

Telecommunications Usage of GPS

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Ed Butterline

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This report will be a brief tutorial of how a U.S. telecommunications carrier uses the GPS timing signal to discipline its network. In a simple manner it will define telecommunication synchronization and the standards that govern it. The symptoms and effects of synchronization degradations will be discussed.

TELECOMMUNICATIONS USAGE OF GPS

ED BUTTERLINE

TELECOMMUNICATIONS SYNCHRONIZATION

- What is synchronization?
- Who says so?

WHAT IS TELECOMMUNICATION SYNCHRONIZATION?

- Synchronization can be defined as an arrangement for operating digital switching and transmission systems at a common clock rate

TELECOMMUNICATION STANDARDS ORGANIZATION

- Accredited by the American National Standards Institute (ANSI)
- Sponsored by The Alliance for Telecommunications Industry Solutions (ATIS)
- Committee T1- Telecommunications
Network Standards
- Technical Subcommittee T1X1- Digital Hierarchy
and Synchronization
- Working Group T1X1.3 - Synchronization Interfaces

STANDARDS PARTICIPATION

- Exchange Carriers 15 members/3 observers
- Interexchange Carriers 7 members/2 observers
- General Interest 11 members/10 observers
- Manufacturers 33 members/127 observers

SYNCHRONIZATION STANDARD

T1.101-1994

- Network nodes shall be traceable to a primary reference standard (PRS)
- Prescribes interface specifications
- Defines components and relationships of a synchronization network

INFORMATION TRANSMISSION

- The Basic Transmission Unit - 1.544 Mbps or a TI
- TI equals 24 voice services
- A TI is transmitted in 193 bit blocks
24 8 bit voice circuits plus 1 sync bit
- Services/circuits are timing buffered

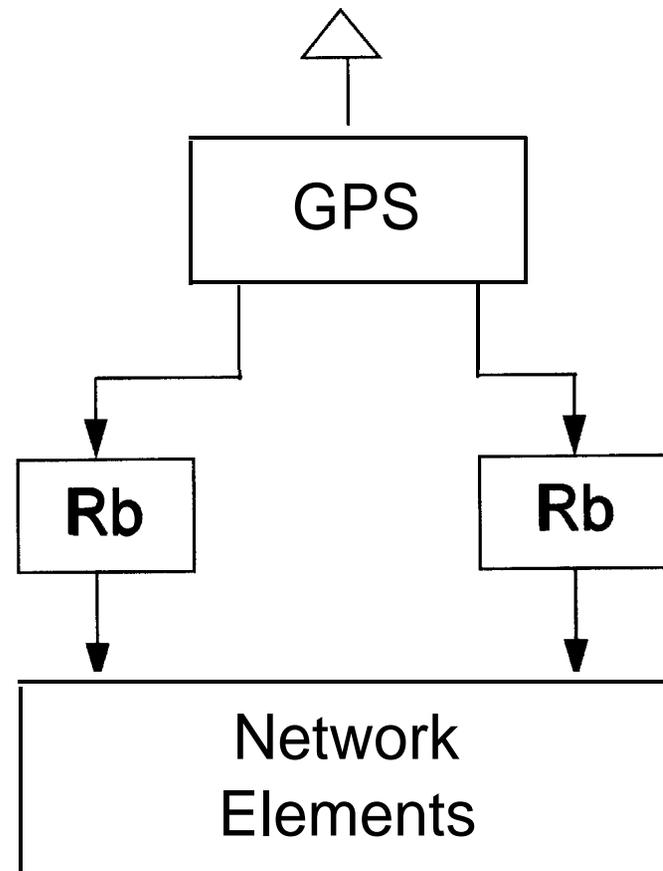
TIMING IMPAIRMENTS (SLIPS)

- Occur when the receive clock is running faster or slower than the transmit clock
- Results in a repetition or deletion of an 8 bit byte

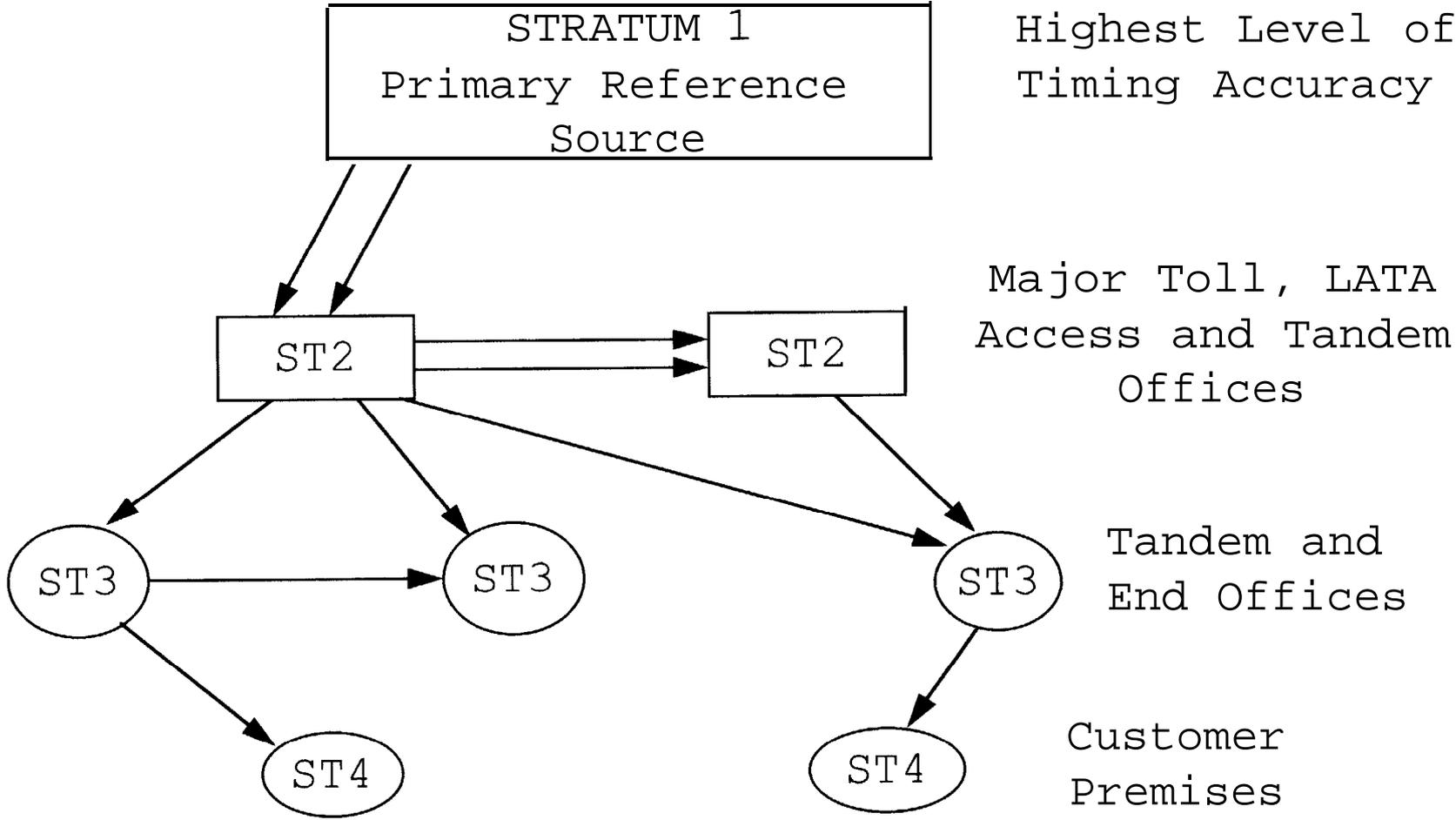
EFFECTS OF SLIPS ON TELECOMMUNICATION SERVICES

- Voice - Noise
- Fax - Loss of picture content
- Data - Re-transmission
- Video - Freeze frame
- Encryption - Re-transmit key code

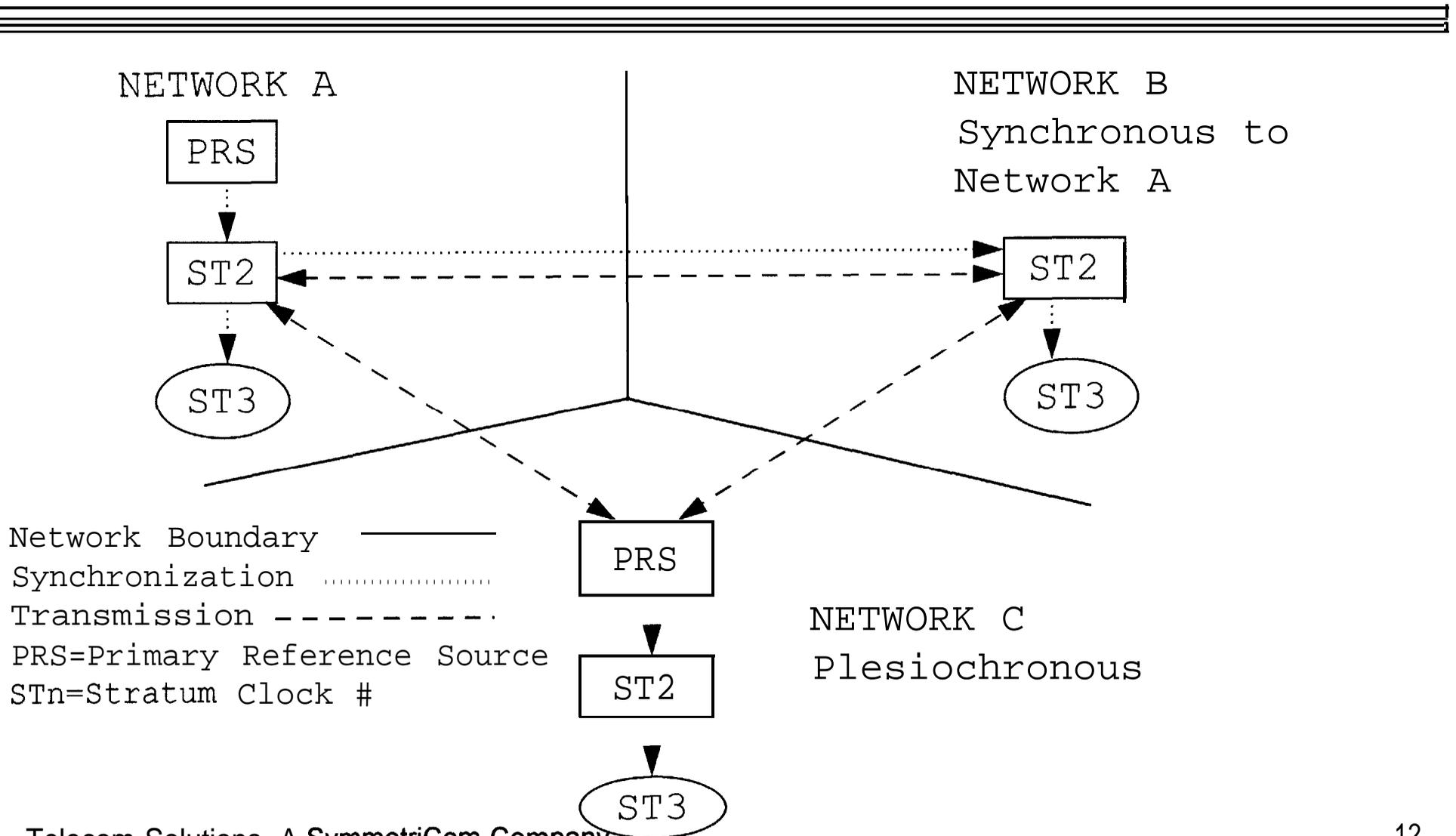
TIMING DISTRIBUTION INTRA-OFFICE



INTER-OFFICE SYNCHRONIZATION HIERARCHY



INTER-NETWORK SYNCHRONIZATION



TELEPHONE SIGNALLING NETWORK

- The signalling network is partitioned from the transmission network
- It is encrypted

TELEPHONE NETWORK

