

Analysis of TSCAI derivation Solution options

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TSN QoS parameters from TSN GM to 5G GM conversion

TSCAI derivation options

Option #1:

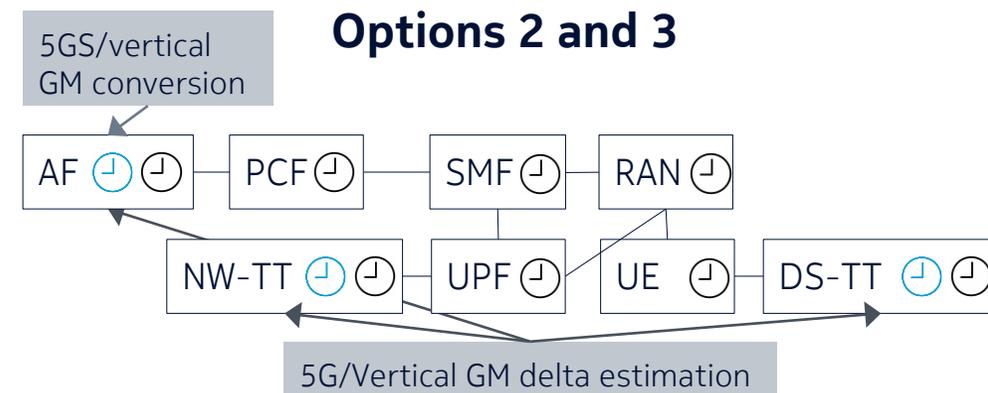
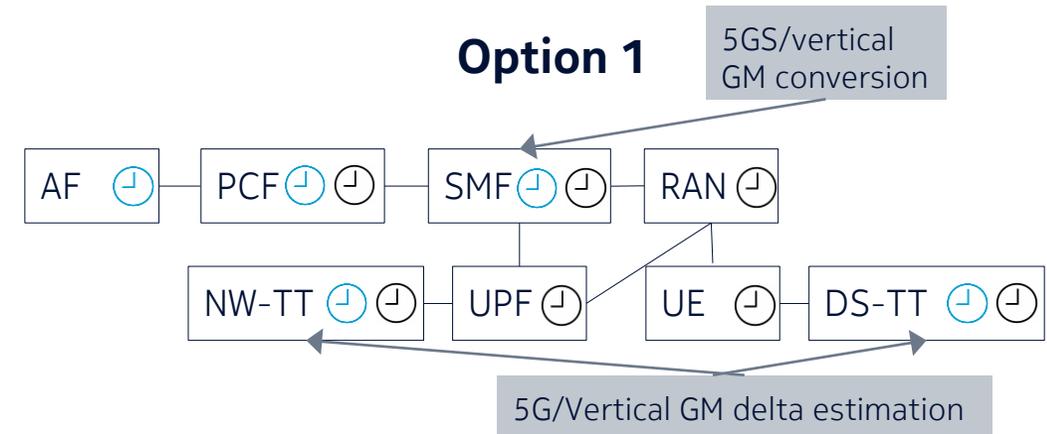
- TSN AF provides the TSN QoS container in reference to TSN GM.
- PCF uses the delay (in reference to TSN GM) to derive 5QI, QoS policies.
- **SMF** does the conversion of parameters from TSN GM to 5G GM and **derives TSCAI** (in reference to 5G GM).

Option #2:

- **TSN AF derives the TSCAI** in reference to the 5G GM, considering clock drift, UE residence time, CN PDB.
- PCF uses the delay for deriving 5QI.
- SMF forwards the TSCAI to RAN.

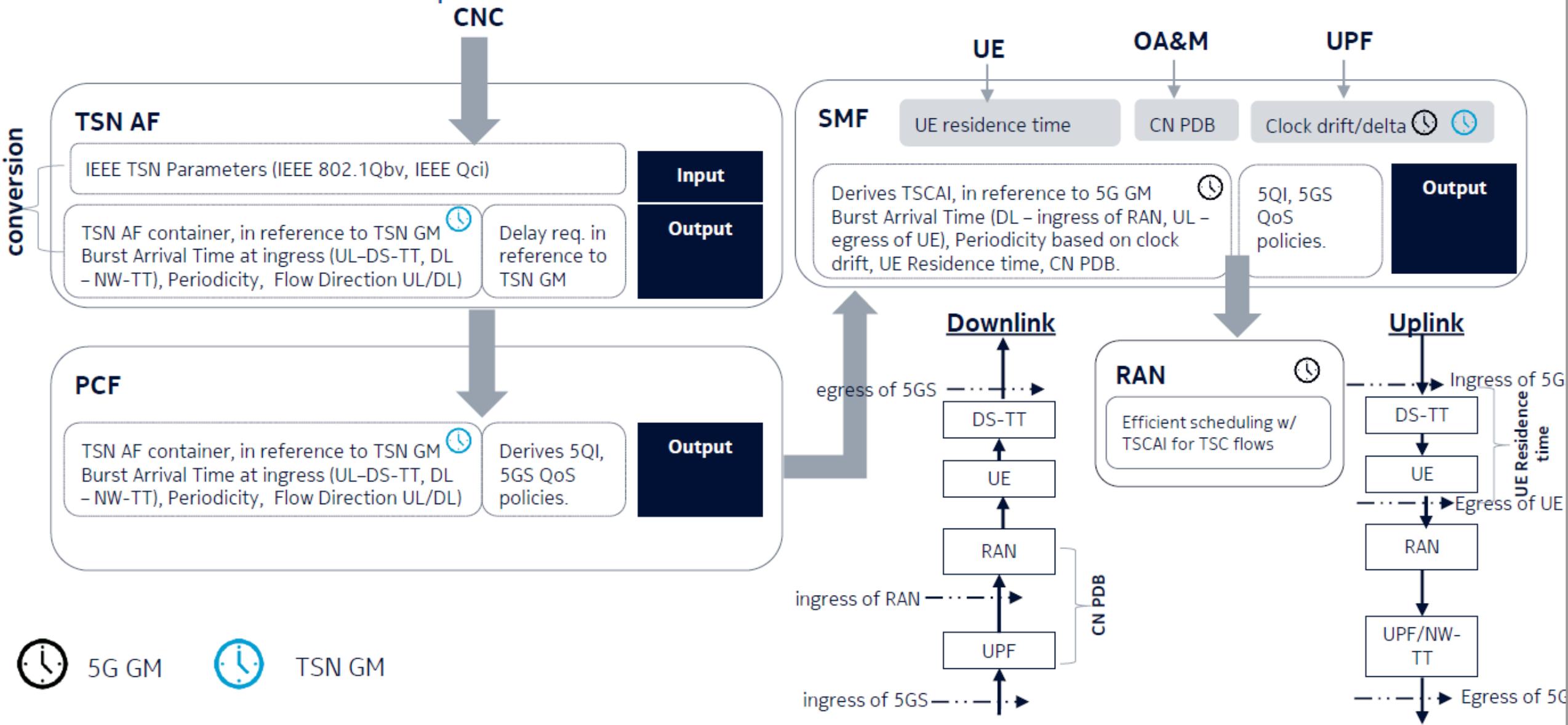
Option #3:

- TSN AF derives the TSN QoS container in reference to the 5G GM, considering clock drift.
- PCF uses the delay for deriving 5QI.
- **SMF derives TSCAI** considering UE residence time, CN PDB.



Analysis of options

TSCAI derivation – Option 1

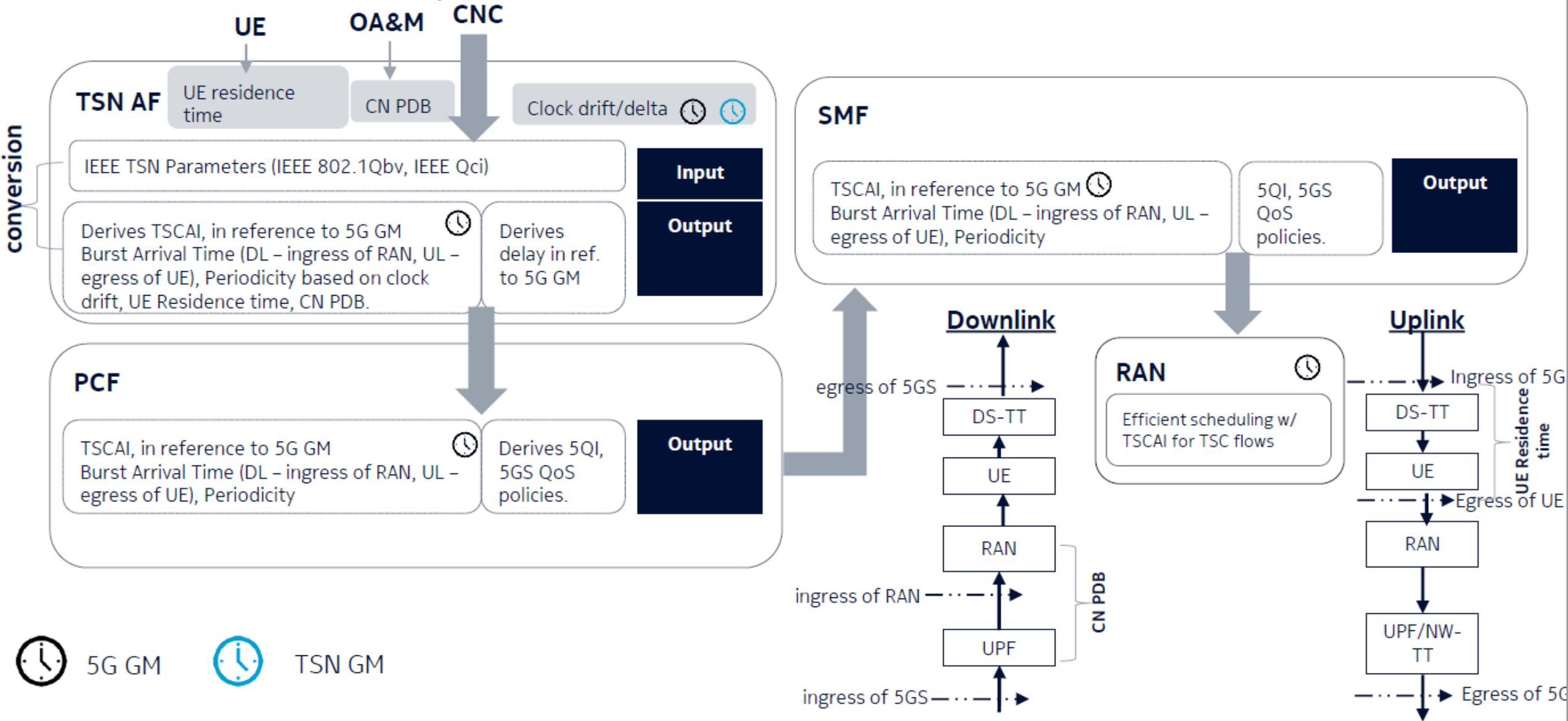


Analysis

Area	Evaluation
Strengths	<ul style="list-style-type: none">• With multiple time domains handled inside the 5GS, updating TSCAI parameters to track clock drift between timing domains is very fast (no involvement of AF that then retunes via the PCF/SMF).• The AF can be a pure software function without ability to know or determine relationship among vertical and 5GS time-domains.
Weaknesses	<ul style="list-style-type: none">• PCF derives 5QI/PDB from delay requirement based on TSN Time domain.• The 5GS has to have deeply integrated knowledge of multiple time-domains, e.g. SMF.

Summary: This is Nokia's preferred option. Allows for most powerful functionalities related to tracking drift among vertical/5GS clock domains, allows for simpler AF software-functionality, and forward compatibility if we later on want to support more clock domains natively. With this solution, PCF does not have knowledge of clock domains

TSCAI derivation – Option 2

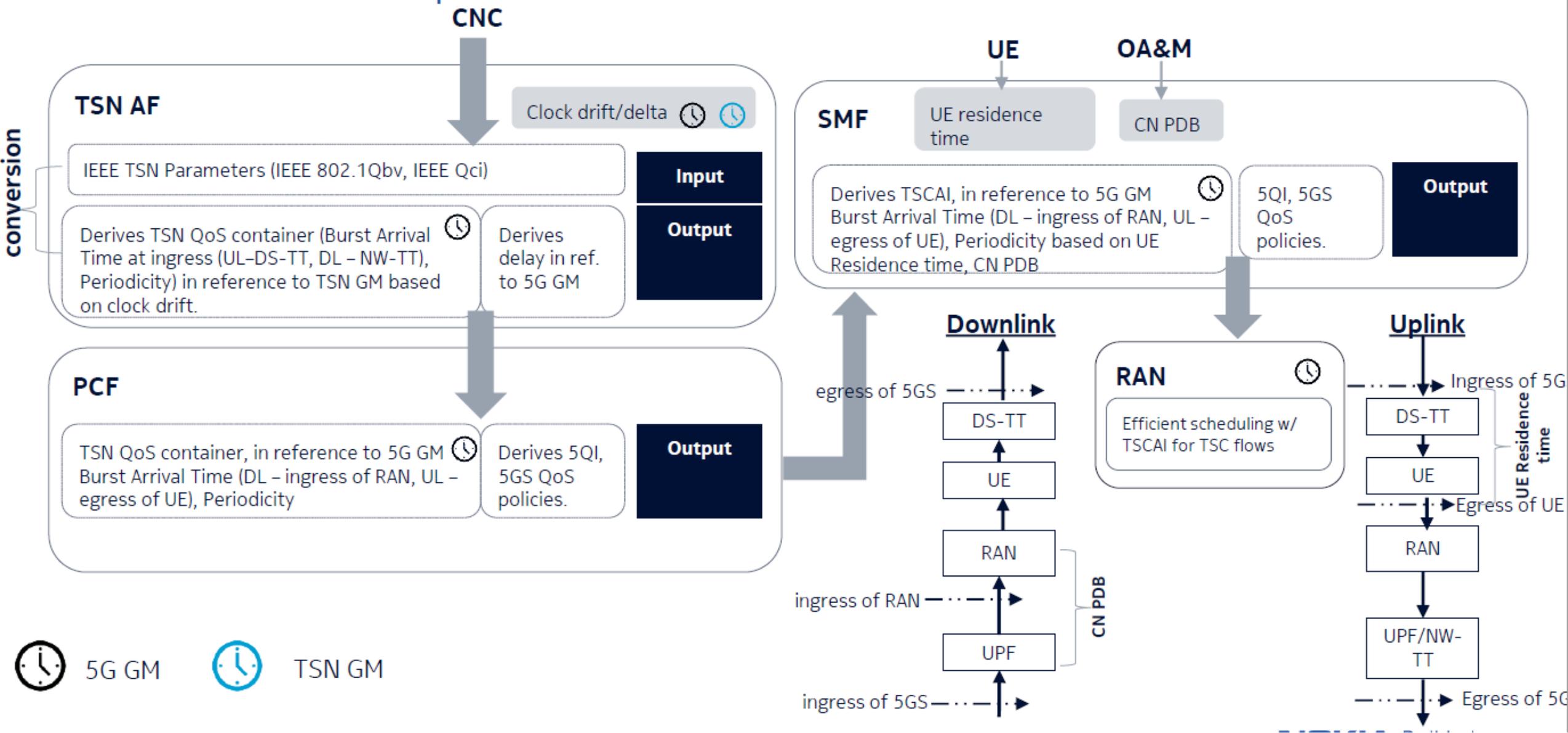


Analysis

Area	Evaluation
Strengths	<ul style="list-style-type: none">• None, option #3 is better if running with the philosophy of option #2.
Weaknesses	<ul style="list-style-type: none">• Makes no sense to expose internal 5GS delays to the AF (e.g. CN PDB) in order for it to derive the TSCAI parameters which are same logical step as deriving the AN PDB. The internal mapping of external requirements should be handled by 5GS functionalities.

Summary: This option makes no sense. The key functionality is whether the 5GS will do clock conversion of parameters or not, e.g. only options #1 and #3 should be considered. Deriving internal parameters such as AN PDB and TSCAI is a 5GS task.

TSCAI derivation - Option 3



Analysis

Area	Evaluation
Strengths	<ul style="list-style-type: none">• 5GS has all the functionalities for handling deterministic traffic flows working only with its own time domain, e.g. other time domains are transparent
Weaknesses	<ul style="list-style-type: none">• Adjusting drift/offsets between vertical clock and 5GS clock requires involvement of the AF and a “slow” reconfiguration of the TSCAI going from the AF to the PCF/SMF.<ul style="list-style-type: none">• Particularly for Rel-16 5GS as a TSN Bridge architecture, more functionalities take place at the TSN AF to convert both GMs (e.g. delta report from NW-TT to TSN AF)

Summary: Avoids the tracking drift among vertical/5GS clock domains within the 5GC (i.e. PCF, SMF). The TDs are transparent within the 5GS but complicates AF design.

Consolidated options

Way forward

- Option #1 benefits AFs that do not need to be synchronized to any clock (e.g. they may just forward the parameters received from applications)
- Option #3 benefits AFs that need to be synchronized to the same clocks as the UEs to provide/obtain meaningful information from 5GS (e.g. AF can subscribe to detailed 5GS sync service events)

One possibility is also to merge options #1 and #3 to provide their benefits and a flexible sync service configuration:

- 5GS supports integrated knowledge of multiple time-domains from option #1
 - SMF can be aware of vertical/5G GMs drift and this can be used to derive TSCAI updates due to frequent drifts and update TSCAI in the NG-RAN
- AF can be synchronized to 5G GM
 - it may be used to derive TSN QoS container based on 5G GM

Combined options #1 and #3 architecture

