Telco Network Synchronization

Presentation to WSTS 2013 by D. R. Kurt

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Packet Optical Technology
Network Development

Agenda

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MTS Allstream Inc.

One of Canada's leading national communications providers, delivers innovative telecommunications solutions that bring value to customers.

Allstream offers a portfolio of solutions to small, medium and large businesses nationally

- IP Connectivity
- Unified Communications
- Security
- IT Consulting

MTS offers a full suite of residential consumer services in the province of Manitoba

- Voice
- High Speed Internet and Data
- Next Generation Wireless
- Digital Television
- HDTV

Network Synchronization Status

- Network Development Synchronization prime
  - Network technology evaluation of new synchronization equipment
  - Administer the Corporate Synchronization Strategy
  - Assist Planning, Engineering, Operations
- MTS Allstream synchronization systems
  - The two business units' 150 synchronization systems were implemented using different legacy synchronization platforms
  - Symmetricom TSG and PRR Nationally versus DCD in Manitoba
  - A common platform is being implemented with system replacements
  - Critical legacy equipment spares stock and escalating repair costs require prudent platform management
  - Valued resources are disappearing; Not only are Rubidiums retiring, so are the experienced synchronization primes
- NOT MUCH HAS CHANGED since WSTS 2010!
  - Amazingly, MTS and Allstream have managed to avoid PTP and SyncE!

Synchronization Strategy

- Stage synchronization system upgrades over many years to maximize return on investment of legacy systems:
  - Recover upgraded equipment to supplement spares for legacy systems
  - Replace sites with new systems warranted by expansion/growth
  - New small, medium and large office PRS/BITS are being deployed
  - A large synchronization system was approved for use in MTS and is in approval process for Allstream to support new standards
- Design Considerations
  - Two PRS feeds for each BITS (GPS and/or network)
  - At least 1 Rubidium clock at every site (2 at large sites)
  - Redundant synchronization systems (GPS, shelves) at major sites:
    - adds 25% to cost versus single GPS equipped shelf with expansion
  - Dedicated private and public NTP sources in all major centres proposed
  - Expand Synchronization Status Messaging (SSM) deployment
    - Network-wide deployment in Manitoba to be expanded nationally

Synchronization is STILL Needed

- Frequency (DS-1, Composite Clock, Logic, E1/2048kHz)
  - Legacy Network Elements:
    - Digital Message Switches (DMS), Signal Transfer Points (STPs), Channel Banks, Digital Data, Digital Signal Line Access Modules (DSLAM)s, Synchronous Optical NETwork (SONET), Digital Cross-connect Systems (DCS)
  - MTSTV Classic (Asynchronous Transfer Mode (ATM) based IP TV)
  - Fibre To The Home (FTTH): Voice Gateway and Optical Line Terminal (OLT)
  - High Speed Packet Access (HSPA) Wireless: switch and Node-B hub
- Time (NTP)
  - Thousands of Transport, Switching and IP Network Elements (NE)
  - Hundreds of Operational Support Systems (OSS)
  - Hundreds of Business Support Systems (BSS)
  - MTSTV Classic (ATM encapsulated IP TV) - hundreds of Distribution NEs + core
  - MTS Ultimate TV (IPTV) – Set Top Boxes (STB) + core
  - Voice Over IP (VOIP) NEs + core
  - HSPA Wireless Equipment – Node B NEs + core
- Legacy Code Division Multiple Access (CDMA) Wireless
  - CDMA Sites in Manitoba each have local GPS Synchronization & Time feeds
  - Master controller has Logic 1.544 Mbps feed; DMX switch has DS-1 Sync feeds

Timing/Time Facility Code Standards

- In 2010, there were limited Common Language codes in Telcordia standards suitable for synchronization facilities

- But now all BITS input and output timing and time facilities are recorded in MTS and Allstream inventory systems using Common Language Facility Identifier (CLFI) codes
  - T0XSL = logic (eg. 1.544 MHz logic)
  - A0SA = analog (eg. 2.048 MHz sine, antenna to shelf cabling)
  - A0SC = Composite Clock
  - T1SS or T1FSS = framed all-ones SF or ESF DS-1s
  - FEHSN or FEGSN = 100/1000 BaseT Ethernet NTP links
  - FEHSP or FEGSP = 100/1000 BaseT PTP IEEE1599v2
  - FEHSE or FEGSE = 100/1000 BaseT SyncE circuits
  - Eg. 1/T1FSS//WNPGMB01H33/WNPGMB01H90

- Telcordia bought by Ericsson

STILL No Sync Interface Standards

- Some things never change ….
- Industry is lacking proper implementation of DS-1 synchronization interfaces and software options in next generation Network Elements
  - This poses challenges as new Network Elements are introduced
  - Non-standard, un-meaningful interface names and software options
  - Some equipment is deployed with only DS1 ESF inputs
  - No SSM option: rely on DS-1 Alarm Indication Signal (AIS)
    - Common Channel Signaling System 7 (CCS7) Signal Transfer Point
    - Voice Gateway (G6, G9)
    - Fiber To The Home (FTTH) Integrated Services Access Manager (ISAM) Equipment
    - HSPA & LTE Wireless
- Industry standards should establish common nomenclature & options (doubt this requirement will ever happen)

Synchronization Upgrades STILL

- Telcos require a multi-year synchronization evolution strategy
- Synchronization is not well understood by Telco executives: industry must provide support to build stronger business cases for synchronization lifecycle enhancements
- There are few formal training courses and self directed study opportunities. With an insufficient volume of work to develop required synchronization resources, this leaves a very small number of senior staff with Frequency and Time (NTP) knowledge
  - Personal plan for 2013 is “Make self redundant” so I am delivering company specific courses on network timing/time to coworkers

STILL NextGen Timing and Time

- Wireless High Speed Packet Access (HSPA & LTE)
  - RNC/Node B sync uses proprietary Network Time Protocol (NTP)
  - Core sync: Time (NTP) and Frequency (DS-1, 2.048 MHz Sine)
- Synchronized Ethernet (SyncE)
  - New technology evaluation and possible introduction in 2013/2014
- Microsoft Mediaroom TV platform
  - Set Top Box (STB) - NTP 1/minute (1/sec for first minute after re/boot)
  - Significant platform growth drove increase in NTP server capacity, new servers
- Propose Stratum 1 Network Time Protocol (NTP) servers at major regional centres.
  - Security polices mandate network firewalls: restricts NTP peering/access
  - Multiple NTP implementations, driven by platforms, networks and services
  - Many service platforms state a requirement for Stratum 1 NTP server access
- Network timing distribution may drive PTP IEEE1588v2 introduction/deployment before customer networks drive it

Network Synchronization Evolving ... STILL

MTS allstream

NOW

Existing synchronization platforms are capable of supporting legacy and emerging systems using only legacy frequency and time reference interface types

Legacy platforms are aging critically

PENDING

Synchronization systems are being upgraded as needed to support emerging telephony platforms requiring new synchronization standards

Introduction of IEEE-1588v2, SyncE ~ 2010-2011 > 2014+

Deployment of regional NTP references ~ 2010+ > 2014+

Retiring aging Rubidiums, Resources ~ 2012+ > 2014+

Acronyms

- AIS – Alarm Indication Signal
- AMI – Alternate Mark Inversion
- ATM – Asynchronous Transport Mode
- CCS7 – Common Channel Signalling System 7
- CLCI – Common Language Circuit Identifier
- DCS – Digital Cross-connect System
- ESF – Extended Super Frame
- FTTH – Fibre To The Home
- HSPA – High Speed Packet Access
- ISAM – Integrated Services Access Manager
- LTE – Long Term Evolution (eg. 4G)
- NE – Network Element
- NTP – Network Timing Protocol
- OLT – Optical Line Terminal
- PRS – Primary Reference Source
- PTP – Precision Time Protocol
- SF – Super Frame
- SONET – Synchronous Optical Network
- SSM – Synchronization Status Messaging
- STB – Set Top Box
- STP – Signal Transfer Point
- SyncE – Synchronized Ethernet
- TOD – Time Of Day