Home Gateway Initiative
Phase 1 QoS Architecture

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Why the Home Gateway Initiative?

- Unavailability of **Home Gateways** providing full support to the telecom operators’ requirements for triple play services
- Unavailability of **reliable, flexible, cost effective** end-to-end solutions (access network + HG + home network architecture) for multiple-play services able to satisfy first of all the customers and, of course, the service providers and manufacturers as well
- The Home Gateway is not seen as a generic advanced modem-router, but a **service enabler device** and an **added value** for both the customer and the service provider
HGI Timeline

- December 15\textsuperscript{th} 2004, founded by 9 members
- March 2\textsuperscript{nd} 2005: official launch
- 69 members (1/4 Telcos) as of April 5\textsuperscript{th} 2006
- July 3\textsuperscript{rd} 2006, official publication of Rel.1 specs
- 1Q-2Q2007: Release 2
HGI Phase 1 Gateway Architecture

Basic System Features
- Management
  - Configuration management
  - FW upgrade management
  - QoS management
  - Security management
  - Device management
  - Local management appl.
  - Remote management client
- Powering
- Processing performance

Control functions
- Device discovery
- DHCP, PPP, SIP, IGMP handling

Service support
- DDNS
- ALGs
- VoIP termination
- Voice/comm. services

Security
- Firewall policies
- Key management
- Authentication

Quality of Service
- Classification
- Queuing
- Mapping

Packet processing
- Classification
- Queuing/Scheduling
- Routing/NAT
- Bridging
- Filtering/Encryption
- Multicast to unicast conversion

WLAN security

Data flow
Management flow
Control flow
QoS Goals

- Management of key congestion points
  - Potential rate mismatches abound

- Traffic classification and prioritization
  - Goal is identification of Service Class
  - Telco-managed services vs unmanaged services
  - Special attention for voice/video

- Handle Diverse flows in the HG:
  - WAN → LAN (downstream)
  - LAN → WAN (upstream)
  - LAN-LAN (transit)

- Focus on QoS handling within the HG
  - With guidelines for LAN components
Congestion Points

ITU-T Workshop on "End-to-End QoE/QoS"
Geneva, 14-16 June 2006

ADSL example with upstream/downstream mismatch
Managed vs Unmanaged Services

- A managed service is a service for which the service provider provides preferential treatment (that can include QoS)
  - IPTV
  - Voice
  - Could also include classifiable LAN-LANflows
- Unmanaged services: an unmanaged service is a service for which the service provider has no commitment to the customer (specially in terms of QoS).
  - Could be: Internet access, peer-peer, general LAN flows....
- Distinguished via classification in the HG
Flow types - details

- Managed Services are typically WAN → LAN or LAN → WAN
- LAN-LAN flows are a “grey zone”. Typically these are unmanaged, BUT
  - Service provider may wish to provide QoS assistance to some LAN-LAN flows
  - Example: VoD download to be streamed to STB at a later time across the home LAN.
- Means to prevent LAN-LAN flows from disrupting managed WAN → LAN flows
  - Fixed queue allocation scheme
  - Optional deep classification of LAN-LAN flows
QoS Datapath Functions
(LAN Side Ingress)
QoS Datapath Functions (WAN side Ingress)

- Classification
- DSCP & L2 Marking
- Bridging, NAT/Routing, Firewall
- LAN Congestion Management
- LAN Queuing
- LAN Ports Scheduler
- LAN Egress 1
- LAN Egress 2
- LAN Egress n

HG traffic sink
Use of DSCP and Layer 2 Markings

- The HG provides capabilities of classification and marking at layer 3 (DSCP)
- Layer 2 classification in the HG may also be supported
- Generally, layer 3 markings (DSCP) are preferred within the LAN
  - We do not wish to encourage use of VLAN/p-bit tags within the LAN due to concern about ability of already installed equipment to handle them
    - Must recognize, though, that these tags may be encountered
  - DSCP is our preferred mechanism to transmit priority information to wifi, powerline, etc.
  - Recommended DSCP markings consistent with DLNA usage
Classification

Classification requirements well delineated

- **WAN ingress**
  - Multifield classification upon layer 4, IP and ethernet fields

- **LAN ingress/WAN egress**
  - Multifield classification upon layer 4, IP and ethernet fields

- **LAN ingress/LAN egress**
  - Typically, simpler classification based only on MAC SA/DA
  - Exception handling (multifield classification) for traffic destined to specified LAN ports
**Queuing**

- Egress queuing model
  - Packets are slotted into egress queues depending on classification and forwarding decisions

- Queue requirements
  - **WAN egress** - min 5 queues, 8 suggested
    - strict priority and WRR scheduling
      - Allows lowest latency to be accorded to voice and flexible allocation to other services
    - shaping at class and port levels
  - **LAN egress ports** - min 4 queues
    - strict priority and WRR scheduling
### Queuing Configuration Example

<table>
<thead>
<tr>
<th>Direction</th>
<th>Purpose</th>
<th>Scheduling into Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upstream</td>
<td>Voice</td>
<td>Strict Priority (highest)</td>
</tr>
<tr>
<td>Upstream</td>
<td>Video</td>
<td>Strict Priority (next)</td>
</tr>
<tr>
<td>Upstream</td>
<td>Temporary Voice</td>
<td>W1 Weighted Round Robin</td>
</tr>
<tr>
<td>Upstream</td>
<td>Premium Data, GPRS Data, Game Data</td>
<td>W2 Weighted Round Robin</td>
</tr>
<tr>
<td>Upstream</td>
<td>Best Effort Data</td>
<td>W3 Weighted Round Robin</td>
</tr>
<tr>
<td>Downstream</td>
<td>Value Added Services</td>
<td>Strict Priority (highest)</td>
</tr>
<tr>
<td>Transit</td>
<td>Value Added Services</td>
<td>Strict Priority (next)</td>
</tr>
<tr>
<td>Downstream</td>
<td>Best Effort Data</td>
<td>W2 Weighted Round Robin</td>
</tr>
</tbody>
</table>
An optional mechanism is defined aimed at preserving QoS of managed service flows in the upstream.

- Requires identification of flow instance using classification.
- Before admitting a new managed service flows to the premium queue, performance is first tested in a lower priority queue.
- This mechanism ensures that already identified flows will not be adversely impacted by newly admitted flows.
Congestion management is a required configurable capability on all queues
  • Random Early Discard

The purpose is to improve performance of TCP oriented traffic in the presence of congestion
  • Particularly applicable to upstream link
Management of QoS Functions

- Phase 1 release of HGI builds upon DSL Forum protocols for managing HG QoS capabilities
- Management from a service provider’s Auto-Configuration Server (ACS)
- TR-069 (CWMP) protocol
- TR-098 Data Model
- HGI specific QoS profile for TR-098
What We Did NOT Cover

- Connection Admission Control
  - No full CAC, although we have a simplified CAC and some flow awareness (in the overload protection scheme)
  - Full CAC requires generalised flow awareness + parameterisation of bandwidth and this is a topic for Phase 2 study
- Interaction with LAN QoS signaling, e.g. UPnP QoS
Phase 2 Goals

- HGI Phase 2 goals are just being developed
- Increased focus on services such as fixed-mobile convergence
- Initial QoS study areas
  - Revisiting VLAN support in LAN
  - CAC
  - UPnP QoS
  - User control over QoS policy
THANKYOU
Questions?