SS7 over IP

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Current Mobile Revenue Trends

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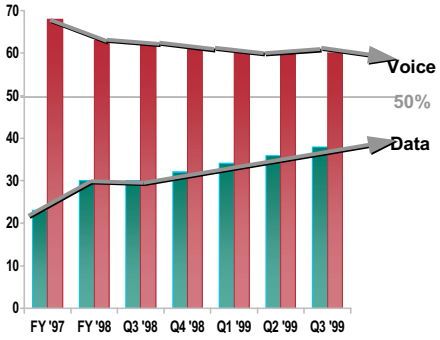
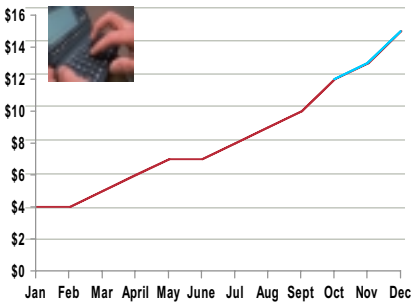
Percentage of Total Revenue



SMS or 'G-Mail' Year 2000

Source: GSM Association



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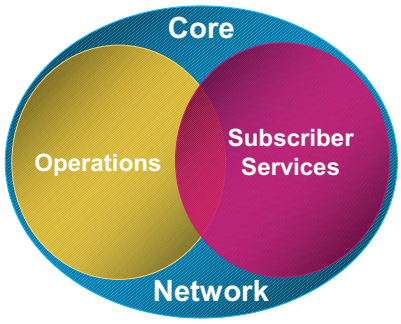
Common Operator Business Objectives



- Operations: drive down operational costs
- Subscriber Services: grow revenue streams
- Core Network: technology enablers that lower market entry barriers to application vendors

What percent of revenue now comes from data services?
What is your target?

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Why send SS7 over IP?

- Current Circuit-based network used for SS7 is inefficient and expensive
- Take advantage of application layer messages and procedures defined by SS7 (ISUP,TCAP)
- Support a single transport network for media and for signaling

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How to support SS7 Apps over IP?

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- Keep upper layers (TCAP, SCCP, ISUP) and use IP transport
- Maintain reliability of SS7 (mimic/support MTP layers)
- Preserve the upper layer timers
- STANDARDS = Sigtran

  Use the correct Sigtran protocol for the right job

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IETF SIGTRAN Working Group

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- Multi-vendor group that is designing SS7oIP standards
- http://www.ietf.org/html.charters/sigtran-charter.html
- SCTP (RFC 2960), M2UA, M2PA, M3UA, SUA
  - Cisco is an author on all of the above except SUA
- TUA – TCAP User Adaptation is a recent proposal
- Cisco is evaluating M2UA and TUA

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Stream Control Transmission Protocol (SCTP)

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- The standard for transporting signaling over IP
- A reliable transport protocol operating on top of IP
- Error-free non-duplicated transfer of user data
- Congestion avoidance and resistance to flooding
- Control of fragmentation, order of delivery, bundling, use of multiple streams
- Network-level fault tolerance through supporting of multi-homing at either or both ends of an association
- Packet Validation and Path Management

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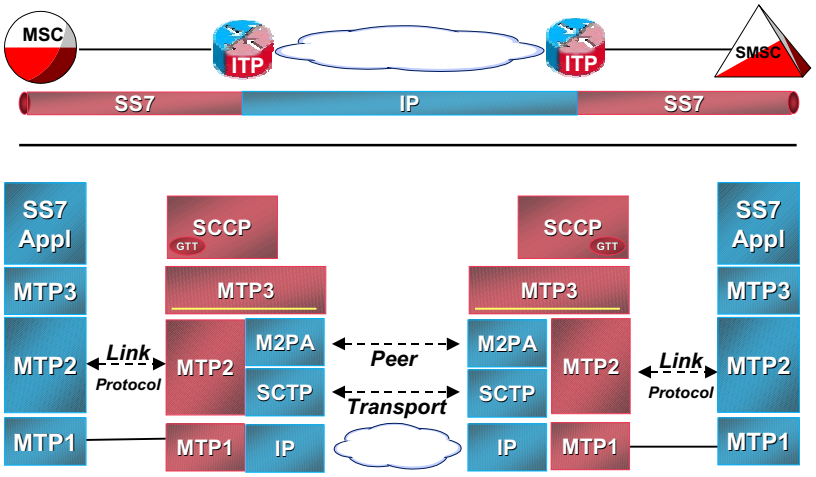
STP Peer-to-Peer SS7 Offload (M2PA) Protocol Architecture



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M2PA Advantages and Disadvantages

- **Advantages**
  - Provides a cost effective alternative to peer-to-peer STPs.
  - Can be deployed in incremental steps with STP network functioning in a load sharing or backup mode.
  - Solution is likely to be as reliable as the current STP network since MTP3 is preserved.
  - Reduces existing TDM facilities expense via IP bandwidth cost efficiencies in 2G networks now! Don't have to wait for 3G.
  - Provisioning and management will be similar to an STP which will allow network staff to more easily transition their skills to manage the SS7 over IP network.
- **Disadvantages**
  - None when used as designed for STP alternative.

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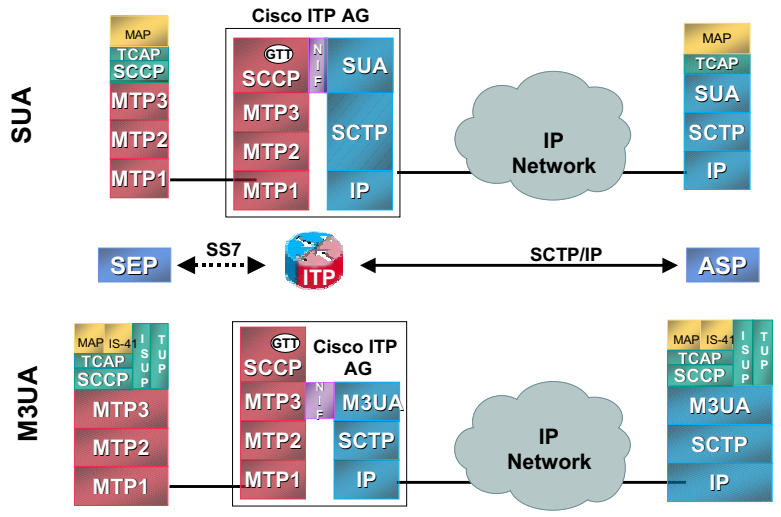
Applications Gateway Protocol Architecture



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M3UA / SUA Advantages and Disadvantages

M3UA

- **Advantages**
  - ISUP, TUP, SCCP access
  - SG performs standard GTT
- **Disadvantages**
  - MTP3 is complex and nn Implementation dependent (undocumented) NIF could make interoperability challenging
  - Designed for IP service end nodes that do not perform STP MTP3 function

SUA

- **Advantages**
  - Simple for SCCP access only
  - IP service end node does not need to implement a SS7 layer 3 adaptation routing protocol
- **Disadvantages**
  - No ability to participate in ISUP flows
  - GTT is adapted within SUA protocol which is still being discussed in the standards group

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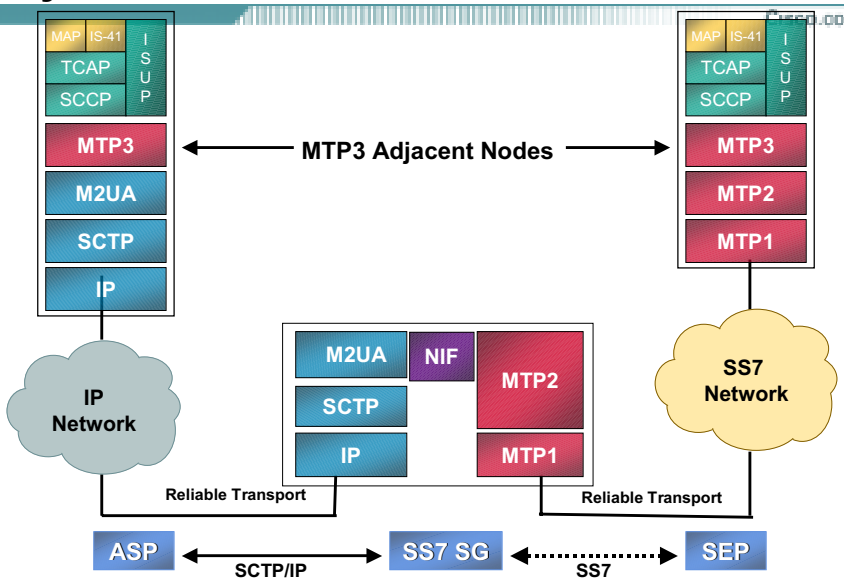
M2UA
Layer 2 Link Extender or SS7 Modem



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M2UA
Advantages and Disadvantages

- **M2UA Advantages**
  - Simple provisioning since only fixed MTP2 link to SCTP link mapping needs to be provisioned.
  - Signalling Gateway is not assigned a point code
- **M2UA disadvantages**
  - A node in the network with no MTP3 management function.
  - Increased risk of MSU loss during IP network outages due to no SS7 MTP2 retrieval and no layer 3 congestion function
  - Network separation between MTP2 and MTP3 introduces risks with sensitive MTP timers over wide area IP networks.

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Ingredients for SS7oIP Networks

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- Revenue-generating services/applications
- Traditional SS7 high network availability
- Provisioning and management of SS7oIP gateways similar to an STP, allowing operations staff to transition their skills to manage the SS7oIP network
- Expertise to build and maintain carrier-class IP networks with end-to-end quality of service

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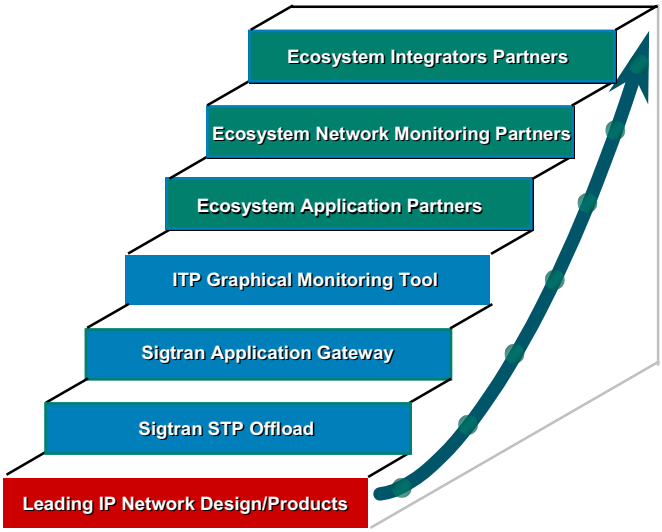
Cisco SS7oIP Elements



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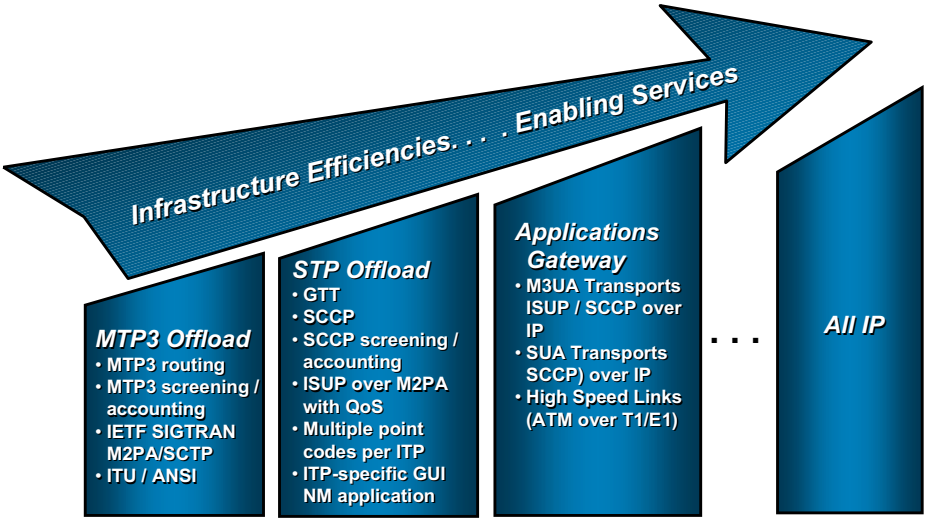
Cisco ITP Product Road Map



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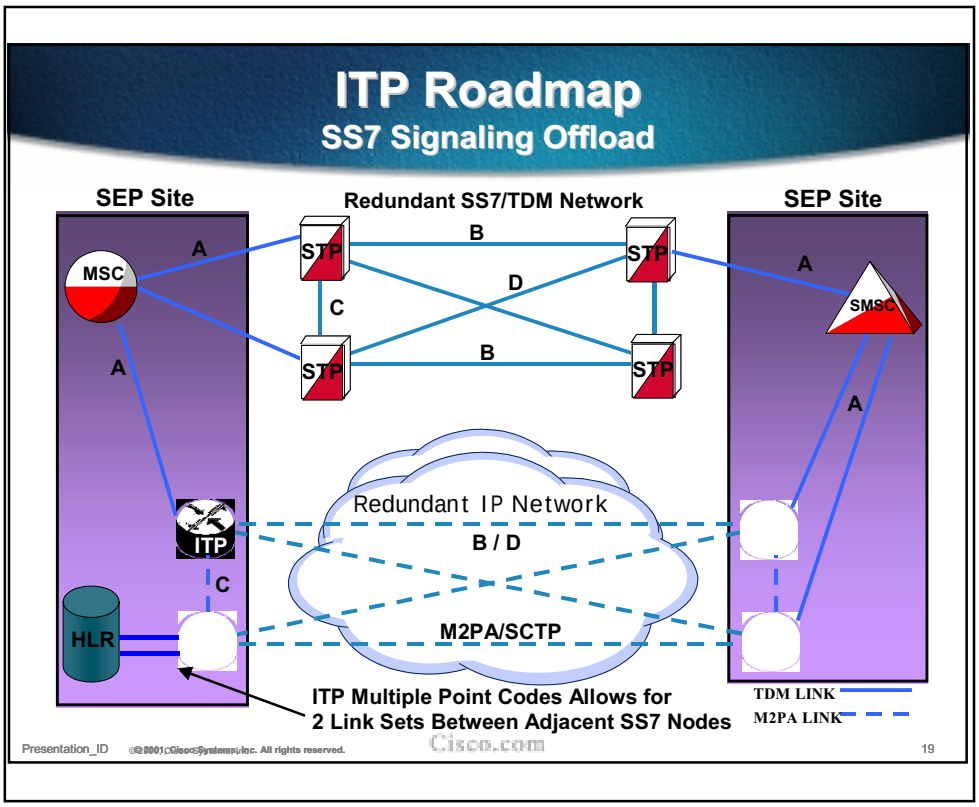

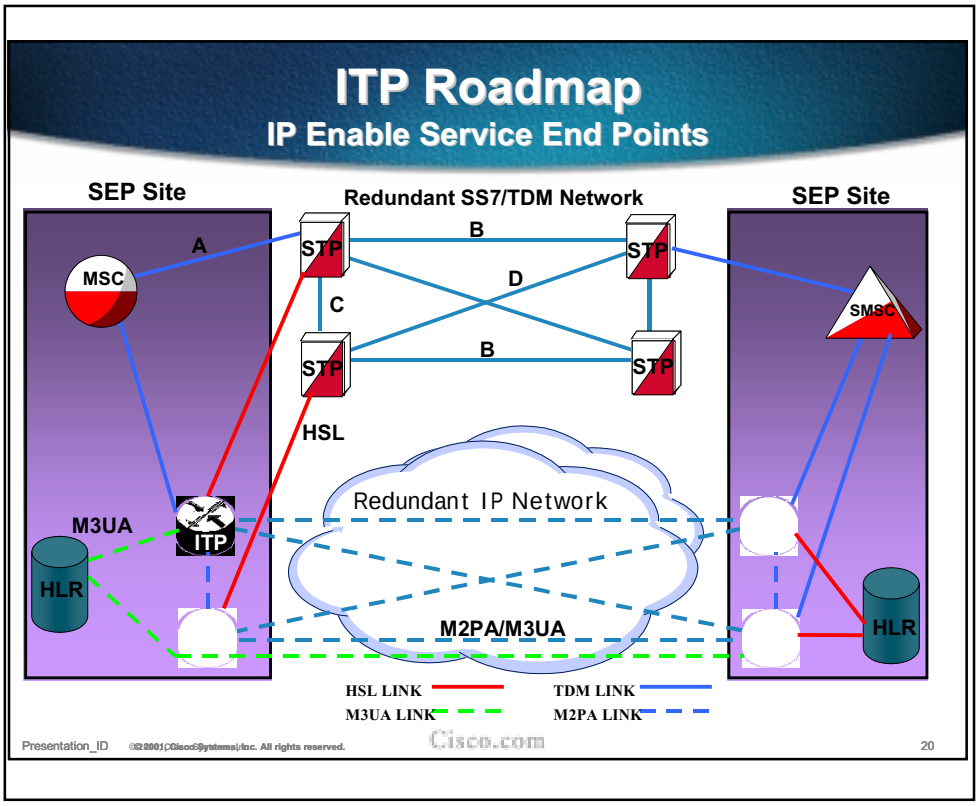

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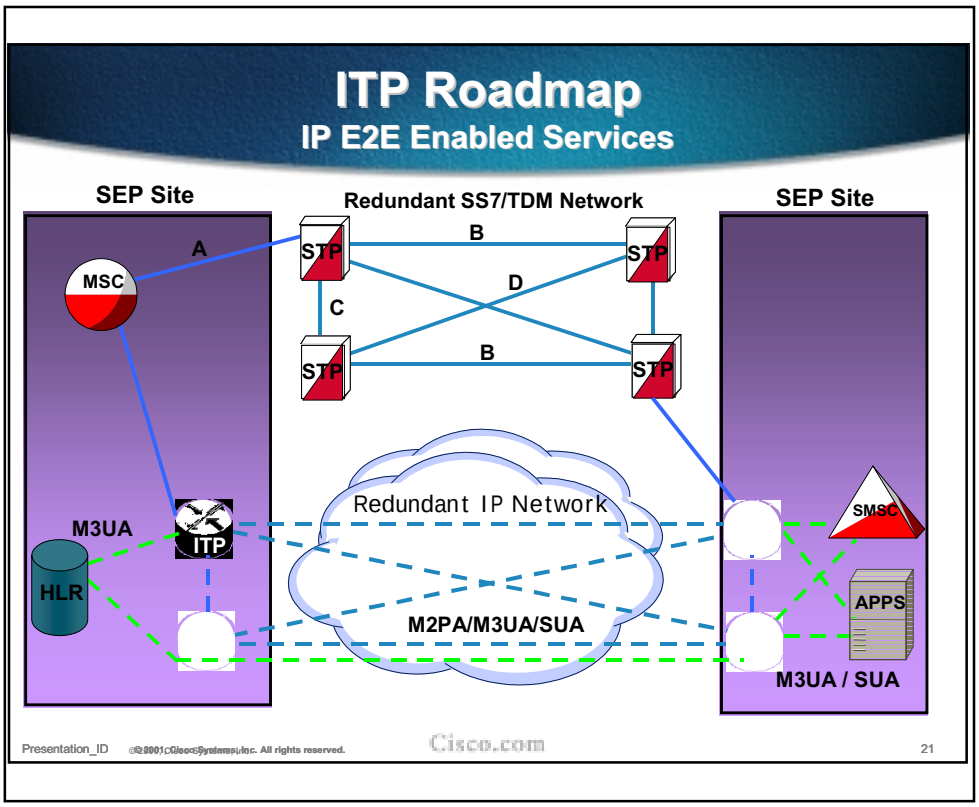

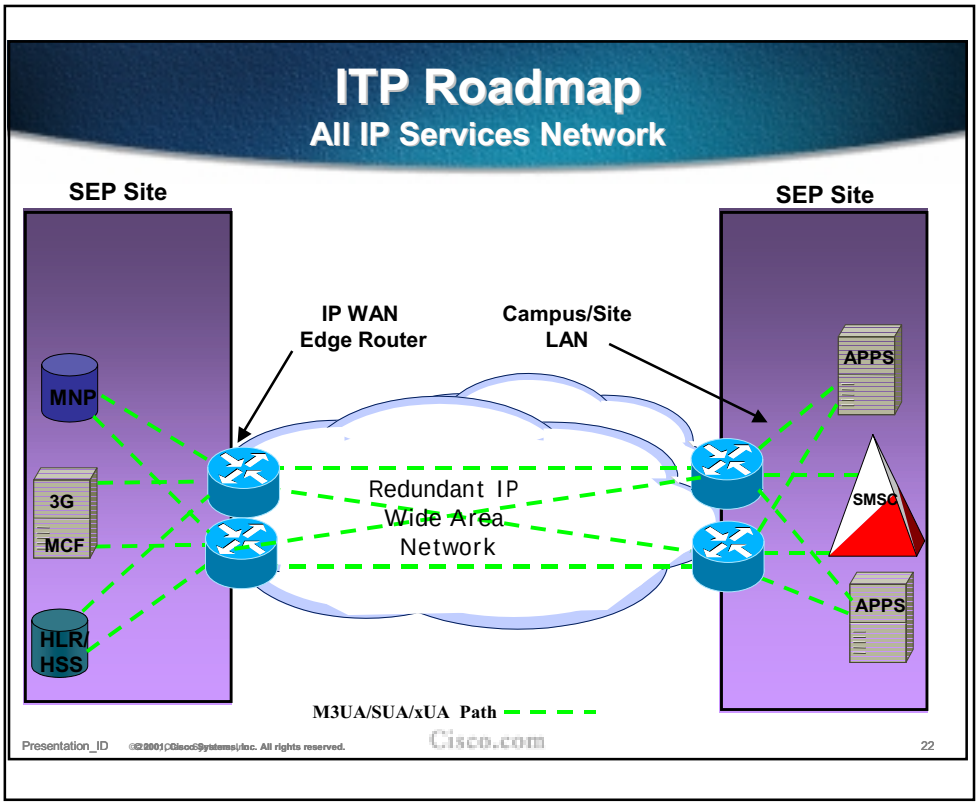

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Quality of Service

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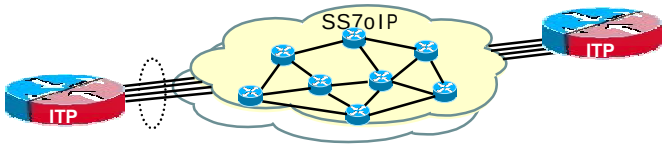
Legacy SS7 networks

- No mechanism for QoS as network burdened with application traffic
- Up to 16 links per link set
- Links are added for additional bandwidth and redundancy



SS7 over IP

- QoS required in SS7oIP networks as application traffic grows
- ITP supports 16 SS7oIP (SCTP) links per link set
- Links are added only for redundancy, not bandwidth
- Two SCTP association "links" provide full redundancy

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ITP Quality of Service

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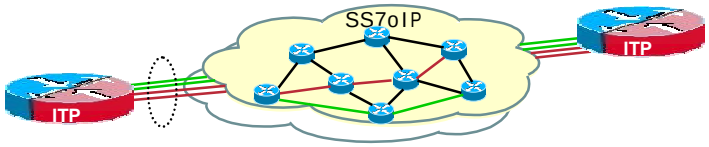

- SCTP links are assigned to an IP QoS class
- MSU is assigned a QoS class before routing based on any combination of
  - Input link set (ex: link set from SMSC)
  - Service Identifier (ex: ISUP or SCCP)
  - Destination Point Code (ex: MSU destined to SMSC)
  - Global Title Address (ex: TT or MSIDN of SMSC)
- Use MSU QoS class and SLS to find link within route-set
- Upon link failure change-over to a link with the same QoS
- Critical that signaling gateway determine QoS and tag packets
- IP Core preserves QoS – Ex: IP, ATM, and MPLS QoS via standards

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Cisco ITP Specs

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- SS7 to SS7 links =
  - 160 @ 1 Erlang/Link
  - *Use this for comparison to legacy STP Cost/port*
- SS7 to SCTP =
  - 160/1000 @ 1 Erlang/Link
- MSUs = 10,000 - 15,000
- Latency 5.5ms (mean)
- Max Routing Table = 10,000
- Max GTT Table = 500,000

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Network Availability

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- Strict adherence to STP (GR-82), SS7, and Sigtran standards
- SEP, SSP, etc re-transmit when ACK not received in seconds
- ITP facts:
  - GR-82 Compliant
  - Mated pairs handle network availability (99.99999%)
  - MTBF on single 7500 (hw/sw) is 1.3 years

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IP Core Network Requirements for SS7oIP

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- How to build a reliable IP Core network for SS7oIP
  - no single point of failure
  - maximum end-to-end latency of 100ms (GR-82 indicates 40ms for single STP latency. ITP mean average latency is 5.5 ms)
  - 95% packet delivery (max 5% drops)
- Redundant IP Core networks
  - Dual IP Interface cards on ITP
  - Parallel IP Core networks to all SCTP multi-homing
- QoS in IP Core network
  - ITP "colors" SS7 traffic in QoS classes
  - IP Core network preserves QoS via IP, ATM, MPLS
  - IP Core network has a minimum of 2 QoS classes

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Feature Comparison

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Feature	Cisco ITP	Legacy over IP	cPCI over IP
SS7 Standards	Yes	Yes	Yes
Transparent to Legacy Equipment	Yes	Yes	Yes
Sigtran M2PA	Yes	Yes [1]	Yes [3]
Sigtran M3UA	Yes	Yes [1]	Yes [3]
Sigtran SUA	Yes	Yes [1]	Yes [3]
IP Routing	Yes	No	No
Effective QoS	Yes	No	No
GR-82 Compliant	Yes	Yes	Yes [4]
ANSI 1996	Yes	Yes	Yes [4]
ITU 1996	Yes	Yes	Yes [4]
STP Replacement	Yes	Yes [2]	No
De-centralized Design	Yes	No	No
Interworking with Agilent acceSS7	Yes	Perhaps	No
Est. Price per port	$ 1884.45	$10,000 [5]	$1,000 - $6,000 [5]

Notes:

1. Tekelec supports proprietary TALI, and "roadmaps" Sigtran. Other Legacy STP vendors are stating support for Sigtran. So far only Cisco shows support for all three Sigtran Protocols in 2001.
2. These are STPs retrofitted with Ethernet ports and a IP transport (either Sigtran or Proprietary)
3. Some encapsulate and tunnel using a proprietary transport for IP. Others use Sigtran M2UA which is a bridging-type protocol and does not support participation in higher layer reliability (MTP3 and SCCP). Some are supporting one of the Sigtran standards, but only Cisco shows support for three Sigtran Protocols in 2001.
4. As most (if not all) of these are simply Signaling Gateways, compliance to these standards may vary.
5. Does not include the required WAN Edge router. The Cisco ITP is software running on such WAN Edge routers.

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SS7oIP Network Monitoring Products

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- Leverage SNMP-based device management tools for SS7oIP (i.e. HP Openview, CW2K, CiscoView)
- Leverage IP network performance monitoring tools (i.e.. Concord Network Health, Cisco IPM)
- Develop ITP-specific network monitoring and provisioning products
  - Auto-discovery network map
  - Device statistics and alerts for SS7, SIGTRAN, and IP
  - Graphical provisioning of Route and Global Title tables
- Integrate ITP management tools into complete Cisco mobile wireless network management package (i.e. including GPRS, MNET)

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ITP Monitoring with the new Signaling Gateway Manager

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- Cisco developed network management software product that provides:
  - ITP monitoring where Cisco ITP routers have replaced legacy SS7 routing equipment
  - ITP (IP Transfer Point) router discovery
  - drill-down diagnostics
- Designed to be released in conjunction with (and in support of) the Topsail project's ITP enhancements to IOS.
- Goes to beta in 3Q ‘01 and will ship in 4Q ’01

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SGM GUI Client

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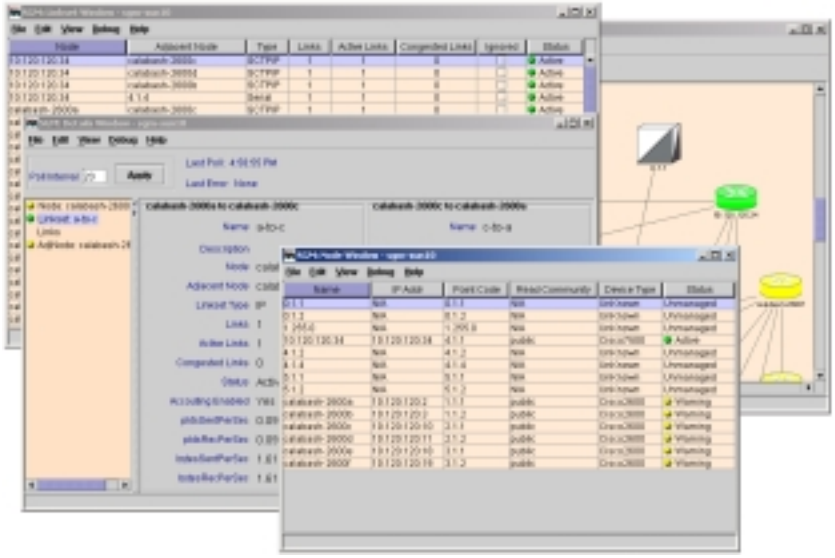

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SGM Topology

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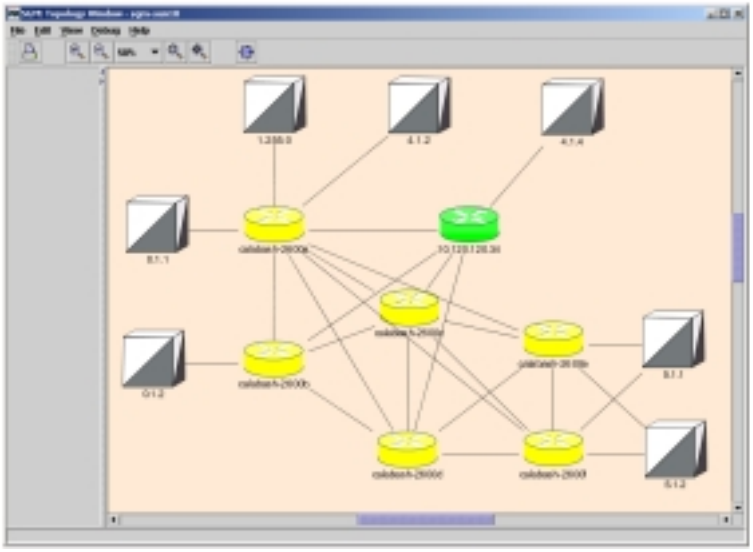

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Cisco and Agilent Strategy

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Agilent Technologies

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Empowering the Internet Generation

- The Cisco ITP - IP leadership /expertise extended to SS7oIP
- Agilent acceSS7 - SS7 monitoring leadership extended to SS7oIP
- Extending the power of acceSS7 into packet networks by ensuring SS7oIP delivers its value proposition over traditional SS7
  - Manage Services across PSTN/packet gateways
  - Accelerate the deployment of hybrid voice/data networks that deliver value added services
  - Ensure service quality and availability
  - Scalability and Cost Efficiency

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Cisco-Agilent Solution Benefits

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- Seamless migration of monitoring system to SS7oIP
  - Maximize skill set efficiency of operations staff
  - Rapidly deploy new infrastructure and services
  - Rapidly resolve deployment and integration issues
  - Maintain and improve quality of service through active monitoring
- Preserves end-to-end visibility of SS7 traffic for SS7oIP
- Positioned to monitor signaling of all IP infrastructure after migration

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Agilent Applications Roadmap

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Phase 1

- IETF Sigtran SS7oIP Decode
- IP Troubleshooting Call Trace
  - Identify and resolve call related failures on your network in real-time
  - Can be used by front-line support
  - Trace calls using MSISDN, IMSI, +
- IP Troubleshooting Protocol Analysis
  - Quickly filter and collect specific types of messages (example: MSUs containing error indications)
  - Export captured data to external applications

Phase 2

- IP Surveillance
  - Traffic Monitor
  - Network Investigator
- GSM Service Management Applications
  - SMS Service Assurance
  - GSM Roaming Management

Phase 3

- IP Call Detail Records

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Summary

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SS7oIP…

- Improves network efficiencies while managing SS7 traffic growth
- Enables new applications for rapid “time to revenue”
- A strategic element for a converged IP voice and data networks

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You’ve got to know both

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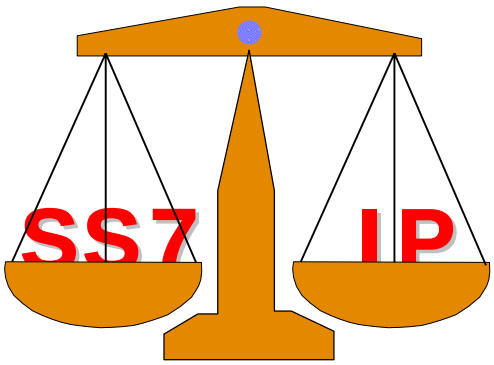

Only Cisco ITP has SS7oIP STP solution built on a router
Only Cisco ITP has SS7oIP solution with effective QoS
Only Cisco has real SS7 and IP expertise

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Questions and Answers

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