White Paper

Fixed Mobile Convergence (FMC): Understanding its Evolution, Advantages, and Challenges

Role of Test, Monitoring, and Service Assurance

1.0 Executive Summary

At the core of understanding the promise and importance of the Fixed Mobile Convergence (FMC) trend is one critical step—get familiar with the complex dynamics surrounding how the consumers of today communicate. For example, while the average user today depends on reliability and seamless delivery of mobile communications services as an increasingly integral part of their daily lives, this convenient method is not always the most cost-efficient. Mobile subscriber growth and the number of minutes used annually are rising steadily. Also, people will use their mobile phone when lower cost, fixed-line options are available. As a result, service providers are deploying FMC architectures (the integration of wireline and wireless technologies), which allows their subscribers to rely on only one device with one phone number and one single service provider that offers the lowest cost connectivity option—whether fixed or mobile.

Several critical areas are explored herein that will help operators maximize the full potential of FMC. This paper provides compelling examples of key business drivers and the latest service delivery advantages that FMC gives customers (whether residential, enterprise, or service providers). It also includes a detailed overview of the important fundamentals of FMC, which elaborates on a variety of networks, technical approaches, standards, and service implications. Due to multiple competing standards, several implementation methods are listed with the pros and cons of each one.

Implementing FMC using any of the diverse methods addressed here presents many technical challenges that service providers must understand and manage to achieve successful deployments in an FMC environment. Properly implementing and managing FMC will lower operational costs, diversify competitive service offerings, and ensure that customers enjoy the highest quality of experience (QoE).

The JDSU global leadership position developing systems, portables, and instruments that test and monitor wireless and broadband services such as voice over internet protocol (VoIP) and IP television (IPTV) positions us well to offer perspective on these challenges and strong recommendations to successfully understand and address FMC throughout the entire deployment lifecycle—from lab to end-user experience.

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1.1 The Evolution of FMC

FMC is important to communications services deployment because it merges and wireless mobile services, making it an increasingly viable and beneficial option with its potential to greatly simplify consumers' communications. In the past, people used multiple providers for each service. For example, mobile phone consumers had to purchase their phones from a wireless provider. If the same consumers wanted a fixed-line service, they obtained it from a different wireline operator, resulting in consumers with duplicate phones and multiple phone numbers, each with its respective voicemail box. FMC immediately eliminated the duplication of resources and streamlined consumer communication methods, providing one service with one phone, one phone number, and one voicemail box.

Mobile and fixed-line operators have different motivations for deploying and offering FMC. Mobile operators regard FMC as an effective way to increase the functionality of the mobile handset and to maintain current average revenue per user (ARPU) levels. They understand the importance of providing excellent coverage in the home (poor coverage has been cited as the number one reason consumers switch wireless providers). In conjunction with coverage for residential users, businesses are now dependant on mobility because many employees use their mobile phone as their primary phone within the office; thus making quality of coverage an important factor for businesses choosing a wireless provider. The deployment of an FMC solution ensures mobile operators better coverage for both residential and business customers.

The implementation of FMC will give operators the ability to remove inefficient network silos and provide services that are access-independent, further enabling them to offer new services that can increase ARPU. Although the primary service that is driving the FMC movement is voice, expansion into video gaming and other future services are being considered as inevitable and soon to follow.

Figure 1 shows the FMC evolution complete with network silos that it ultimately streamlines for efficiency. It also shows how the JDSU NetComplete solution provides service assurance across the board.

Fixed-line operators expect FMC to serve as a means of countering substitution and displacement trends. They also expect to reap the operational savings that will result in combining their wireless and wireline networks. To protect against losing customers to wireless offerings, wireline providers must provide a more robust offering of both mobile and broadband services. However, for a majority of tier 1 operators today, these services are managed separately in independent silos.

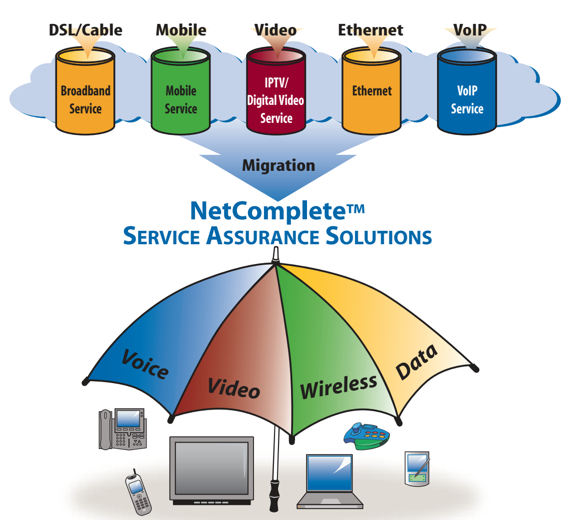

Figure 1 The Evolution of FMC

2.0 FMC Technical Overview

Just as FMC is important in the deployment of communications services, it is equally as complex. Several approaches are available today for deploying and offering FMC that provide critical detail on both the advantages and disadvantages.

2.1 Unlicensed Mobile Access (UMA)

The commonly known UMA technology standard left over from the Third Generation Partnership Project (3GPP)-approved specifications for Generic Access to A/Gb interfaces for 3GPP Release 6 (TS 43.318 and TS 44.318, which was renamed to Generic Access Network, or GAN) gives users access to their local wireless 802.11 network so they can use mobility services in the home. It allows mobile operators to leverage the cost and performance advantages of IP access technologies (digital subscriber line [DSL], cable, and Wi-Fi, among others) when delivering high-quality, low-cost mobile voice and data services in the location where subscribers spend most of their time (typically either the home or office). Using this standard, a dual-mode handset is needed to roam seamlessly between 2G/3G wireless networks and the 802.11 network. When the phone detects an 802.11 network, it will switch to it. The UMA standard defines a new core network element, known as the UMA Network Controller (UNC), and associated protocols that ensure the secure transport of mobile signaling and user traffic over IP. (The UNC is also the element with which the phone communicates when in an 802.11 network.) The phone encapsulates normal wireless protocols into IP packets, the UNC then un-encapsulates them and acts as a gateway into the wireless network, as Figure 2 shows.

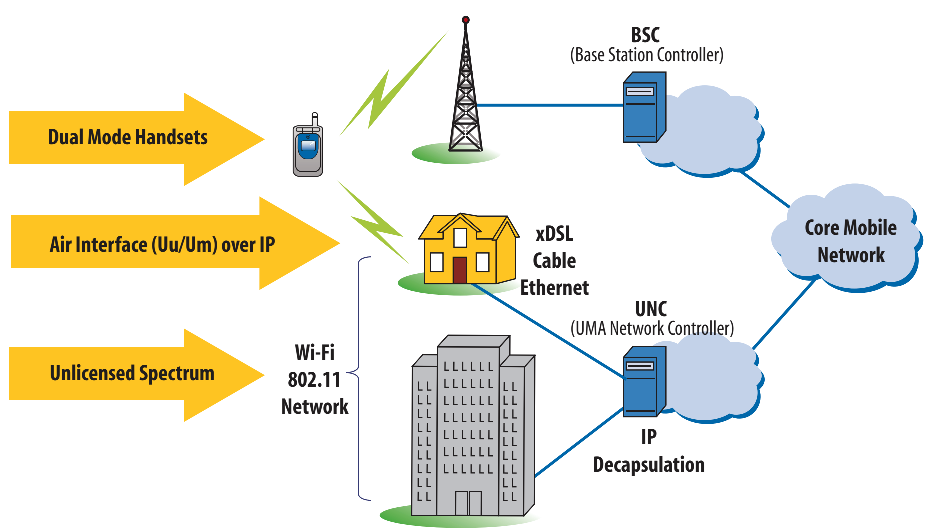

Figure 2 UMA Network

2.2 Voice Call Continuity (VCC)

VCC is a 3GPP-defined specification that describes how a voice call continues/persists even as a mobile phone moves between circuit-switched and packet-switched radio domains (3GPP TS 23.206). As with UMA, VCC is defined to take advantage of broadband and 802.11 networks in homes and businesses. VCC lets the user switch to a strong 802.11 signal in the home or at the office. When the phone detects an available 802.11 signal, it will use session initiation protocol (SIP) to create the voice session over the 802.11 broadband IP network. VCC differs from UMA in that VCC is a SIP-centric approach to FMC.

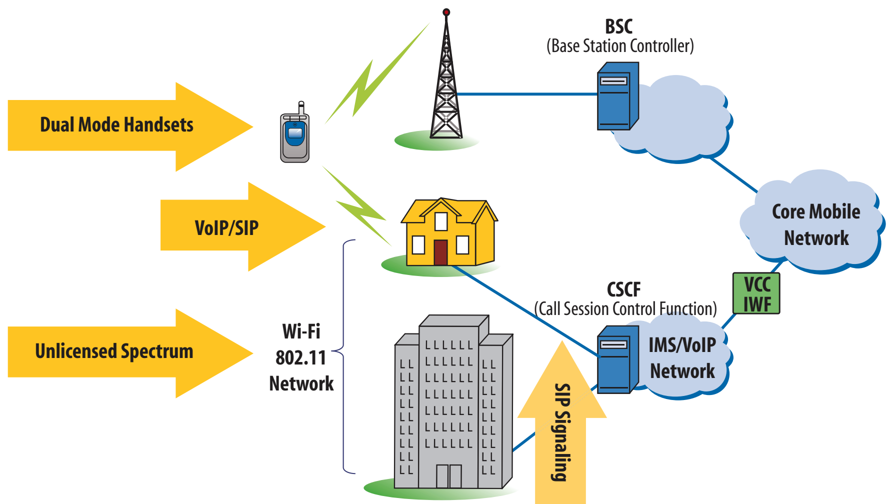

Figure 3 VCC Architecture

2.3 Femtocells

Femtocells are small cellular base stations designed for use in residential or small business environments. Femtocell-based deployments bring several advantages, which include working with existing handsets that use existing wireless technologies for wireless transmission. Femtocells also increase both capacity and coverage while reducing both capital and operational expenditures. Femtocell base stations typically rely on the Internet for connectivity with the back-end based on either UMA or other IP standards such as SIP.

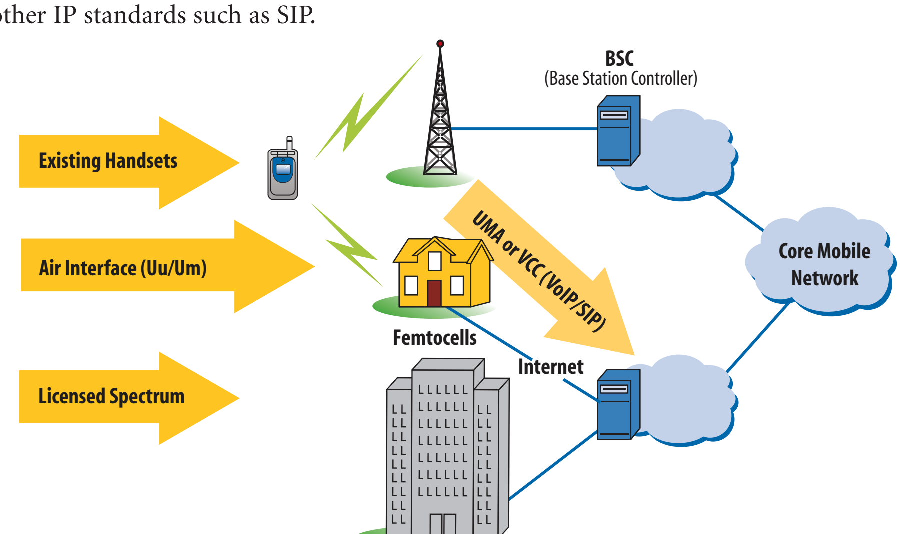

Figure 4 Femtocell

2.4 IP Multimedia Subsystem (IMS)

Service providers today are also considering IMS for their FMC strategy. IMS is a network architecture created by 3GPP that serves as an infrastructure for the delivery of next-generation services. The IMS architecture provides a common platform for IP applications and allows more efficient roll-out of services, thus eliminating the deployment of an entirely new network for each new service (see Figure 5 IMS Architecture). The IMS network consists of the following components: the Call/Session Control Function (CSCF), the Home Subscriber Server (HSS) and the Subscription Locator Function (SLF) databases. The IMS network shown in Figure 5 may seem complicated; however, the boxes in the architecture diagram represent functions, not actual network elements. Multiple functions can be contained in a single network element.

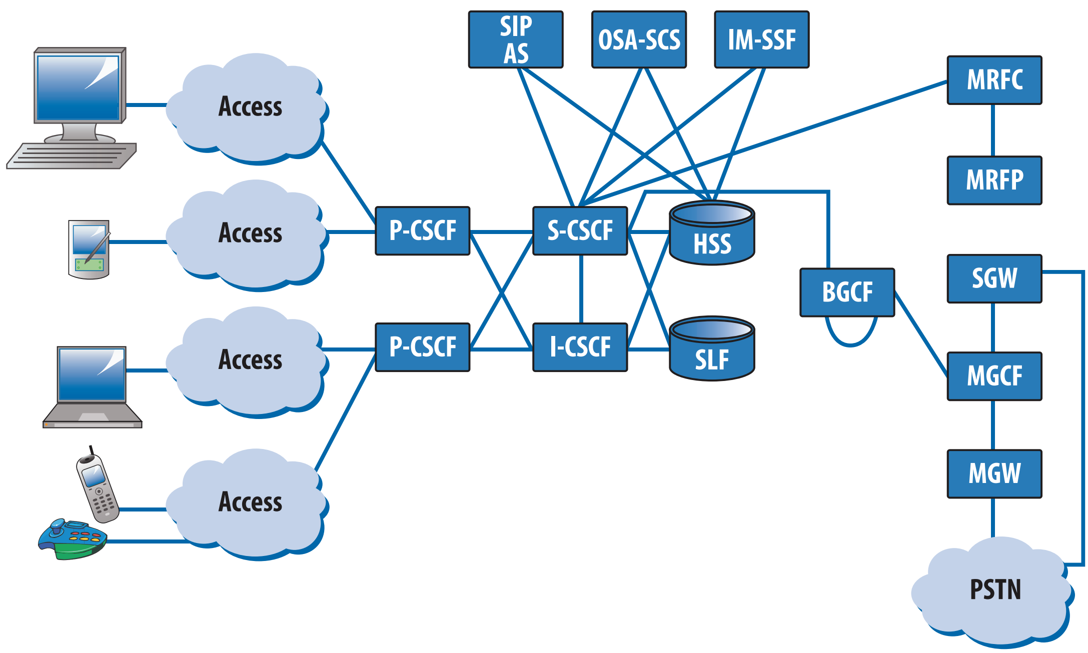

Figure 5 IMS Architecture

3.0 Technical Challenges with FMC

New technologies and methods to deliver communications services, such as FMC, invariably add several challenges that require best practices with which to overcome them. Previously, networks were managed as independent silos, where operators separately tasked several operations groups to manage wireless, broadband, and fixed-line services. These services had boundaries and technicians created tools and processes to address problems occurring within them. With the introduction of FMC and the combining of mobile and fixed-line networks, these management silos are being merged, which blurs the boundaries and makes existing tools and processes less effective. Providers are now challenged with mobility and services that cross boundaries, which operationally creates new problems when looking end-to-end, where the “end” is in a state of change.

3.1 Broadband IP Backhaul Challenges

Many new technologies referenced here rely on IP as the main transport for the service. IP is a proven technology for data services but not for sensitive services dependent on real-time and exceptional performance such as IPTV or VoIP. The highest quality delivery of VoIP service occurs when the provider owns the access and controls the traffic. Yet managing a real-time service still can be a challenge. With FMC, the provider often does not own the access, which results in the network treating all user traffic the same and leaving services such as VoIP, which are more sensitive to network effects such as packet loss and jitter, disproportionately and negatively affected.

In these circumstances, the complexity of managing the service increases. For instance, if the end device is poorly managed, whether it is a phone, femtocell, home gateway, or the access network, the end user could have better coverage in the home but poorer quality because of the IP network.

3.2 Signaling Challenges

Signaling on its own is complex and creates several challenges. Consider the following scenarios. Signaling depends on timing to ensure that packets are received to complete signaling transactions. With FMC several standards pertain to signaling. UMA encapsulates signaling over IP, which could create new timing dimensions that can cause problems. In the best environment, packet loss can cause problems with the completion of signaling transactions. A technology such as VCC depends on SIP signaling technology, which means a network must handle both 3G and SIP signaling which can pose very complex problems. The handover between 3G and SIP is complex as well. In addition, broadband access can cause a wide range of timing issues.

3.3 Home/Office Challenges

The home/office network and its broadband access are critical areas of the network to manage to ensure that services reach the end user with quality. In the home, providers cannot control how users configure their firewall and broadband access; nor can they control such things as electrical appliances, electronic games, or audio/visual (A/V) equipment that also competes for bandwidth. The office environment poses these issues and more with business applications going over the Internet access. Managing the network inside the home or office is critical to ensuring QoE.

3.4 Dual Mode Handset Challenges

As cell phones become more like mobile PCs, problems occur when operating a Dual Mode handset. Cost and power were major concerns when developing handsets; therefore, little memory or processing power was built into them. As providers move toward IP applications, a potential problem is that no standard operating systems exist for handsets. Each implementation supporting the applications can differ enough to cause interoperability issues. The industry is moving toward standardized operating systems for the handsets, but this could take years.

4.0 Testing and Managing Requirements for an FMC Network

When deploying new services, the priority is generating revenue. The role of testing—ensuring that the network and services are functioning properly with tools, software, and systems—is critical to success. Testing often focuses on the network and later it focuses on network elements during installation or deployment. To effectively manage the network and to improve performance and service quality, it is important to create and implement a proactive strategy early for rolling out FMC that includes service assurance management, testing, and troubleshooting. Several areas exist where oversight and poor planning in test, measurement, and service assurance can cause network and service problems. One significant delay in rolling out services is the inability of the service provider to quickly identify and fix a problem that impacts service moving to the next launch phase until its resolution. Such problems can stall the ability to quickly generate revenue. An inability to solve these issues could potentially prevent the service from ever being deployed. Having a strategy from the beginning that addresses quality or roll out issues can ensure successful deployment. Another common mistake is to neglect engineering in the planning process and not properly budget for service assurance tools. Waiting until after the network plan and design have been created—and not taking a proactive approach that addresses the entire lifecycle of the network and service early—can increase costs significantly.

To properly execute FMC deployment, a solid service assurance strategy—one that addresses every phase of the network and service lifecycle—to manage the service is essential. Since services will cross multiple traditional operational groups, providers must define a strategy that eliminates the silos and allows operations groups to work in unison with a common framework and toolset.

When creating a service assurance plan, it is important to have tools and processes that eliminate boundaries and provide an end-to-end view of the service, without recreating the same problems with siloed service assurance tools that are being removed with the deployment of FMC.

5.0 The JDSU Solution for Testing and Managing FMC/IMS

5.1 NetComplete

The JDSU NetComplete portfolio is the umbrella solution including comprehensive Service Assurance Solutions—such as industry-leading test probes, software, and systems—that support worldwide communications providers delivering next-generation network and FMC services. NetComplete provides best-in-class business solutions so service providers can effectively manage the entire lifecycle for quality voice, video, data, and wireless services. It also lets providers manage multiple services over multiple access technologies and removes the siloed approach to ensuring network and service deployment through service assurance methods.

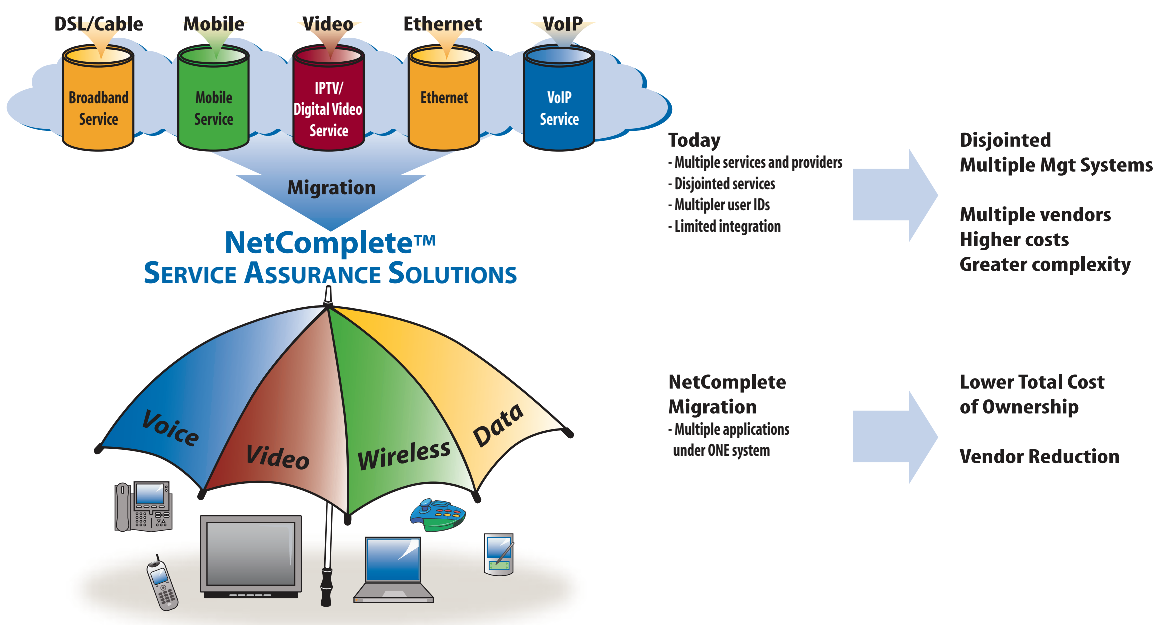

Figure 6 JDSU advantage

5.1.1 NetComplete Service Assurance Solutions Portfolio

NetOptimize
NetOptimize is an operations support system (OSS) that provides data collection, processing, analysis, and reporting for triple-play performance management and capacity planning.

NetAnalyst
NetAnalyst is client/server test management OSS software that controls remote test probes/units that test the entire network. It enables test automation and provides a secure, managed platform for centralized testing of private line, data, and triple-play services.

Home Performance Management (PM)
Home PM provides a suite of monitoring, diagnostic, and troubleshooting tools for the home network and service performance management based on TR-069, TR-135, and TR-104 standards.

QT-600 Ethernet and Triple Play Probe
The QT-600 is a distributed probe targeted at addressing the needs of service providers who deliver and guarantee service-level performance for VoIP, IPTV, and data. The QT-600 uses an affordable distributed approach to provide a total service assurance solution for service turn-up verification, fault isolation, and active and passive performance management.

QT-200 xDSL and Triple Play Probe
The QT-200 xDSL and Triple-Play probe provides an unsurpassed ability to pre-qualify, provision, maintain, monitor, and troubleshoot DSL triple-play services as well as copper loop and plain old telephone service (POTS) lines.

QT-50
The QT-50 provides the flexibility to monitor and rapidly troubleshoot VoIP issues as experienced by the end customer. Easy to implement, a technician or customer can install the software probe on the premises.

Remote Cellular Automated Test System (RCATS)
RCATS is for wireless service providers who must assure efficient service turn-up, troubleshooting, and performance management of subscriber services while minimizing field dispatches and trouble tickets.

6.0 Conclusion
FMC has reached a pivotal stage. It brings service providers an excellent opportunity to enrich their services portfolio, lower operational costs, and engage in a technology convergence that can greatly simplify the way that customers communicate today. To fully take advantage of its potential, an understanding of the complexities, architecture, standards, and challenges that FMC presents is imperative to developing the most effective business, operations, installation, and deployment game plan. The proper test, measurement, and service assurance considerations are closely tied to making FMC a success.

The JDSU test capability—particularly industry-leading service assurance—gives operators an advantage with a complete end-to-end solution that is ideal for FMC over any access with any service.

The JDSU advantages are:

– The only solution that can cover all access technologies under one system to truly provide end-to-end QoE monitoring.

– The strongest media content monitoring for VoIP, video, and data across all technologies in a single system.

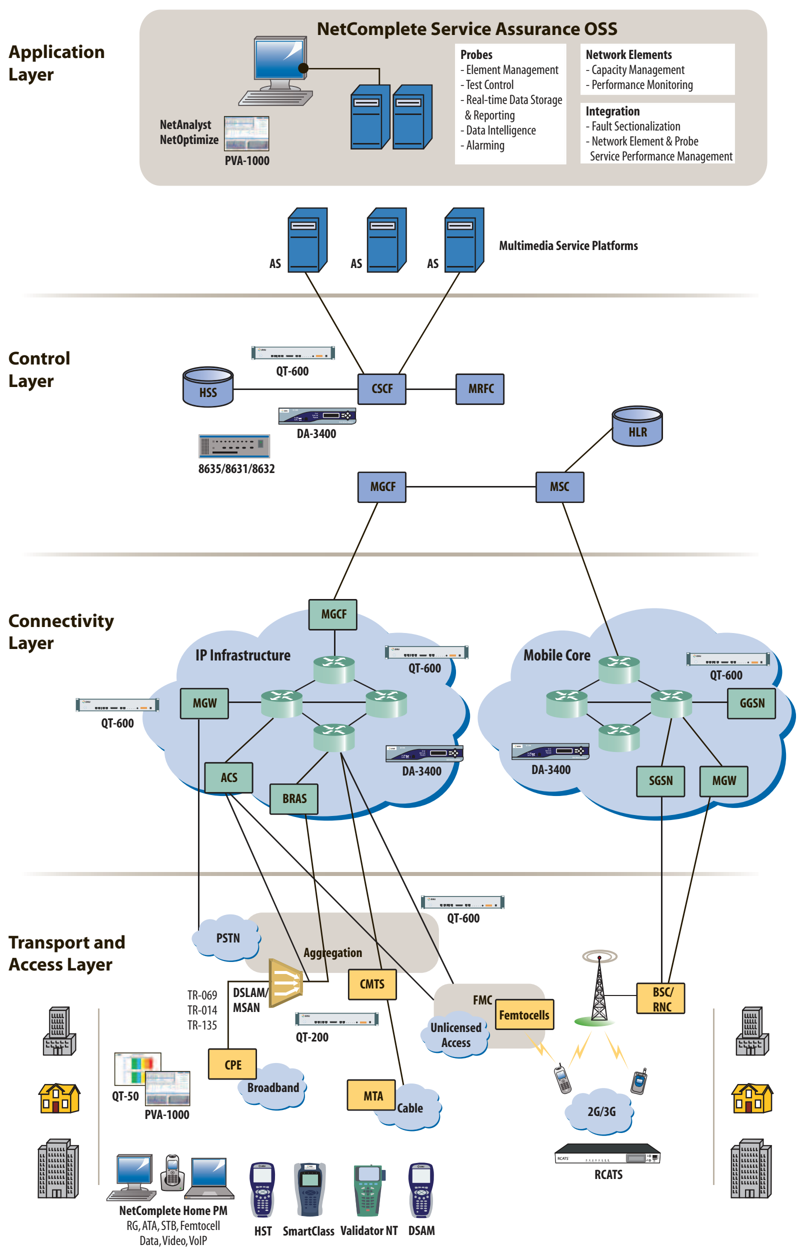

Figure 8 JDSU can provide complete service assurance coverage over an FMC service

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30149348 001 0808 FMC.WP.SAS.TM.AE August 2008