SOLUTION BRIEF
Intel® Atom™ Processor
GoS* Networks GoS Gateway
M2M Communications

M2M Communications

Smart Connected Services and Smart Connected Devices

"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

The next phase of mobile growth is expected to occur in the field of machine to machine communications, or M2M. The GSMA is forecasting a connected universe of up to 50 billion devices developing in the next 15 years.[1] Each device delivers critical information via a wireless connection to control and processing applications resident in the cloud. This presents a significant opportunity for a wide range of stakeholders, including device and chip manufacturers, application providers, communications providers and Mobile Network Operators (MNOs).

M2M devices will be deployed in a variety of applications and markets, for example:

- Building Management
- Energy
- Consumer and Home
- Healthcare and Life Sciences
- Industrial
- Transport, both Public and Private vehicles
- Retail
- Security and Public Safety
- IT and Networks

The common factor for all potential applications is that the traffic from each will consist primarily of data, not voice, communications. There will be different service and processing requirements for this data, depending on the application served:

- **Rich content** – high bandwidth requirement, high computational demand
- **Analytic information** – medium bandwidth requirement, moderate computational demand
- **Monitor and sensor information**: low bandwidth requirement, low computational demand
- **Real-time information** – various bandwidth requirements, but data must transit the network in a timely fashion
- **Non-real-time information** – various bandwidth requirements, data is not time critical

Many applications will include multiple local M2M devices reporting on different aspects of the system being monitored. For example, a building might have multiple sensors collecting data, such as temperature, occupancy and humidity, from different trigger points. These could include system controls, security and surveillance cameras, and time-sensitive alarms. A vehicle might support multiple M2M reporting points, covering data such as location, fuel consumption, alarms,

performance data, etc. The data collected may consist of a combination of low bandwidth sensor information and, at the same time, high bandwidth, rich display content. Ensuring that each different stream of data receives the appropriate class of service is a complex challenge.

As a result, there is a need for smart M2M aggregation devices that can collect data from a range of local serving devices and forward it in a timely and efficient manner to the network using a connection: such as a mobile Radio Access Network (RAN). This capability is now available in an Intel® Atom™ processor-based M2M Open Service Platform, which intelligently manages M2M data from a wide range of serving devices and provides efficient optimisation and routing to the collection centre across the RAN. The M2M Open Service Platform incorporates software from GoS* Networks, which performs prioritisation and optimisation of traffic and policy enforcement, ensuring that each individual application and device has fair and appropriate access to the RAN.

M2M Open Service Platform

For M2M opportunities to be realised, the complex issue of managing multiple data streams from the same location or vehicle needs to be addressed. Simplifying access and control of data collection, the M2M Open Service Platform - built with powerful Intel® architecture processors – is a single-box, Nano-express based form factor solution that functions as an M2M gateway, collection, aggregation and forwarding device.

By deploying the M2M Open Services Platform, M2M application vendors and MNOs can efficiently collect prioritised data from multiple sources and ensure that appropriate QoS is applied to each stream. Some of the benefits provided by the M2M Open Services Platform include:

- Simplifies M2M service delivery by providing a single, common aggregation point for multiple, variable bandwidth data streams
- Manages, aggregates, sorts and prioritises M2M data
- Optimises M2M data collection by efficiently prioritising traffic with different QoS requirements
- Ensures each managed device has fair access to the network
- Provides a central "connection manager" responsible for managing multiple local interfaces
- Protects infrastructure investments with an Intel® architecture-based platform that can run current and future applications for M2M data collection

Key Features

The most important feature of the M2M Open Service Platform is the provision of a wide range of local and wide area network connectivity options. A complete software stack is provided that includes the connection manager and supports options for integrating different WANs and gateways.

Southbound on the LAN side, the M2M Open Service Platform supports 802.11 b/g/n WiFi, Zigbee*, Gigabit Ethernet and USB connectivity for Bluetooth* and ZWave*, ensuring connectivity to any Personal Area Network (PAN).

Northbound to the RAN, any carrier modem device can be integrated, providing connectivity to 3G UMTS / HSPX networks and allowing full 4G access to be supported in the future.

Other key features and functionality:

- Zero-touch provisioning and remote manageability using TR-069
- Self-diagnostic and management features
- Security and firewall via IPSec / VPN, or Link Layer
- Monitoring, statistics and alarms
- Small form factor
- Thermal solutions for compute and radio modules
- Server applications (e.g., Web, File, Media)
- Back-up and failover functionality
- Application framework for enabling Java and other applications to be run on the platform itself

Defining Service Quality Classes

The rapid growth of M2M traffic is creating an opportunity for service providers and M2M application vendors to improve the quality and delivery of collected data. A major issue is that the standard delivery process does not provide any

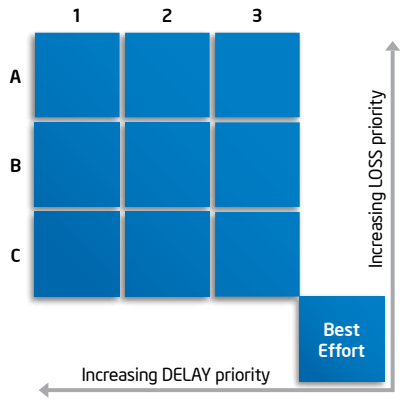


Figure 1. Two-Dimensional Classification of Network Quality

predictable level of quality of service (QoS); that is to say, there is absolutely no guarantee. In orderer to be effective, M2M applications that generate traffic with high bandwidth demands require QoS guarantees. Application vendors and MNOs can differentiate their services based on the promise of reliable QoS and service guarantees. A successful QoS mechanism for demanding and emerging M2M applications must simultaneously provide reliable quality to an assortment of aggregated M2M services, each with different needs.

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 M2M application vendors and MNOs an easy-to-use solution that delivers predictable quality of service in an efficient and reliable manner, for today's and tomorrow's services.

MNOs classify data streams into different classes, using an intuitive two-dimensional configuration matrix with nine quality classes, as shown in Figure 1. 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 reuse of all link bandwidth, adapting to bursty traffic patterns and never wasting available network capacity.

Delivering QoS with GoS

On a normal network link without QoS, all traffic competes for bandwidth on a best effort basis, making the performance relatively unpredictable under heavy load. Moreover, there is no differentiation between applications with higher bandwidth and lower latency requirements. When GoS control is applied, traffic that is entitled to priority treatment will automatically displace best-effort traffic when necessary, up to its bandwidth limit. 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 determine 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.

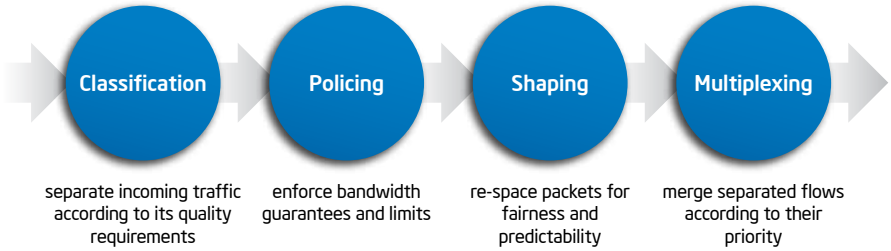


Figure 2. GoS* Datapath

The GoS datapath consists of four processing stages, described briefly in the following and shown in Figure 2:

1. **Classification:** Packets are marked based on information in packet headers that identify 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 permits 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.

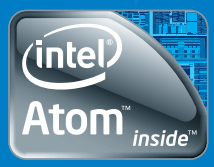
Benefits of GoS to M2M Application Vendors and MNOs

M2M applications have different demands which must be satisfied. Allocating fair QoS via the M2M Open Service Platform will ensure greater satisfaction for M2M application users, leading to fewer service calls to application vendors and MNOs. Helping networks perform better, GoS Networks technology enables M2M applications to deal with contention for network resources in a controlled and predictable way. The M2M Open Service Platform 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.

"Since the Intel® Atom™ processor has considerably more processing power than alternative embedded platforms, there's headroom available for other services and applications to run at the same time,"

Adam O'Hare

GoS Networks



The Intel® Atom™ Processor

The M2M Open Service Platform – processing 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 processor-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).

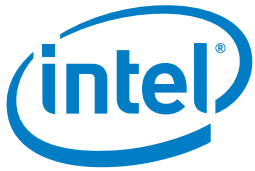
Enabling Efficient Deployment of Rich M2M Services

Using the same Intel® technology widely used for telephony, networking and Internet applications, the M2M Open Service Platform allows QoS to be applied to multiple parallel M2M applications. It offers a convenient, efficient and manageable way for application vendors and MNOs to guarantee QoS for innovative and emerging M2M applications. MNOs, application vendors and equipment manufacturers can take advantage of Intel's reference design platforms and accelerate development in the emerging field of M2M communications.

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/go/connecteddevices

[1] Source: GSM World Website, "GSMA* Outlines Potential for Embedded Mobile: Enabling a World of Connected Devices", February 15, 2010, http://www.gsmworld.com/newsroom/press-releases/2010/4635.htm



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