# Synchronisation Requirements for Wireline and Wireless Convergence

**Ghani Abbas**

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# Topics

- Why do we need synchronisation?
- Market and Technology Trends Impacting Synchronisation
- Synchronisation Architectures
- Synchronisation Overview
- IP/Ethernet QoS Requirements
- Wireless and Wireline networks convergence
- Summary

# Role of Synchronisation in the Network

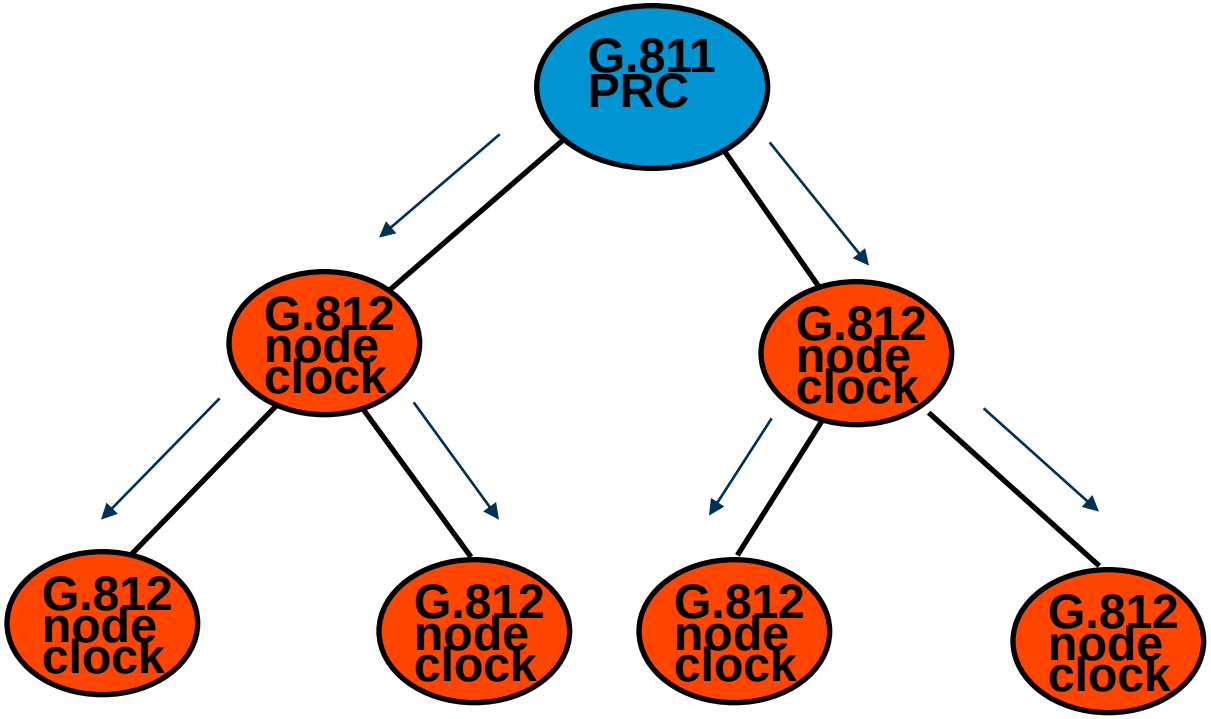
- Synchronisation is required to ensure that Quality of Service (QoS) requirements are met
- In Mobile networks, precise synchronisation is needed in Call handover and efficient bandwidth utilisation
- Some services such as voice, voice-band services and high bandwidth data services in wireless network are dependent on synchronisation

# Market and Technology Trends Impacting Synchronisation

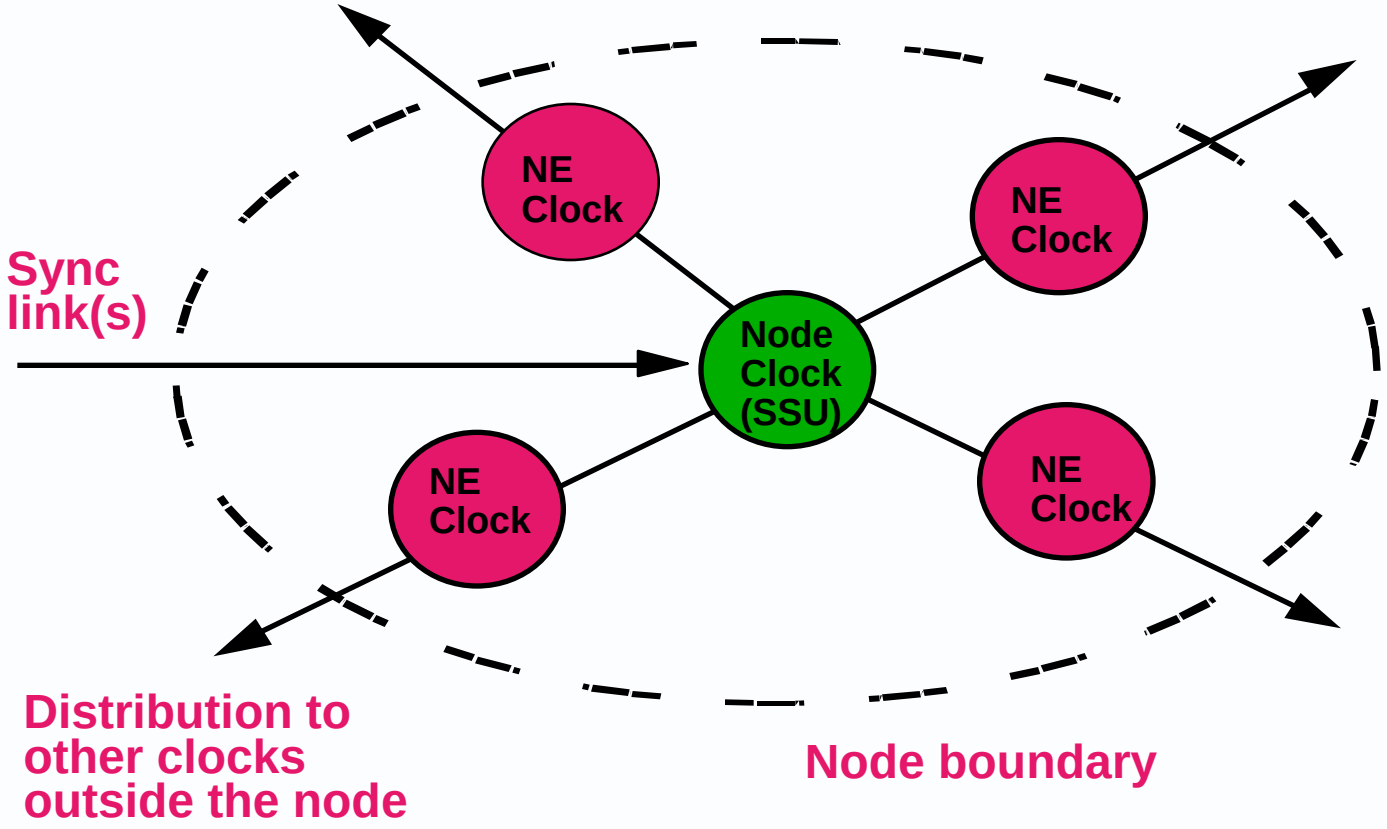
- The network is evolving towards packet rather circuit based network
- Packet networks can not transport synchronisation. Alternative techniques are required
- Packet networks do not offer features for synchronisation fault finding. Alternative techniques may be required
- Enterprise Networks are migrating towards packet networks. E1 sync is no longer available

# Synchronisation Architectures

# Synchronisation Architecture Inter-node Distribution



# Synchronisation Architecture Intra-node Distribution



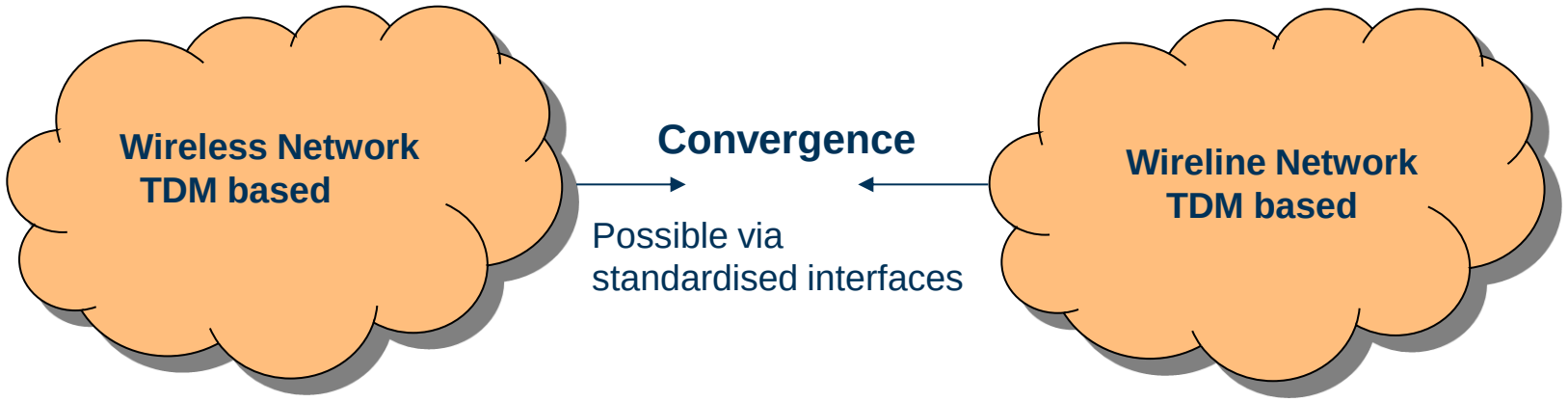
# Synchronisation Overview

- In connection oriented circuit switched networks (such as PDH, SDH) sync is carried by the bearer signal (ie. bit rates of the physical link)
- Output line rates are locked to a node synchronisation unit such as SSU or BITS which are locked to a selectable sync feed
- Synchronisation planning ensures no timing loops are possible
- In IP/Ethernet networks clocks do not meet telecom synchronisation requirements and can not be locked to a synchronisation input

# IP/Ethernet QoS Requirements

- Delay
  - Target delay less than 5 mS
- Delay Variation
  - Less than 2 mS
- Packet Loss
  - Less than 1E-6
- Clock Stability
  - Timing accuracy must be such that the RBS radio frequency stays within +/- 50ppb

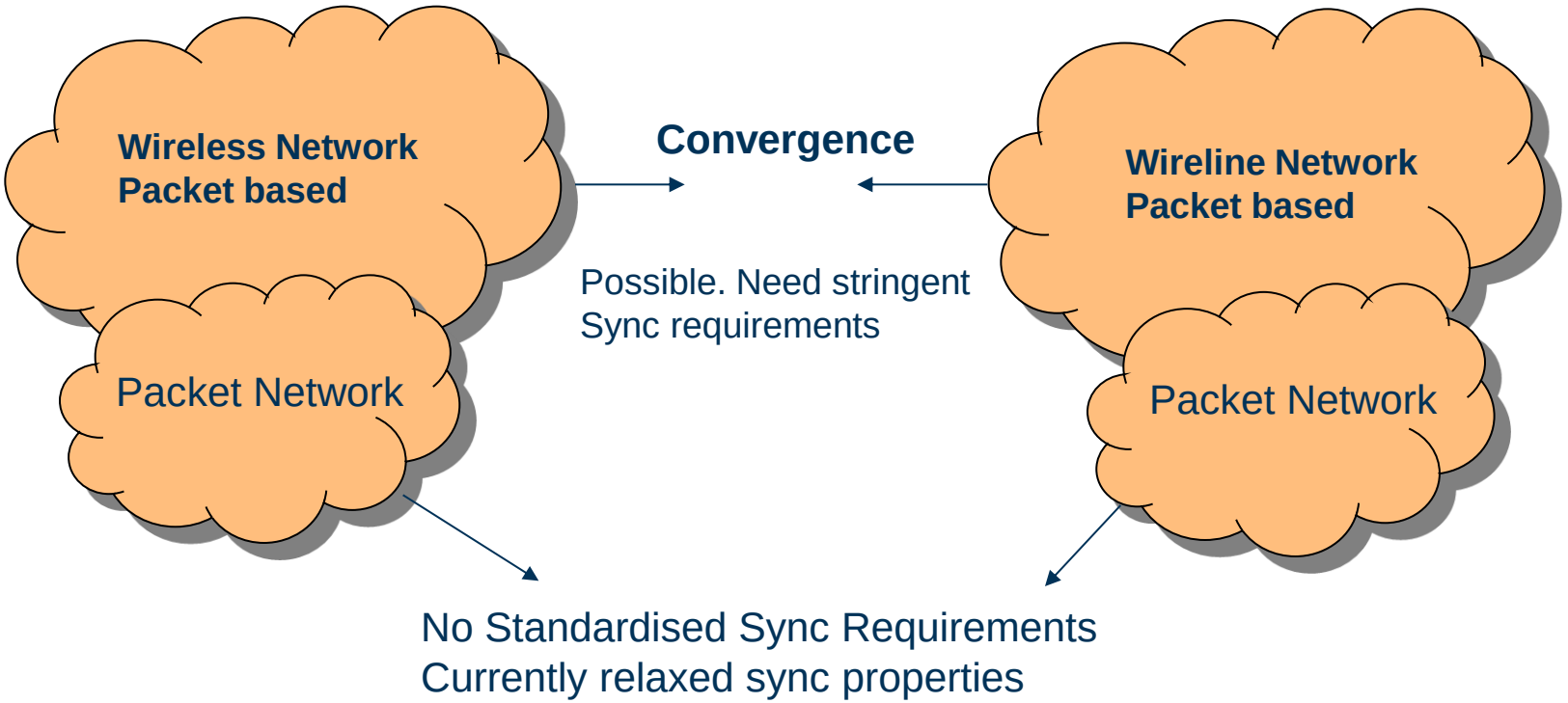
# Convergence of Wireline and Wireless Networks ------ 1




Demanding Sync requirements.
Standards are well established

Stringent Sync Requirements.
Standards are well established

# Convergence of Wireline and Wireless Networks ------ 2



# Possible Solutions To Packet Networks Synchronisation

- GPS Synchronisation to all nodes in the network
  - Available now
- Circuit Emulation over IP
  - Available now through OEM
- Time Stamps in Packet
  - Under development

# GPS in all Network Nodes

- No impact on the current network synchronisation architecture
- No guarantee  that Satellite signals are always available
- It is likely to be expensive in certain network applications (surveys, external antenna, over-voltage protection, mounting etc)

# Circuit Emulation over IP

- Minimum impact on current synchronisation network architecture
- Additional delays introduced by the extra processing
- Extra cost for the cards/boxes

# Time Stamp Synchronisation

- Generally applicable to any packet networks
- No additional equipment are needed
- Numerous algorithms are under consideration. Difficult to validate

# Summary

- Next Generation Networks will be packet based. Synchronisation is a major issue require resolution
- Convergence of Wireless and Wireline networks requires smooth migration for the synchronisation trail end-to-end
- There are a number of Synchronisation techniques available for Packet Networks but Time Stamping offers the best solution
- There are a number of proprietary algorithms for Time Stamping Synchronisation but a standardised one is still under development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