Synchronization protocol inter-working

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Synchronization protocol inter-working

Content

- I- Introduction
  - Requirements and problem statement
  - Prioritization : Frequency or Time?
- II- Protocol –interworking
- III- Benefits demonstration
- IV- Conclusions

(*) « BACK TO THE FUTURE » movie

Requirements and problem statement

- **Need for accurate frequency with or without time**, especially for Mobile Networks (optimization of rare radio resources)
  - Frequency accuracy <50 ppb at the air interface
  - Time requirements at the microsecond or sub-microsecond range (xCDMA TDD, LTE)

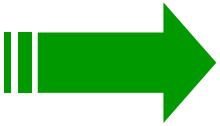
- **Moving from TDM-based network to packet-based network, frequency and/or time distribution is still an issue in terms of:**
  - Synchronization architecture: synchronization resource allocation
  - CAPEX and OPEX regarding deployment/migration scenarios and overall synchronization management
  - Handling of this multi-technology (software/hardware) and multi-layer environment : layer 1 (SDH, xDSL…), Layer 2 (SSM-SyncE, 1588V2/Eth…), layer 3 (NTP-PTPV2/ UDP/Ip…)

Task prioritization : Frequency …or Time?

- **A recurrent debate :** derive frequency from time or distribute frequency to support time?

- **Market perspective :**
  - Accurate frequency distribution is a prerequisite for mobile networks (<50ppb)
  - From a migration perspective, first concern is to deal with the distribution of a network clock and especially to address the distribution of a frequency reference in a PSN
  - Accurate Time is pushed by emerging TDD technologies (WiMAX, LTE)

- **Technical perspective:**
  - Time accuracy at the time client level is inherently dependent to its frequency accuracy/stability
  - Frequency support is thus a welcome prerequisite for an efficient/accurate distribution of a Time reference



First : consider the Frequency distribution

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- II- Protocol interworking
  - Deployment picture
  - Identification of the Inter-working areas
  - Expected inter-working benefits

- III- Benefits demonstration
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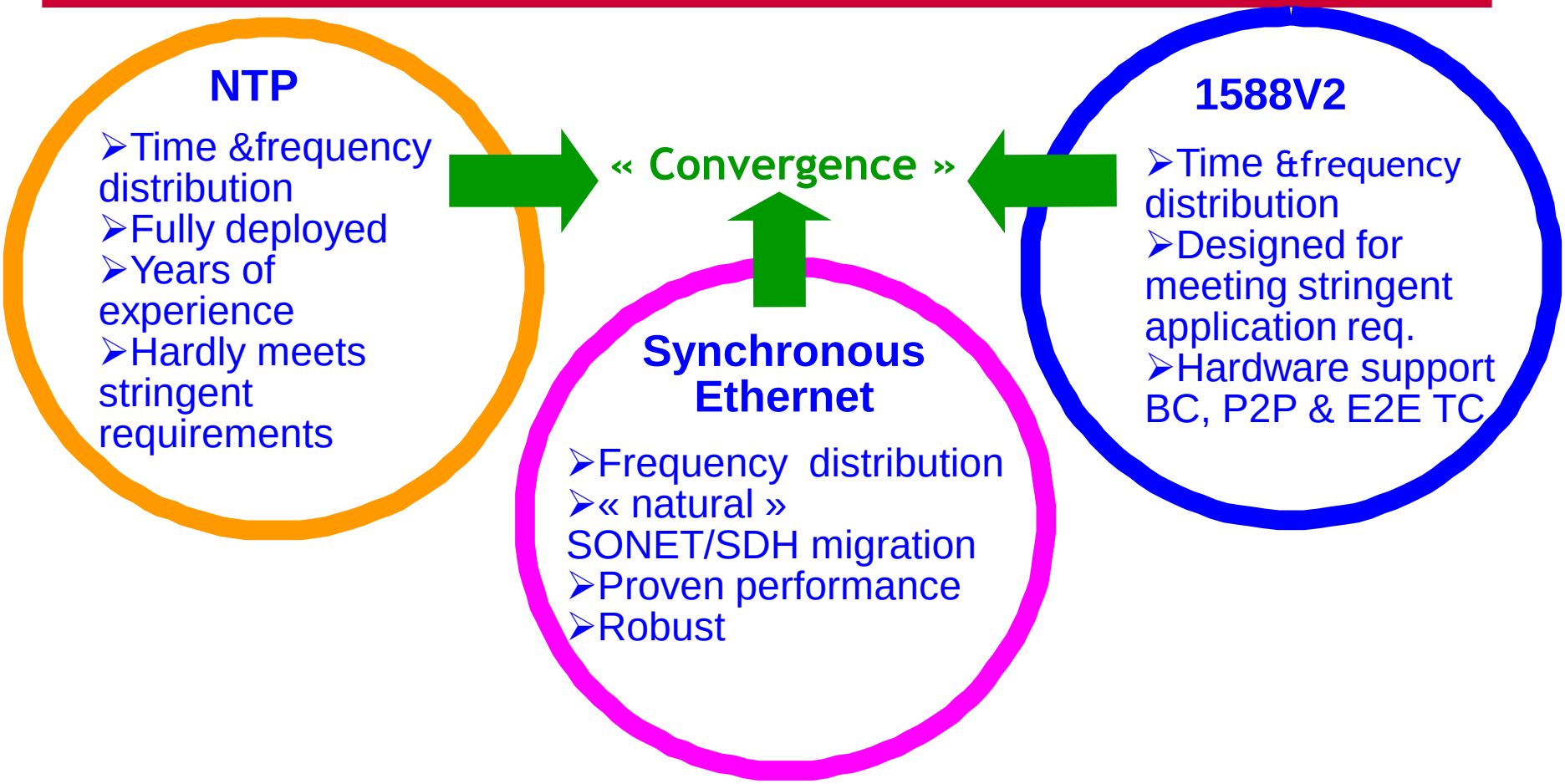
Deployment picture

Complex protocols/technologies, migration issues … In such a context, synchronization protocols are rather evolving separately, without taking advantage of any inter-working capabilities



Identification of the Inter-working areas

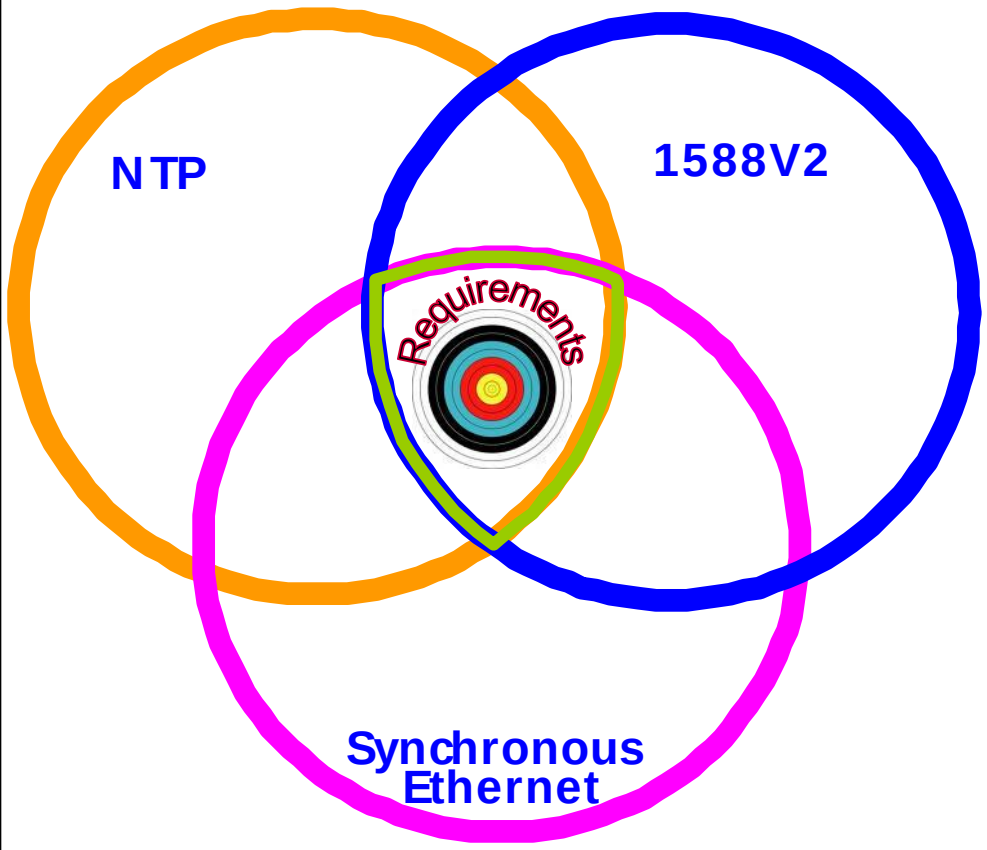
Sync Technology	Synchronous Ethernet	IEEE 1588V2	IETF NTP
Synchronization layer	Physical L1	Ethernet, *UDP/IPv4,6…*	Mainly *UDP/IPv4,6*
Clock Topology	PRC,SSU-T, SSU-L, SEC	Ordinary, GrandMaster, *Transparent clocks* *Boundary clocks*	Client, Server Hierarchical topology
Signaling layer	Ethernet	Ethernet, *UDP/IPv4,6…*	Mainly *UDP/IPv4,6*
"Quality" descriptors	ITU-T G.811, G.812, G.813, DNU (SSM)	Datasets (*Announce*): Priority 1, *clock quality* (class, accuracy, variance), priority 2, Identity	*Stratum*

"Time" inter-working

"Time" inter-working

"Frequency" inter-working

Expected inter-working benefits



- End to End traceability
- Better protection schemes
- (Re) source sharing/balancing
- Some operations handled at the "sync control plane level"

Yielding to :

- **A Simpler and cost efficient management**
- **A Better Time distribution performance**

OPEX/ CAPEX savings

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  - Frequency: SyncE/PTPV2/SyncE, SSM flow continuity across time domains
  - Time: IEEE1588V2/ SyncE performance & protection
  - Time : IEEE1588V2/NTP resource sharing, transparent clock use case
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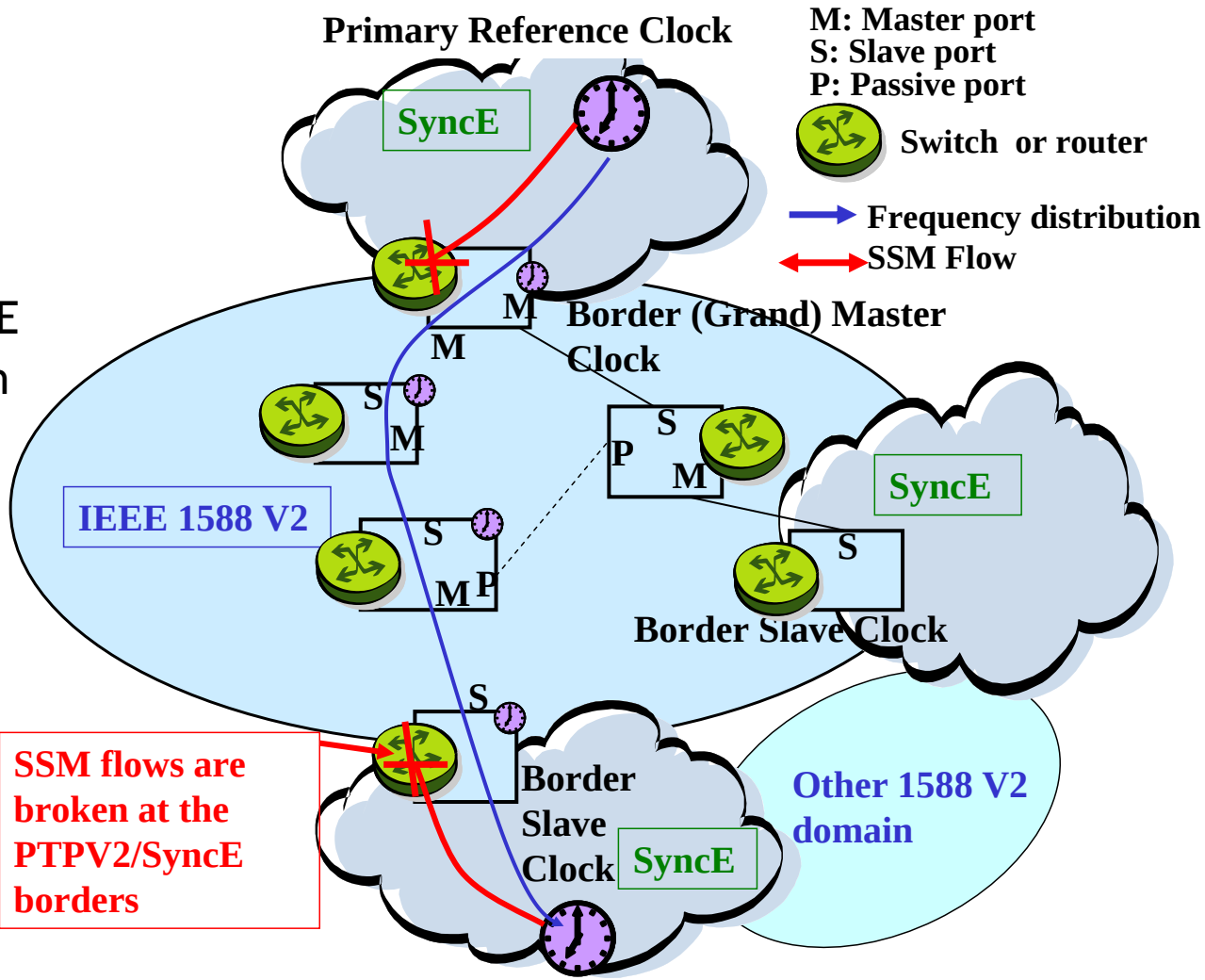
Deployment scenario: SyncE/PTPV2/syncE

- **Migration context:**
  - Segmented domain
  - SyncE/1588V2/SyncE
- **Main Issue:** loss of SyncE SSM traceability through the IEEE1588V2 domain



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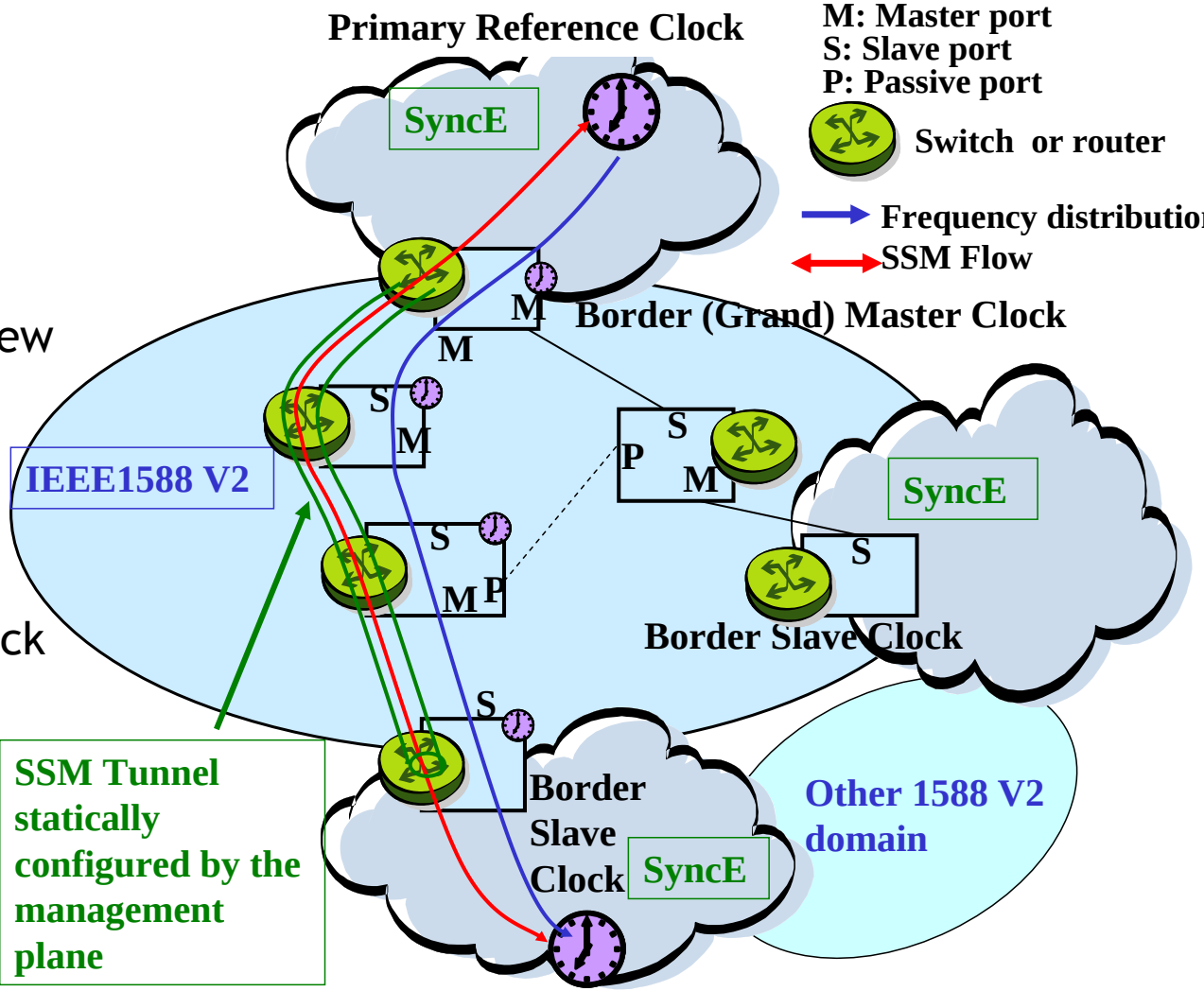
Straightforward solution: “Synchronization management plane” approach

Description:

- Tunneling approach to convey the SSM: static configuration
- Implies a consolidated view of the different synchronization domains

Drawbacks:

- The 1588V2 is still a “black box”: manual re-configuration in case of failure detection (e.g. alarms)



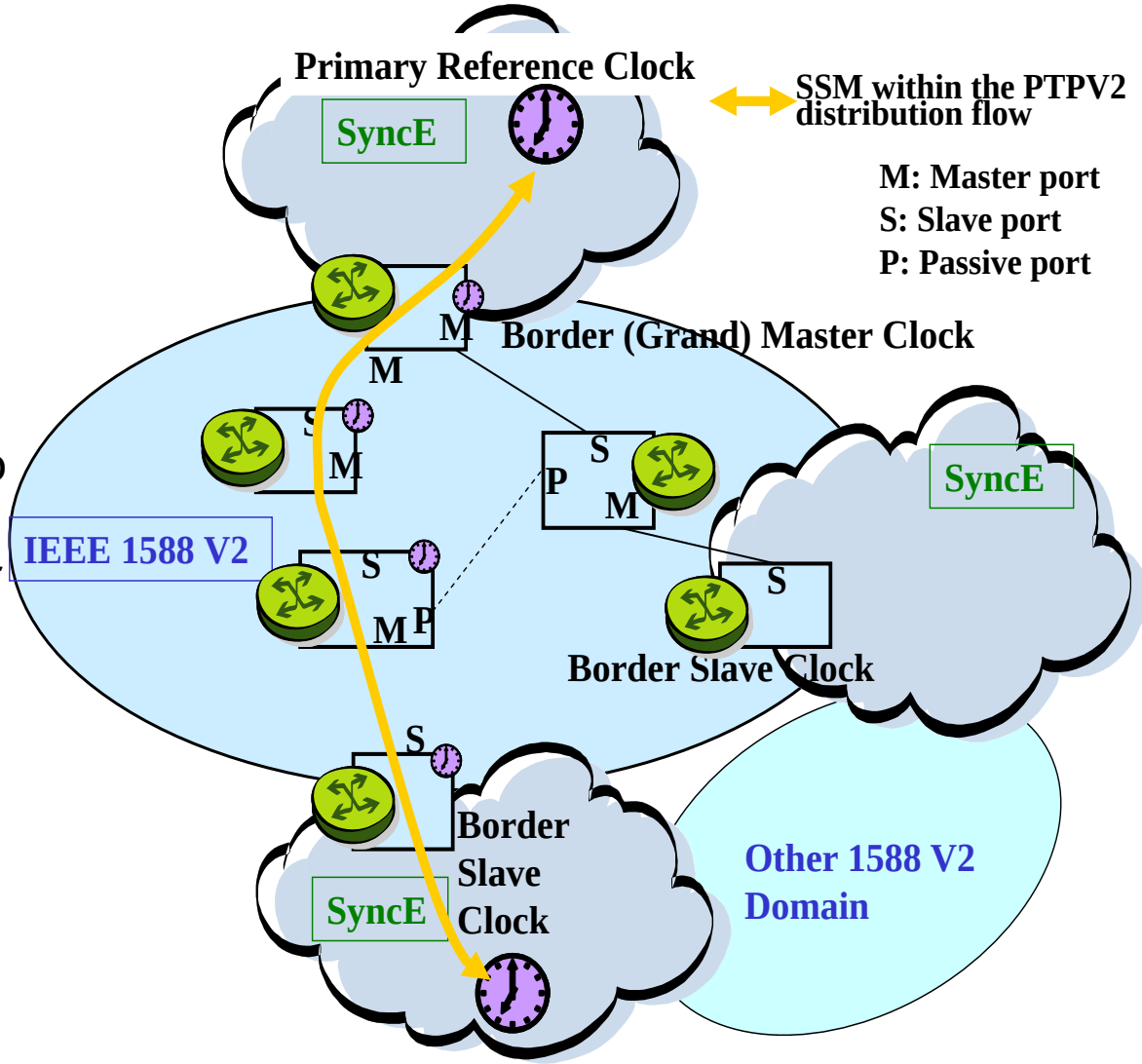
Inter-working solution: “synchronization control plane” approach

Description:

- Border Clocks de/encapsulate the SSM information from/into the 1588V2 signaling
- SSM information is carried by the 1588V2 signaling within the PTPV2 domain
- 1588V2 nodes have the ability to modify the SSM QL field into a DNU in case of node failure
- Failure detection: The “Border slave” sends out the DNU in case of PTPV2 self-healing failure

Benefits

- Simpler management
- Fast announce of a 1588V2 node failure and reactive behavior



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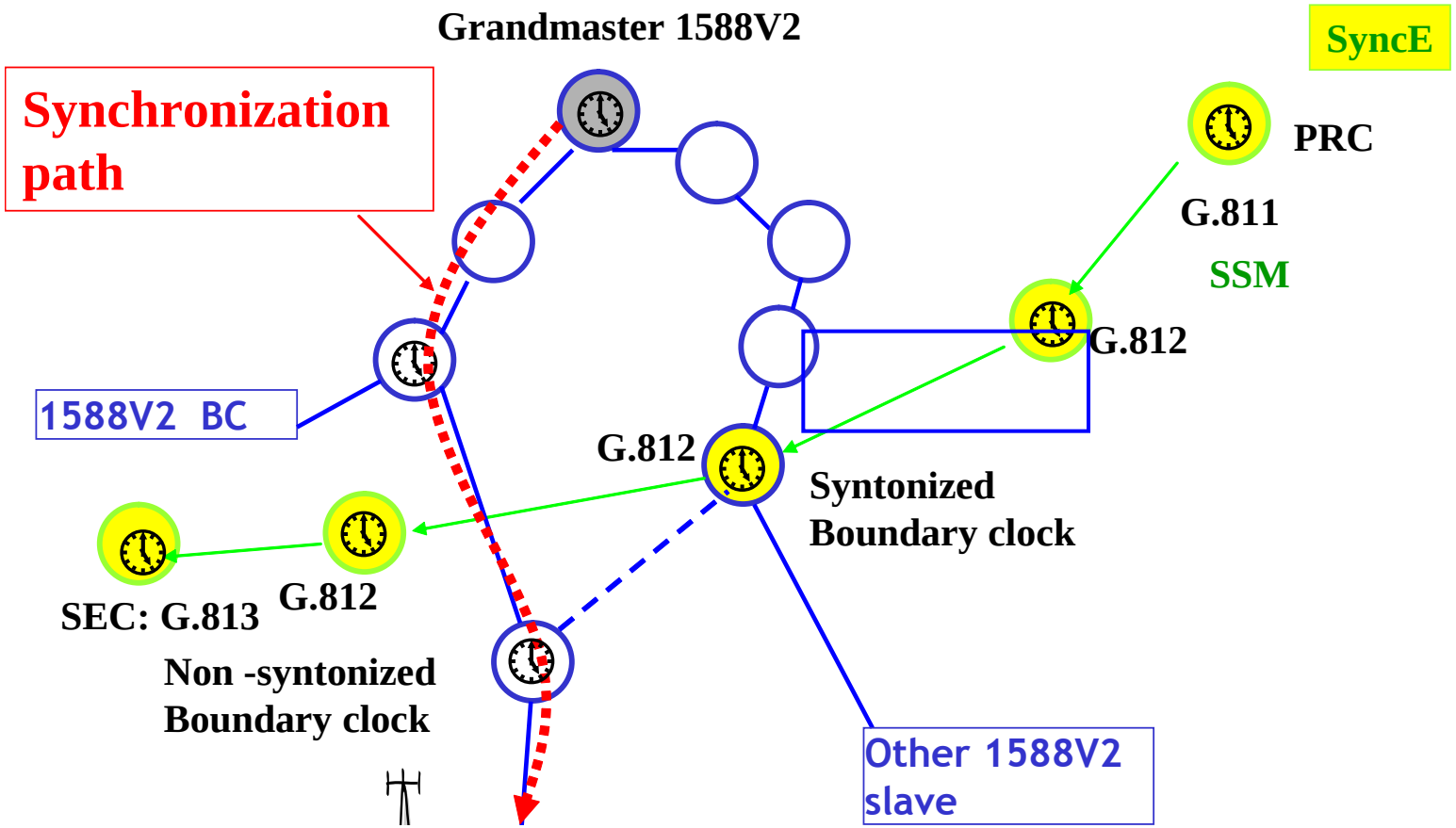
Still synchronized?

“IEEE 1588V2 + SyncE” study case Segmented scheme

- Description of a Time distribution scheme ignoring any syntonization support : no protocol collaboration



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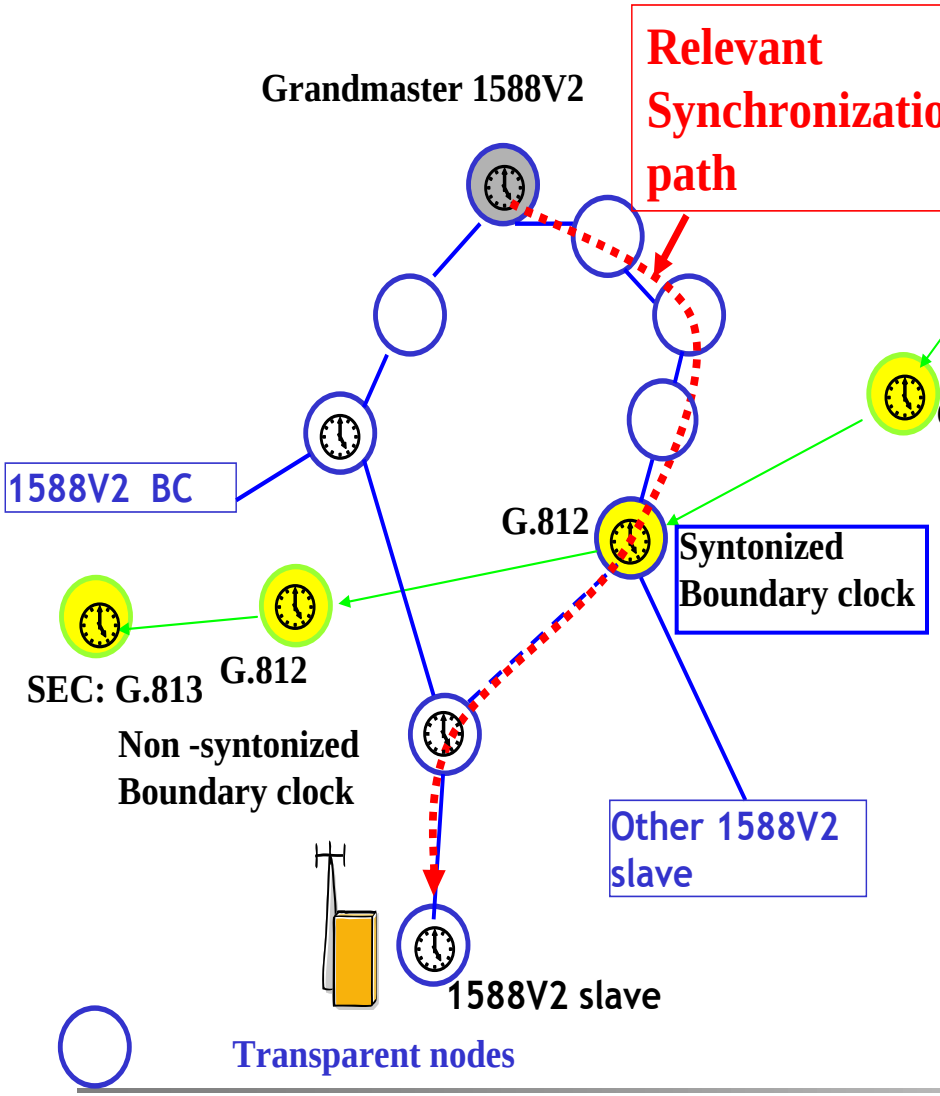
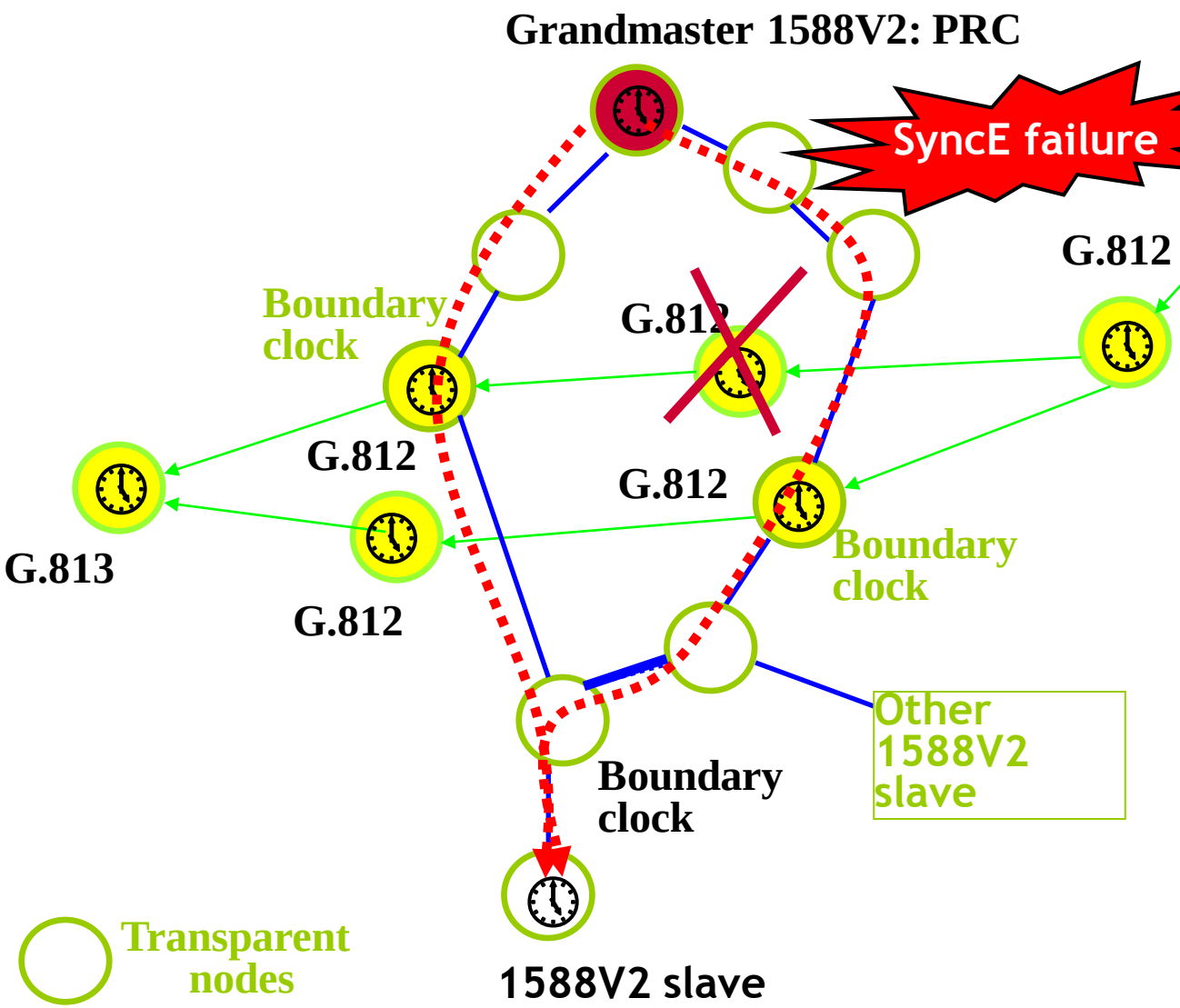
“IEEE 1588V2 + SyncE” study case Inter-working scheme



Description

- SSM QL (Quality Level) within IEEE1588V2 announce message
- The relevant (performance/stability) “Time distribution” topology is computed by the Best Master Clock algorithm by taking into account the existing SyncE syntonization support

“IEEE 1588V2 + SyncE” study case Inter-working scheme



Benefits

- The BMC takes into account the Quality Level degradation
- **Automatic and quick re-configuration of the Time topology according to On-Path-Support Failure**

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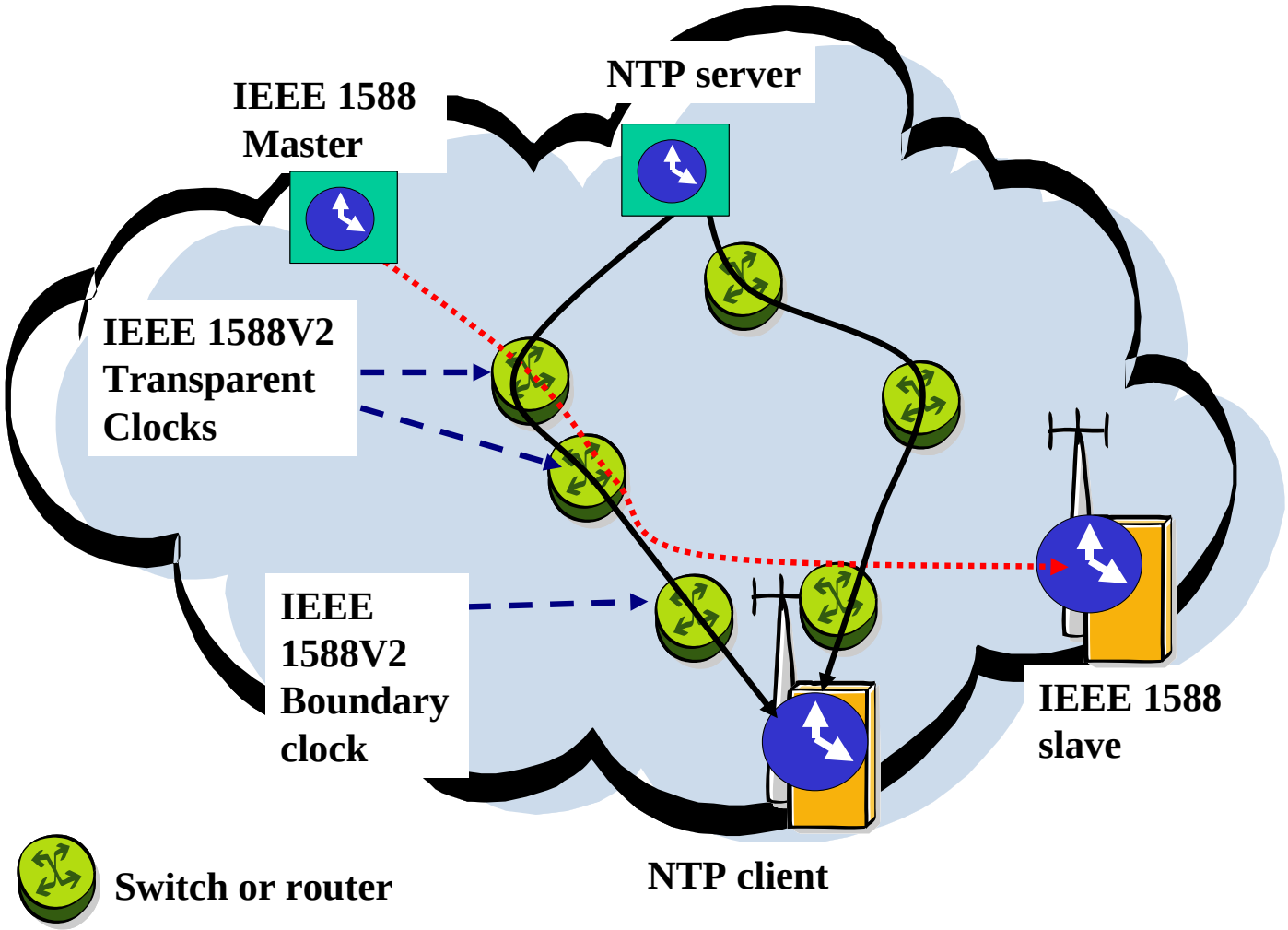
Still synchronized?

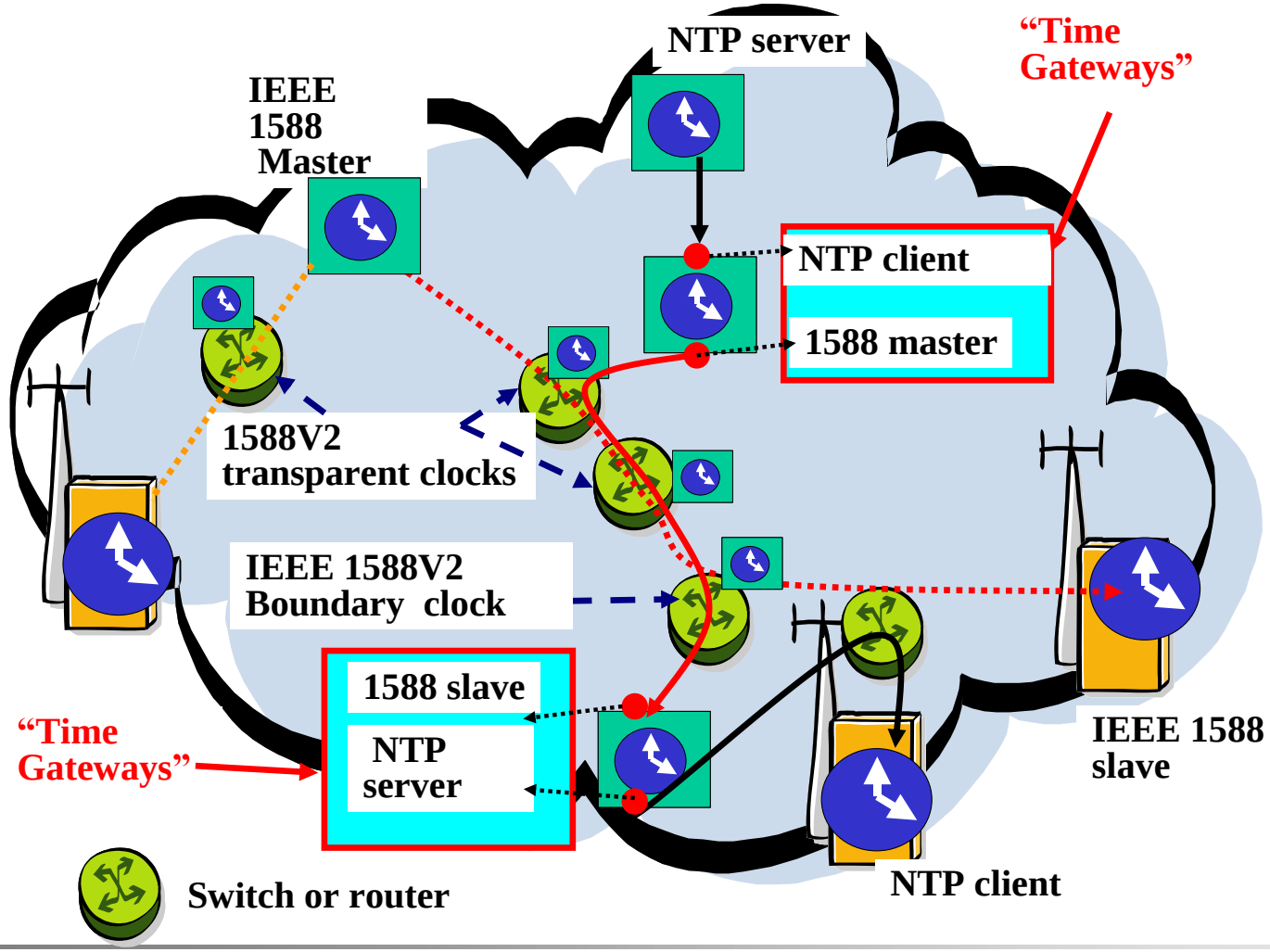
NTP and 1588V2 in concurrent deployment Full ignorance

- Independent deployment : no collaboration

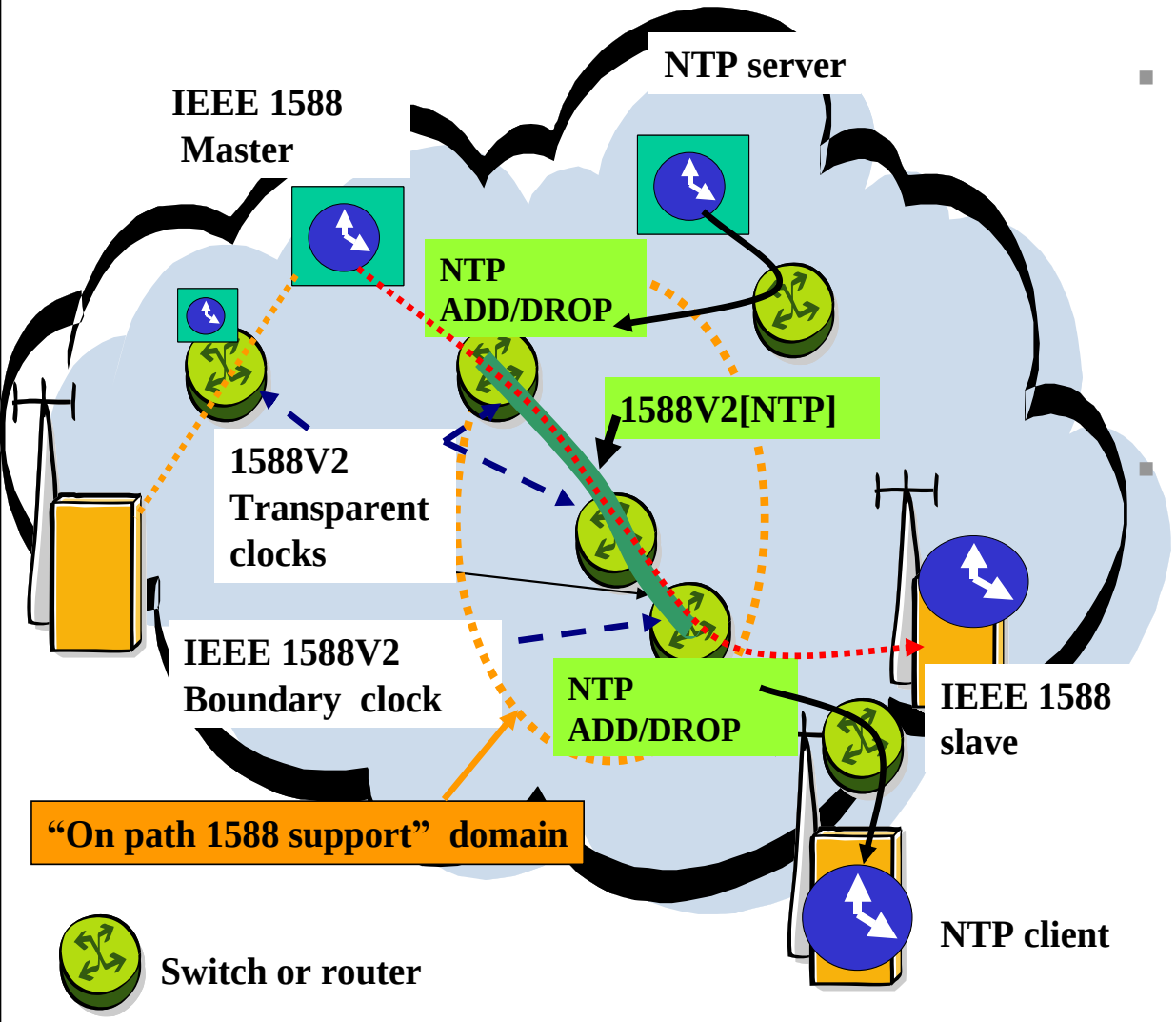


NTP and 1588V2 in concurrent deployment Co- existence

- Limited cooperation : protocol translation at “Time GateWays”



NTP and 1588V2 in concurrent deployment Inter-working scheme



Description:

- "ADD/DROP" elements
  - (de) encapsulate NTP within IEEE1588V2 event signaling
  - Updates NTP Time-stamps thanks to the 1588V2 Correction Field

Benefits:

- Cost savings by **the reuse of TCs by NTP**
- **Low-cost ADD/DROP clocks**
- NTP performance improvement thanks to the Transparent Clock support
- Deployment flexibility: source sharing/balancing

Conclusion

Interworking schemes, in the context of frequency and time distribution, have been presented, demonstrating

- **Benefits in terms of :**
  - Overall performance improvement
  - Management simplification with respect to self-reconfiguration (ex. failure, QL degradation)
  - Cost savings by an optimized and flexible use of synchronization resources
- **The need for a good cooperation between standardization organizations** in order to:
  - Harmonize some similar concepts, such as quality descriptors…
  - Address such inter-working schemes with relevant signaling extension (SSM, 1588V2, NTP TLVs…)

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Because
the world is
Always on