates at realistic distances the loop in most instances will need to be terminated on FTTC (Fiber to the Curb) or FTTB (Fiber to the Building) terminal equipment.

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About WireIE

As an international wireless professional services company, WireIE specializes in the cradle-to-grave deployment of broadband wireless networks including: Site Acquisition, RF Design, IP Core Network Design, Furnish and Installation of network infrastructure, along with Network Monitoring services and Billing solutions. These comprehensive services are supported by leasing options for the operator. In addition, WireIE offers extensive consulting expertise in enterprise wireless solutions.

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