PERFORMANCE TECHNOLOGIES

Satellite IP

Using IP to Transport SS7 over Satellite

VON Europe 2006

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Characteristics of Satellite Communications

- At 23,000 miles above the Earth…
  - Signals take around 270 milliseconds from ground to space to ground again
  - Round trip time (RTT) is twice as much, along with processing delay – typically 600 ms
  - More prone to transmission errors
  - Impacts message acknowledgement, hence stream reliability

SS7 over Satellite?

- SS7 over satellite uses fixed bandwidth (64 kbits)
- Typically low utilization links to get to remote areas
  - Less efficient usage of the circuit
- Uses older technology typically resulting in higher error rates
  - Links are more prone to “bouncing,” especially in bad weather conditions
  - Subscribers affected by momentary loss of service
- PCR helps with reliability, but far from perfect

IP over Satellite?

- Mostly newer technology
  - Better error rates, better error recovery algorithms
  - Resulting in better reliability
- However…
  - TCP/IP was designed for reliable networks
  - TCP/IP has a flexible window acknowledgement scheme, but…
  - Retransmission algorithms are fixed, and ill suited for high latency networks with high error rates

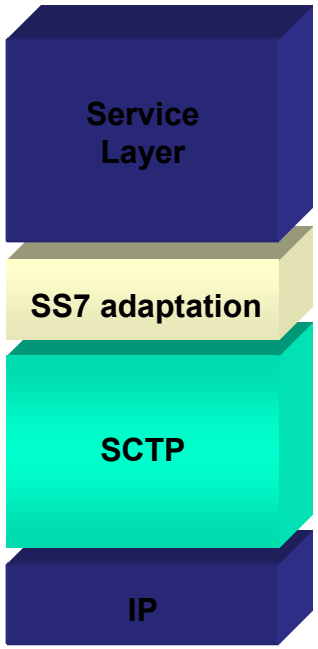
How to put SS7 over IP

- UDP
  - No message acknowledgement, no message sequencing
  - Not reliable
- TCP
  - Reliable, but prone to head-of-line blocking
  - Not configurable
  - No redundancy
- SCTP (SIGTRAN) was designed for signaling over IP

SIGTRAN

- SIGTRAN Workgroup
  - **Part of the IETF, define a set of protocols for signaling transport (mostly SS7 today) over IP**
  - **Mandate: ensure reliability similar to circuit-based SS7 of today, but over IP networks**
- Transport:
  - **SCTP (RFC 2960, 3306) has been a standard for more than four years**
- Applications:
  - **Specifically tailored to the signaling layers - M3UA, M2UA, M2PA, SUA, IUA, etc. - use SCTP as a transport layer**

What Does SCTP Offer?



- Acknowledged, error-free transfer of signaling messages
- Network level fault tolerance through support of multiple IP connections (multi-homing)
- Sequenced delivery of user messages over multiple streams
- Security (resistance to IP attacks)
- Performance optimized for signaling messages

Configuring SCTP

- Retransmit timeout (RTO) – init, min, max
  - Allows to specify when to retransmit unacknowledged messages
  - Can be set higher than RTT for highest efficiency…
  - Or can be set lower than RTT for “PCR” like retransmission in high error rate deployments
- Number of retransmissions
  - Can be tailored to be very persistent
- Other parameters: initial congestion window, etc…

SS7: circuit or packet over Satellite?

Circuit

- Retransmission using preventative cyclical redundancy (PCR)
- Constantly retransmit messages until acknowledged
- “Fastest” way to get MSU to destination
- Most costly, bandwidth
- Link stability vulnerable to errors, still with stringent timers.

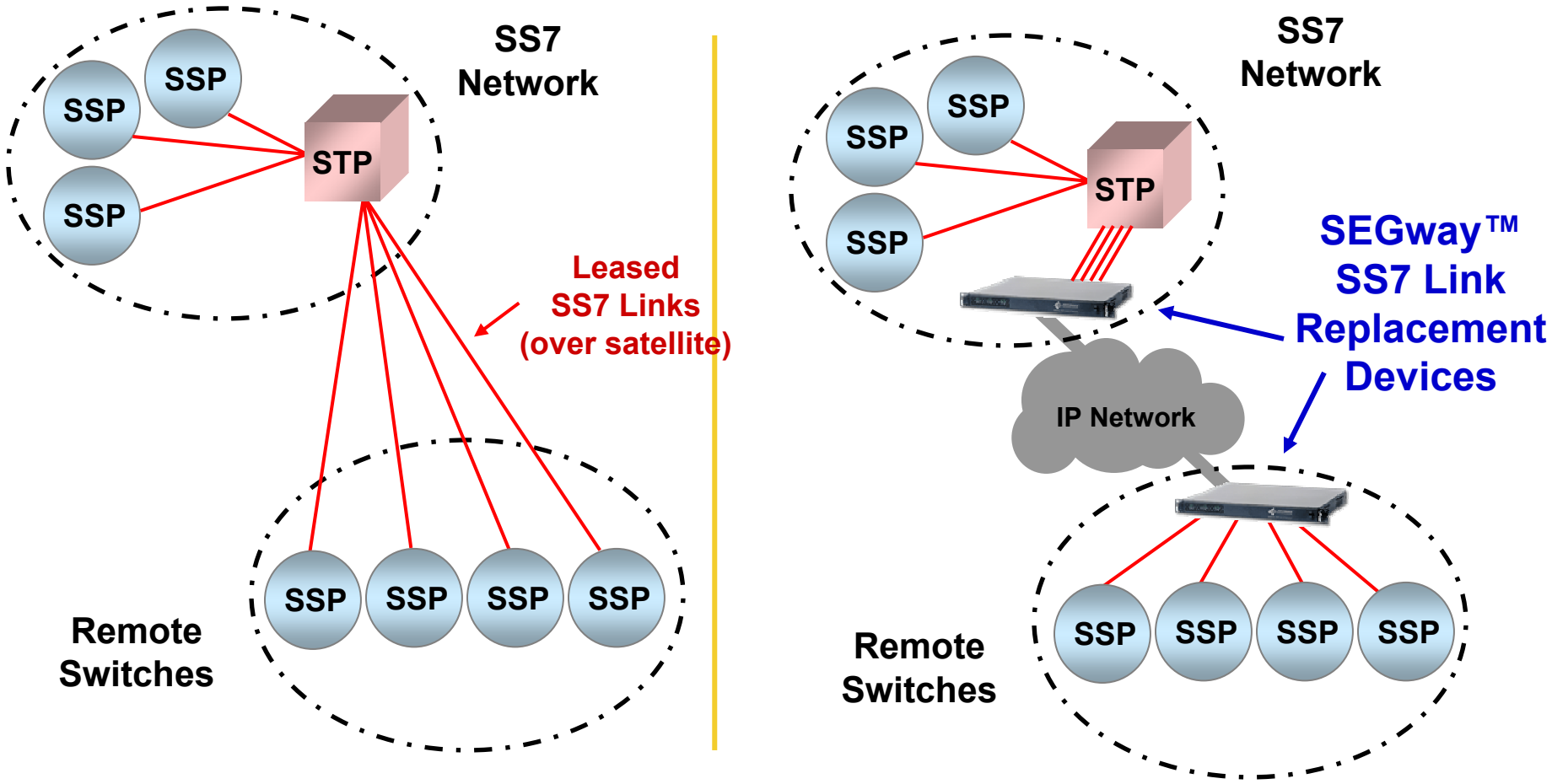
Packet

- SCTP retransmission “on demand” as acknowledgements timeout
- Sophisticated timeout retransmission algorithm, based on RTT
- Slower to get MSU to destination (sometimes)
- Less costly
- Link stability less vulnerable to errors, with SS7 MSU acknowledgement emulation

Benefits of SS7 over IP for Satellite

- For most applications, less bandwidth utilization
- Can share bandwidth with other applications (QoS recommended)
- More reliable than SS7 over Satellite with PCR
- More configurable than traditional deployments
- Lower operating costs
- Readily available

SS7 over IP Tunneling Example



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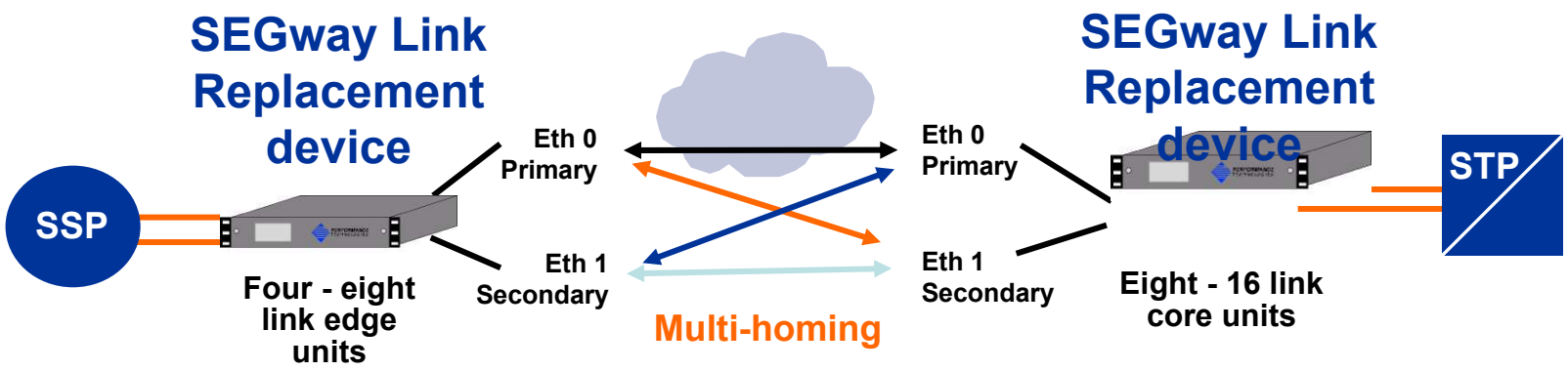
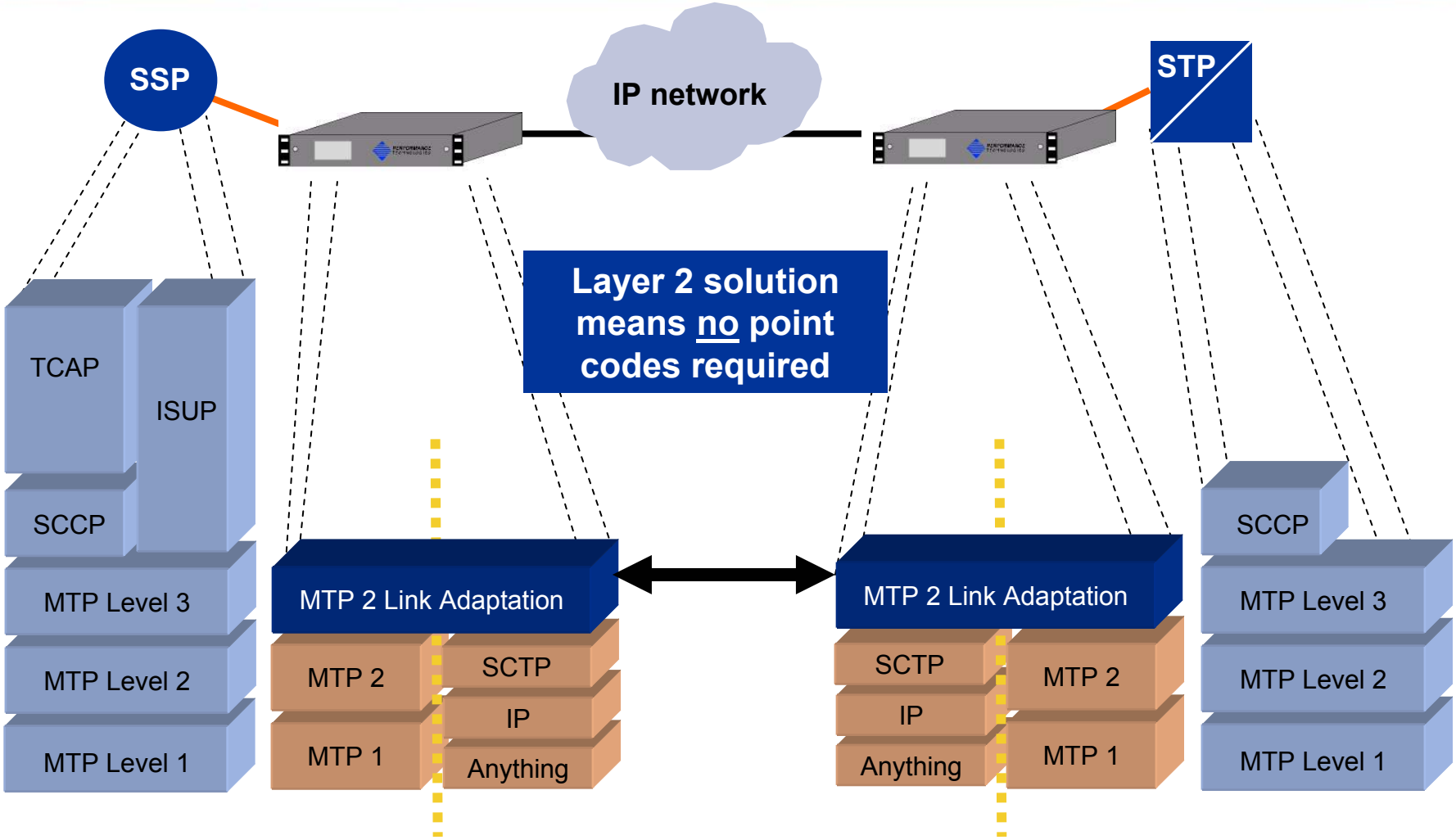
SS7 over IP: Link Replacement



- Transparent solution requires no point code
- Solution has been deployed for more than four years
- More than 200 installations worldwide
- Landline, satellite and microwave link implementations

Link Replacement Is Transparent to the Network



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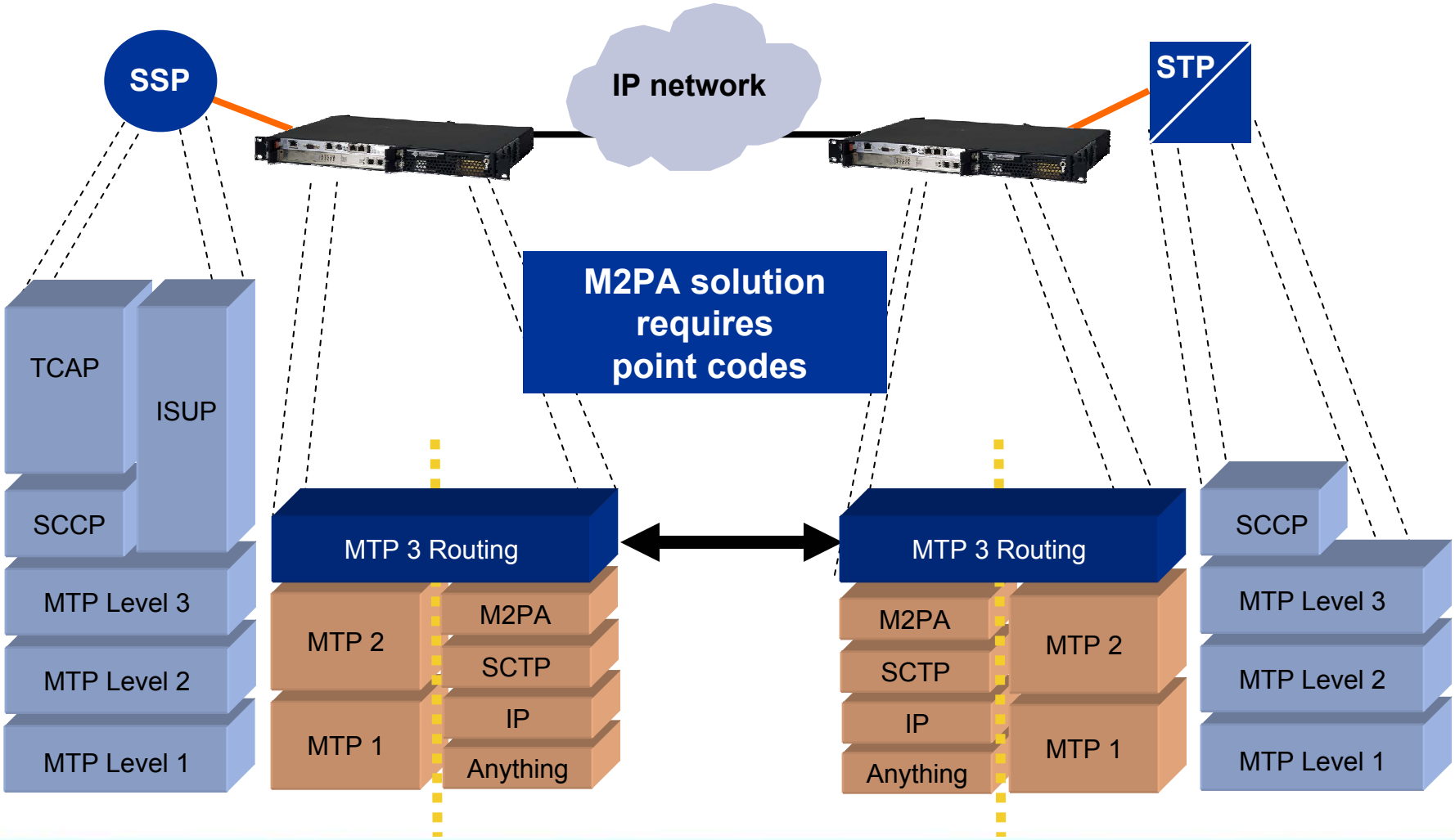
M2PA over Satellite: Requires Point Code



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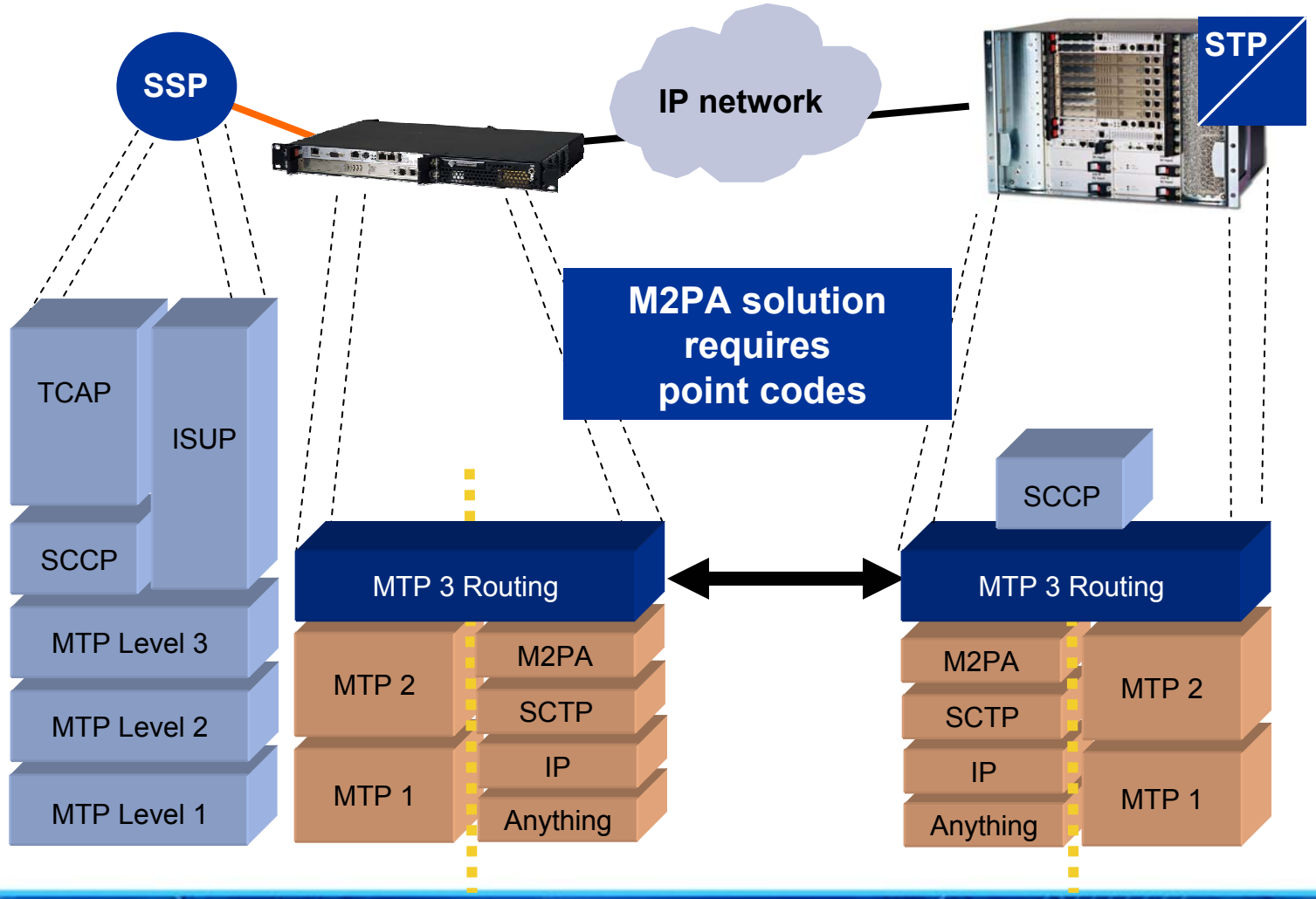
M2PA enabled STP



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Is SCTP suited for SS7/IP/Satellite?

- SCTP offers a compromise between fast retransmission and IP congestion prevention
  - On land, packet loss is mostly due to congested routers
  - On satellite, packet loss is mostly due to errors
- Our findings:
  - IP satellites are generally more reliable
  - With more “relaxed” timers, SCTP offers stability of SS7 links over fast retransmission
  - For typical low-usage links, SCTP offers lower bandwidth utilization

Case Study: Geolink

- Geolink provides GSM service to boats, installing picocells on boats traveling in international waters
- Uses satellite communication to reach the on-land MSC, VLR, HLR, etc.
- Initially used circuits to carry voice and signaling over satellite
- Switched to packet, using Performance Technologies' SEGway 1200, and greatly increased reliability of network, while lowering operational costs.

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Thank you!

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