SS7 over IP Solution for 2G/3G Mobile Wireless

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Introduction of Cisco's SS7 over IP Solution for CDMA2000 and UMTS

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Agenda

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- IETF Sigtran Standard Overview
- Introduction of ITP
- Introduction of SGM
- Resilience and QoS Issues on SS7 over IP Network
- The Sigtran requirements for Mobile Standard
- SS7 over IP Deployment for 2G
- SS7 over IP Deployment for 3G
- ITP go-to-market Partner
- Customer Deployment and Trial Status

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IETF SIGTRAN Working Group

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- Multi-vendor group that is designing SS7oIP standards
  - Group includes Cisco, NT, Lucent, Alcatel, Ericsson, Nokia, Seimens, Tekelec, etc.
- 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

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IETF SIGTRAN Protocol

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- SCTP (Stream Control Transmission Protocol, RFC2960) – transport layer that provides reliable data transfer.
- M2PA (MTP2-User Peer-to-Peer Adaptation, draft status) – provides MTP3 with equivalent transport layer services as MTP2.
- M2UA (MTP2-User Adaptation, draft status) – client/server protocol providing a gateway to legacy SS7 network for IP-based applications that interface at the MTP2 layer.
- M3UA (MTP3-User Adaptation, draft status) – client/server protocol providing a gateway to legacy SS7 network for IP-based applications that interface at the MTP3 layer.
- SUA (SCCP-User Adaptation, draft status) – client/server protocol providing a gateway to legacy SS7 network for IP-based applications that interface at the SCCP layer.

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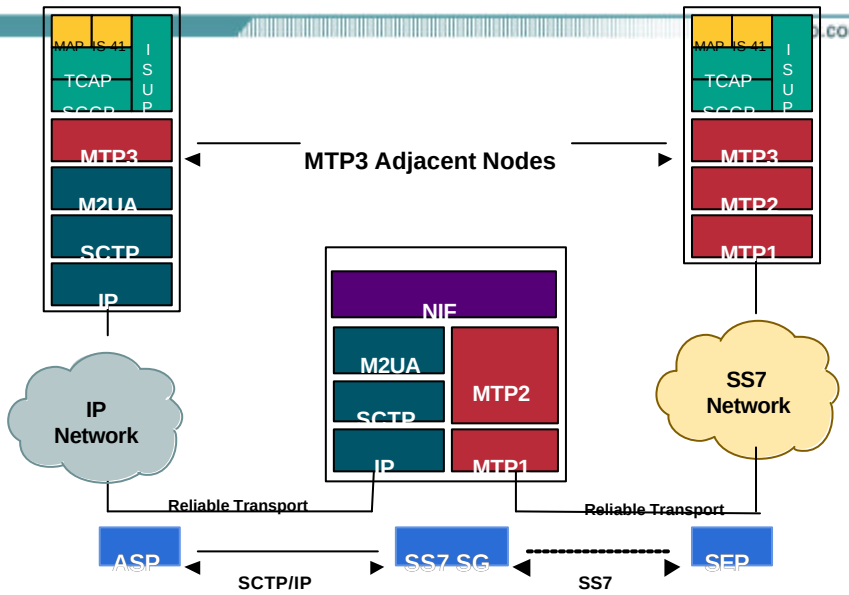
M2UA Protocol Stack



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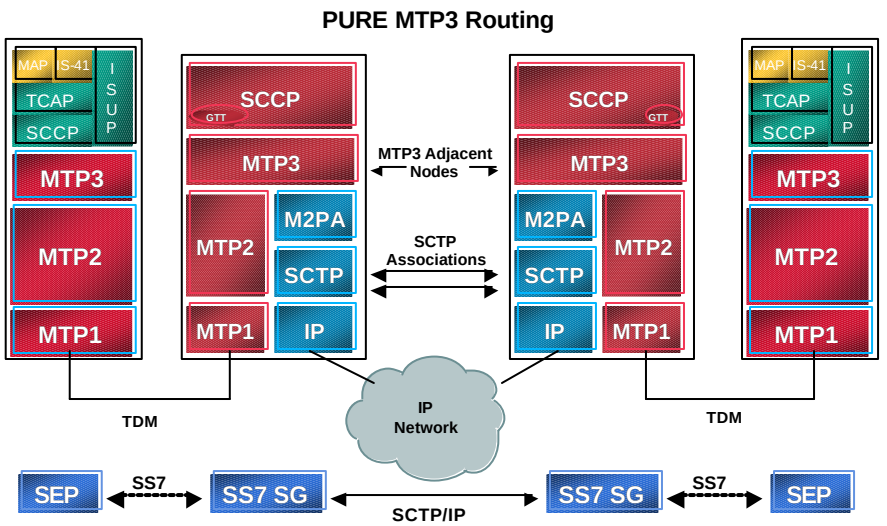
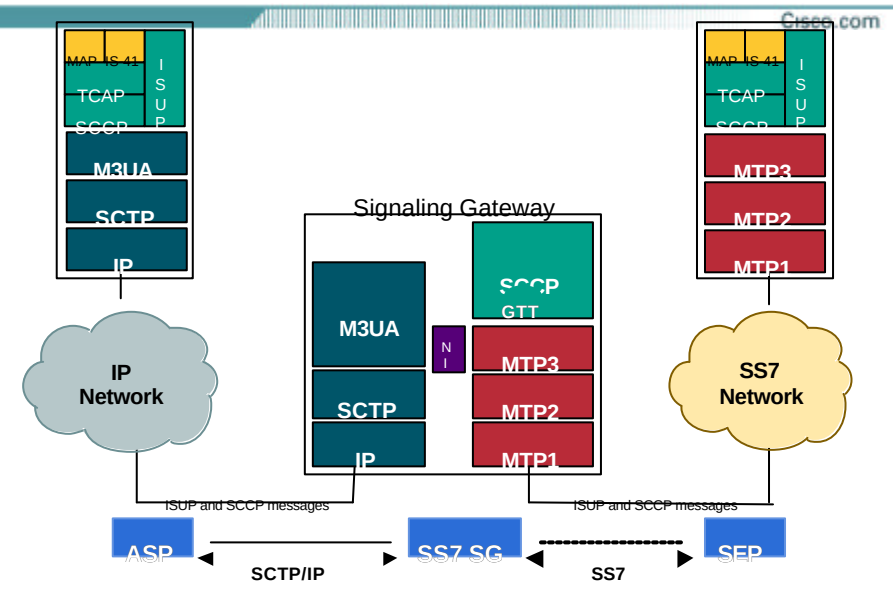
M2PA Protocol Stack



M3UA Protocol Stack



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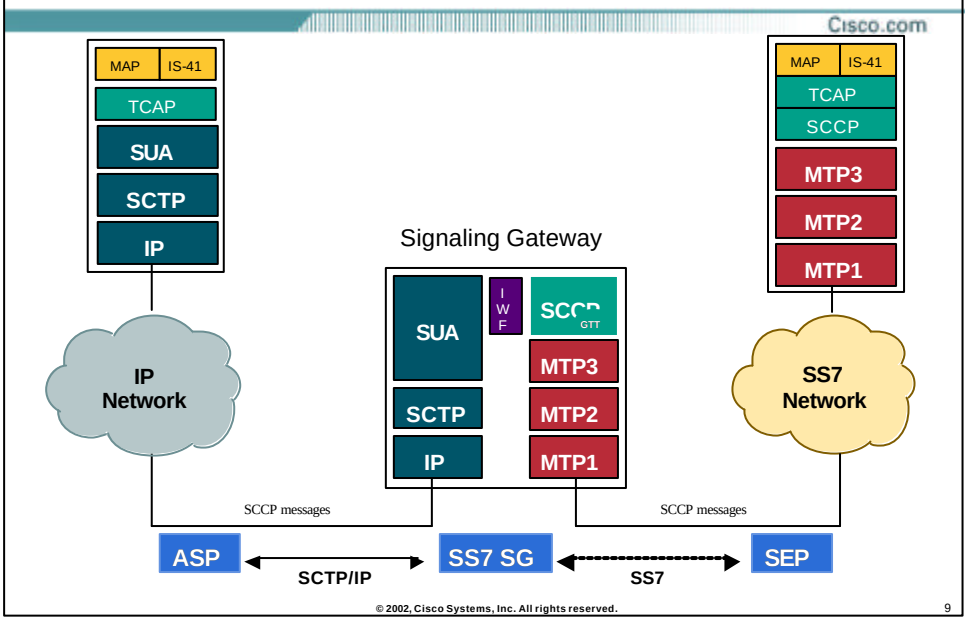
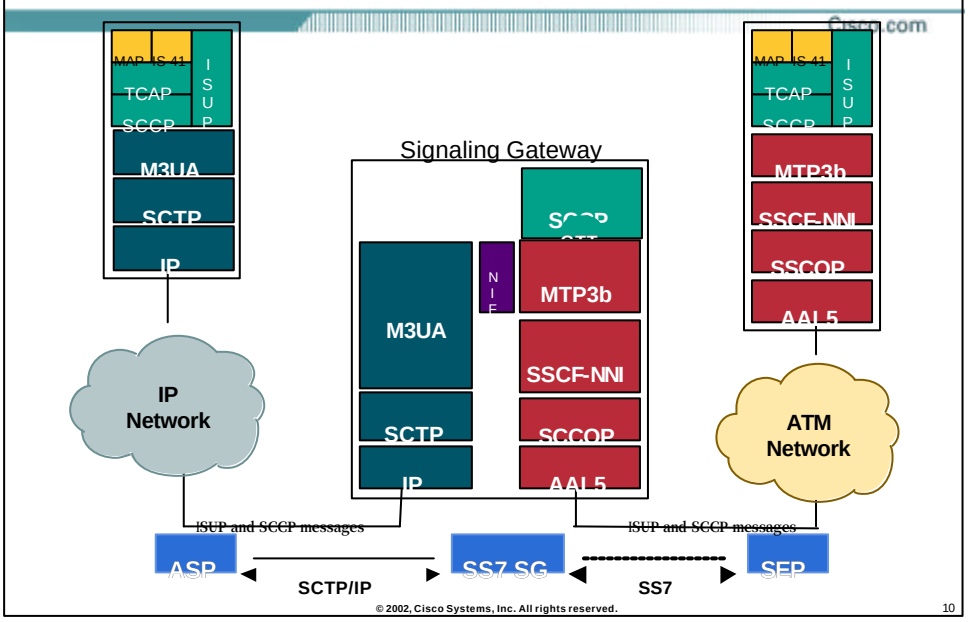
SUA Protocol Stack



MTP3b Protocol Stack



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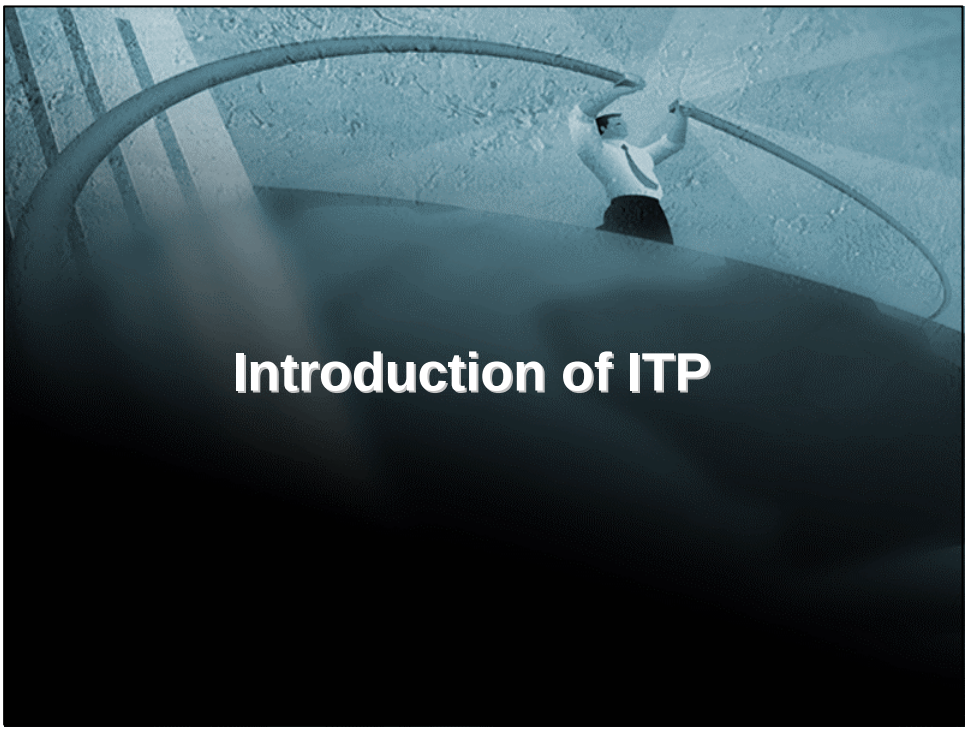

Cisco ITP Standard Compliant

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Protocol	Specification
MTP (1,2, and 3) SS7	ITU-T Q.701-Q.709 White 1996 (interworks with Blue), ANSI T1.111-1996
SCCP	ITU-T Q.711-Q.719 White 1996 (interworks with Blue), ANSI T1.112-1996
M2PA, M3UA, SUA	Internet Engineering Task Force (IETF) Signaling Transport (SIGTRAN)
SCTP	IETF RFC 2960 - Stream Control Transmission Protocol (SCTP)

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Sigtran Protocol Architecture on ITP

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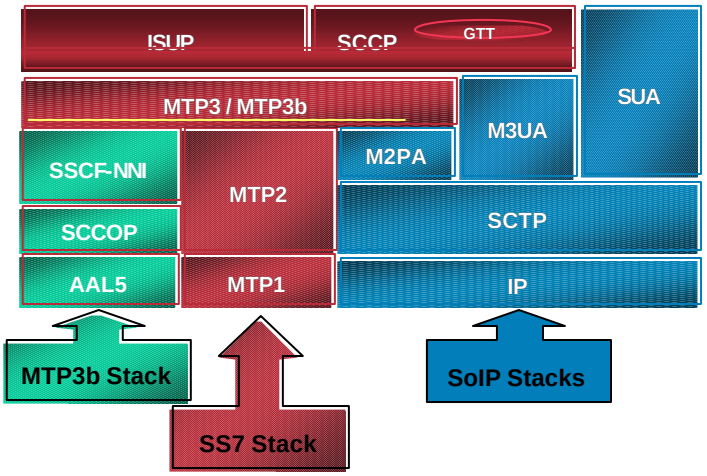
Cisco IOS ITP Base Sigtran Bundle



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Cisco ITP Platform

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HIGH END PLATFORM (7507/7513)	**LOW END PLATFORM (2651)**
ITP is IOS Software bundled on existing Cisco platforms	
Dual Processor	Single Processor
Dual DC Power	External Dual DC Power
Hot-swap line cards	No Hot-swap capability
NEBS Compliant	NEBS Compliant
Any IP WAN media	2- 10/100 Ethernet Ports/ 1 - Network Module for other WAN media
720 SS7 TDM Links / 1000 M2PA Links	4 SS7 Links / 100 M2PA Links
SS7 Interfaces: T-1, E1, V.35, RS-449	SS7 Interfaces: T-1, E1, V.35, RS-449

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ITP7500 IP Network Features

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- IP Routing
  - High performance IP routing
  - Support for many routing protocols or static routing
- IP Media
  - 10/100/1000 Ethernet
  - Channelized or unchannelized T1 or T3
  - ATM over T3, OC3 single-mode, OC3 multi-mode
  - Frame Relay, SMDS, X.25
  - Packet over SONET – OC3 or OC12
- IP Features Include
  - IP Screening / Filtering / Quality of Service / DHCP
  - Security (Ex: IPSec), Authentication, Authorization, and Accounting (AAA)
  - IP load balancing

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Cisco 7500 Hardware Architecture

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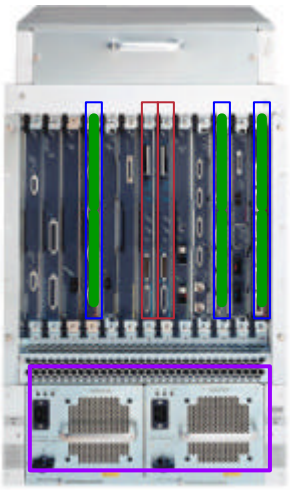
Route Switch Processors (RSP)

RSP8 / RSP16
Add second RSP for Redundancy



Versatile Interface Processors (VIP)

VIP4-80 / VIP6-80
Increase Performance

Port and Services Adaptors

Industry Leading 70+ LAN & WAN Adaptors To Choose From

Provides SS7 or IP network ports

2 Power Supplies for Redundancy

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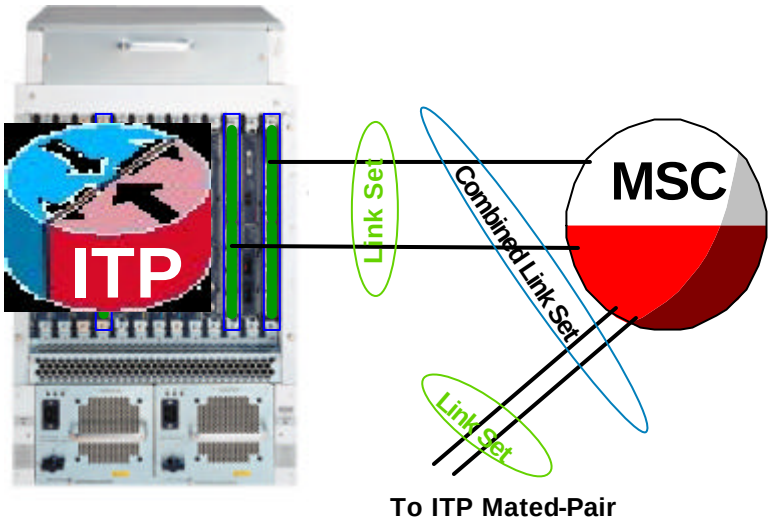
Recommended LinkSet / Link Configuration



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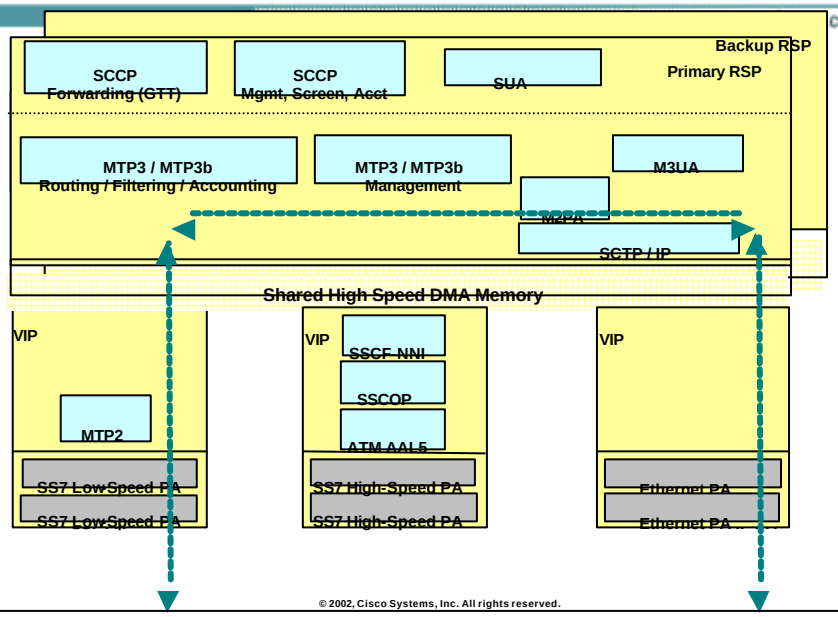
Protocol Architecture Diagram
- ITP7500 Release 2.0/3.0 (Available Now)



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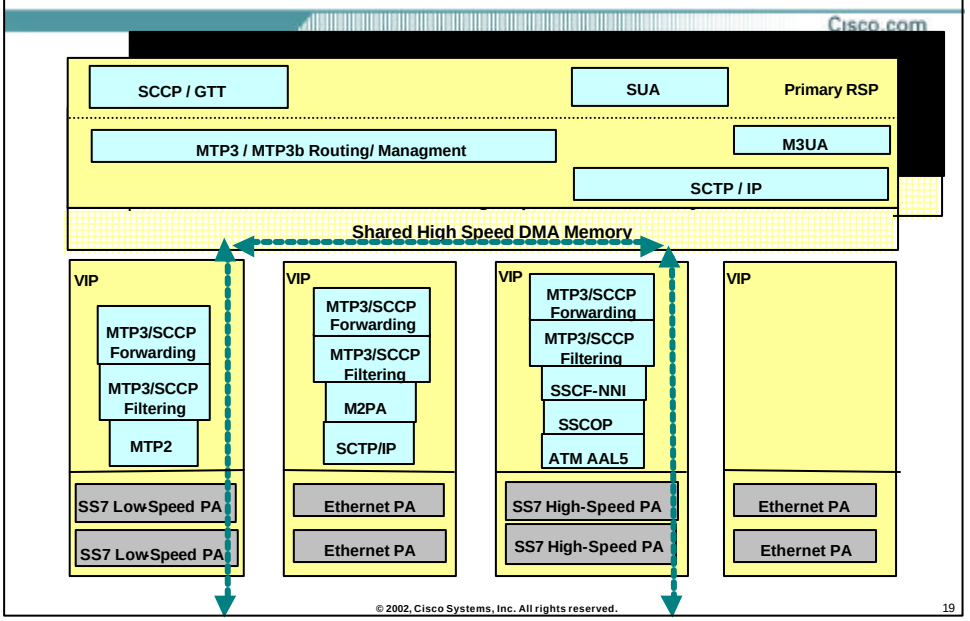
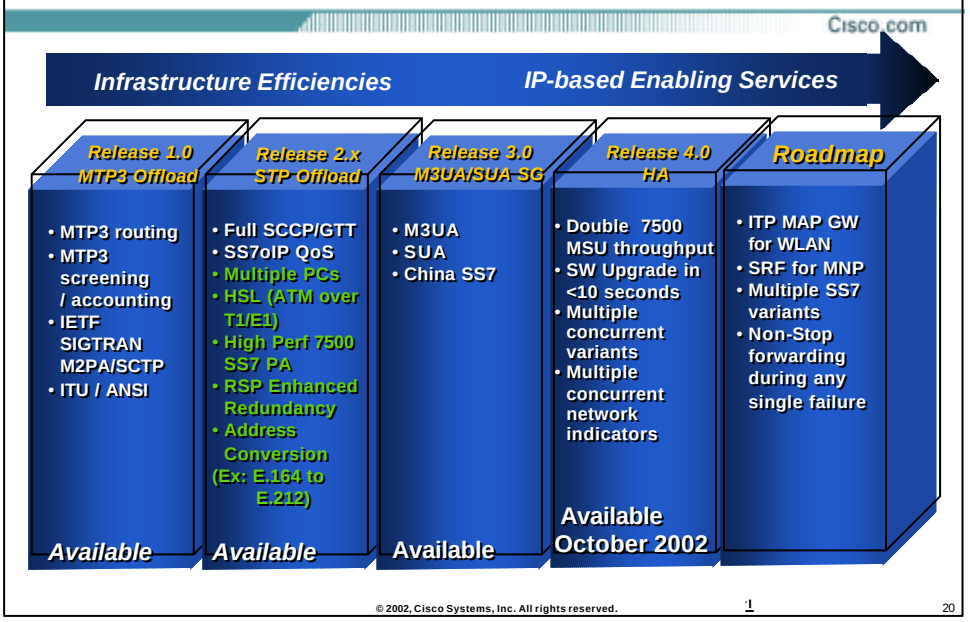
Protocol Architecture Diagram
- ITP7500 Release 4.0



ITP Product Roadmap



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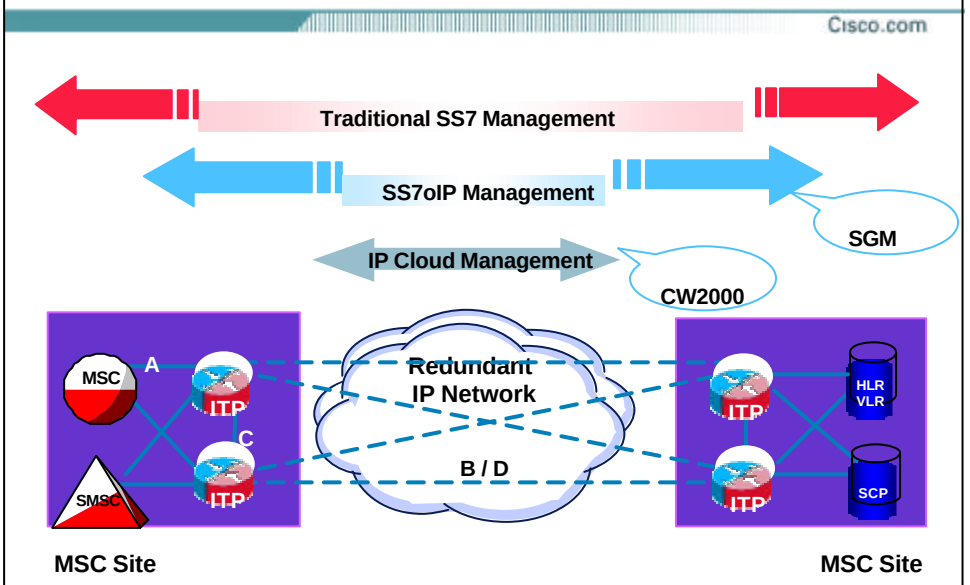
ITP Network Management View



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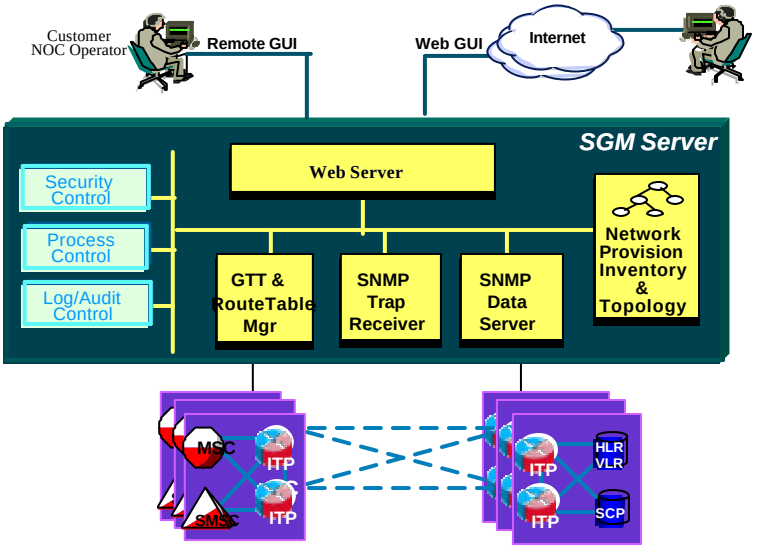
SGM System Functional View



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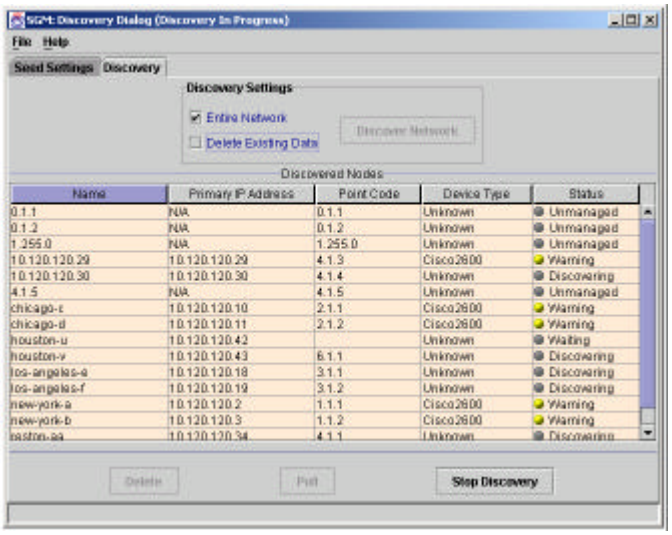
SS7 Node Discover Window



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Topology Window

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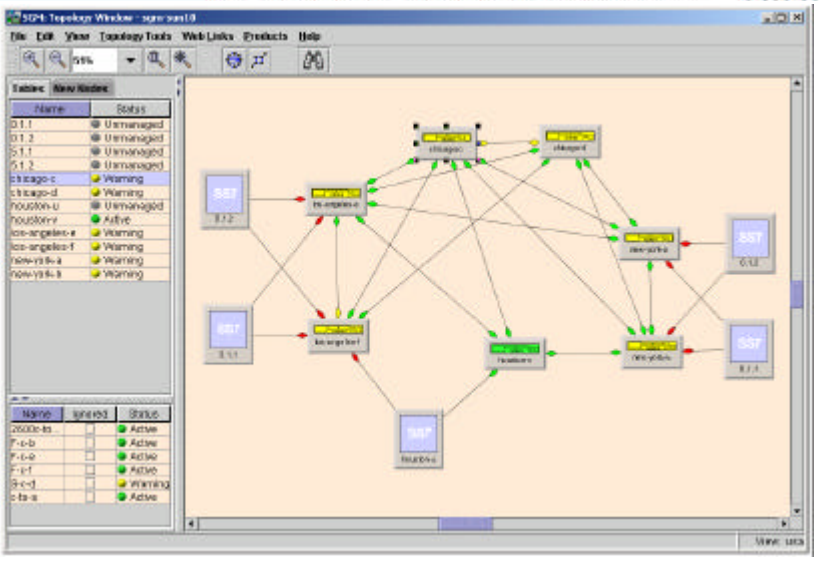

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LinkSet Window

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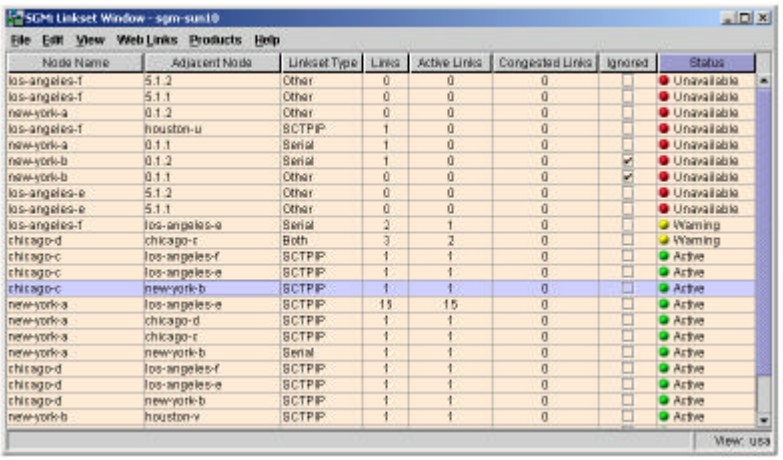

Node Name	Adjacent Node	Linkset Type	Links	Active Links	Congested Links	Ignored	Status
los-angeles-f	5.1.2	Other	0	0	0		Unavailable
los-angeles-f	5.1.1	Other	0	0	0		Unavailable
new-york-a	0.1.2	Other	0	0	0		Unavailable
los-angeles-f	houston-u	SCTPIP	1	0	0		Unavailable
new-york-a	0.1.1	Serial	1	0	0		Unavailable
new-york-b	0.1.2	Serial	1	0	0	✓	Unavailable
new-york-b	0.1.1	Other	0	0	0	✓	Unavailable
los-angeles-e	5.1.2	Other	0	0	0		Unavailable
los-angeles-e	5.1.1	Other	0	0	0		Unavailable
los-angeles-f	los-angeles-e	Serial	2	1	0		Warning
chicago-d	chicago-c	Both	3	2	0		Warning
chicago-c	los-angeles-f	SCTPIP	1	1	0		Active
chicago-c	los-angeles-e	SCTPIP	1	1	0		Active
chicago-c	new-york-b	SCTPIP	1	1	0		Active
new-york-a	los-angeles-e	SCTPIP	15	15	0		Active
new-york-a	chicago-d	SCTPIP	1	1	0		Active
new-york-a	chicago-c	SCTPIP	1	1	0		Active
new-york-a	new-york-b	Serial	1	1	0		Active
chicago-d	los-angeles-f	SCTPIP	1	1	0		Active
chicago-d	los-angeles-e	SCTPIP	1	1	0		Active
chicago-d	new-york-b	SCTPIP	1	1	0		Active
new-york-b	houston-v	SCTPIP	1	1	0		Active

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LinkSet Details

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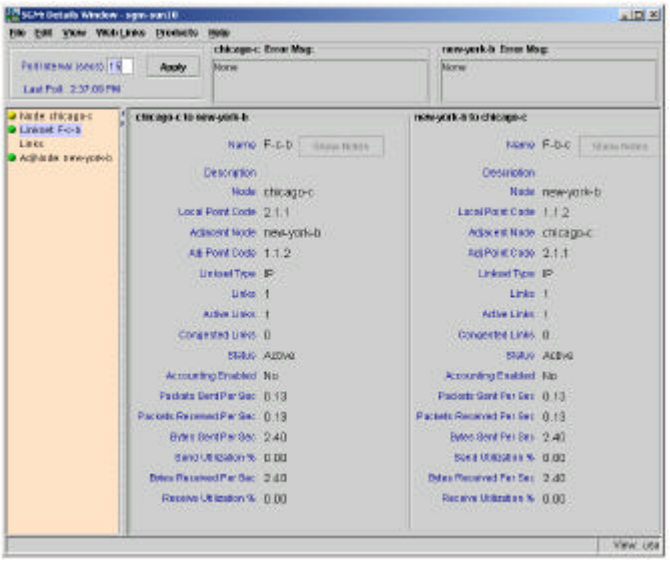

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DPC Route Table Configuration

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SGM: Route Table Dialog -- roma-2600-a

Destination Point Code	Destination Linkset	Mask	Cost
5.1.2	a-to-f	7.255.7	5
5.1.1	a-to-f	7.255.7	3
3.1.2	a-to-c	7.255.7	1
3.1.2	a-to-d	7.255.7	2
3.1.2	a-to-f	7.255.7	3
3.1.1	a-to-f	7.255.7	3
2.1.1	a-to-d	7.255.7	3
2.1.1	a-to-c	7.255.7	5

Save Delete Print Cancel Help

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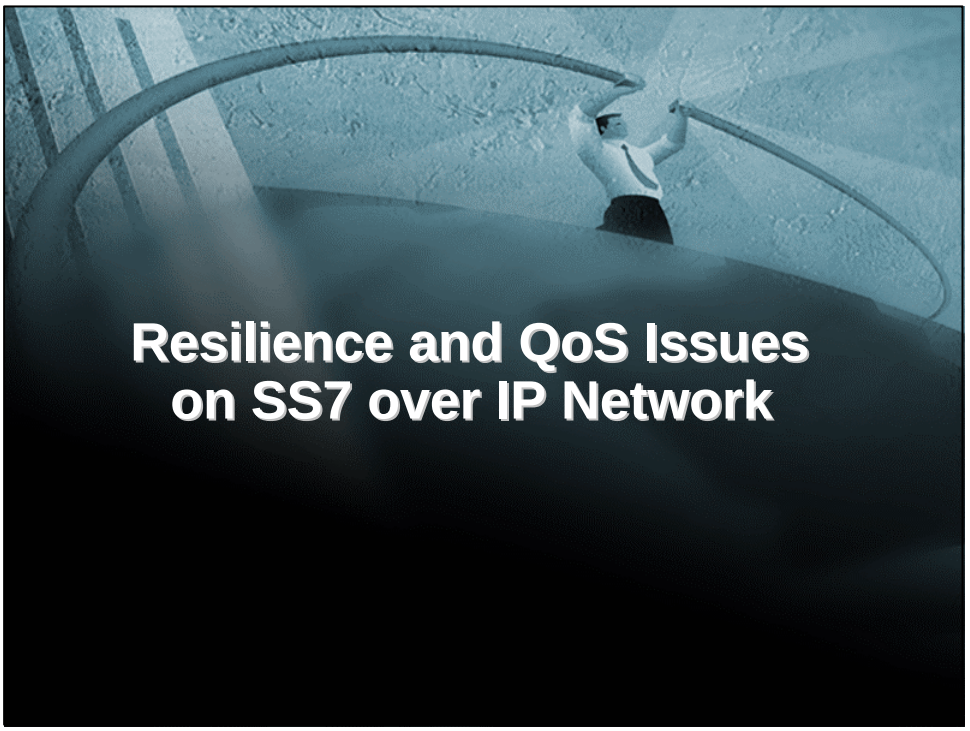

Resilience Features on ITP
- SG Integrated on Cisco IOS

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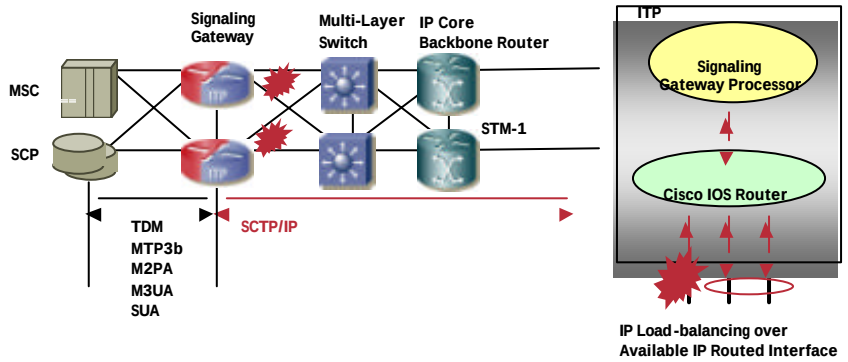

- ✍Built in Routing Capability (Cisco IOS)
- ✍ITP Provides Self-Determined Redundancy IP Routing Path
- ✍SCTP Transmission recovery Time is less than 1sec (SCTP Multi-homing)
- ✍Inter-operability function with other standard based SG vendor

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SCTP Multi-Homing Configuration

- No single point-of-failure for LinkSet X and Link1,Link2

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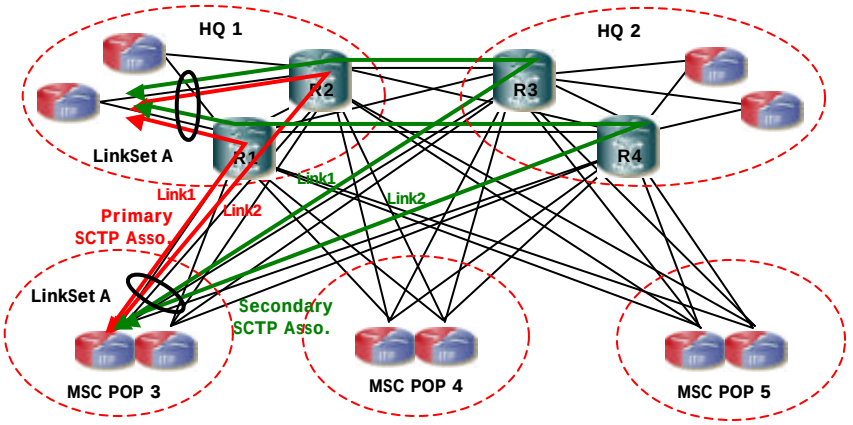

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QoS Features on ITP

- SS7 Message based QoS Classification and IP TOS Marking

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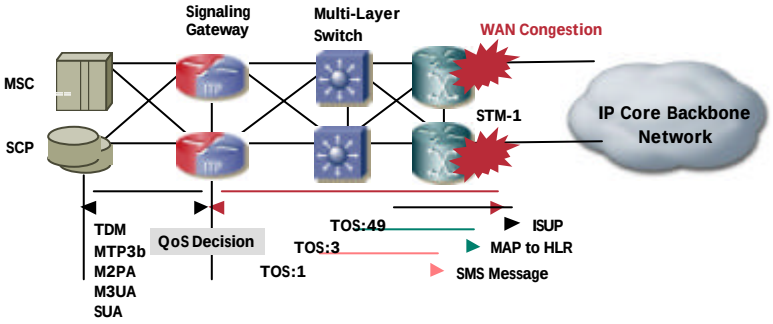

- Each SCTP/IP Packet has its own IP TOS based on QoS Policy configured in ITP
- ITP Provides Various QoS Condition (Input LS/SIO/DPC/Access-List/GTA/ASP/AS)

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IP QoS Consideration for Signaling
- Class Definition and Cisco QoS Tools for Signaling Traffic

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Traffic Class	Signaling Class	Conversational Class	Streaming Class	Interactive Class	Background Class
Transmission Protocol	SCTP/UDP/TCP	UDP/RTP	UDP/RTP	TCP	TCP
Retransmission	Yes	No	No	Yes	Yes
DiffServ PHB	Signal	EF	AF:C1 / C2	AF:C3 / C4	BE
	110001	101110	001xxx / 010xxx	011xxx / 100xxx	000000
InServ	Guaranteed	Guaranteed	Controlled Load	Controlled Load	Best Effort
Application	.SS7 over IP .SIP .MGCP .RSVP Message .COPS Message	.Voice over IP Bearer	.Streaming Real Time Audio/Video Application	.Interactive WWW .Telnet .FTP	.E-Mail .FAX .FTP-data
Scheduling in Edge/Distribute	LLQ	LLQ	CBWFQ	CBWFQ	CBWFQ
Shaping in the Distribute/Core	CAR				
Congestion Avoid Tool in the Core	WRED				
Latency Control in the Core	MDRR				

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IP QoS Consideration for Signaling
- Sample Captured SCTP Packet

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```
⊞ Frame 4 (130 on wire, 130 captured)
⊞ Ethernet II
⊟ Internet Protocol, Src Addr: llalicke.vtc.csc.com (20.1.1.3), Dst Addr: 20.1.2.3 (20.1.2.3)
    Version: 4
    Header Length: 20 bytes
  ⊞ Differentiated Services Field: 0xb8 (DSCP 0x2e: Expedited Forwarding; ECN: 0x00)
    Total Length: 116
    Identification: 0x689e
  ⊞ Flags: 0x00
    Fragment offset: 0
    Time to live: 255
    Protocol: SCTP (0x84)
    Header checksum: 0x26a8 (correct)
    Source: llalicke.vtc.csc.com (20.1.1.3)
    Destination: 20.1.2.3 (20.1.2.3)
⊞ Stream Control Transmission Protocol
⊞ MTP2 Peer Adaptation Layer
⊟ Message Transfer Part Level 3
  ⊟ Service Information Octet
      10.. .... = Network Indicator: National network (0x02)
      ..00 .... = Spare: 0x00
      .... 1000 = Service Indicator: MTP testing user part (0x08)
  ⊟ Routing Label
      .... .... .... .... ..00 1000 0001 0011 = DPC: 2067
      .... 0010 0000 0010 11.. .... .... .... = OPC: 2059
      0000 .... .... .... .... .... .... .... = Signalling Link Selector: 0
    Payload (34 bytes)
```

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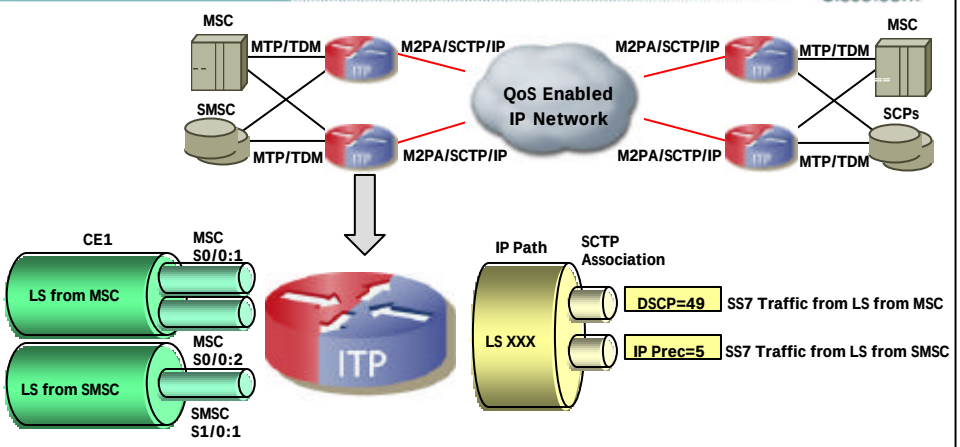
QoS/Screening Features on ITP
- Input LinkSet based Classification



✍QoS Classification and Mark for SS7 over IP Traffic based on Input LinkSet

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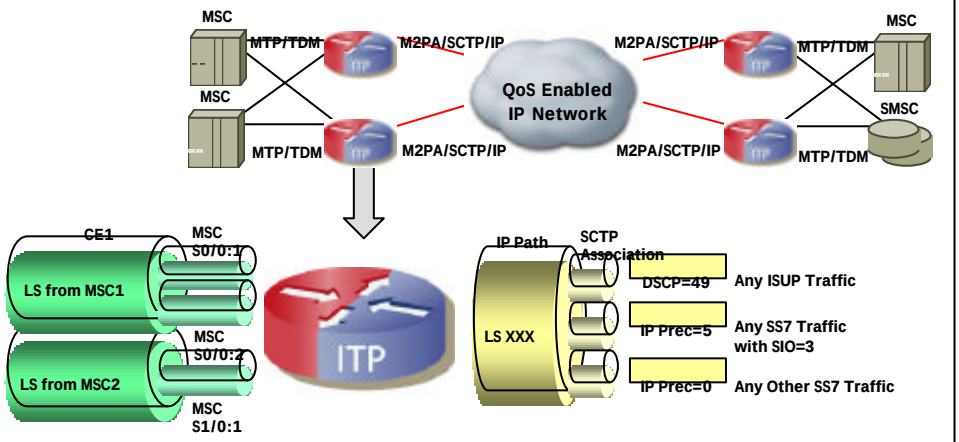
QoS/Screening Features on ITP
- Service Indicator based Classification



✍QoS Classification and Mark for SS7 over IP Traffic based on SIO Pattern

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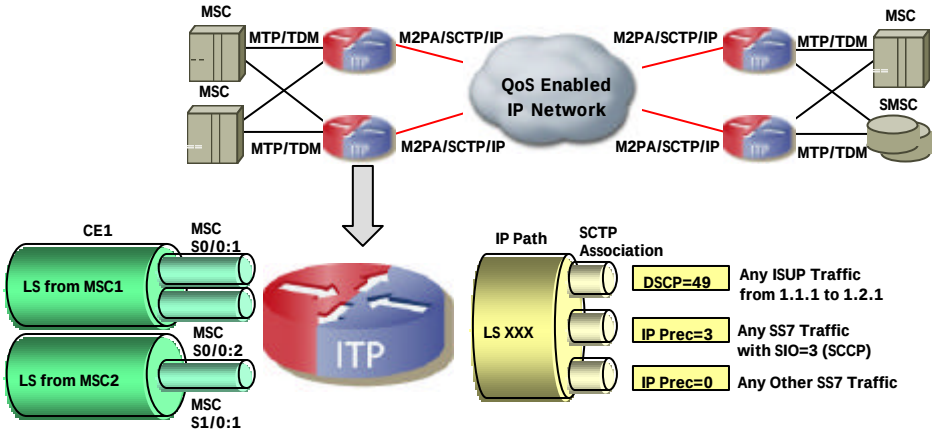
QoS/Screening Features on ITP
- Access Control List based Classification



✍QoS Classification and Mark for SS7 over IP Traffic based on Complex Condition Determined by IOS Access Control List (2700 ~ 3000)

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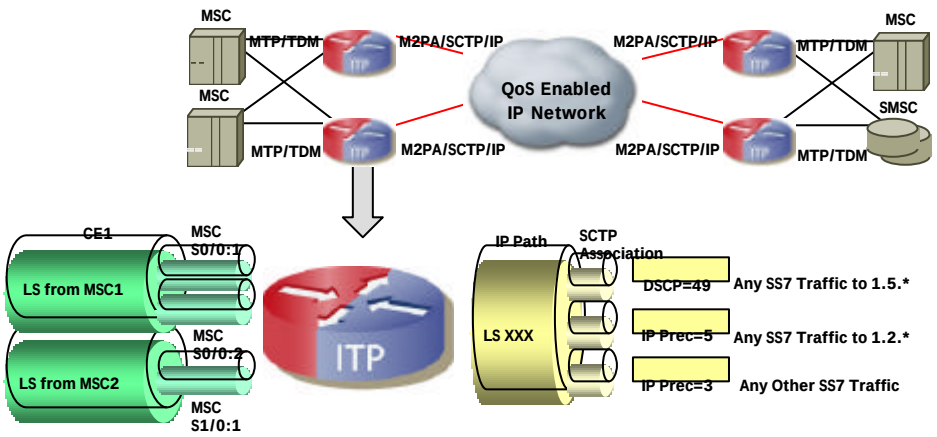
QoS/Screening Features on ITP
- Destination Point Code based Classification



✍QoS Classification and Mark for SS7 over IP Traffic based on DPC

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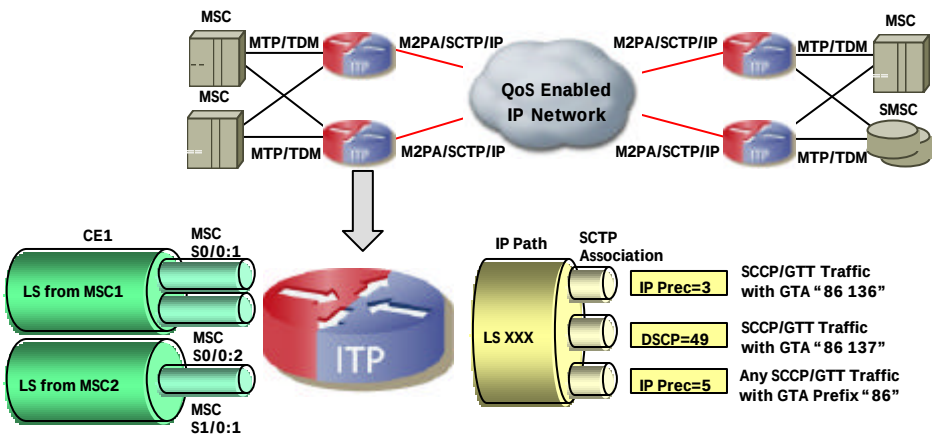
QoS/Screening Features on ITP
- SCCP/GTT based Classification



✍QoS Classification and Mark for SS7 over IP Traffic based on GTA Pattern

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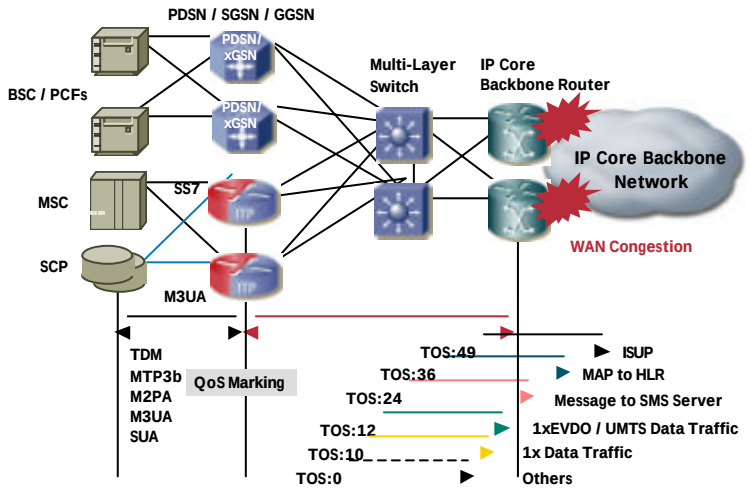
QoS Features on ITP
- Sample QoS Configuration for CDMA/UMTS Operator



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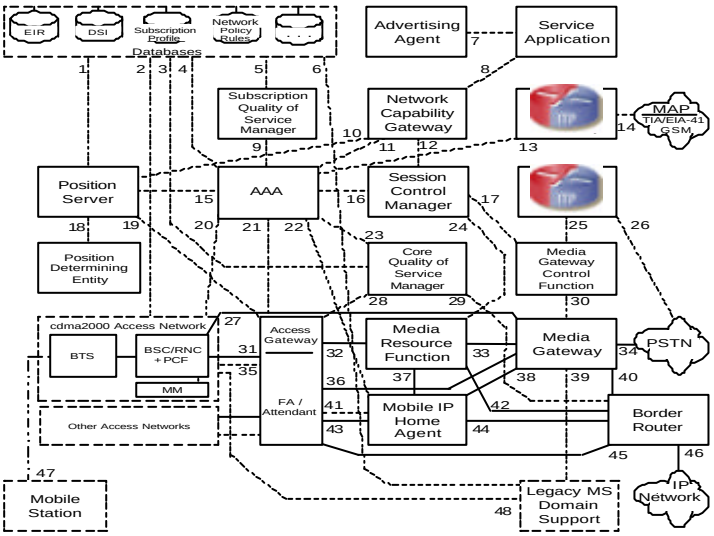
3GPP2 All IP Architecture

- All IP NAM Rev 1.1.1 (8.2001)



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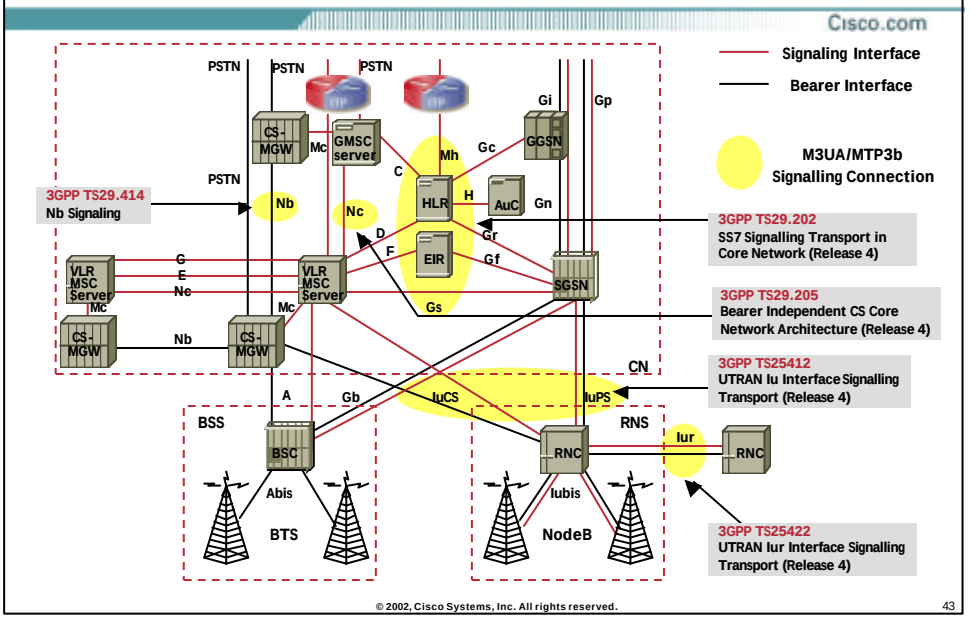
3GPP UMTS R4 Architecture

- M3UA/MTP3b Signaling Requirement



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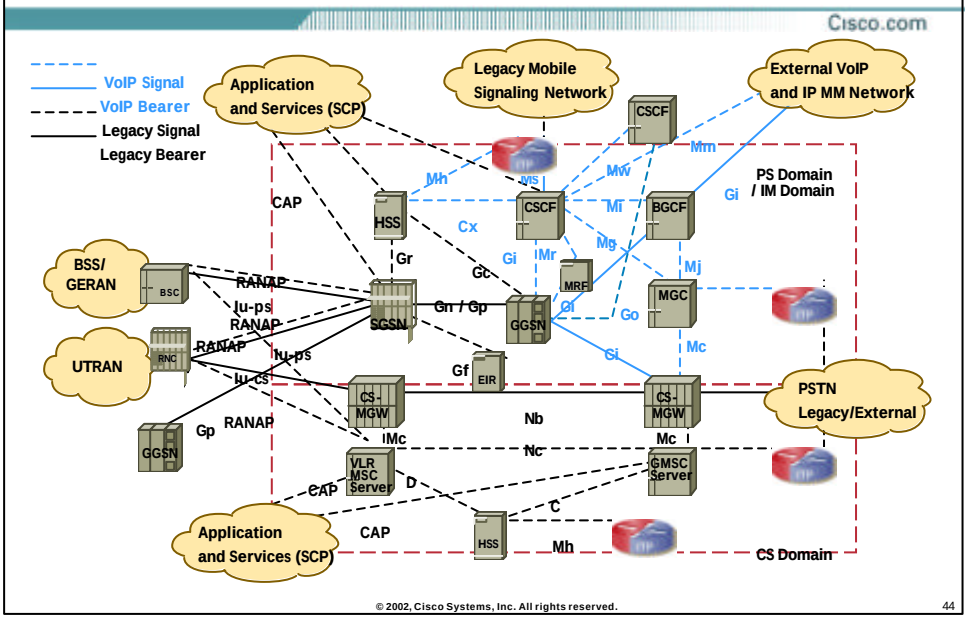
3GPP UMTS R5 Architecture

- TS23.002-540 Architecture .vs Cisco's Solution



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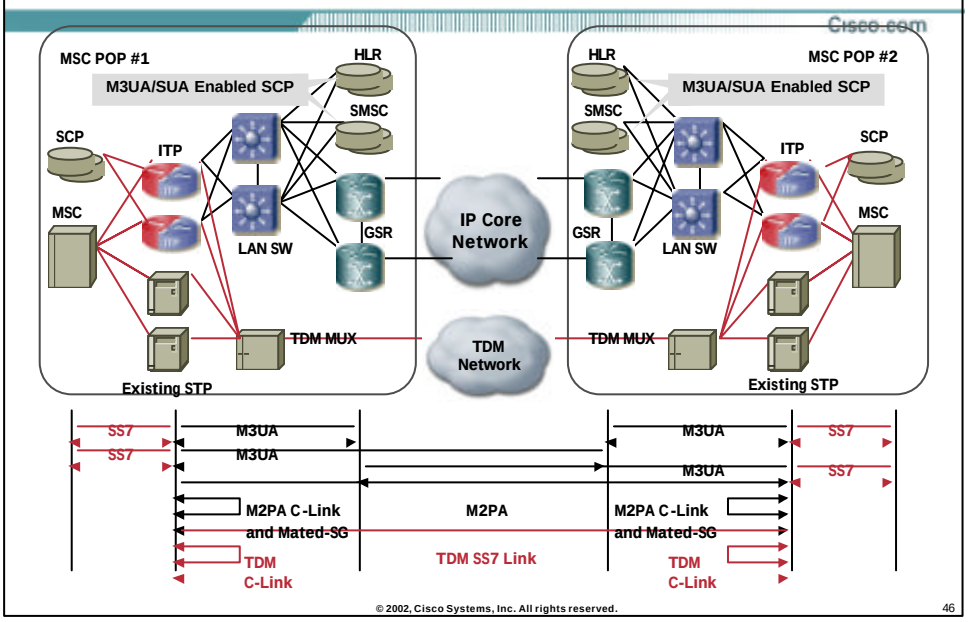
SS7 over IP Deployment for 2G
- M3UA/SUA/M2PA with TDM



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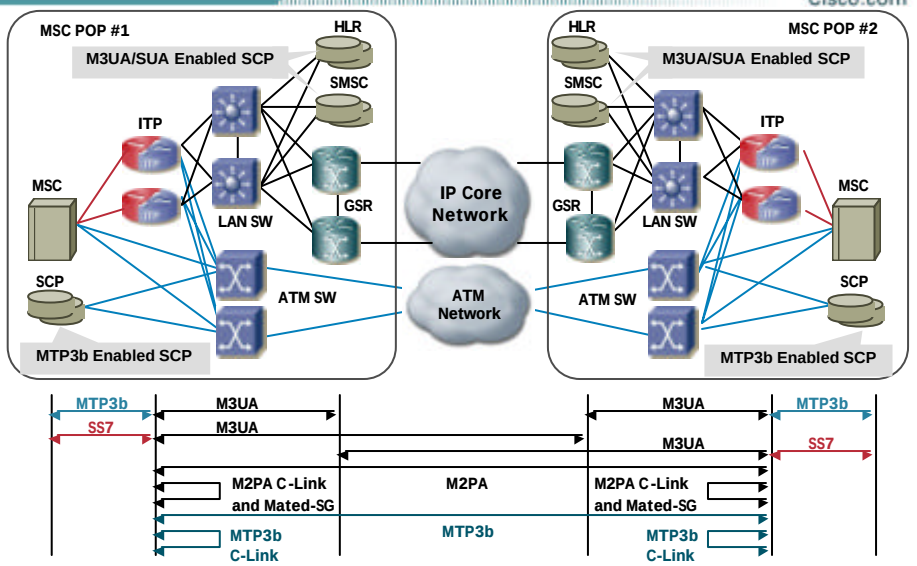
SS7 over IP Deployment for 2G
- M3UA/SUA/M2PA with MTP3b



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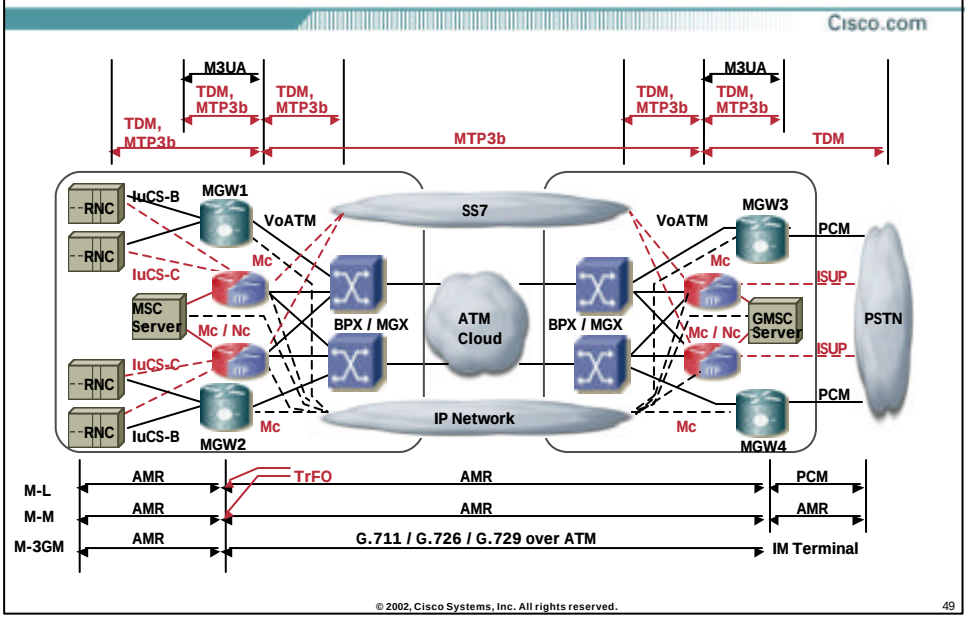
3GPP UMTS R4 Architecture

- UMTS R4 CN Deployment : example for VoATM



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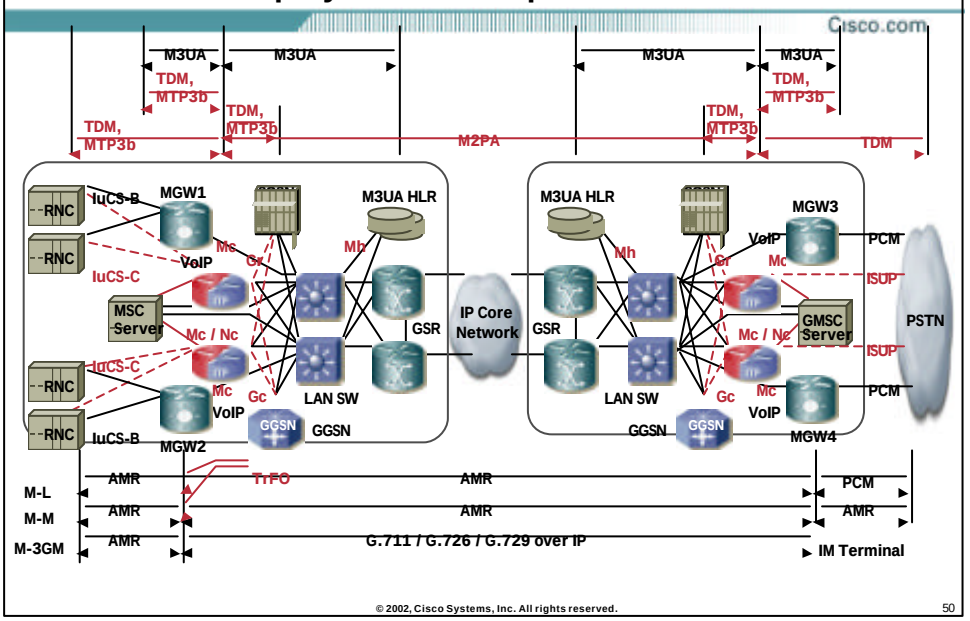
3GPP UMTS R4 Architecture

- UMTS R4 CN Deployment : example for VoIP



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SG Deployment Sample for UMTS Trial

- TDM CE1, ATM MTP3b E1/STM-1 , M2PA , M3UA, SUA

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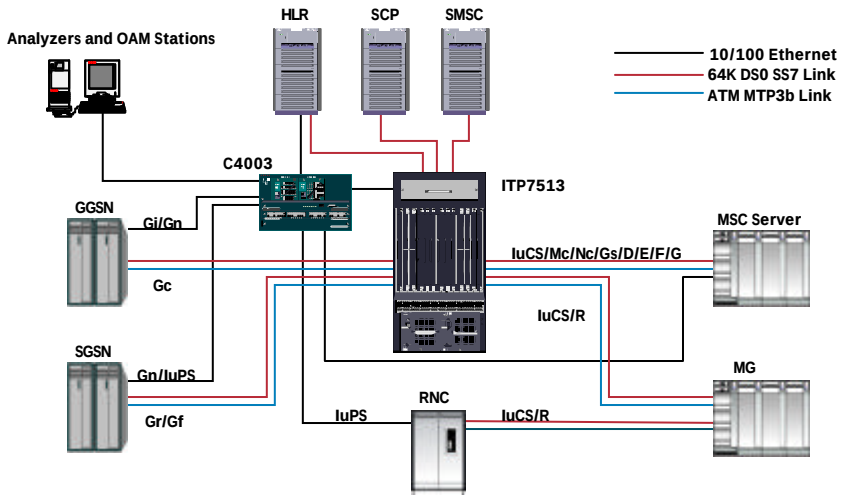

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Dual Stack HLR for CDMA & UMTS

- Signaling Link Aggregation and Protocol Conversion

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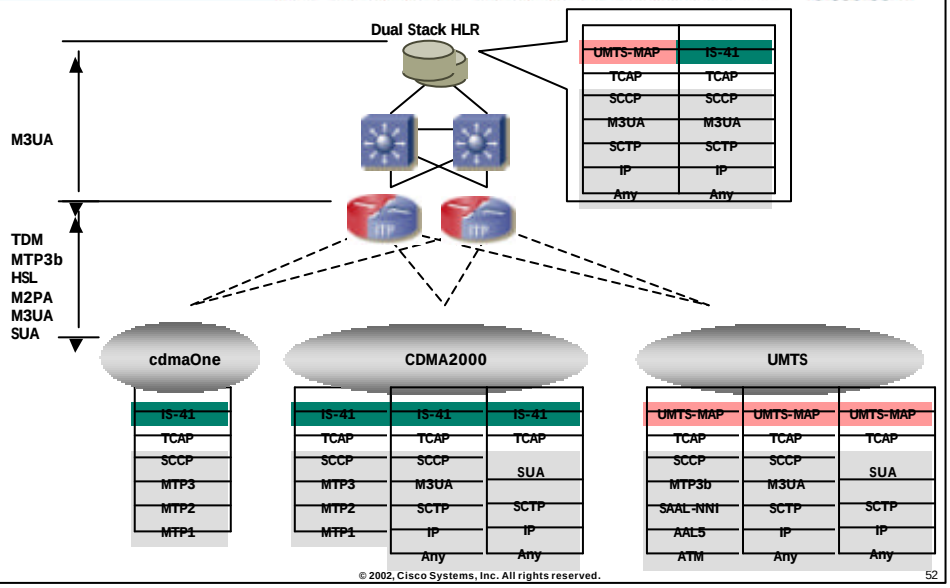

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