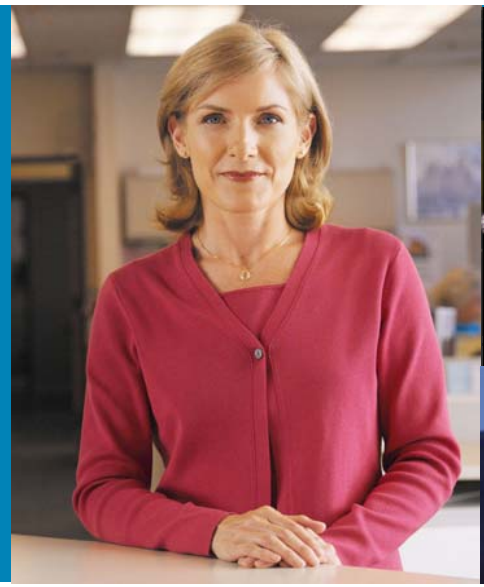
Next Generation Signaling Transport

Cisco ITP
IP Transfer Point



October 2007

Mobility, Signaling and Control Business Unit

What is an “ITP”?

- IP-enabled core STP (SS7 router) & Signaling Gateway
- Integrated high-capacity IP and SS7 routing in one box
- A core STP with:
  - Carrier Grade reliability with Low Power & Small Footprint
  - Traditional TDM-based plus next-generation STP with SS7oIP
  - Integrated applications such as Number Portability and Flexible Numbering and Equipment Identity Register (EIR)
- A Signaling Gateway with:
  - Flexible range of platforms to suit all operator needs
  - Strong SMS routing capabilities with MLR
  - Strong partnership with messaging and IN vendors

ITP Market History

- ITP released to the market in June 2001
- ITPs are deployed as either core STPs, Signaling Gateways, or more frequently, in both roles together
- ITPs have been widely deployed in mobile, wireline, cable and CLEC environments worldwide
- Key drivers for ITP deployments include subscriber growth, new services, text messaging, pre-paid, VoIP, transition to IP-based signaling, etc
- Increasingly ITPs are used to deploy applications for the operator: such as number portability; messaging; flexible numbering and application-level routing

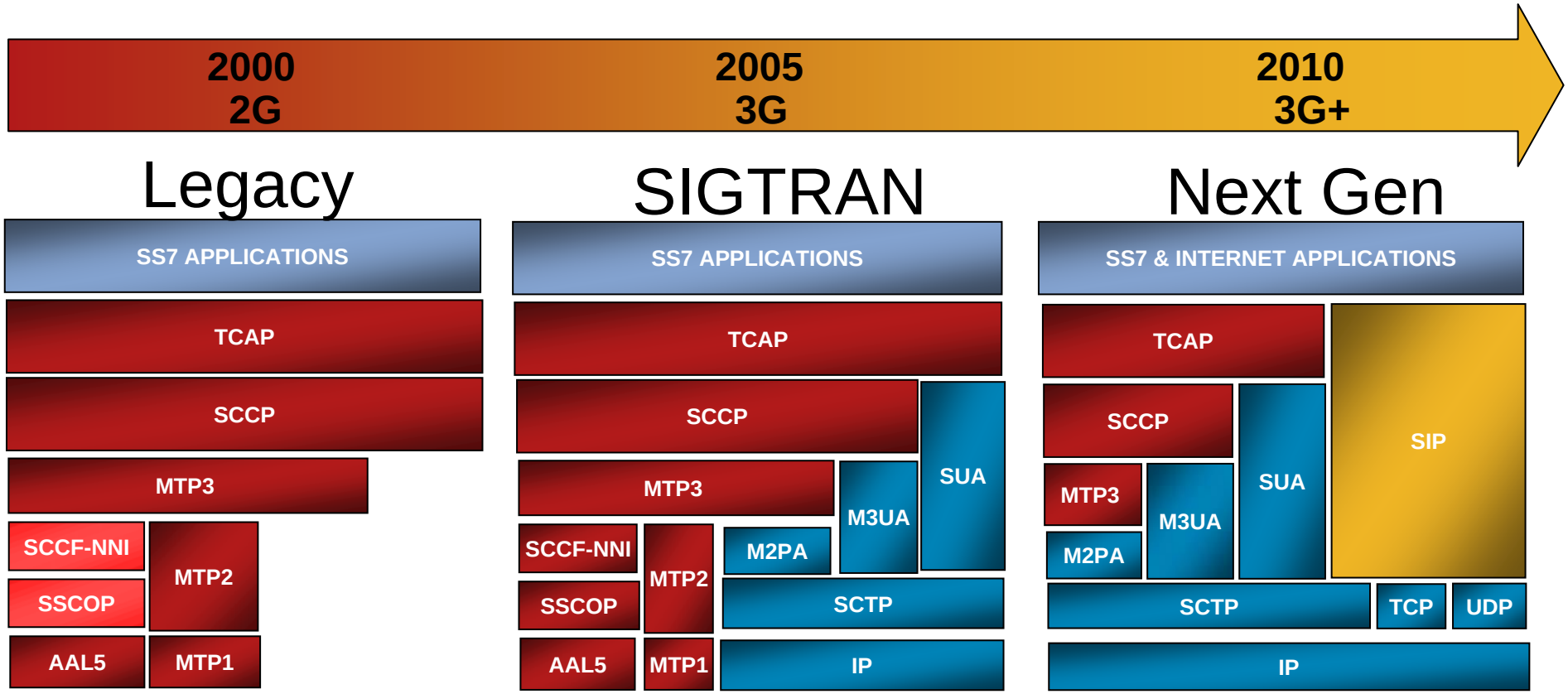
Core Signaling Requirements

Requirement	Feature
Flexible, evergreen core signaling platforms that quickly adopts to changing industry requirements and standards	ITP supports all current and next generation signaling protocols and easily adopts future signaling protocols
Network reliability and performance are maintained at expected levels with lower cost	ITP provides industry leading reliability and performance at significant cost savings on a carrier grade platform
IP routing and signaling protocol functions both required for next generation signaling networks	ITP is a one box solution for both legacy and next generation signaling networks. All other STP vendors need 2 boxes (STP+ router) for next generation networks

Core Signaling Requirements

Requirement	Feature
Standards compliance	ITP supports ITU, ANSI, Chinese and Japanese SS7 variants, as well as IETF Sigtran, ATM, HSL, and TDM with industry certification
Flexible network management that integrates seamlessly into the operational environment of the SS7 network	High performance provisioning, surveillance, fault isolation, and capacity management capabilities Auto-discovery of all SS7 elements
Commitment to product support, evolution and enhancement	Cisco is fully committed to the SS7 market with continuing investment in resources, products and technologies Cisco ITP is the industry leader in SIGTRAN deployments

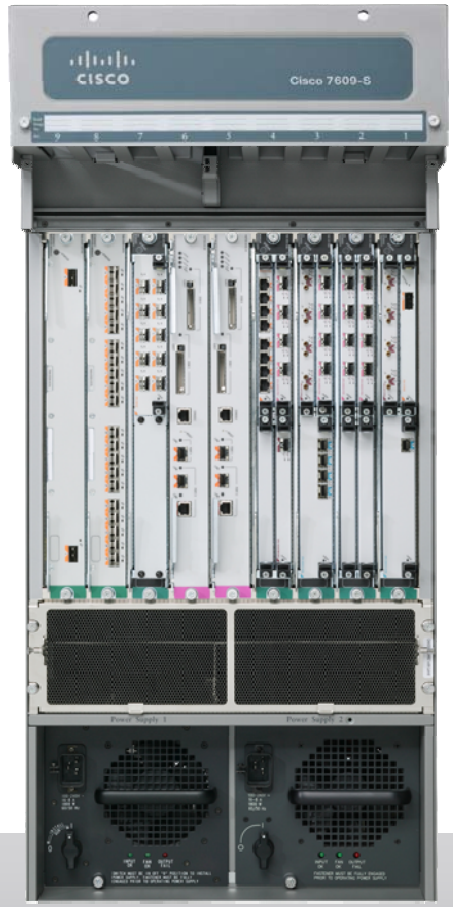
Signaling Core Network Evolution



- Networks will continue to evolve and converge to an IP centric model
- The speed of this evolution and convergence is debatable and it will happen at speeds which will vary per operator

ITP Core STP Platform Attributes

- World Class Carrier Grade Platform
  - Feature Rich Platform
  - Non-disruptive Software Upgrades
  - Full hardware redundancy features
  - Hot insertion and removal of cards
- High Capacity Platform
  - Support for LSL, ATM, HSL, IP links
  - Integrated IP, MTP and SCCP routing
- Any ⇔ Any Routing
  - M2PA, M3UA, SUA, TDM, ATM
- Integrated IP Routing Protocols
  - OSPF, BGP, EIGRP, HSRP, IGRP, NHRP
  - Configurable QoS Per Connection
- Dedicated Network Management
  - Auto Discovery, Multiple Network Views, Route/GTT Editor



ITP - Key Features

- Investment Protection

  Traditional STP vendors are imposing expensive **end-of-life upgrades** which will require forklift upgrades

  ITP supports traditional TDM and ATM signaling as well as combining with **IP signaling** in a single platform

  ITP supports **mixed link types** within a linkset to allow smooth network migrations to IP

  ITP includes required features (e.g. GTT) in the **base price**

- Scalable SS7 Applications

  Traditional STP devices are not able to scale their applications because they use proprietary or **embedded hardware**

  Investment constraints means their applications are limited in both scalability or richness of features

ITP - Key Features

- Industry Leading Value

  Best **price/performance** for legacy and IP based signaling

  Low power consumption, small **footprint**, affordable services

  ITP is only STP to support **both** SS7 and IP routing protocols

- Network Management and Flexibility

  Flexible "**any-to-any**" as well as **application layer** routing

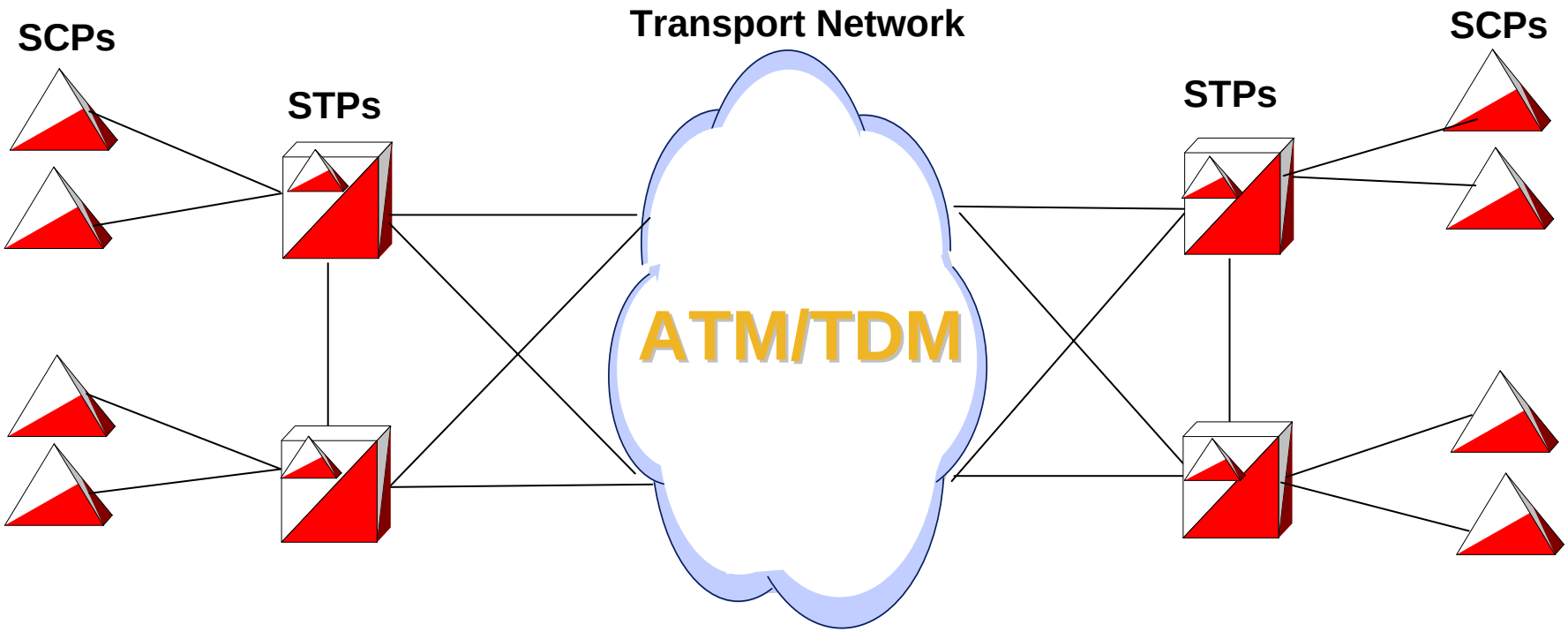
  Easily add capacity for new **revenue-generation** service deployment using MLR and an ITP signaling gateway

  Implement "**triggerless**" services by the use of MLR

  IP-based network monitoring and provisioning improve **operational efficiencies** over traditional approaches

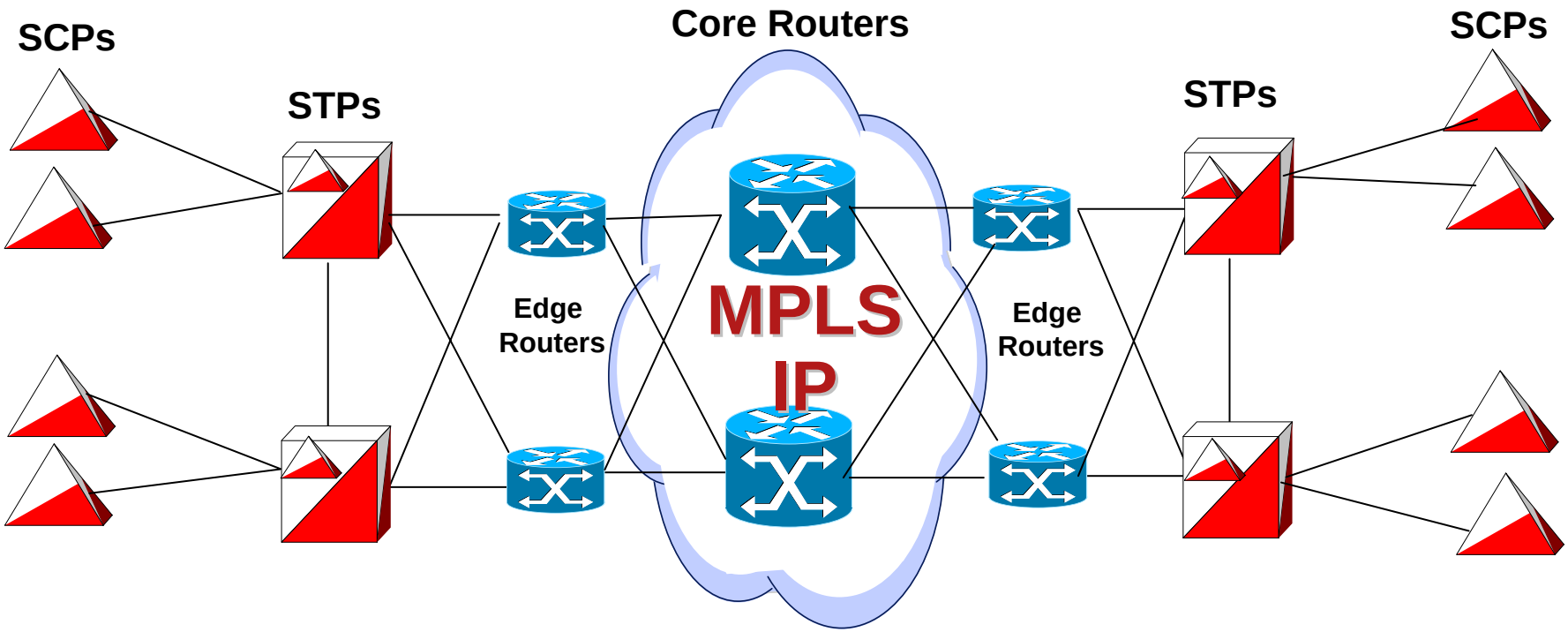
ITP as a Next Generation Core STP

Legacy STP SS7 Deployment



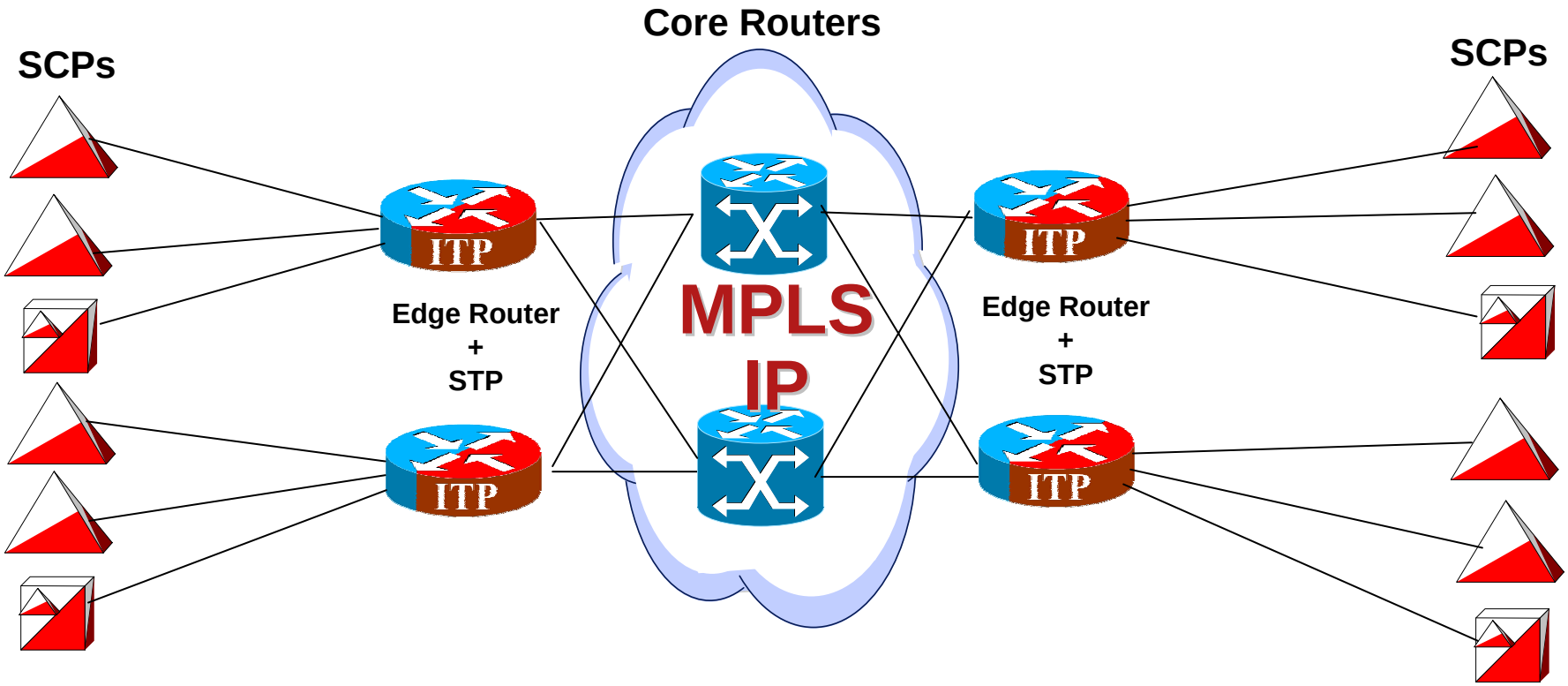
- Legacy STPs require a large footprint, have large power requirements and are expensive to upgrade.
- Legacy STPs do not provide a seamless migration to IP networks

Legacy STP SIGTRAN Deployment



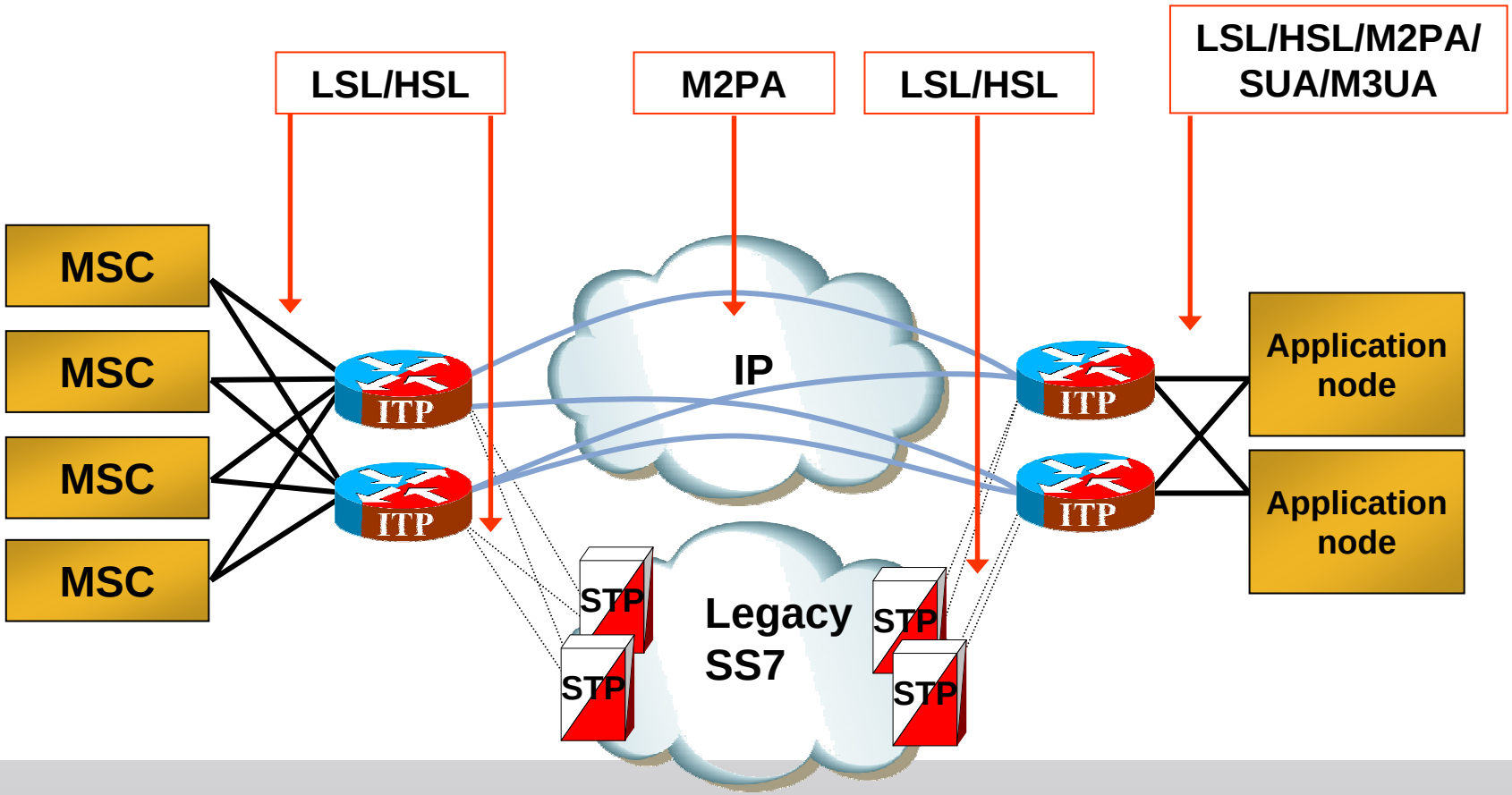
- Legacy STPs require an Edge router to connect to an IP network for SIGTRAN (2 box solution)
- Legacy STP vendors may not have the IP expertise to deploy an end to end IP network

Cisco SIGTRAN Deployment



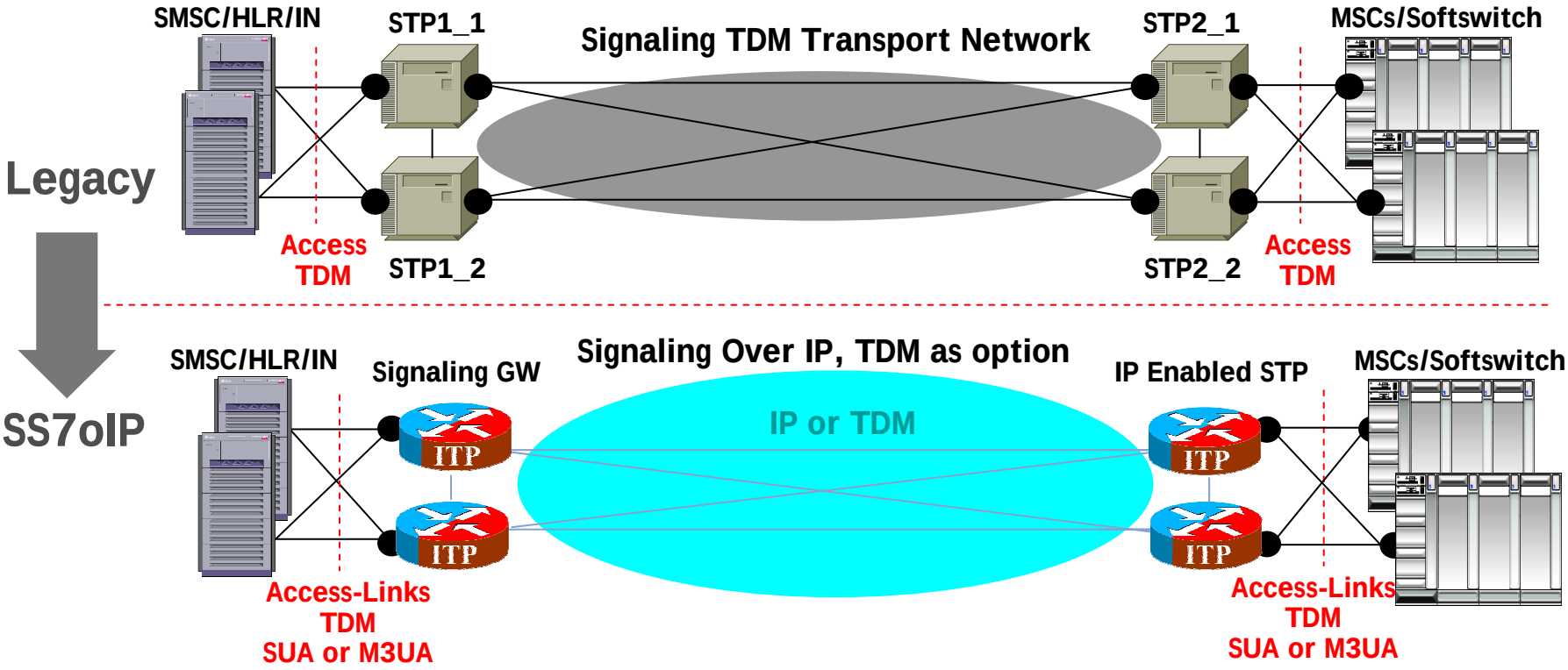
- ITPs are native IP devices and allow the operator maximum flexibility in both SS7 and IP routing capabilities in one device
- Cisco has the IP expertise to properly deploy IP networks
- ITPs can be deployed with integrated IP routing

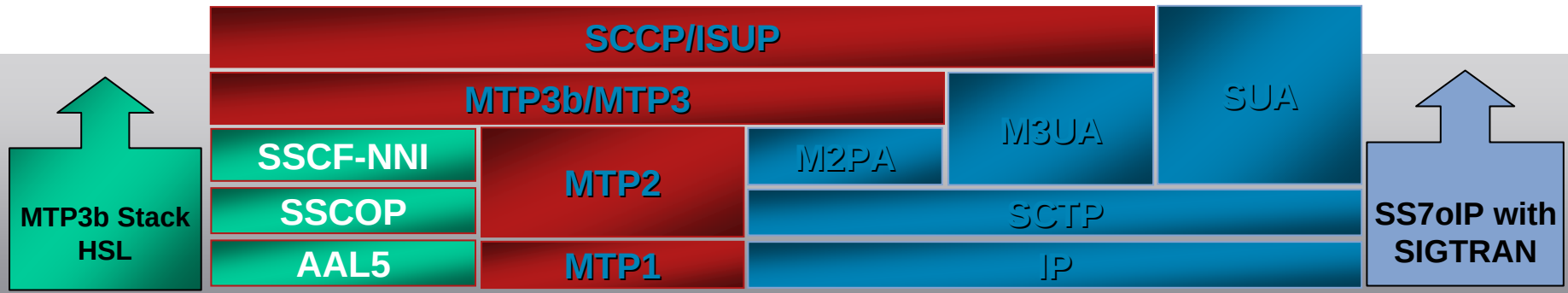
SS7 Offload Network



- Save money on the expensive legacy equipment.
- Transport bulk SCCP traffic (e.g. SMS) over IP

Signaling Infrastructure
Migration to IP





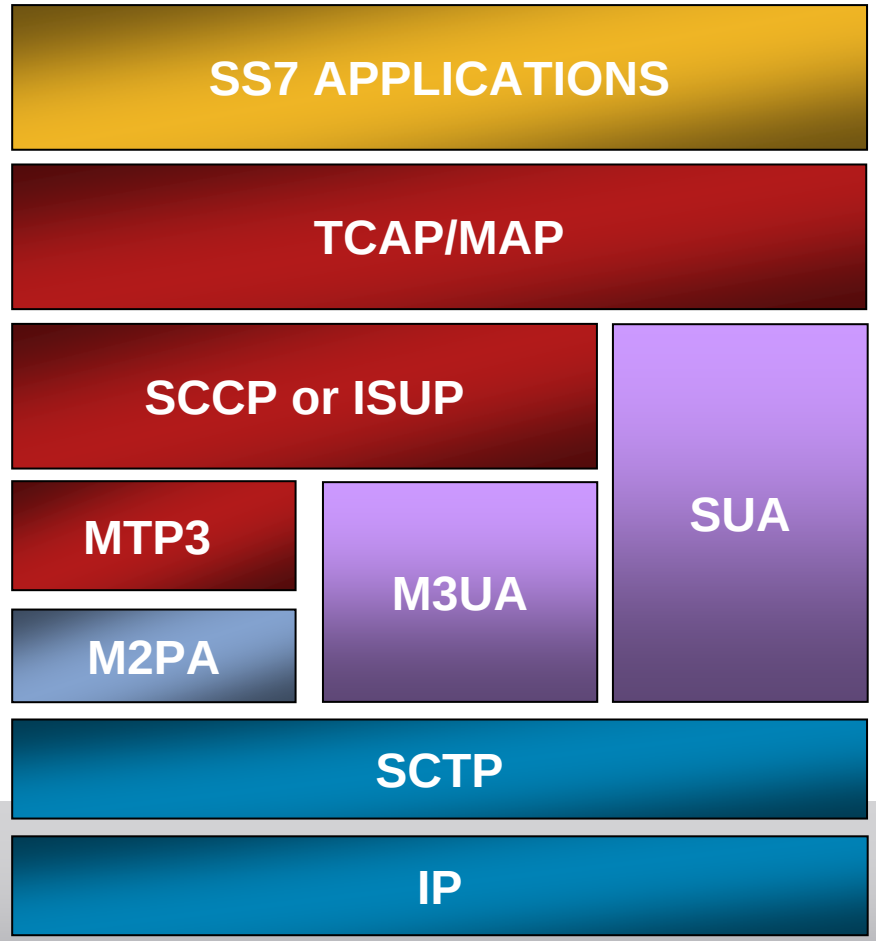
SS7 over IP (SS7oIP)

SS7oIP Benefits

- Cost Efficiencies
  - More efficient network for SS7 transport
  - Operationally simpler and more cost-effective to manage
- Enables a variety of IP-based revenue-generating services/applications
  - Further enhanced bandwidth efficiencies
  - Lower barriers to entry for application vendors
  - Seamless operation over network generations
- Smooth transition from 2G to 3G
- Blends the advantages of SS7 and IP together
- Based on a protocol called SCTP (not TCP, not UDP)

ITP Supported SIGTRAN Protocols

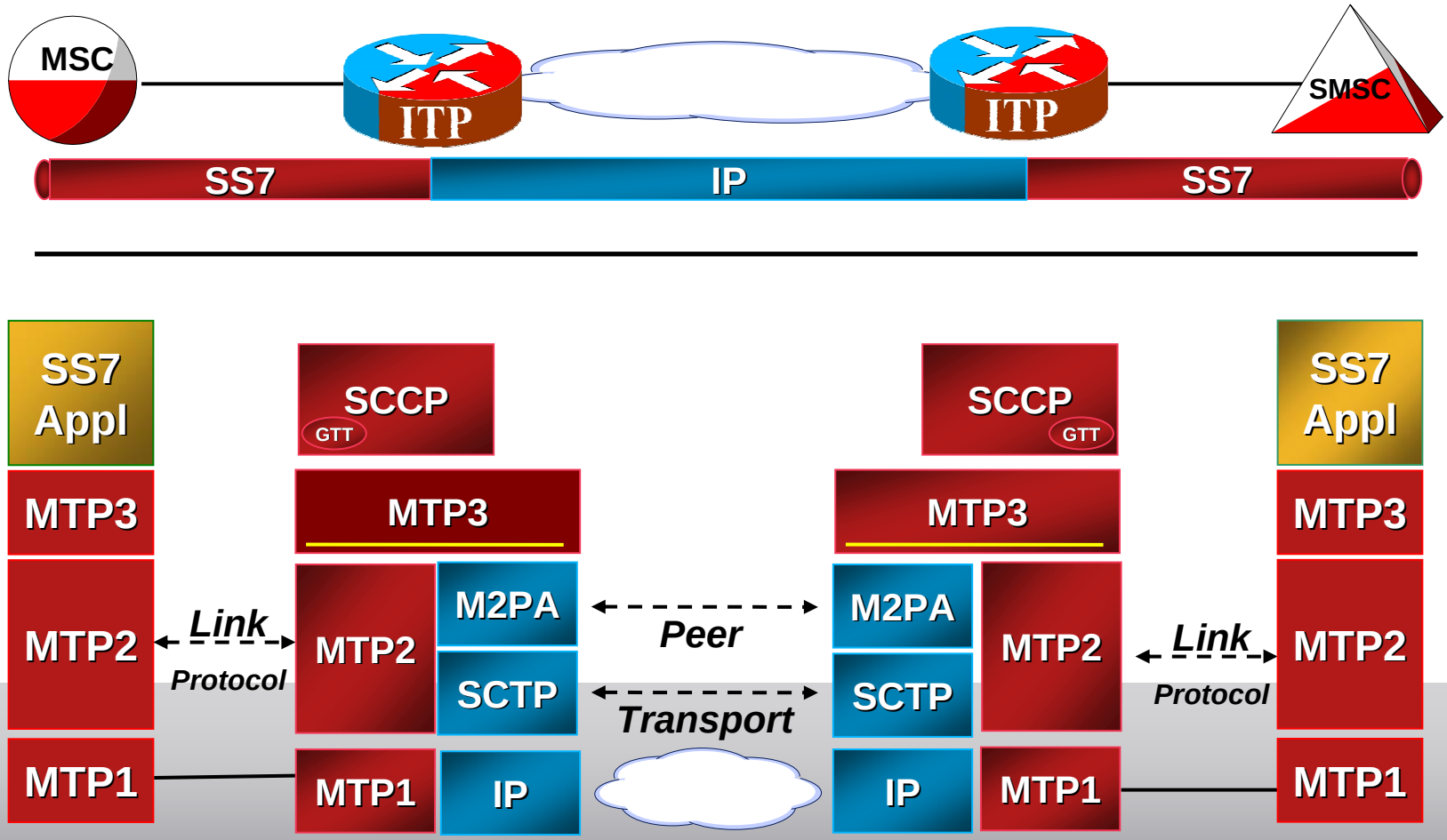
- SCTP
  - RFC 2960
  - RFC 3309 Checksum
- M2PA
  - RFC 4165
- M3UA
  - RFC 3332
  - RFC 4666
- SUA
  - RFC 3868



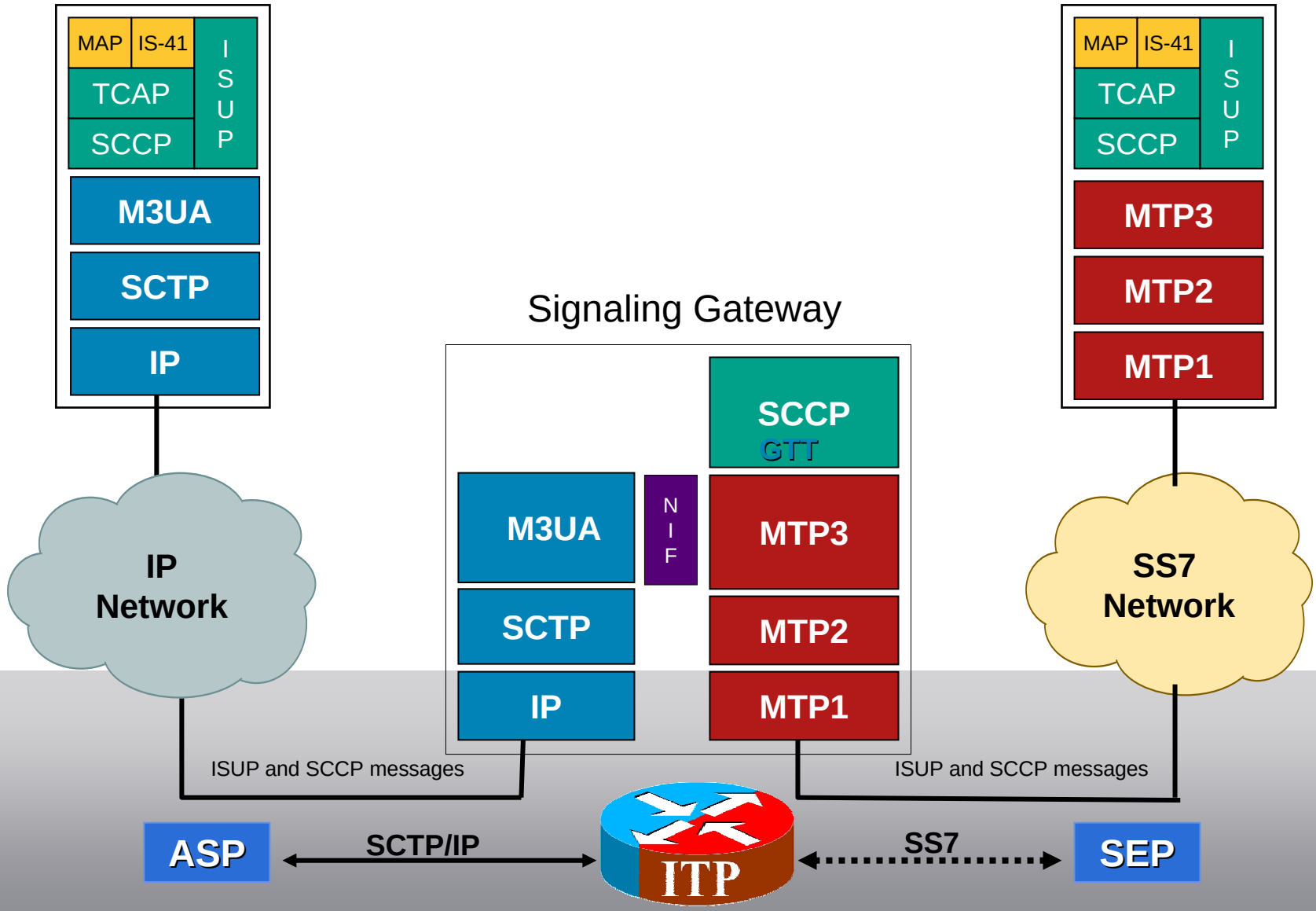
SCTP Provides:

- Acknowledged error-free, non-duplicated transfer of data within multiple independent streams of data
- Data fragmentation to conform to the SS7 Message Transfer Unit (MTU) size restrictions
- Sequenced delivery of user messages with an option for order of arrival and delivery of individual user messages
- Bundling of multiple user messages into a single SCTP packet allowing more efficient usage of bandwidth
- Multi-homing for network fault tolerance of association (multiple source and destination addresses with automatic failover between them)
- Signaling reliability and performance at an IP price

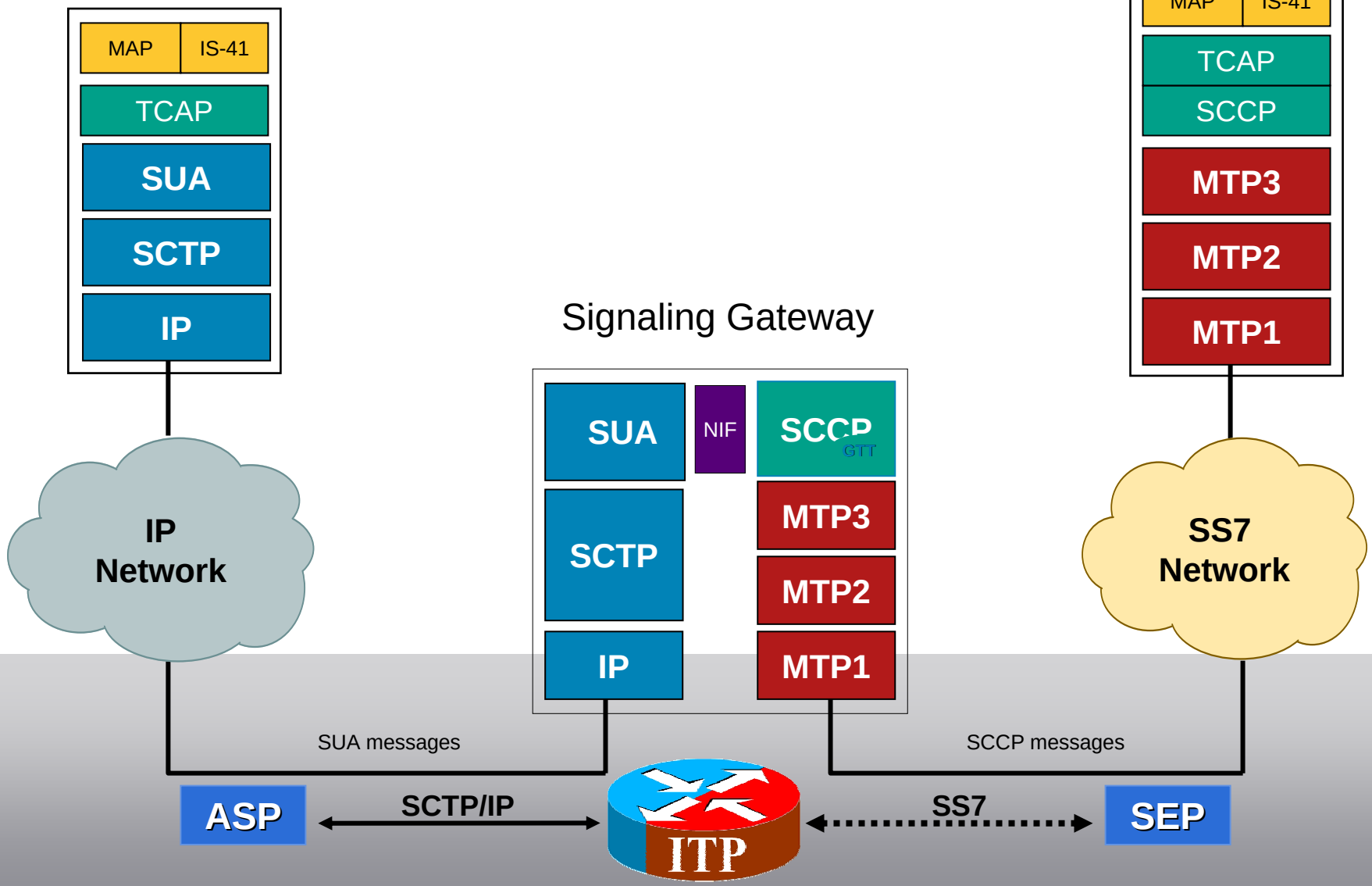
STP Peer-to-Peer SS7 Offload (M2PA)
Protocol Architecture



M3UA Protocol Stacks

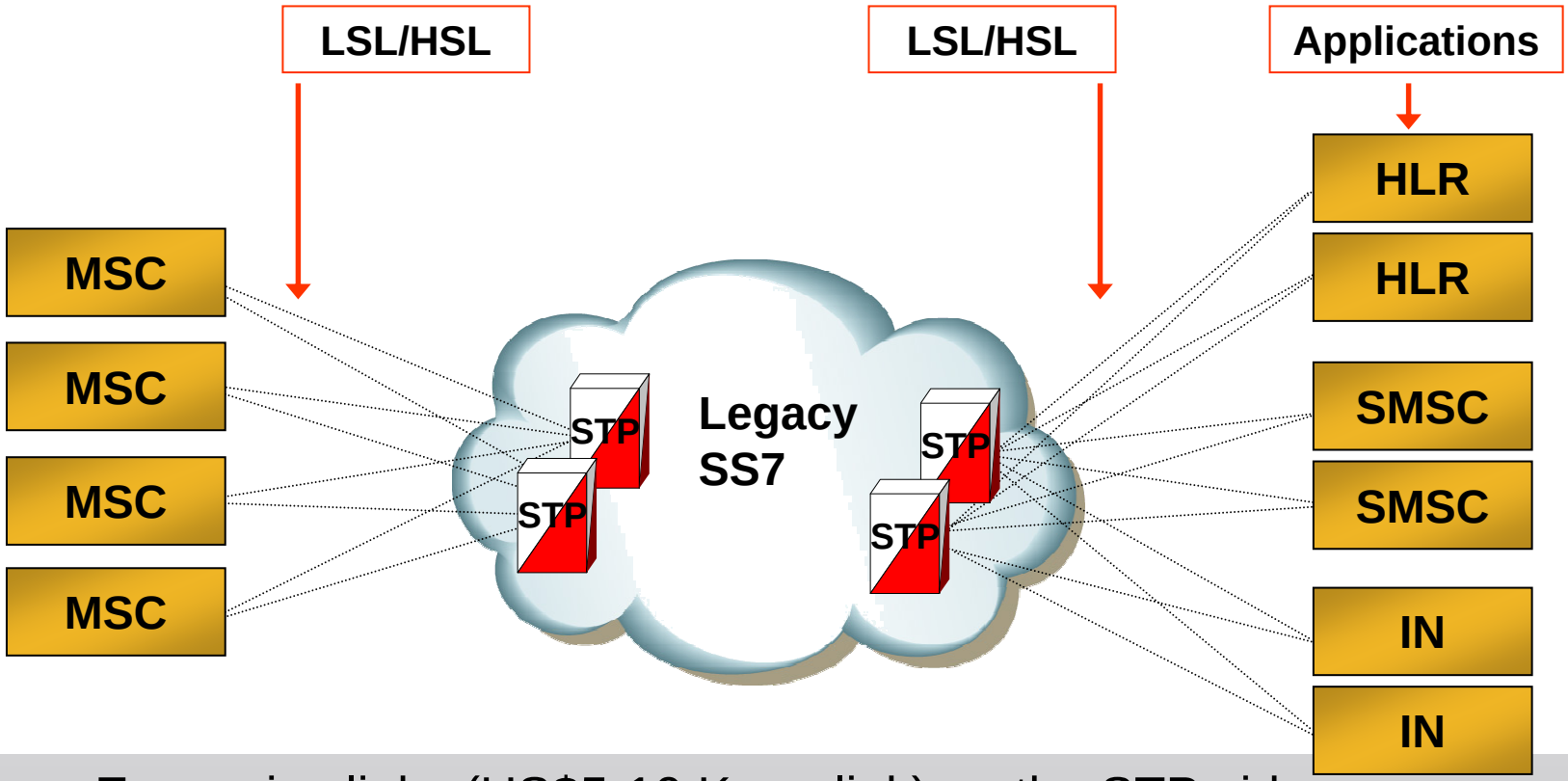


SUA Protocol Stacks



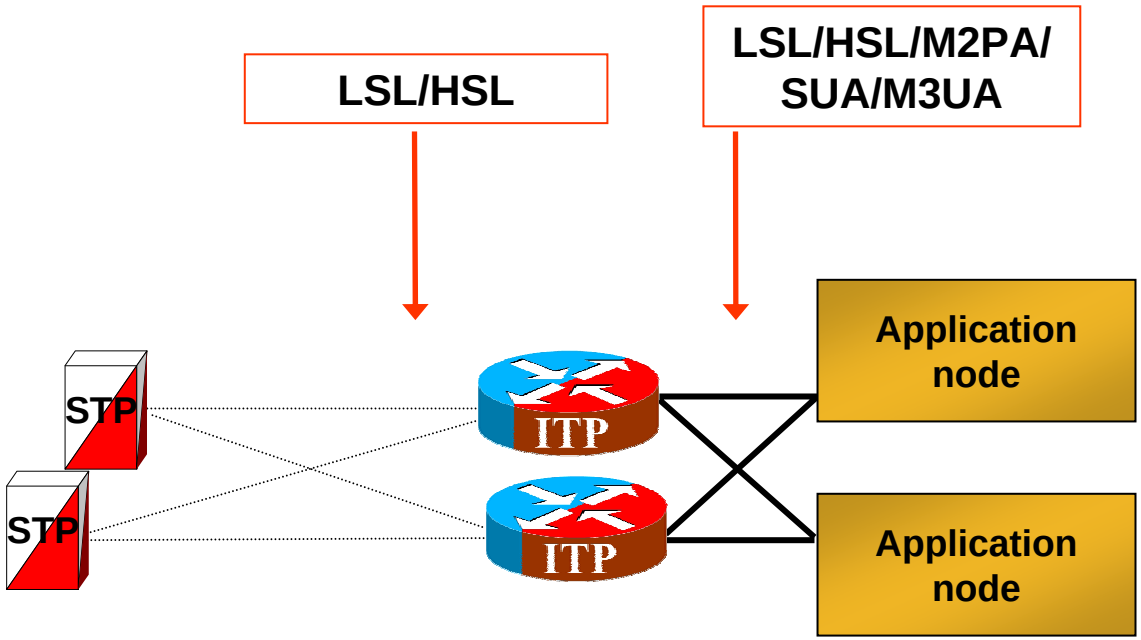
ITP as a Signaling Gateway

Signaling Gateway Problem Statement



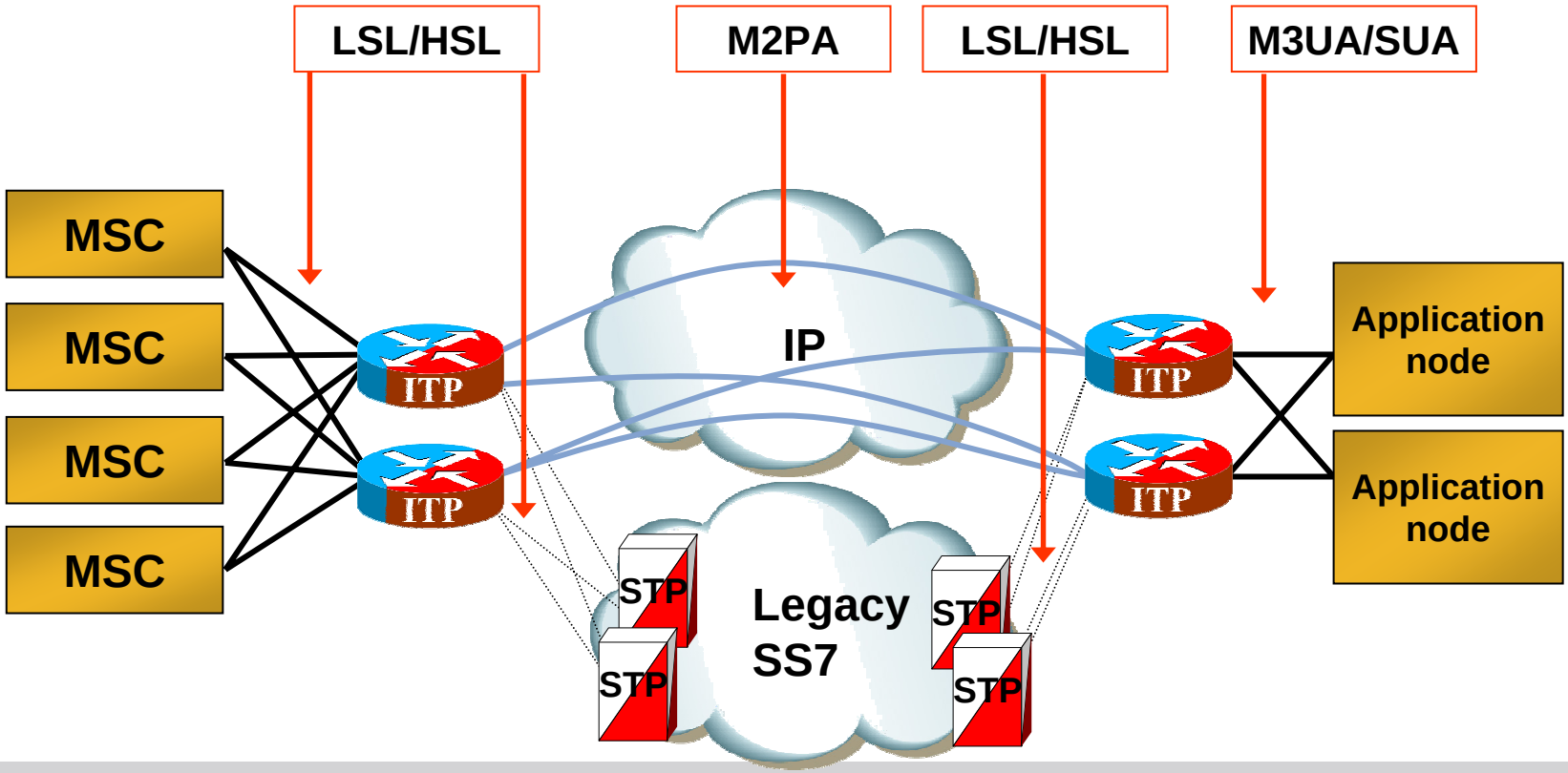
- Expensive links (US$5-10 K per link) on the STP side
- Huge footprint and power consumption
- A new element means new point-codes and network changes

ITP Signaling Gateway Solution



- High performance gateway between legacy (ATM/TDM) SS7 and SIGTRAN signaling
- SIGTRAN protocol support for M2PA, M3UA and SUA
- True appliance architecture → OPEX reduction
- Signaling gateway AND Cisco IOS-based router in a single system

IP Enabled Messaging Network



- Increased bandwidth to application (Ethernet)
- Improved performance of application nodes
- Decreased signaling costs (commoditized)

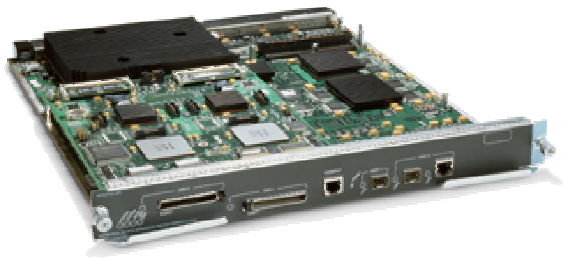
ITP Architecture, Platforms and Features

Cisco ITP Platforms Positioning

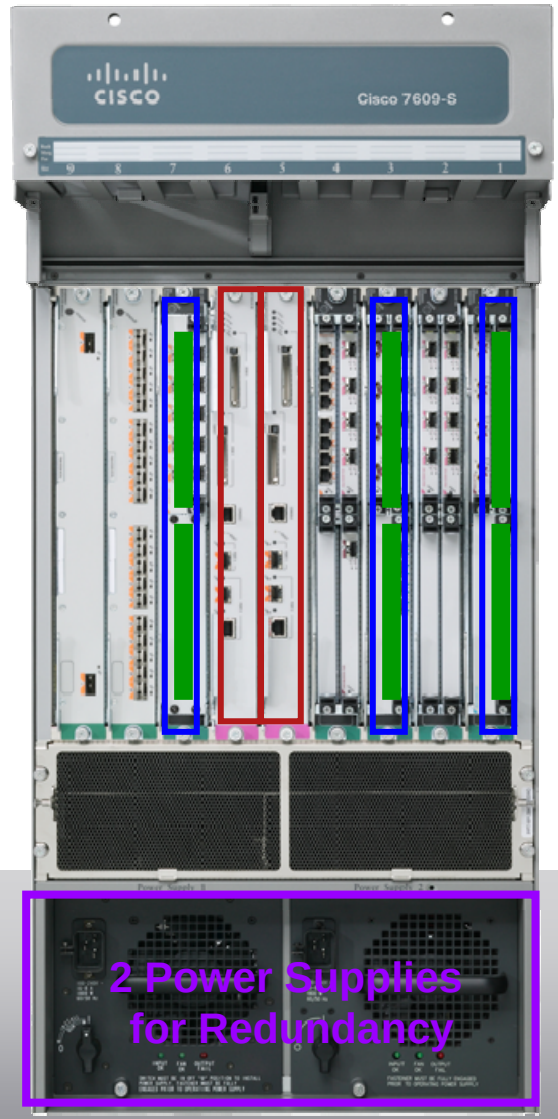
	2811	7204/6	7301	7600
Core STP				✓
Signaling Gateway	✓	✓	✓	✓

Cisco 7600 Series Platform
Redundancy, High Availability & Performance

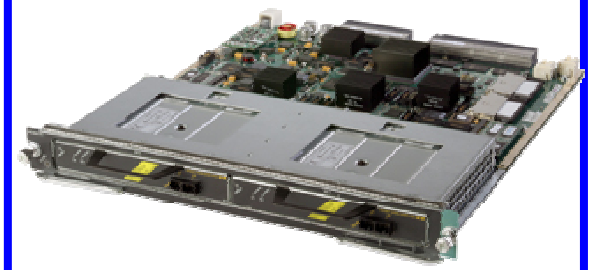
SUP Management CPU



Redundant Main Processors



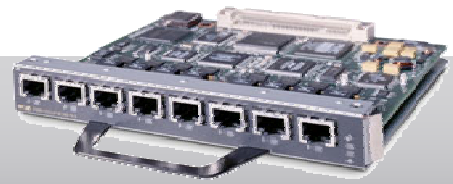
Enhanced FlexWAN



Increased port density and capacity

- 70+ service / port adapters
- Industry leading features
- Scalable / high performance
- Carrier-class high availability

Port Adaptors



Same adapters as the 7200 series

ITP Non Disruptive Upgrade

- Dual supervisors keep state synchronized for redundancy
- Active supervisor can be pulled without service impact
- Supervisors are not involved in packet forwarding
- These features allow an operator to upgrade an ITP to a new version of IOS without loss of service
- Supervisors and line cards are reloaded serially to maintain service and routing of traffic during the upgrade
- Design allows for graceful back-outs
- Supported on the 7600 ITP

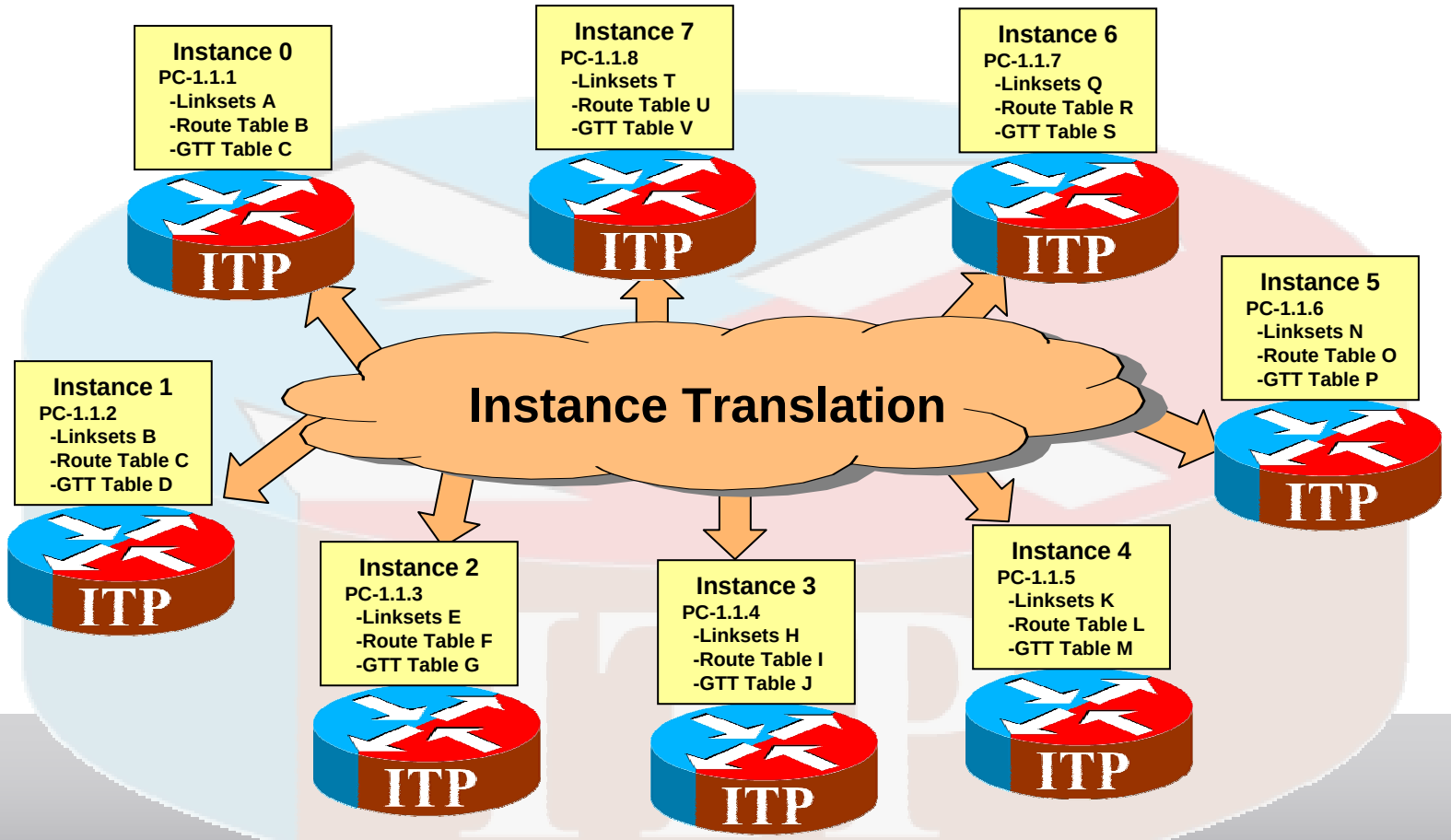
ITP Advanced Features

Enhanced Gateway Screening (EGWS)

- Exceeds the requirements of GR-82-Core and ITU Q.705
- Circular GWS rules are prevented by the use of tables
- Screening can be either incoming or outgoing
- Screening can be either on MTP linksets or Sigtran AS
- EGWS can pass packets to MLR for application-level screening
- Screening is be based on parameters from the following layers:
  - MTP3
  - ISUP
  - SCCP
  - MAP
  - SMS
  - MTP or SCCP management messages

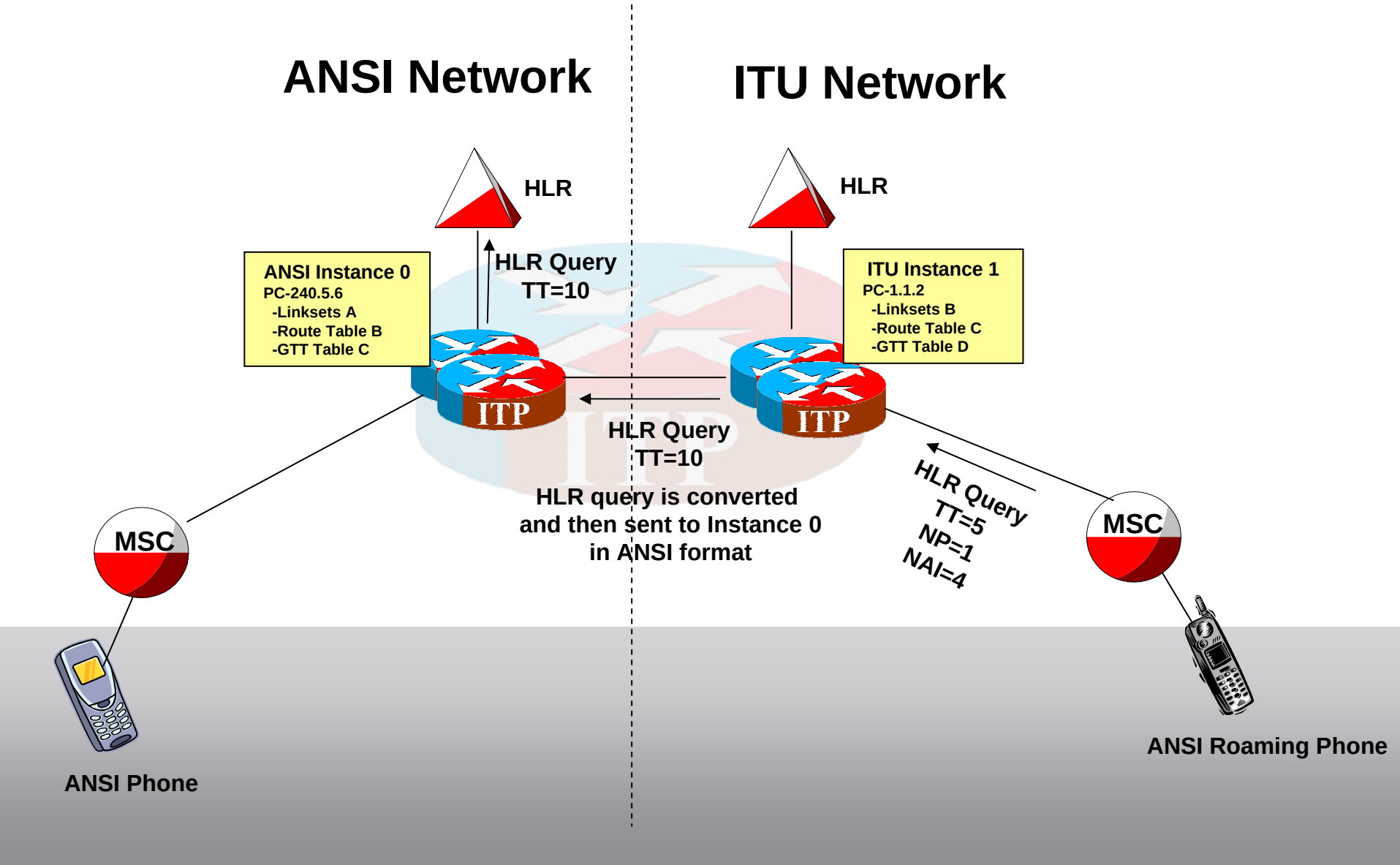
Multiple Instances-Virtual STP

Allows up to 8 separate Virtual STPs to exist in one platform

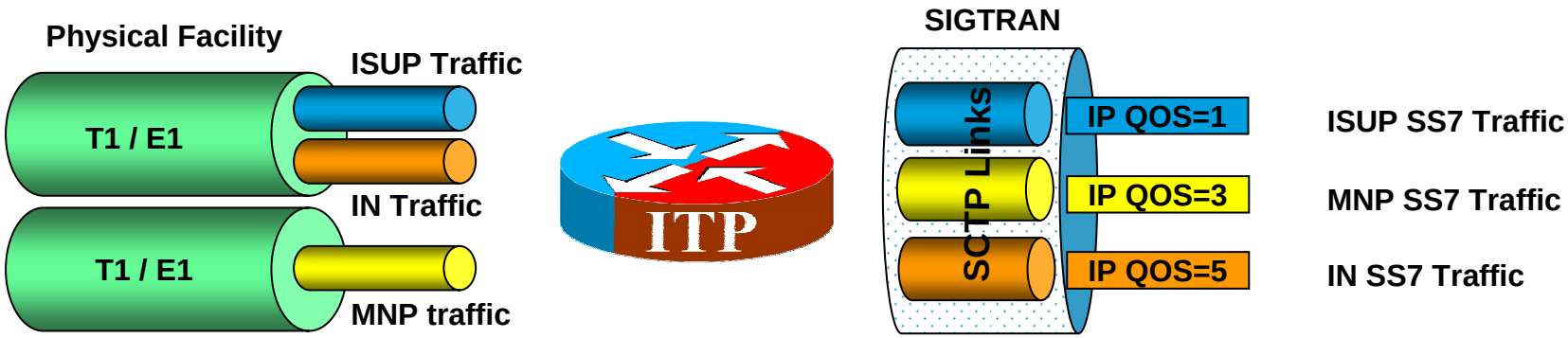


The ITP supports conversion when moving between NI and SS7 variants

Instance Conversion with Multiple SS7 Variants

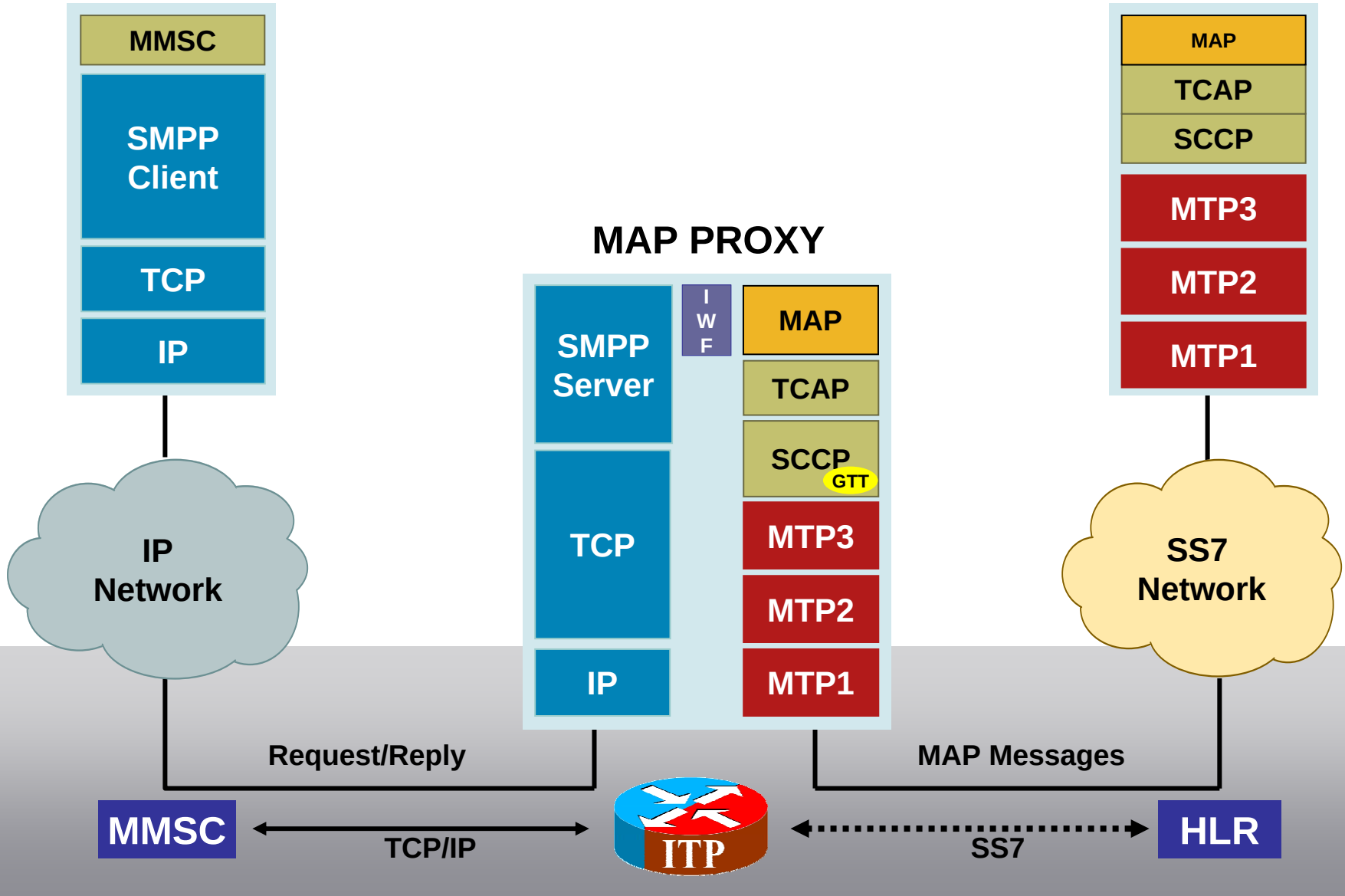


ITP QoS – Traffic Flexibility
Predictable Delivery, Latency, Bandwidth

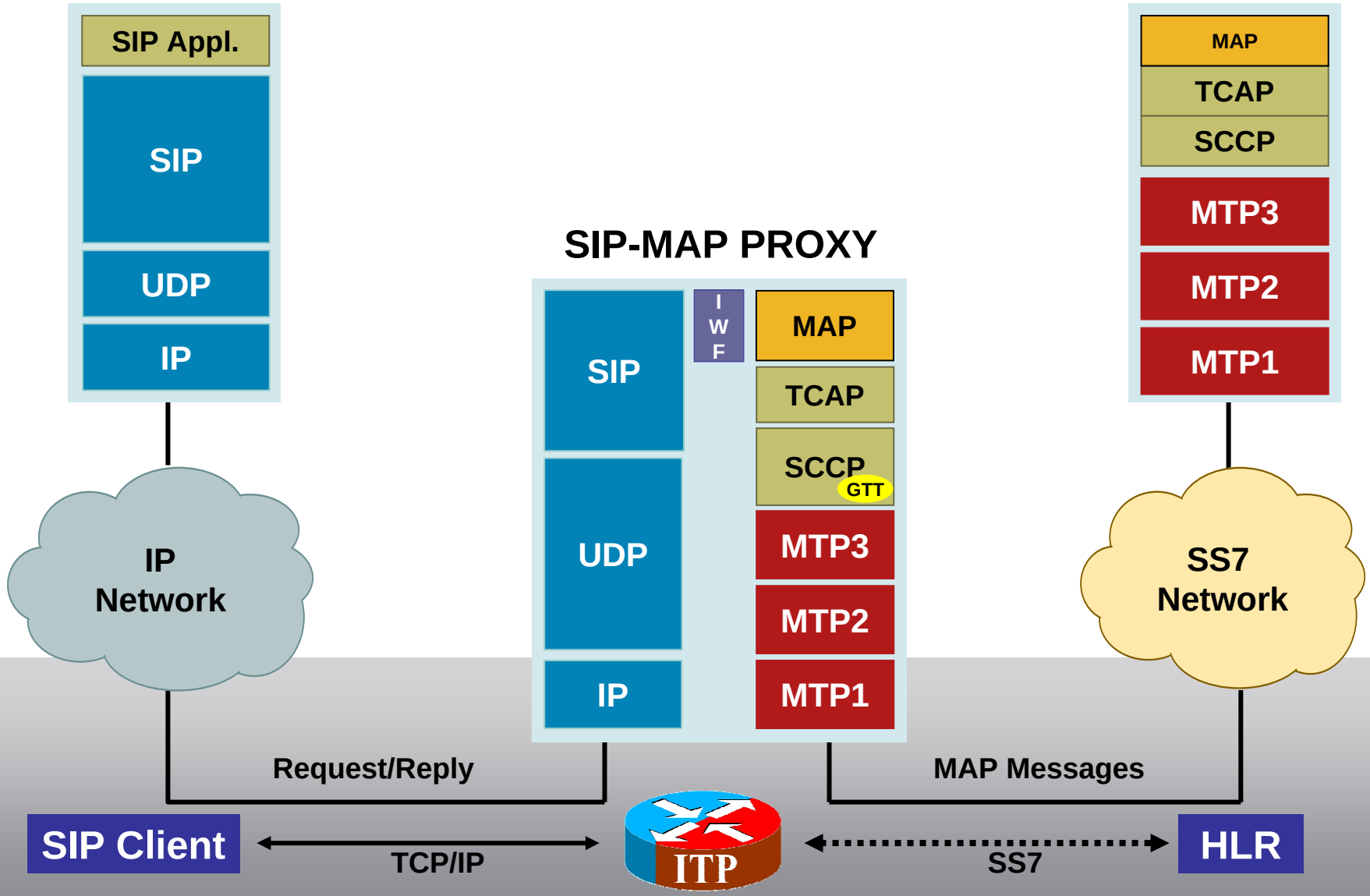


- The ITP can color ITP packets based on SS7 parameters – something no IP router can do
- Allows an operator to share IP infrastructure and yet still achieve the required latency and bandwidth

MMSC MAP Gateway

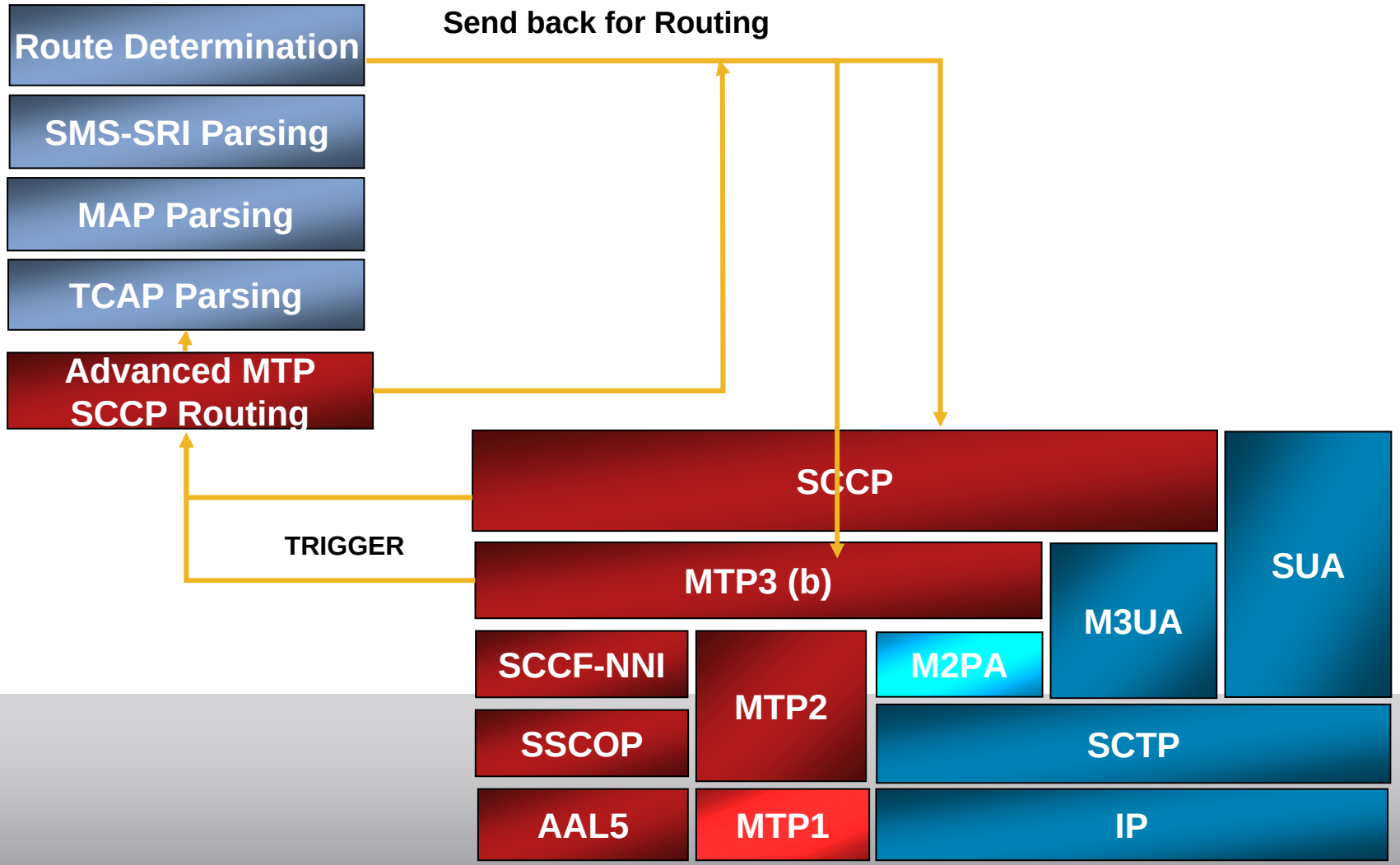


ITP SIP-SS7 MAP Gateway



ITP Multi-Layer Routing

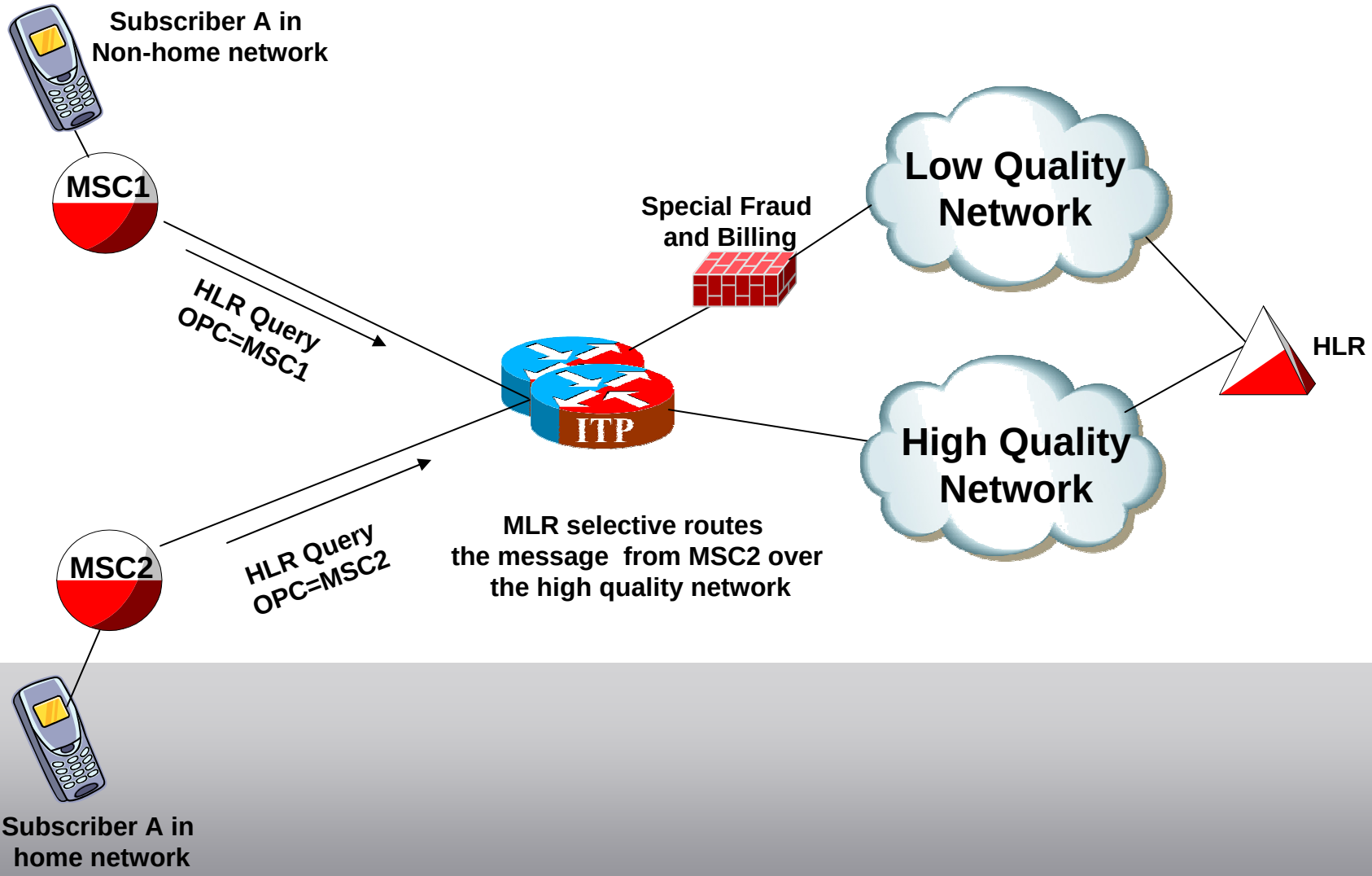
MLR & SMS Router Architecture



ITP Multi-Layer Routing (MLR)

- Select messages with Gateway Screening rules:
  - Destination or originating addresses for MTP
  - Service Indicator (ISUP or SCCP)
  - SCCP Called Party Address fields
  - SCCP Calling Party Address fields, etc
- Route messages based on a combination of:
  - Any MAP Operation code from GSM-MAP
  - SMS parameters from MO and MT operations
  - SRI-SM parameters
- Distribute messages to a server group connected via TDM, HSL or SIGTRAN links
- Guarantee to send segmented or concatenated SMS to the same server for re-assembly
- Optionally modify SCCP Calling or Called Party addresses (and some MAP addresses)

MLR MTP3 OPC-DPC Routing



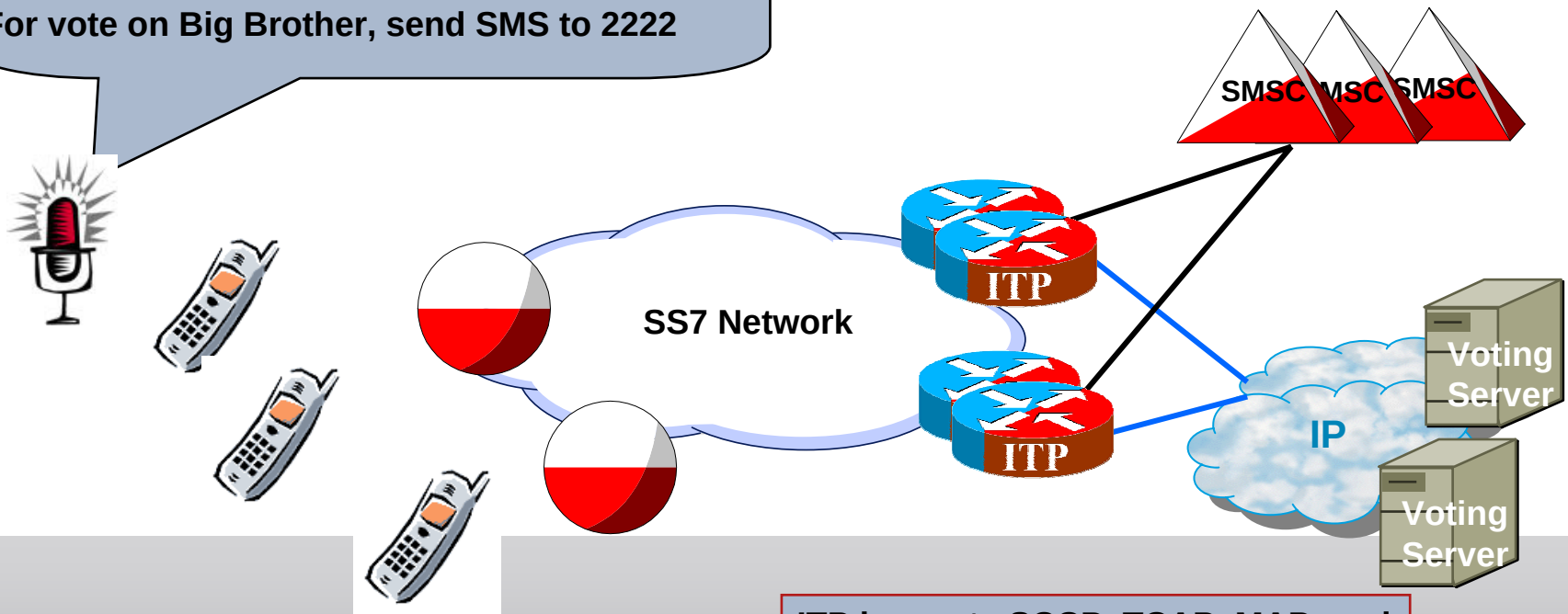
Multi-Layer Routing (MLR)
Example: Short Message Service Center

Broadcast Event

To vote on American Idol, send SMS to 1111

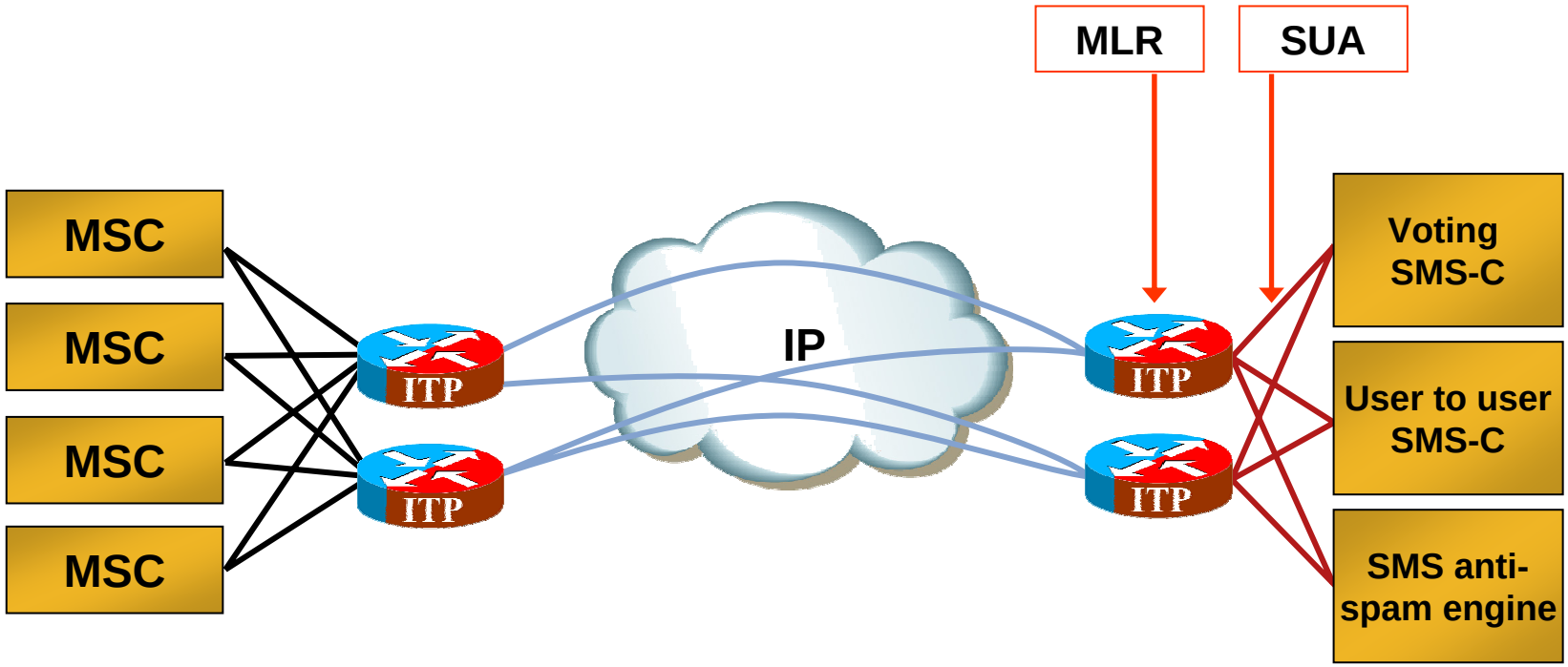
For vote on Big Brother, send SMS to 2222

ITP distributes messages in a weighted round-robin fashion when multiple servers can handle the same service



ITP inspects SCCP, TCAP, MAP, and MAP-User parameters to route SMS-MO to the correct service centers handling the message

MLR Controlled Messaging



- MLR allows for optimization of messaging nodes for specific traffic types (e.g. voting messages)
- Differentiation of SLA and QOS per traffic type or user group
- (Re)-direct traffic to anti-spam/virus engine

ITP Applications

Cisco Database for Telecoms
Required Features

- Capacity

  Able to increase database capacity to meet subscriber and application needs

- Throughput

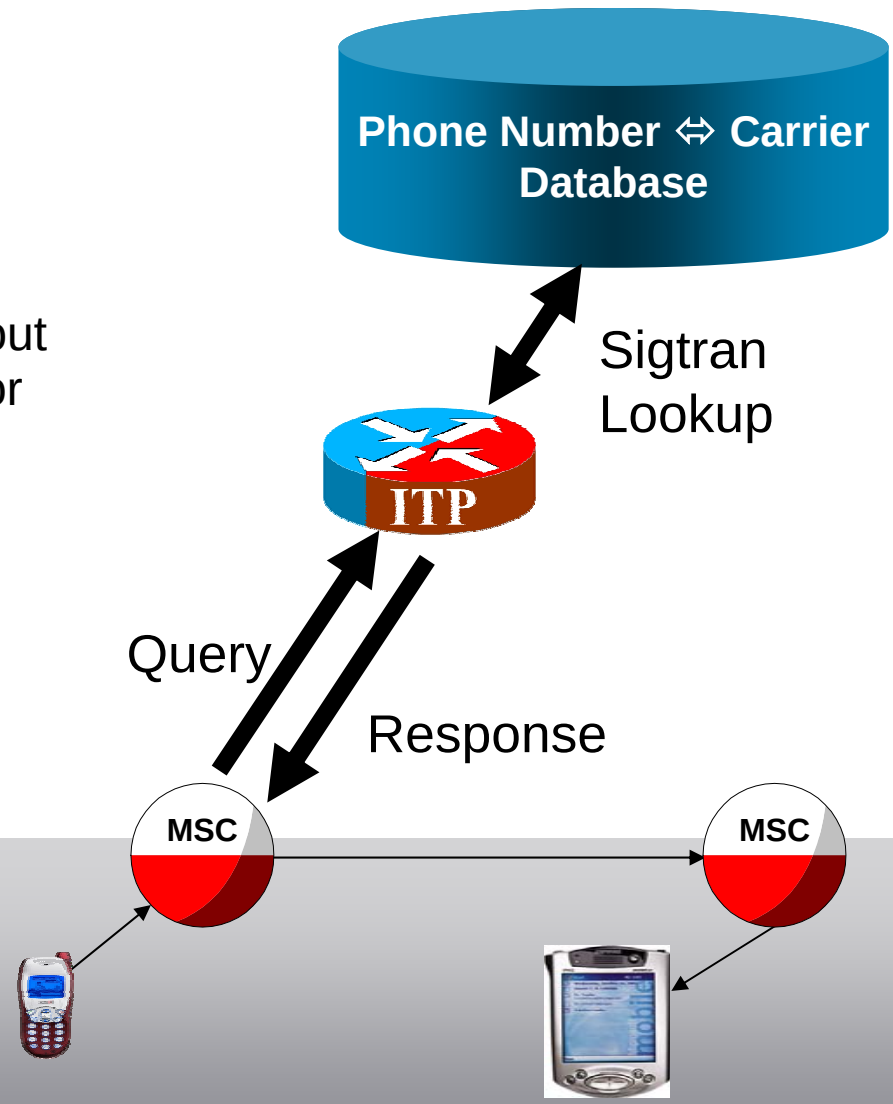
  Able to scale processing capacity without incurring significant hardware change or incur footprint issues

- Flexible

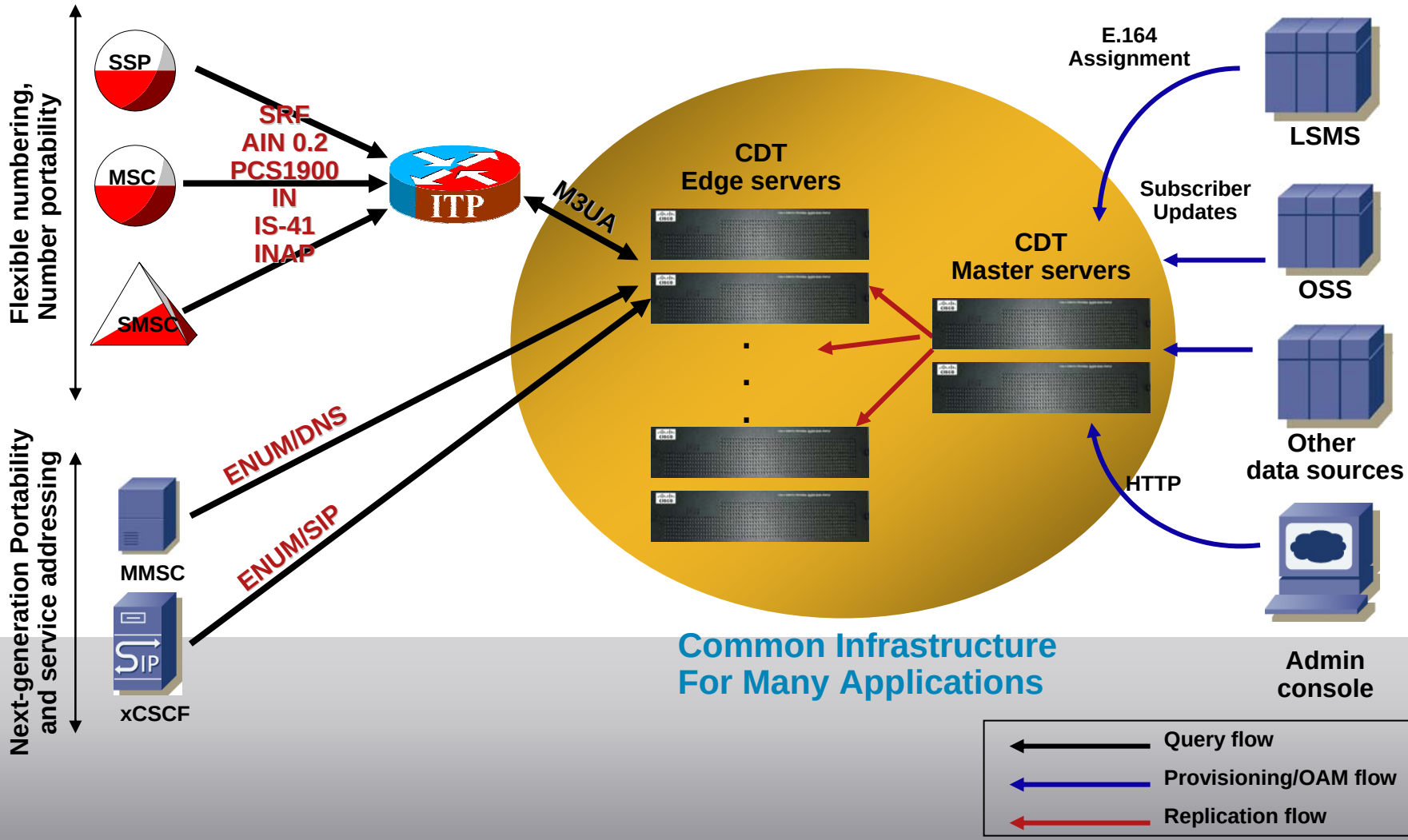
  Able to add or change applications without requiring significant hardware additions or redesigns (meet time-to-market requirements)

- Reliable

  Able to meet carrier requirements for uptime and maintenance

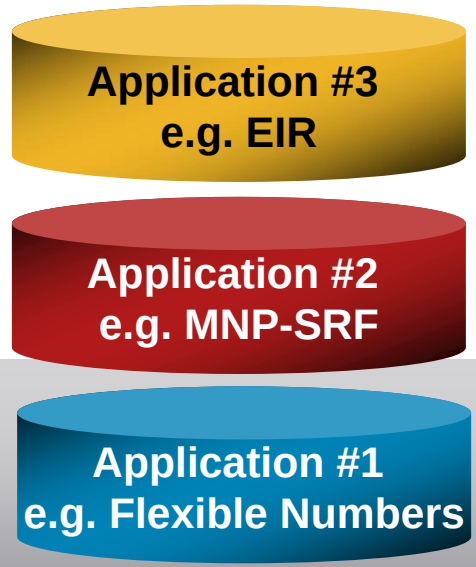


Cisco Application Architecture



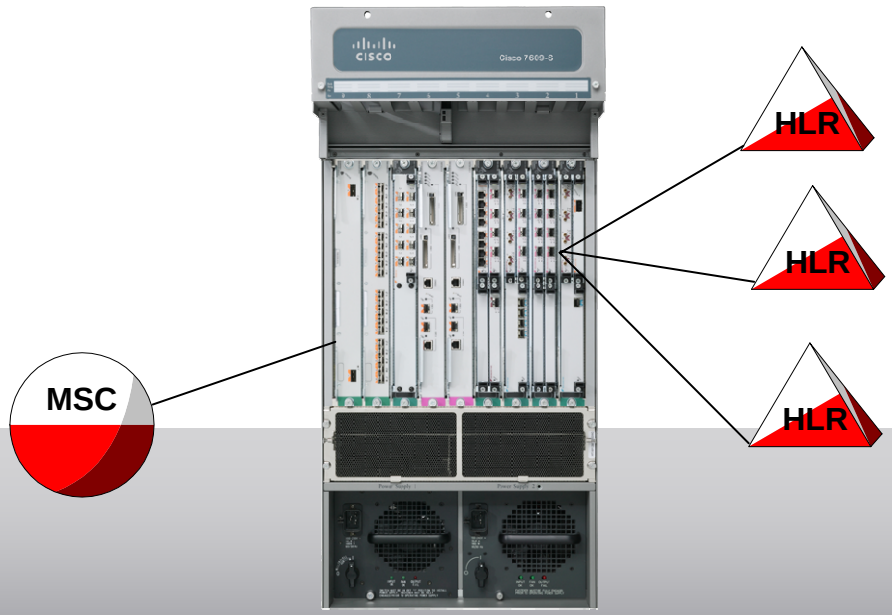
Cisco Telecommunication Database Attributes

- All processing occurs in RAM
- Flexible design allows data for multiple applications to be searched in a single transaction-already supports up to 32 applications
- CDT capacity increased by adding more servers



Application Routing Director (ARD)

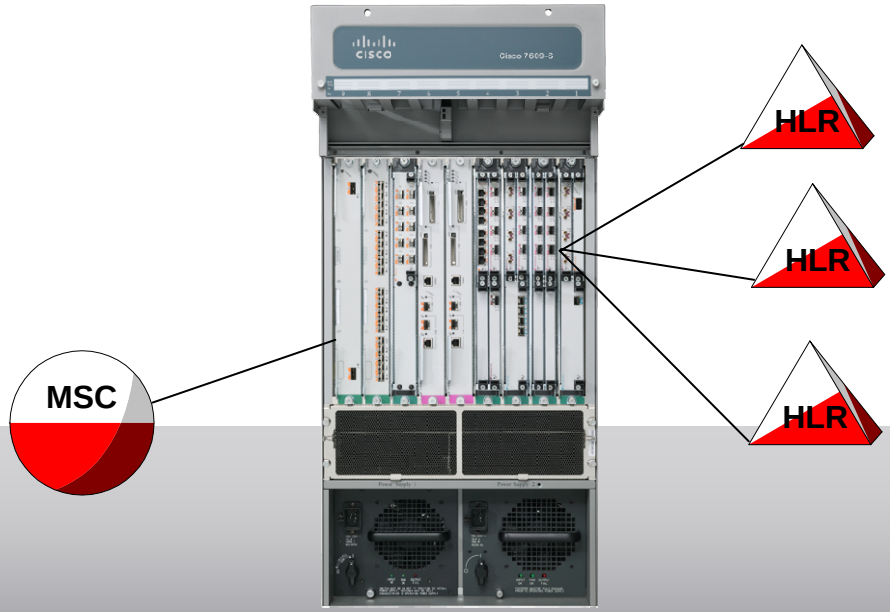
ARD is an carrier-grade flexible numbering system that can be used to address databases on a per subscriber number basis



- Full Digit GTT routing to multiple HLRs based on:
  - IMSI or MSISDN
  - MIN-MSID or MDN
- Carriers can distribute subscribers to any HLR
  - Solve MNP IMSI/MSISDN split
  - Maximize HLR utilization
  - Fill in HLR “holes”
  - Ease HLR migration
  - Facilitates carrier mergers

MNP-SRF

MNP-SRF is a carrier-grade number portability application that provides routing info to route onto the home carrier for that number



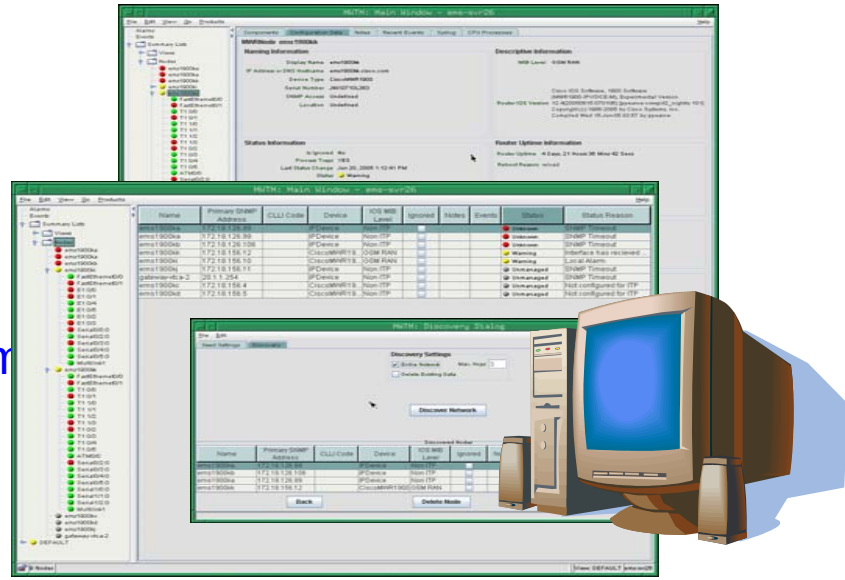
- For call related messages, fetches subscriber data and provides routing number back to the MSC
- For non call related messages, fetches subscriber data and routes the message on via GTT
- Compliant to 3GPP TS 23.066
- Supports many forms of NP, including CAMEL, INAP, LNP and ATI.

Network Management and Monitoring

ITP Network Management Attributes

- Automatic Network Discovery
  - Inventory & Topology
- Flexible Topology Maps
  - Alarm and event representation
  - Device/Port Status
- Detailed Fault Management (Events/Alarms)
  - Alarms/Events drill-down to device/port
  - Customizable Categories and Severities
  - Web based Alarm History Viewing System
- Configurable Web based Reporting
  - Real-Time Performance Polling/Graphing
  - Network Status Dashboard
  - Alarm and Security Logs
- Robust North-bound OSS Interfaces
  - ASCII Performance data, Alarm History, Device Status
  - SNMP Event/Alarm forwarding
  - CiscoWorks LMS integration

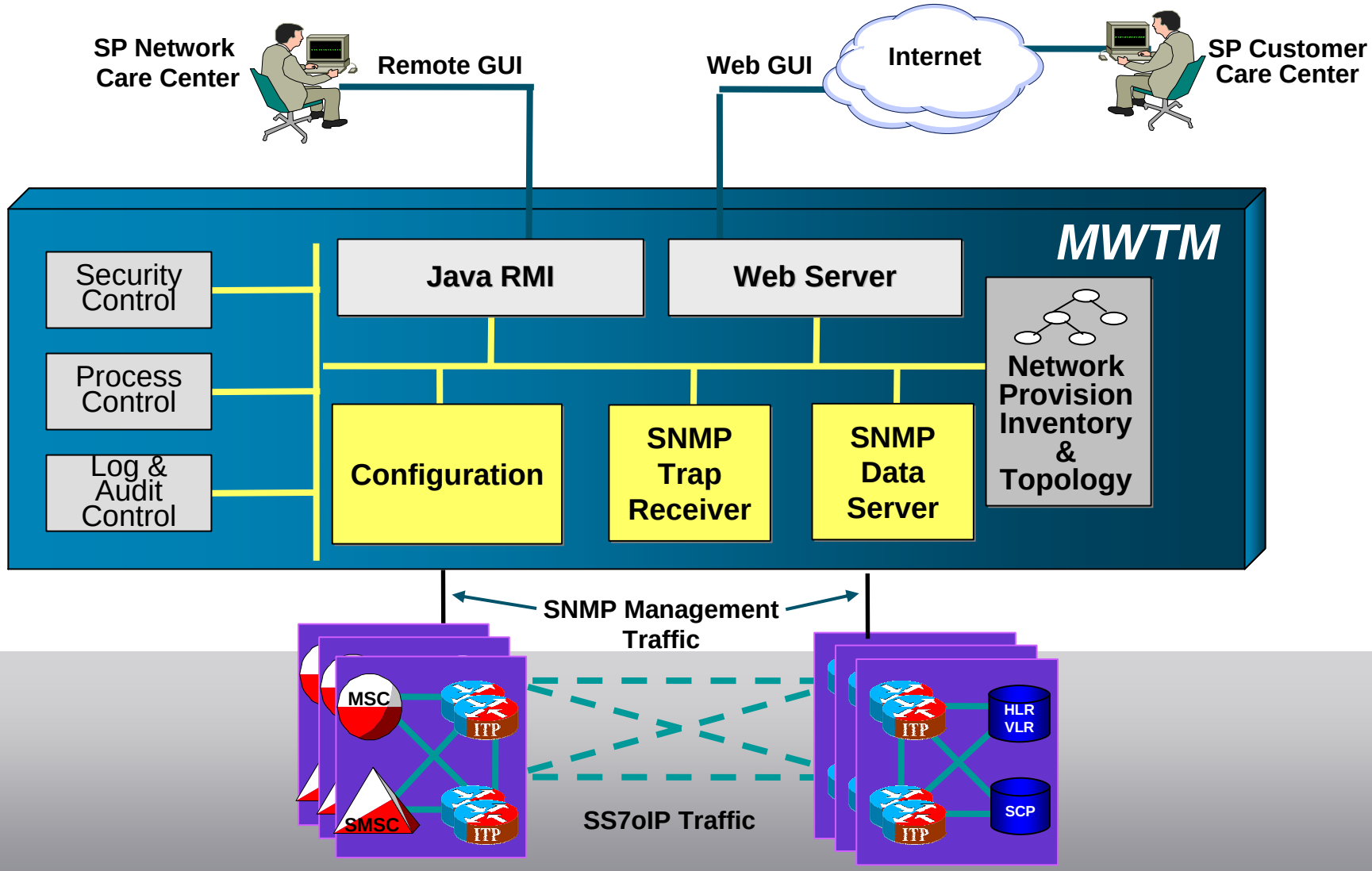
Transport Manager



Cisco MWTM High-Level Overview

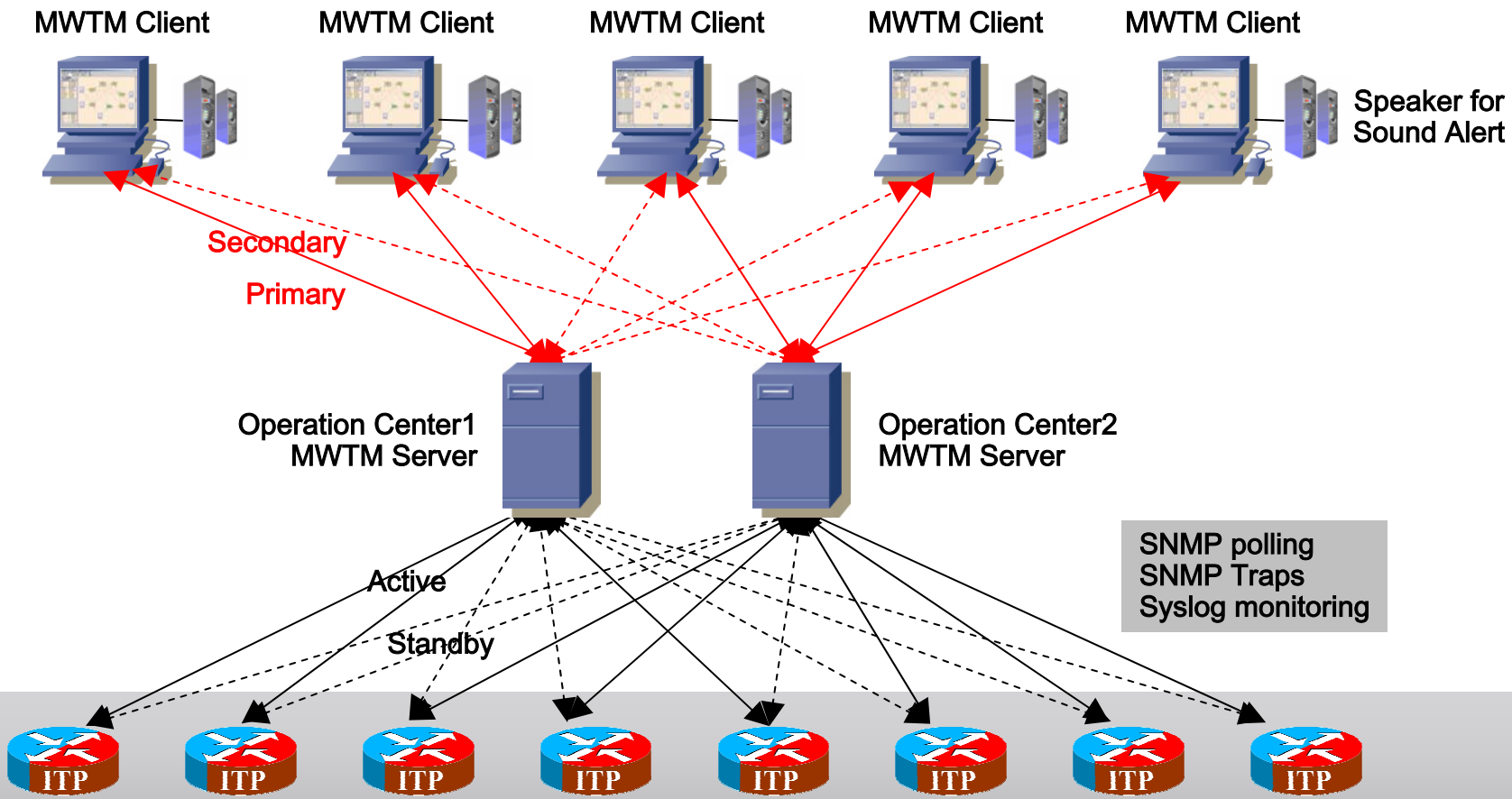
- Carrier-class product
  - OSS integration interfaces - SNMP, ASCII/FTP, Java RMI, URL-based queries, command-line tools
  - Workflow-based configuration interface - Not IOS CLI in a GUI!
  - High availability, Scalability and Performance
- Insulation from software and hardware changes
  - New versions of element software
  - New chassis and line cards
- Complete abstraction from complexities of CLI & SNMP
  - First line support doesn't need to be CCIE certified
- Critical component of any successful ITP deployment
  - High volume provisioning, fault isolation, and capacity management

Cisco MWTM System Functional View



Mobile Wireless Transport Manager

Network Structure for Signaling Gateway Management



MWTM Feature Overview

- **Automatic Network Discovery**
  - Inventory & Topology
  - Seed file and seed network
- **Topology Maps**
  - Logical layer visualization of the network
  - Alarm and event representation
  - Device/Port Status
- **Status Monitoring and Drill-down Analysis**
  - Contextual menus
  - Alarms/Events drill-down to device/port
- **Fault Management (Events/Alarms)**
  - Customizable Categories and Severity
  - Sorting, Filtering, Acknowledgment
  - Forwarding (SNMP)
  - Alarm History
- **Web based Alarm History Viewing System**
  - Sorting, Filtering, Archiving, Metrics
- **Security Services**
  - Multi-Level access for users, SSH, SSL, Audit Trails

MWTM Feature Overview

- **NorthBound Interface**
  - XML/SOAP APIs - programmatically manage MWTM events, access MWTM inventory
  - CSV data exports
  - SNMP – Event/Alarm forwarding, Clear/Ack
- **CiscoWorks LMS integration**
  - OAM&P Functions – SWIM, Netconfig, Inventory Reporting, Configuration Archive
- **Troubleshooting**
  - Customizable troubleshooting tools with integrated, online, context-sensitive help
- **Web based Reporting**
  - Link/Linkset, MLR, Probe statistics
  - AS, ASP, GTT, MTP3 Accounting
  - Q.752 compliant reporting
  - Network Status Dashboard
- **Real-Time Performance Polling**
  - Real-time graphs of key statistics
  - msu-rate graphs
- **Provisioning**
  - GTT, Route Table and MLR provisioning, syntax checking, archiving.
  - Provision Links / Linksets / ASP and more

Cisco MWTM Benefits

- Speeds service delivery
  - GTT and Route Table templates
- Improves efficiency and accuracy of service provisioning
  - Configuration mistakes prevent unnecessary downtime
  - Data consistency in provisioning
- Security
  - Direct device access limited to experienced personnel
  - Audit trail and access control
- Proactive Network Monitoring
  - Capacity management using collected statistics
  - Threshold warnings triggered early on

Cisco MWTM Benefits

- Rapidly Troubleshoot End-to-end SS7oIP Issues
  - Detailed topology maps
  - Inventory – Logical and Physical characteristics
  - Real-time device view – configuration, alarms, performance
  - Drill-down for faults and alarms
- OPEX
  - Reduce overhead associated with training Level 1 support
  - Minimize fallout from faulty provisioning
  - Time-to-Resolution drastically reduced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