**Most Firms See Bandwidth Requirement Ballooning**

How much will Internet bandwidth usage increase during the next two years?

![Traffic Growth Chart]

- Seventy percent of firms will increase Internet bandwidth usage by at least 60% in next two years.

**Growing Demand, Constrained Budget**

Result: Network Rationalization

Traffic type by percentage volumes

- LAN (application) data (IP, IPX, NetBIOS, etc.): 81.3%
- Legacy data (SNA, DECnet, etc.): 6.2%
- Voice: 11.3%
- Video: 0.6%
- Other: 0.7%

Source: IDC Dec 00

- Control Operating Expenses
  Converge all applications on a single network

- Control Capital Expenses
  Move towards a common IP infrastructure

**IP Solves Some Problems But Creates Others**

<table>
<thead>
<tr>
<th>Bandwidth Requirements</th>
<th>Streaming Video</th>
<th>Video Conferencing</th>
<th>E-mail with Attachments</th>
<th>Napster</th>
<th>Text e-mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH</td>
<td>Streaming Video</td>
<td>Video Conferencing</td>
<td>E-mail with Attachments</td>
<td>Napster</td>
<td>Text e-mail</td>
</tr>
<tr>
<td>LOW</td>
<td>Streaming Video</td>
<td>Video Conferencing</td>
<td>E-mail with Attachments</td>
<td>Napster</td>
<td>Text e-mail</td>
</tr>
</tbody>
</table>

**Ballooning Bandwidth Requirements**

- Latency Sensitivity

Manickam R. Sridhar
CTO
msridhar@sitaranetworks.com
The Need for Quality of Service (QoS) Provision and Enforce Application SLAs

1. Minimum Bandwidth
2. Latency
3. Packet Loss Rate
4. Jitter
5. Availability

Need for QoS: Network Topology

<table>
<thead>
<tr>
<th>Aggregation Point</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Enterprise</td>
<td>Access Pop or Hosting Site</td>
<td>Edge of Core</td>
</tr>
<tr>
<td>Speed</td>
<td>64K - 100 Mbps</td>
<td>10M - OC3</td>
<td>OC12-OC192</td>
</tr>
</tbody>
</table>

The Broadband Wireless Network Model

SLA Provisioning Example
**QoS Framework for a Broadband Wireless Access Network**

- **Policy Control**
  - Analysis
  - Enforcement
  - Manageability

- **Application Services**
  - Proxy, Signaling, Caching, Redirection

- **Bandwidth Management**
  - L2-7 Classification, Switching, Shaping, Tagging, Queuing, Statistics, Bridging

- **Sitara QoS Technology**
  - Intuitive Policy Management
  - Class-Based Queuing
  - Real-Time Monitoring/Reporting
  - Future Functions
  - High-speed Classification
  - TCP Rate Shaping
  - Additional AccuRate™ Features
  - Transparent Web Caching

**Sitara’s Unique QoS Architecture**

- **Guaranteed VoIP B/W**
  - Platinum: x kbps
  - Gold: y kbps
  - Silver: z kbps

- **# of Voice Sessions**
  - Platinum: X
  - Gold: Y
  - Silver: Z

- **Maximum Burst**
  - Platinum: Pipe Speed
  - Gold: 3/4 Pipe
  - Silver: 1/2 Pipe

- **Priority traffic (Other)**
  - Core Business
  - Email
  - FTP
  - Web
  - Platinum: High
  - Gold: Medium
  - Silver: Low

**Service Level Agreements**

- **Voice over IP (example)**
  - Platinum (example)
  - Gold (example)
  - Silver (example)

**Sitara’s Unique QoS Architecture**

- **QoS System**
  - Air Interface
  - Flow control

**QoS Future**

- QoSDirector
- qosSWorks 3000
- qosArray 1000
- qosFuture 10 Gbps (OC192)

**Service Level Agreements**

- **Policy Control**
  - Enforcement
  - Decisions

- **Application Services**
  - Proxy, Signaling, Caching, Redirection

- **Bandwidth Management**
  - L2-7 Classification, Switching, Shaping, Tagging, Queuing, Statistics, Bridging

- **Sitara QoS Technology**
  - Intuitive Policy Management
  - Class-Based Queuing
  - Real-Time Monitoring/Reporting
  - Future Functions

- **Complete, integrated best-of-breed QoS solution**
- **Requires no change in existing network infrastructure**
- **Optimal network bandwidth utilization to maximize user satisfaction**

**LAN Clients**