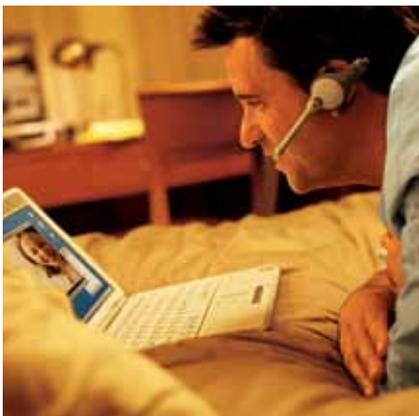# More Reliable Business-Grade VoIP and Broadband Service

Gateway platform overcomes IP network quality of service (QoS) issues

"Guarantee of Service (GoS) is a technology to manage network congestion, the principle cause of loss and delay in IP networks, in a controlled and predictable way."

Peter Thompson
Chief Scientist of GoS Networks

Broadband service is a key component of the communications and information infrastructure for a majority of businesses, large and small. They use broadband to make VoIP calls, manage e-commerce portals, conduct research, transfer files and email, and more. As a result, today's networks are not only handling more data, they are transmitting a wide variety of media streams that are delivering voice, video, media and data content.

Now, service providers can offer customer premises equipment (CPE) that handles IP traffic in a controlled and predictable way. This capability is available on a connected services gateway for the small office market based on the Intel® Atom™ processor and GoS Networks* GoS Gateway* software. GoS Networks software addresses the quality limitations of IP, while retaining the simplicity and flexibility that has made the Internet the technology of choice for delivering new services. This paper describes the key technologies employed in this revolutionary connected services gateway.

Connected Services Gateway

Today's small businesses value all the media and communications services available, but they often find the job of managing them too complex. Simplifying access and control of services, the connected services gateway (CSG) - built with powerful Intel® Architecture Processors – is a single-box, Plug and Play solution that functions as a gateway, server, router and storage device. Consequently, it's easier for businesses to access and manage the wide range of services they currently use, such as phone, internet, security and energy management. Some of the benefits provided by a connected services gateway include:

- Simplifies service provider delivery by creating an established, common, reliable business infrastructure for current and future services

- Reduces complexity by eliminating the need for multiple interfaces and devices, and by presenting a unified interface for accessing various media and communications services

- Provides a central control point that allows small business managers to go to one place and operate, manage and troubleshoot the network

- Protects infrastructure investments with an Intel® architecture-based platform that can run current and future applications for communications, data, security and media
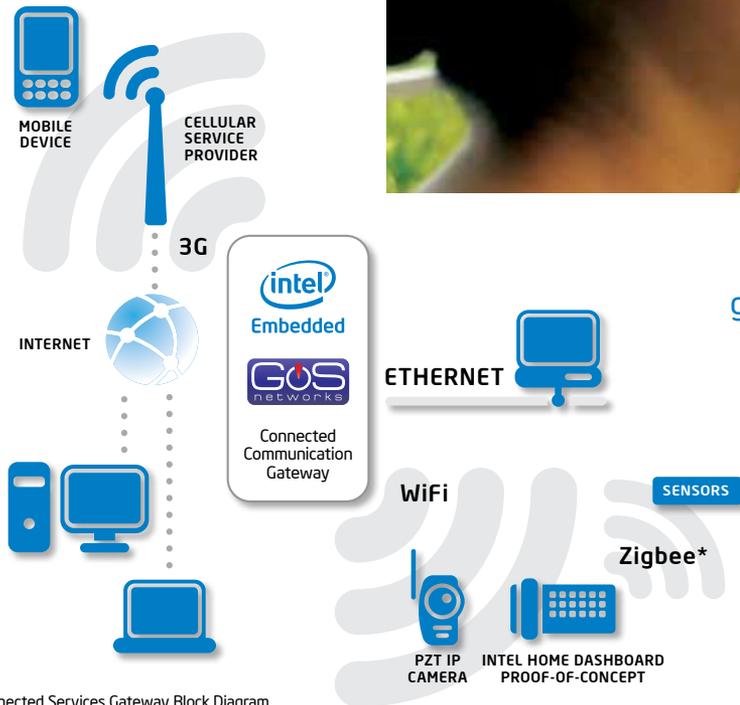
Figure 1. Connected Services Gateway Block Diagram

"The GoS Gateway* software enables a gateway solution that can be drop-shipped to the end user with zero touch on the part of the service provider."

John Power
CEO of GoS Networks

Key Features

Perhaps the most important feature of a connected services gateway is providing a broad selection of connectivity options, giving small businesses a high degree of flexibility. For example, Figure 1 illustrates a gateway with 3G/4G wireless, Ethernet, WiFi and ZigBee* interfaces that can be used for telephony, broadband and personal area network (PAN) based services. In addition, the gateway supports various protocols and codecs required for other connectivity-associated functionality, such as VPN, IP Centrex and POTS.

Other key features and functionality:

- Zero-touch provisioning and remote manageability (TR-069)
- Self-diagnostics, management and ease of use features
- Security and firewall
- Monitoring, statistics and alarms
- Server applications (e.g., Web, File, Media)
- Back-up and failover functionality

Defining Service Quality Classes

Increasing traffic flowing across business networks is creating an opportunity for service providers who can overcome the limitations of IP networks and improve quality. A major issue is that the standard IP delivery process does not provide any predictable level of quality of service (QoS); that is to say, there is absolutely no guarantee. Businesses with a heavy
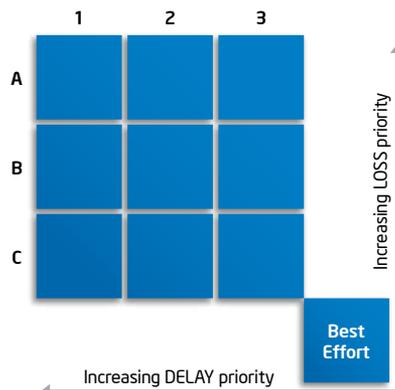

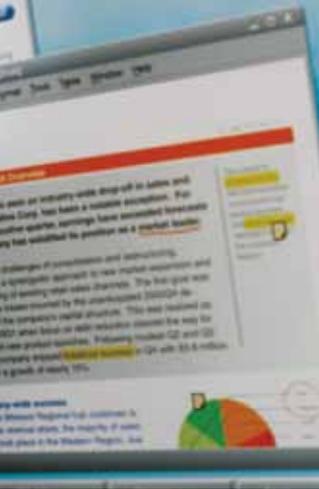Figure 2. Two-Dimensional Classification of Network Quality

reliance on the Internet are likely to prefer service providers with more reliable VoIP and broadband service. A successful QoS mechanism for today's networks needs to simultaneously provide reliable quality to an assortment of services, each with different requirements.

GoS Networks addresses QoS issues on IP networks with a software solution called guarantee of service or GoS. It is based on the fundamental relationship between three related aspects of each packet stream: loss, delay and throughput. GoS offers businesses an easy to use solution that delivers predictable quality of service in an efficient and reliable manner, for today's and tomorrow's services.

Users classify data streams into different classes, using an intuitive two-dimensional configuration matrix with nine quality classes, as shown in Figure 2. Each class offers a different quality level based on data loss and delay (i.e., latency) priority, and is allocated guaranteed bandwidth that is shared fairly between individual streams. An additional class, called Best Effort (BE), enables the efficient re-use of all link bandwidth, adapting to bursty traffic patterns and never wasting available network capacity.

Figure 3. GoS Datapath

Classification — separate incoming traffic according to its quality requirements

Policing — enforce bandwidth guarantees and limits

Shaping — re-space packets for fairness and predictability

Multiplexing — merge separated flows according to their priority

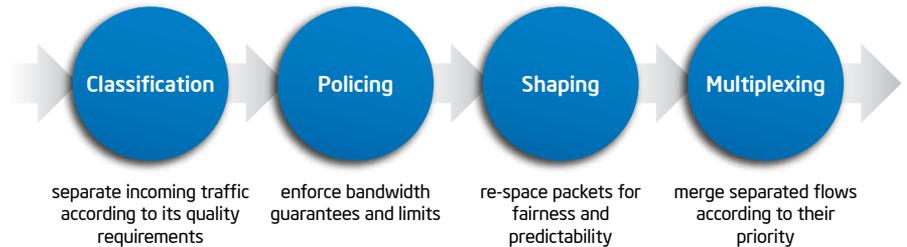## Delivering QoS with GoS

On a normal network link without GoS, all traffic competes for bandwidth on a best effort or simple prioritisation basis, making the performance unpredictable, particularly under heavy load. With GoS, multiple real-time traffic streams can receive predictable service, automatically displacing best-effort traffic as necessary. This allows spare capacity to be used freely for best-effort traffic, without affecting priority traffic.

When the link is heavily loaded, lower-priority packets will be lost or delayed to allow higher-priority packets to overtake them. QoS algorithms use traffic priority based on the services' quality requirements and make "drop or queue" decisions for packets. Even with bandwidth control, some packets may be delayed if they have to be queued for transmission, and occasionally they are dropped when queues become too long.

The GoS datapath consists of four processing stages, described briefly in the following and shown in Figure 3:

1) **Classification:** Packets are marked based on information in packet headers that identifies their particular traffic type.
2) **Policing:** Each quality group is fed through its own bandwidth-controlling component.
3) **Shaping:** Small random perturbations are added to the delays experienced by quality groups, which allows streams to be recombined in a predictable, stable manner. This stage avoids stream starvation, merges steams in a fair manner and allows network performance to degrade gracefully when overloaded.
4) **Multiplexing:** Packets are brought back together to feed into a single output link, at which point the order of packet output is finalized.

Benefits of GoS to Service Providers

When customers have well-functioning networks, service providers benefit from satisfied customers and fewer service calls. Helping networks perform better, GoS Networks technology enables businesses to deal with contention for network resources in a controlled and predictable way. Businesses can simultaneously and independently manage packet loss and delay with the help of precise statistical predictions of performance for all network traffic types. GoS polices all traffic streams fairly; that is, no one stream is allowed to use excessive network resources. Furthermore, service providers can confidently and remotely enable multiple value-added services.

The Intel® Atom™ Processor

Connected services gateways – processing voice, video and data media streams – can take full advantage of the performance, graphics and power efficiency of the Intel® Atom™ processor N450. This Intel® Architecture Processors-based platform is well-suited for small form factor, thermally constrained and fanless embedded applications, and provides the following features:

- **Processor:** The power-efficient Intel® Atom™ processor delivers high computing performance in a small footprint.
  - Based on Intel® architecture, the platform for over 90 percent of the world's software.
  - The Intel Atom processor integrates a memory controller and an enhanced graphics engine that provides a rich visual experience, while eliminating the power consumption and board space needed for a stand-alone graphics solution.
- **Chipset:** Incorporating the Intel® 82801HM I/O controller, this two-chip solution provides an Intel® High Definition Audio interface, along with rich I/O capabilities and flexibility through high bandwidth interfaces such as PCI Express*, PCI, Serial ATA and Hi-Speed USB 2.0 connectivity.
- **Fanless:** Designs have a low cost thermal solution (main board: 15W)
- **Connectivity:** Hardware platforms can support nearly any interface, including Ethernet, WiFi/WiMAX, ZigBee*, 3G and ZWAVE*.
- **Software Flexibility:** The platform runs firewall, advanced networking, Digital Living Network Alliance (DLNA) media server, intelligent network attached storage (NAS) and telephony.

Platform Benefits for Developers

- Enables new design possibilities due to its remarkably small size and performance-per-watt advantages.
- Runs a wide range of applications and operating systems, because it's software backwards-compatible with prior 32-bit Intel® processors.
- Protects development investment with long life component support.
- Reduces development time via an Intel® reference design (http://edc.intel.com).

A Game Changer for Service Providers

Using the same Intel® technology widely used for telephony, networking and Internet applications, a connected services gateway puts multiple services under one umbrella. It offers a convenient, efficient and manageable way for small business to get the quality and reliability they need from their IP-based services. Service providers and equipment manufacturers can take advantage of Intel's reference design platforms and speed up development in this new product category.

To learn more about GoS Networks solutions, please visit www.gosnetworks.com

To learn more about connected services gateway solutions from Intel, please visit www.intel.com/embedded/connecteddevices