SS7

Mercantec

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Common Channel Signaling System No. 7

- basic call setup, management, and tear down
- wireless services such as personal communications services (PCS), wireless roaming, and mobile subscriber authentication
- local number portability (LNP)
- enhanced call features such as call forwarding, calling party name/number display, and three-way calling
- efficient and secure worldwide telecommunications

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- faster call setup times (compared to in-band signaling using multi-frequency (MF) signaling tones)

- more efficient use of voice circuits

- support for **Intelligent Network** (IN) services which require signaling to network elements without voice trunks (e.g., database systems)

- improved control over fraudulent network usage

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- **SSP** (Service Switching Point)
- **STP** (Signal Transfer Point)
- **SCP** (Service Control Point)
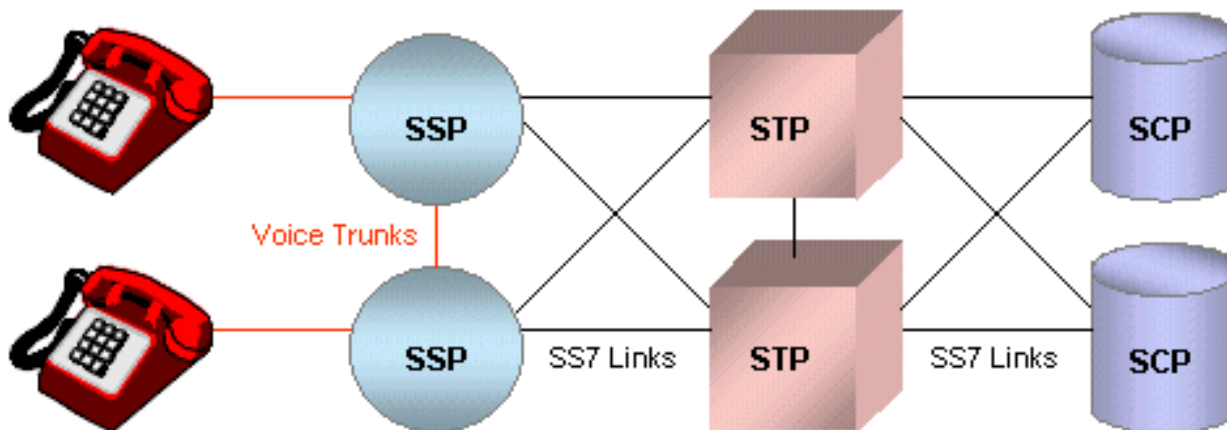
SSP

- **SSPs** are switches that originate, terminate, or tandem calls. An SSP sends signaling messages to other SSPs to setup, manage, and release voice circuits required to complete a call. An SSP may also send a query message to a centralized database (an **SCP**) to determine how to route a call (e.g., a toll-free 1-800/888 call in North America). An SCP sends a response to the originating SSP containing the routing number(s) associated with the dialed number. An alternate routing number may be used by the SSP if the primary number is busy or the call is unanswered within a specified time. Actual call features vary from network to network and from service to service.

STP

- Network traffic between signaling points may be routed via a packet switch called an **STP**. An STP routes each incoming message to an outgoing signaling link based on routing information contained in the SS7 message. Because it acts as a network hub, an STP provides improved utilization of the SS7 network by eliminating the need for direct links between signaling points. An STP may perform **global title translation**, a procedure by which the destination signaling point is determined from digits present in the signaling message (e.g., the dialed 800 number, calling card number, or mobile subscriber identification number). An STP can also act as a "firewall" to screen SS7 messages exchanged with other networks.

SCP

- Because the SS7 network is critical to call processing, SCPs and STPs are usually deployed in mated pair configurations in separate physical locations to ensure network-wide service in the event of an isolated failure. Links between signaling points are also provisioned in pairs. Traffic is shared across all links in the linkset. If one of the links fails, the signaling traffic is rerouted over another link in the **linkset**. The SS7 protocol provides both error correction and retransmission capabilities to allow continued service in the event of signaling point or link failures.

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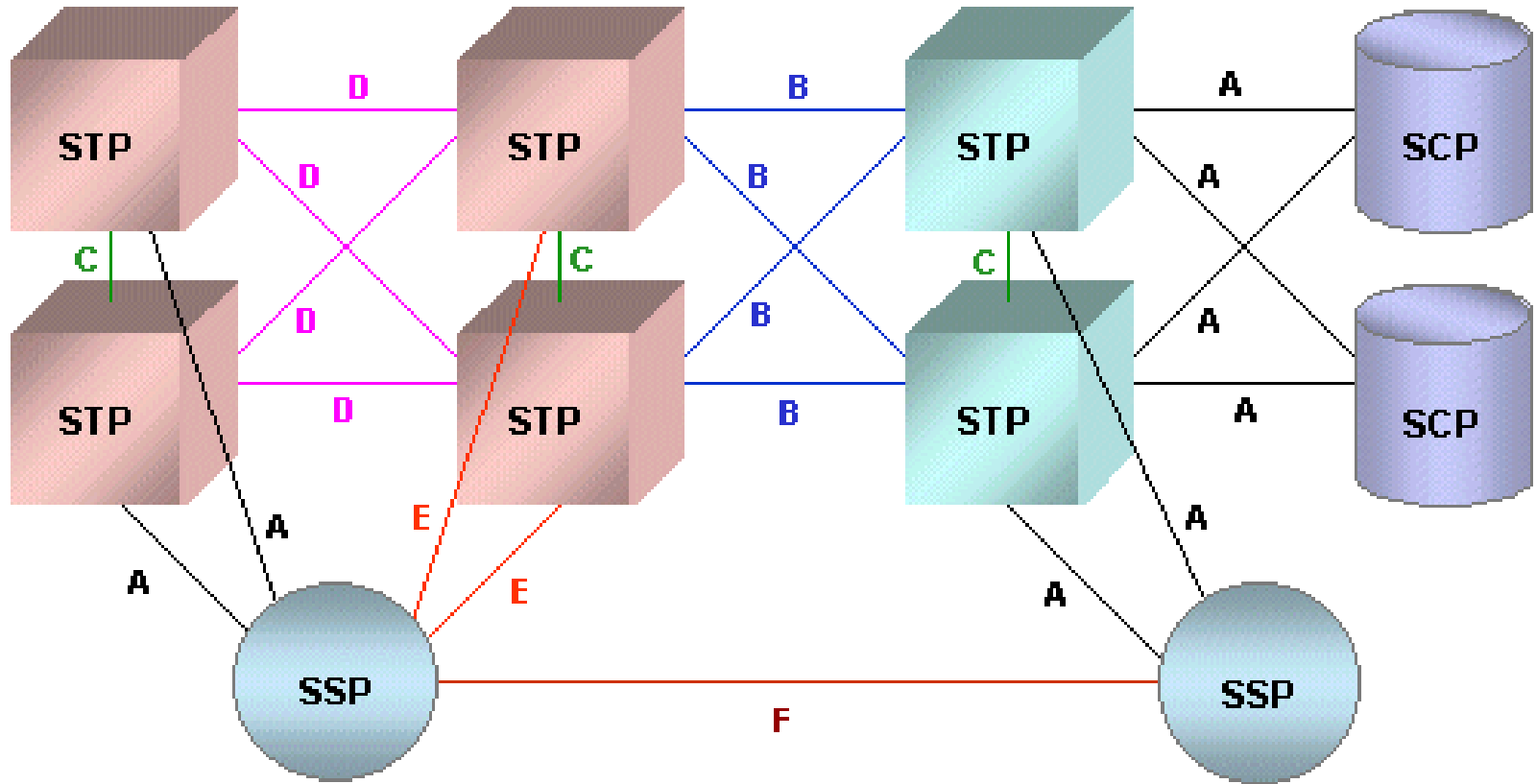
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- **A** Link:
  An "A" (access) link connects a signaling end point (e.g., an SCP or SSP) to an STP. Only messages originating from or destined to the signaling end point are transmitted on an "A" link.

- **B** Link:
  A "B" (bridge) link connects an STP to another STP. Typically, a quad of "B" links interconnect peer (or primary) STPs (e.g., the STPs from one network to the STPs of another network). The distinction between a "B" link and a "D" link is rather arbitrary. For this reason, such links may be referred to as "B/D" links.

- **C** Link:
  A "C" (cross) link connects STPs performing identical functions into a **mated pair**. A "C" link is used only when an STP has no other route available to a destination signaling point due to link failure(s). Note that SCPs may also be deployed in pairs to improve reliability; unlike STPs, however, mated SCPs are not interconnected by signaling links.

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- **D** Link:
  A "D" (diagonal) link connects a secondary (e.g., local or regional) STP pair to a primary (e.g., inter-network gateway) STP pair in a quad-link configuration. Secondary STPs within the same network are connected via a quad of "D" links. The distinction between a "B" link and a "D" link is rather arbitrary. For this reason, such links may be referred to as "B/D" links.

- **E** Link:
  An "E" (extended) link connects an SSP to an alternate STP. "E" links provide an alternate signaling path if an SSP's "home" STP cannot be reached via an "A" link. "E" links are not usually provisioned unless the benefit of a marginally higher degree of reliability justifies the added expense.

- **F** Link:
  An "F" (fully associated) link connects two signaling end points (i.e., SSPs and SCPs). "F" links are not usually used in networks with STPs. In networks without STPs, "F" links directly connect signaling points.

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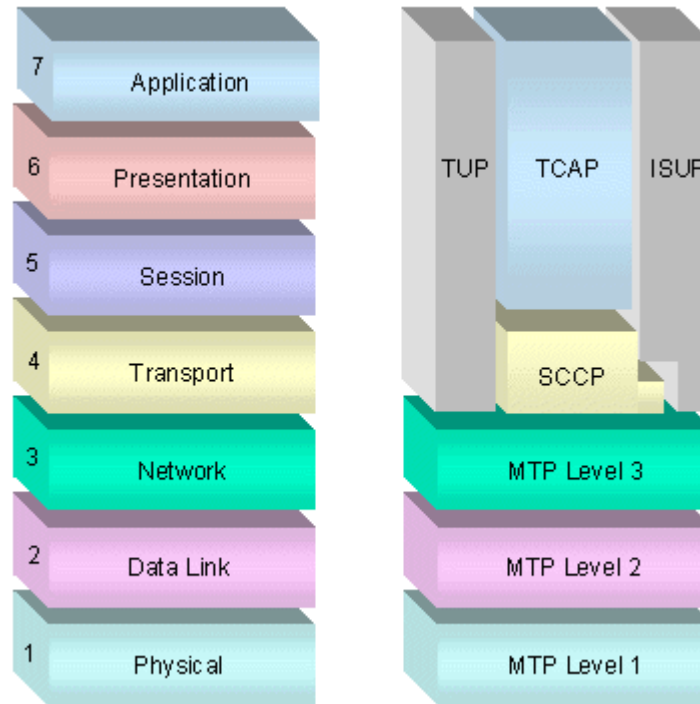
The OSI Reference Model and the SS7 Protocol Stack

Lag 1-3

- **Message Transfer Part**
- The Message Transfer Part (MTP) is divided into three levels. The lowest level, **MTP Level 1**, is equivalent to the OSI Physical Layer. MTP Level 1 defines the physical, electrical, and functional characteristics of the digital signaling link. Physical interfaces defined include **E-1** (2048 kb/s; 32 64 kb/s channels), **DS-1** (1544 kb/s; 24 64kb/s channels), **V.35** (64 kb/s), **DS-0** (64 kb/s), and **DS-0A** (56 kb/s).
- **MTP Level 2** ensures accurate end-to-end transmission of a message across a signaling link. Level 2 implements flow control, message sequence validation, and error checking. When an error occurs on a signaling link, the message (or set of messages) is retransmitted. MTP Level 2 is equivalent to the OSI Data Link Layer.
- **MTP Level 3** provides message routing between signaling points in the SS7 network. MTP Level 3 re-routes traffic away from failed links and signaling points and controls traffic when congestion occurs. MTP Level 3 is equivalent to the OSI Network Layer.

Lag 4-7

- **ISDN User Part (ISUP)**
- The ISDN User Part (ISUP) defines the protocol used to set-up, manage, and release trunk circuits that carry voice and data between terminating line exchanges (e.g., between a calling party and a called party). ISUP is used for both ISDN and non-ISDN calls. However, calls that originate and terminate at the same switch do not use ISUP signaling.
- **Telephone User Part (TUP)**
- In some parts of the world (e.g., China, Brazil), the **Telephone User Part** (TUP) is used to support basic call setup and tear-down. TUP handles analog circuits only. In many countries, ISUP has replaced TUP for call management.
- **Signaling Connection Control Part (SCCP)**
- SCCP provides connectionless and connection-oriented network services and **global title translation** (GTT) capabilities above MTP Level 3. A **global title** is an address (e.g., a dialed 800 number, calling card number, or mobile subscriber identification number) which is translated by SCCP into a destination point code and **subsystem number**. A subsystem number uniquely identifies an application at the destination signaling point. SCCP is used as the transport layer for TCAP-based services.

Lag 4-7

- **Transaction Capabilities Applications Part (TCAP)**
- TCAP supports the exchange of non-circuit related data between applications across the SS7 network using the SCCP connectionless service. Queries and responses sent between SSPs and SCPs are carried in TCAP messages. For example, an SSP sends a TCAP query to determine the routing number associated with a dialed 800/888 number and to check the personal identification number (PIN) of a calling card user. In mobile networks (**IS-41** and **GSM**), TCAP carries **Mobile Application Part** (MAP) messages sent between mobile switches and databases to support user authentication, equipment identification, and roaming.
- **Operations, Maintenance and Administration Part (OMAP) and ASE**
- OMAP and ASE are areas for future definition. Presently, OMAP services may be used to verify network routing databases and to diagnose link problems.

Standarder!

SS7 Level	ITU Standard	ANSI Standard	JTC (Japan) Standard
MTP Level 2	ITU Q.701 - Q.703, 1992	ANSI T1.111.2-.3, 1992	JT-Q.701 - JT-Q.703, 1992
MTP Level 3	ITU Q.704 - Q.707, 1992	ANSI T1.111.4-.7, 1992	JT-Q.704 - JT-Q.707, 1992
SCCP	ITU Q.711 - Q.714, 1992	ANSI T1.112, 1992	JT-Q.711 - JT-Q.714, 1992
TUP	CCITT Q.721 - Q.724, 1988	N/A	N/A
ISUP	ITU Q.761 - Q.764, 1992	ANSI T1.113, 1992	JT-Q.761 - JT-Q.764, 1992
TCAP	ITU Q.771 - Q.775, 1992	ANSI T1.114, 1992	JT-Q.771 - JT-Q.775, 1992