SRV6 as Data Plane for 3GPP N9 Interface

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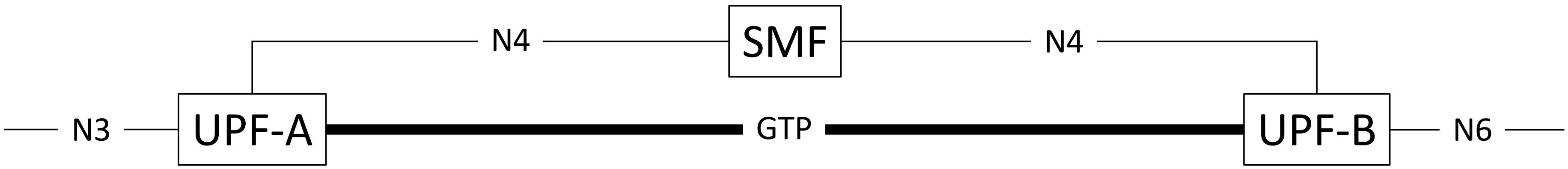
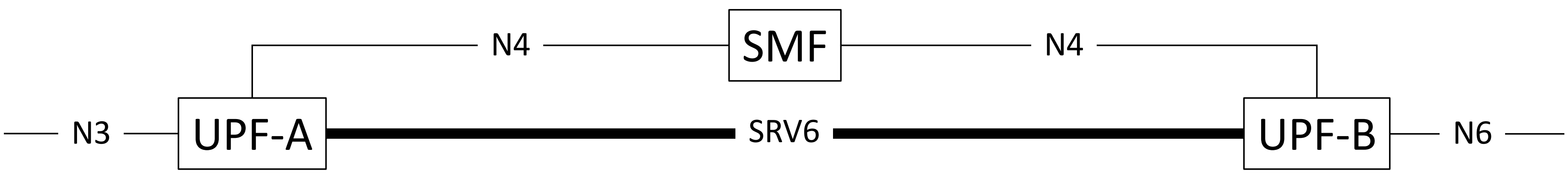
Challenging Objectives in 5G Networking

- Simplification
- UPF Movement
- Delay Minimisation
- Support for 5G Slicing
- Smooth Migration Path
- Advanced Mobility and Fixed Mobile Convergence

SRV6 for 3GPP N9 Interface

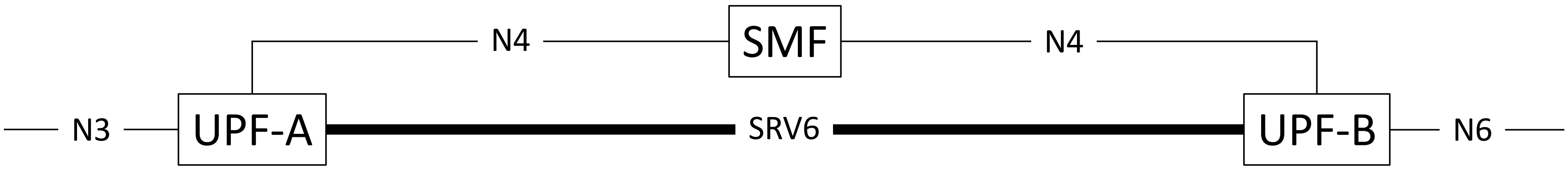


Current Model



SRV6 Drop-In Replacement for GTP, Carry GTP Info. in SRV6
No Change to Control Plane

SRV6 for 3GPP N9 Interface



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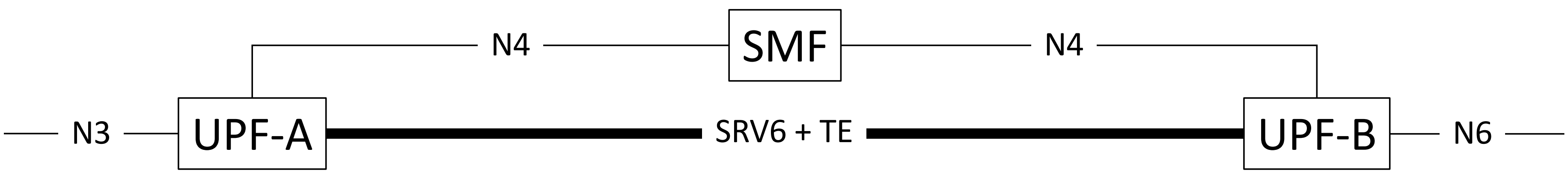

Add Traffic Engineering
TE SIDs can be obtained via different methods

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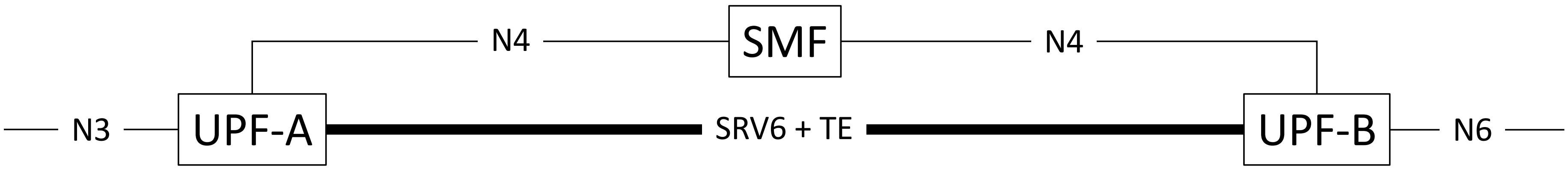

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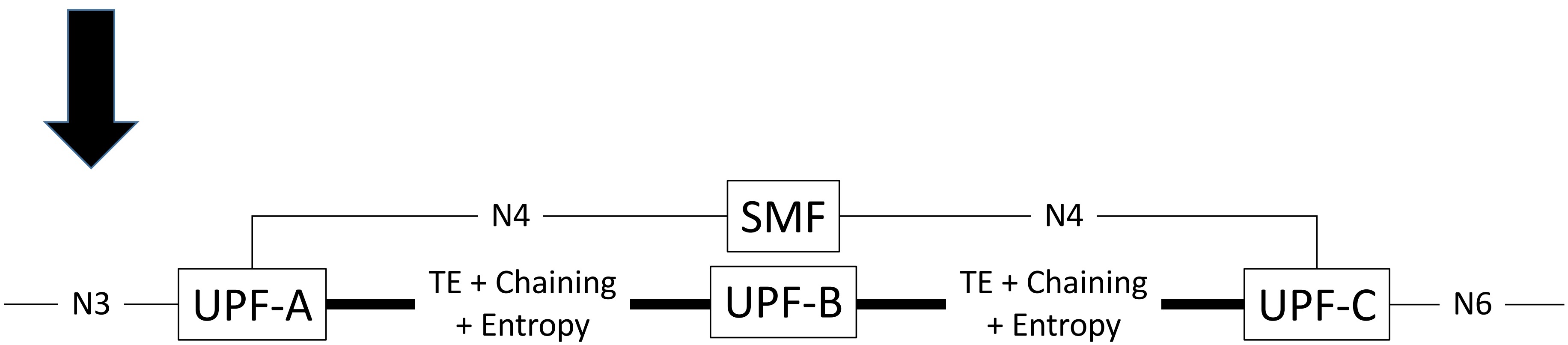
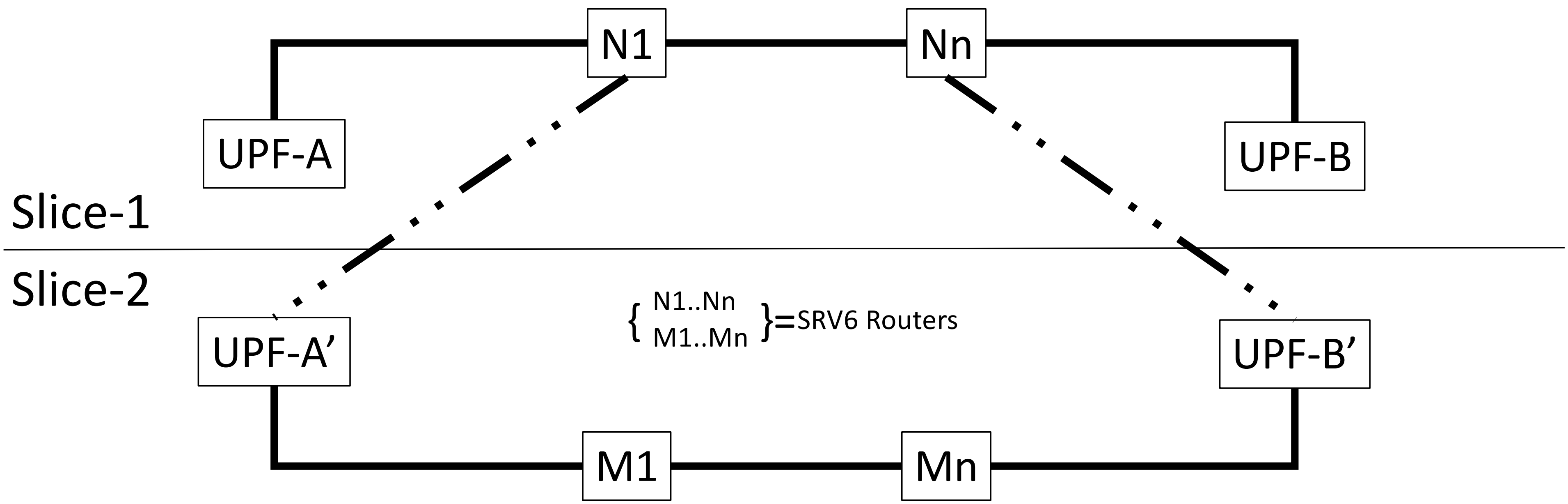


Add UPF Chaining + Support Entropy
SIDs can be obtained via different methods

SRV6 for 3GPP N9 Interface



- Support different routing path, network resource sharing, protection sparing, etc, for different slices in 5G.
- Lawful Interception: SIDs can represent "Fork and Forward" function at any UPF along the traffic path.

Toward Advanced Mobility with SRV6

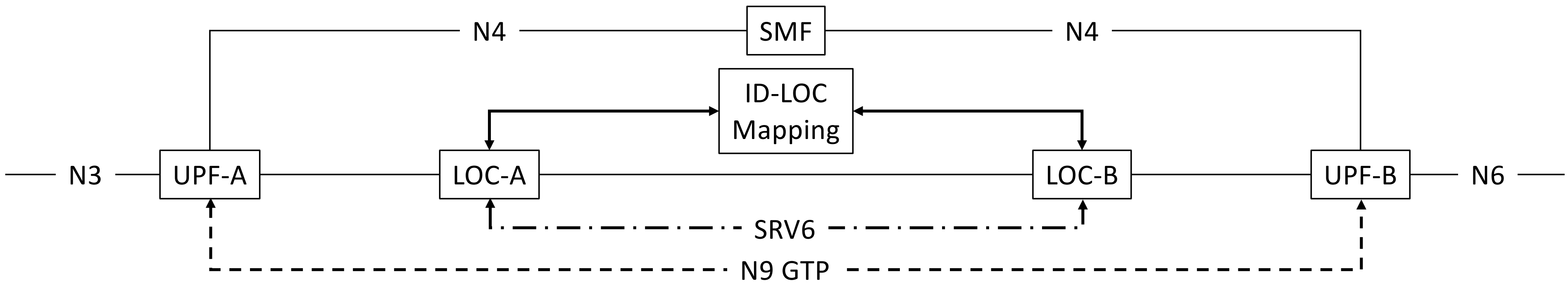


Figure 1. Overlay Model with SRV6 Locators

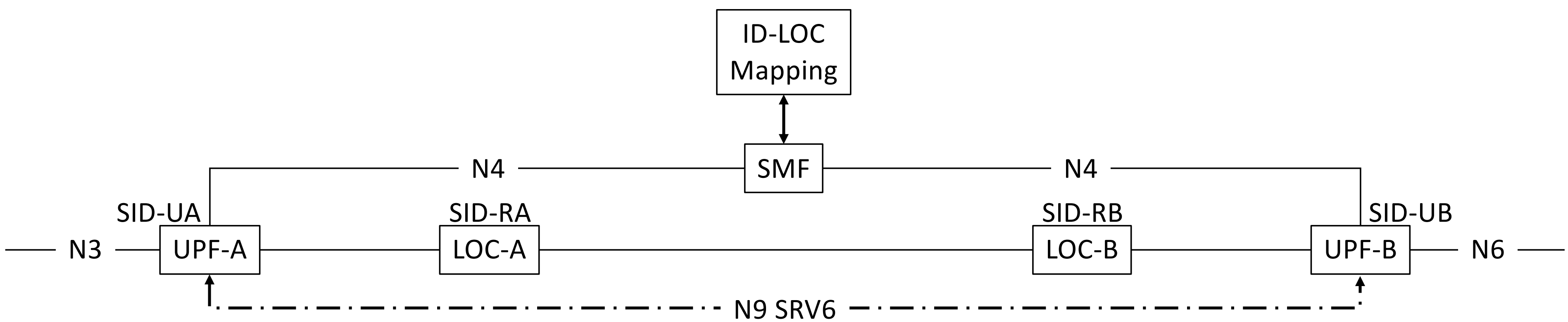


Figure 2. SRV6 Capable UPFs and Locators

SRV6's native features such as TE, QoS support, UPF Chaining, etc. can be easily added to ID-Locator support.

SRV6 Offers a Smooth Transition & A Pragmatic Approach for Changing N9

1. Drop in SRV6 to replace GTP-U in data plane without changing the control plane
2. Gradually introduce SRV6 features as needed.
3. Optionally add advanced mobility support either at global, 5G slice level, or for a particular set of flows

Some Areas of Concerns:

- IPV6 availability in mobile back-haul.
- Support for UPFs with IPV4 address is under study.
- Possible additional header tax on payload and impact on MTU.
- Security:
  - Exposed traffic path
  - Header encryption is not possible

Concluding Remarks

Backup/Reference Slides

Challenging Objectives in 5G Networking

Simplification

- Use of GTP tunnels for connection establishment especially in emerging 5G services such as mMTC complicates network manageability and operations.

- 5G core networking is looking at techniques to simplify its control and user planes to make them more suitable for both massive numbers of mobile and non-mobile devices.

Challenging Objectives in 5G Networking

UPF Movement

- UPF virtualisation and therefore portability are part of 5G network's DNA.
- It is imperative to provide flexibility for on demand instantiation, reincarnation, placement, movement, and removal of user plane functions or anchor points within the network.
- UPFs can also expand/contract (Breath) through multiple instantiation/removal at specific network locations.

Challenging Objectives in 5G Networking

Delay Minimisation

- Considerable effort/research and funding has been expended on the new air interfaces for 5G to achieve actual delays of 1-2ms for specific 5G slices. A new approach to data plane is required to sustain those hard won gains.

- Failing to reduce or eliminate packet core delays not only diminishes the value of the new low latency RAN air interface slice type, but will also negatively impacts both the value and scope of their intended application space.

Challenging Objectives in 5G Networking

Support for 5G Slicing

- Different 5G slices have different requirements w.r.t TE, Routing Path, Network Resource Sharing, Protection and Sparing, etc.

Smooth Migration Path

- In addition to new features like UPF chaining, existing features such as QoS, Policy Enforcement, Lawful Intercept, Billing, Roaming, MVNO, etc. MUST keep functioning.

Challenging Objectives in 5G Networking

Advanced Mobility and Fixed Mobile Convergence

- Fixed Mobile Convergence is the use of common core processing to provide consumers with seamless accessibility across different access technologies.

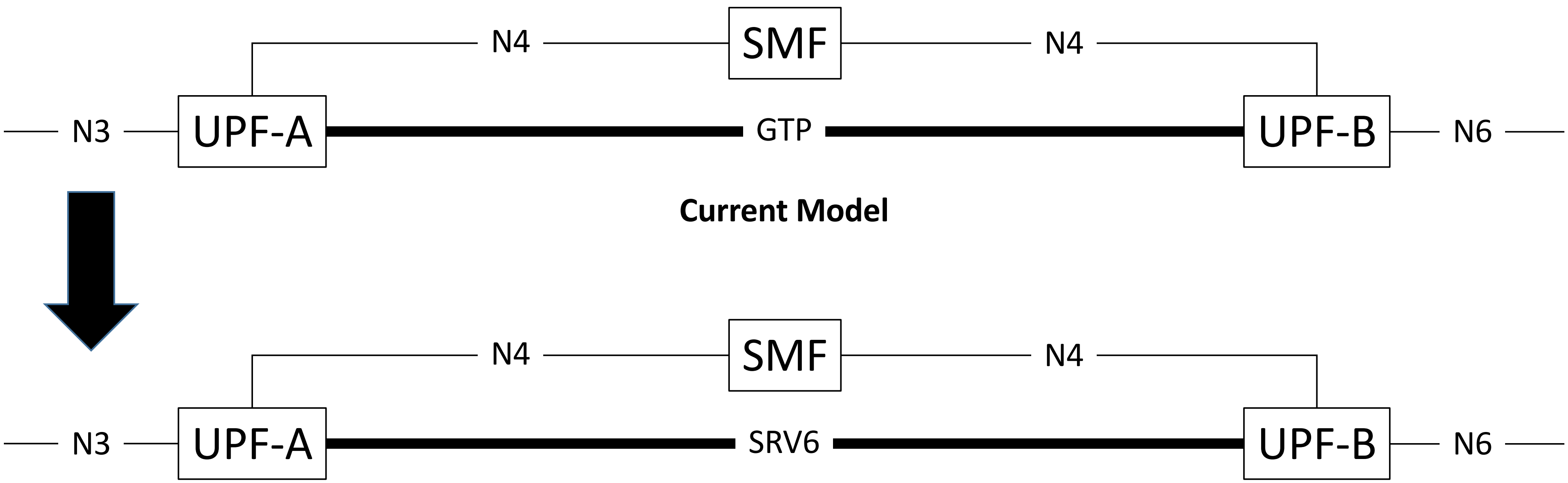
- Cellular, Wi-Fi and Broadband access today use different authentication, control, and user planes.

- A simple & flexible technique to accommodate all the different access technologies is one of the key requirements in next generation networking including 5G.

SRV6 for 3GPP N9 Interface

SRV6 as Drop-In Replacement for GTP-U

- No Change to control plane. CP is unaware of SRV6 data plane between UPFs. From CP point of view, UPFs are still connected via GTP-U.
- SRV6 carries GTP tunnel information in SIDs , “Tag” or optional TLVs between the UPFs.
- UPFs retrieve GTP information and follow the existing process to handle user traffic.
- Supports Hybrid IPV4/IPV6 Core Network Interworking.

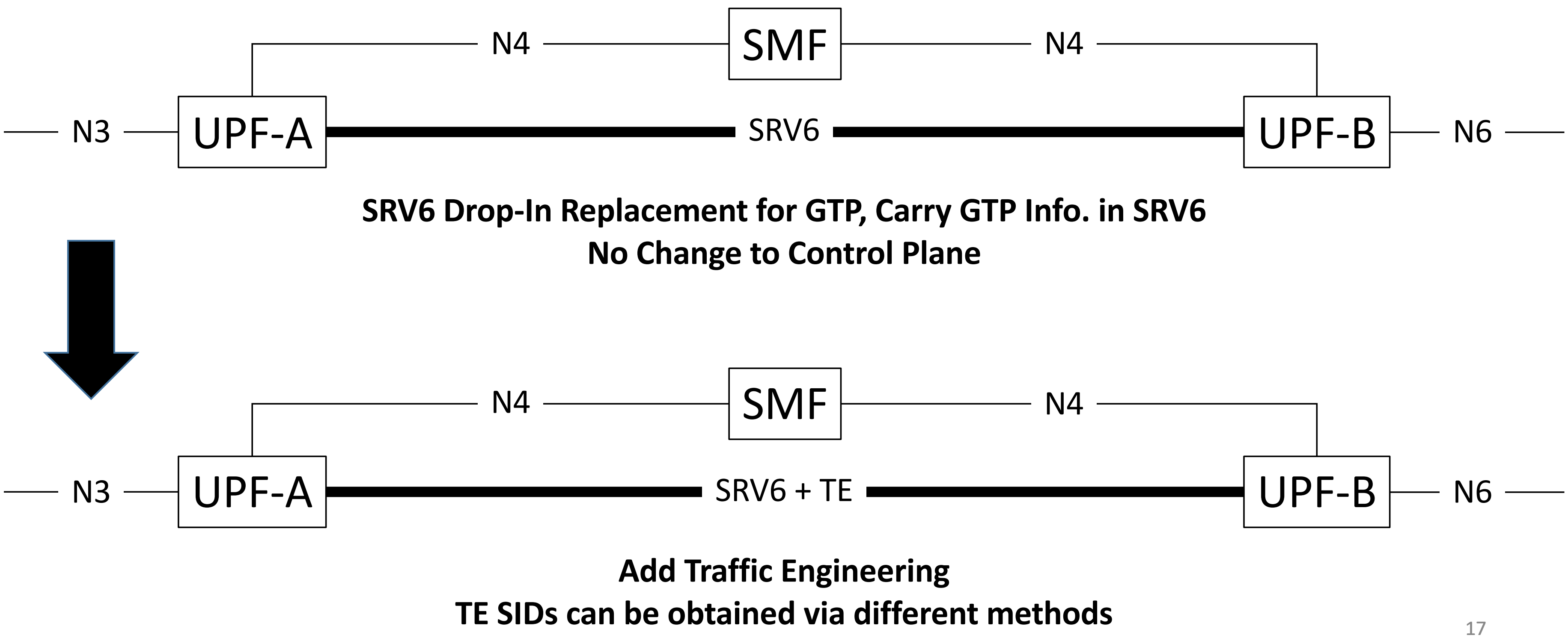


SRV6 Drop-In Replacement for GTP, Carry GTP Info. in SRV6
No Change to Control Plane

SRV6 for 3GPP N9 Interface

Integrated Traffic Engineering Support

- SRV6 supports both strict and loose models.
- TE can be added on top of Drop-In Replacement for GTP-U.
- There are several methods (with and without changing the control plane) for obtaining TE.



SRV6 for 3GPP N9 Interface

UPF Chaining

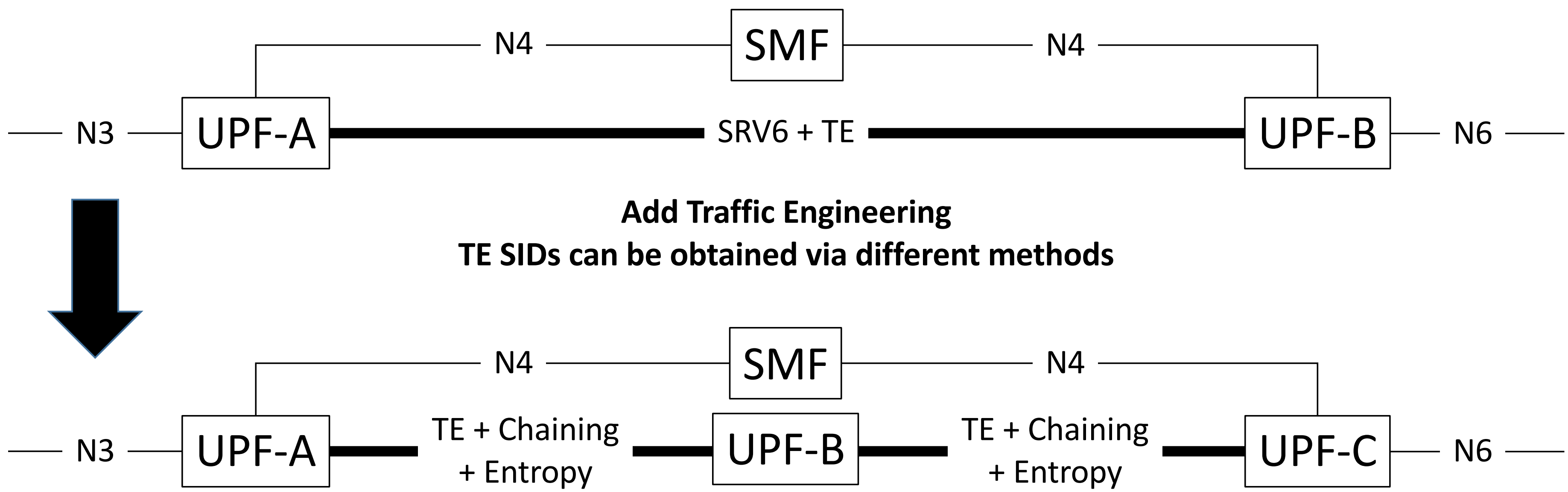
- Form a SRH with a set of SIDs where each SID identifies a specific UPF that performs specific tasks or executes certain functions on user traffic.
- Can be used in conjunction with other features such as TE.

Entropy

- SRV6 can accommodate entropy at either hop by hop or global level.
- Reserve a set of bits in the SID construct itself. This eliminate the need for a special entropy Segment ID in SRH. The hashing algorithm at different nodes. distribute traffic flows based on the SID which has been copied to IPV6 DA.
- Alternatively, we can use optional TLVs to carry entropy related information.

Lawful Interception

- SIDs can represent "Fork and Forward" function at any UPF along the traffic path.

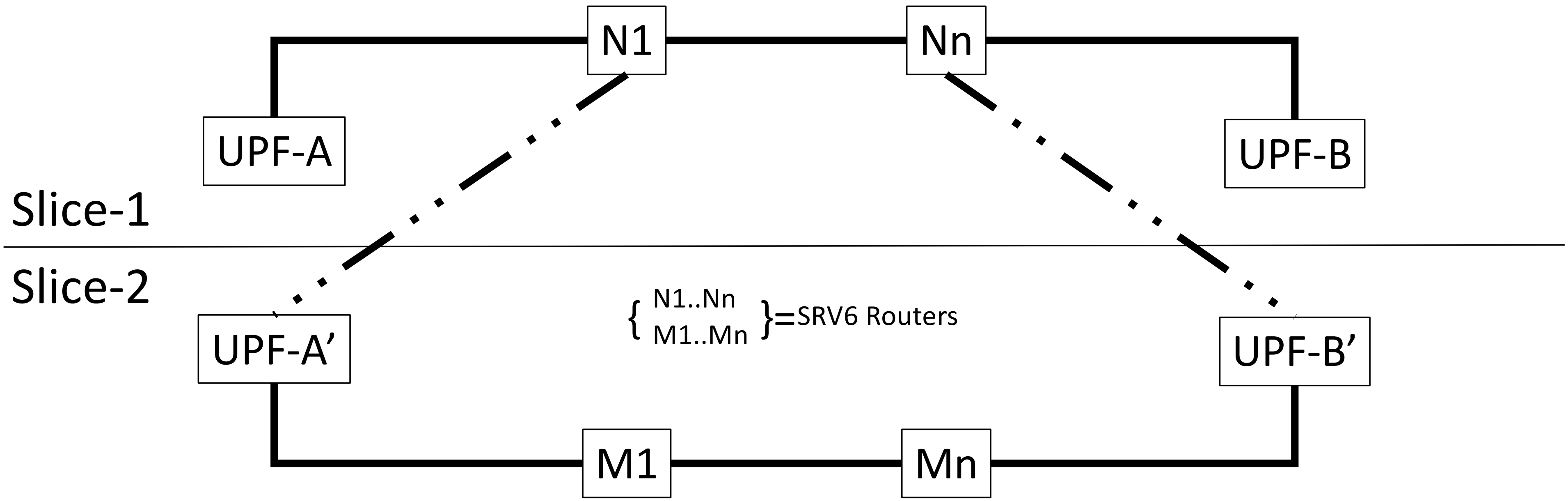


Add UPF Chaining + Support Entropy
SIDs can be obtained via different methods

SRV6 for 3GPP N9 Interface

Addressing 5G Slicing Requirements

- Several Slices with different requirements can coexist on top of the common network infrastructure. Diverse flows belonging to different 5G slices can be completely disjoint or can share different parts of the network infrastructure.
- SRV6's native features such as TE, Chaining, one-plus-one protection and sparing, etc. either in stand-alone or in conjunction with other alternatives for mobility support such as ID-LOC model lend themselves well to 5G slicing paradigm.

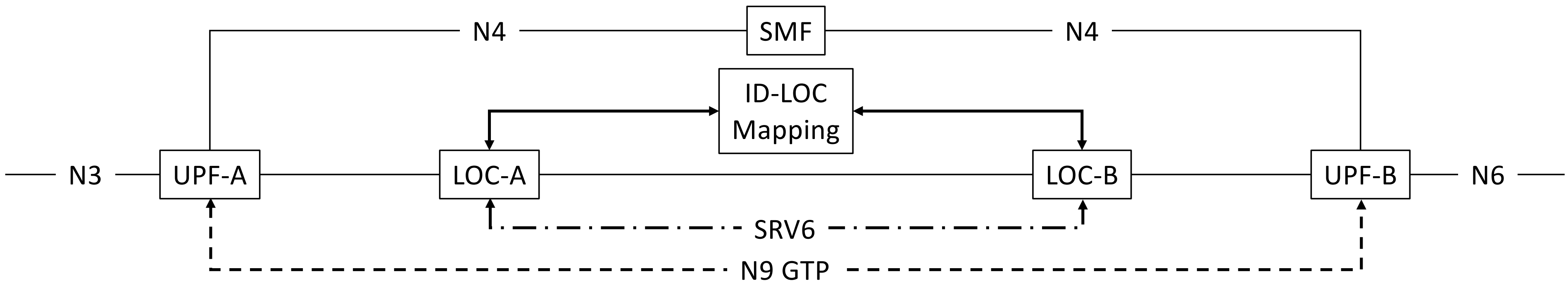


Toward Advanced Mobility with SRV6

- **Location-ID Namespace Separation**
  - One of the front runners to support advanced mobility, anchorless mobile back-haul, and FMC.
  - Splits device identity and its network location into separate name spaces: End-point IDs (ID), and Locators(LOC) with IDs hanging off of LOCs.
  - Route with LOC in the core, terminate traffic at IDs.

- **Location-ID Namespace Separation via SRV6 for UPF Connectivity**
  - SIDs are once again the main vehicle.
  - UPFs are considered to be the IDs while the nodes where the UPFs attach take on the role of the Locators.
  - Multiple UPFs are allowed to attach to the same Locator. It is also possible for a UPF to connect to multiple Locators.

Overlay Model with SRV6 Locators



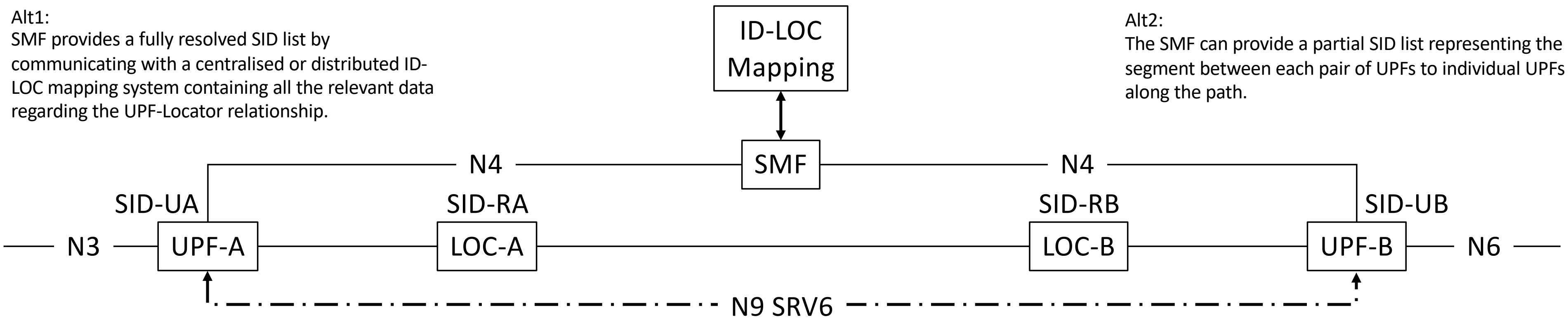
- UPFs connect to SRV6 capable LOCs.
- UPFs use IPV4/IPV6 transport either with or without GTP and send the traffic to their associated Locator at the near end (Ingress SRV6 Locator).
- Ingress SRV6 Locator uses the DA and identifies the far end Locator (Egress SRV6 Locator) where the target UPF is attached and obtains its associated SID. This can be done via a CP or a lookup into a mapping system.
- For GTP encapsulated traffic, the ingress SRV6 Locator encodes GTP related information into SRH either as SID, Tag, or optional TLV.
- The ingress SRV6 Locator sends the traffic to the egress SRV6 Locator.
- Egress Locator marks the end of the segment and ships the traffic to the target UPF.

SRV6's native features such as TE, QoS support, UPF Chaining, etc. can be easily added to ID-Locator support.

SRV6 Capable UPFs and Locators

Alt1:
SMF provides a fully resolved SID list by communicating with a centralised or distributed ID-LOC mapping system containing all the relevant data regarding the UPF-Locator relationship.

Alt2:
The SMF can provide a partial SID list representing the segment between each pair of UPFs to individual UPFs along the path.



- UPFs are the entity that construct the SRH.
- UPFs and LOCs are represented by SIDs in SRH.
- The SID list establishes either a partial or the full path to a target or a set of UPFs that traffic is required to traverse.
- Modified 3GPP control plane distributes UPF’s endpoint information.
- SMF using policy information prepares a set of one or more UPFs along the traffic path and distributes this set in the form a SID list to the ingress UPF.
- The SID list of UPFs is then gets augmented with a set of SIDs identifying the Locators representing the current point of attachment for each UPF along the data path.
- Changes to UPF’s point of attachment are reflected in the mapping system and are communicated to the SMF for distribution to the appropriate set of UPFs.
- As long as the mapping database is up-to-date, UPFs can be easily moved in the network.

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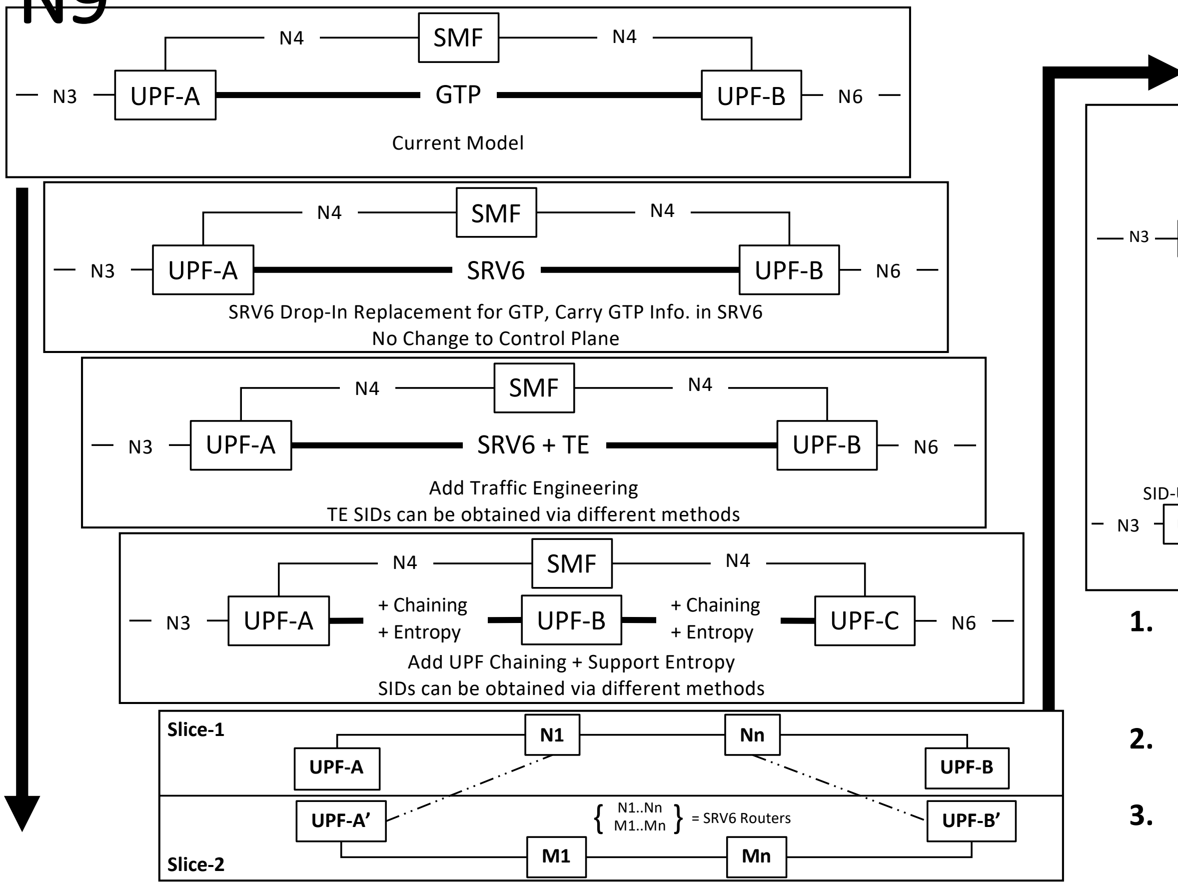
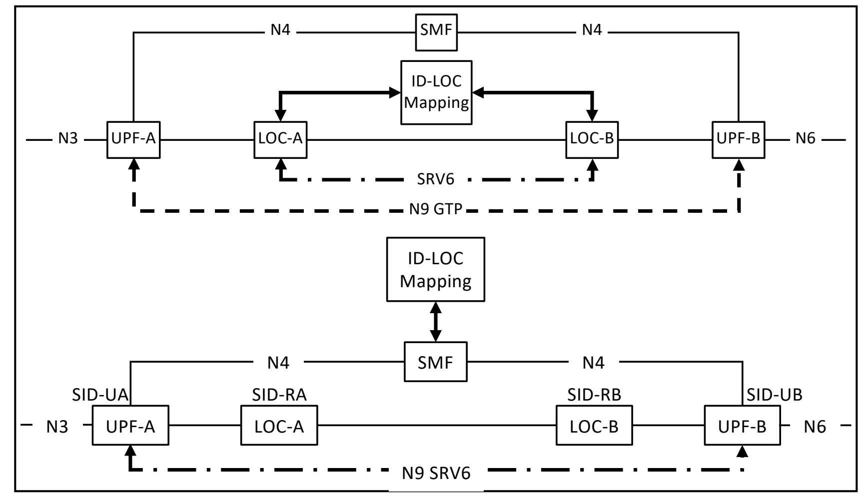
Smooth Transition and Pragmatic Approach for Changing N9



Toward Advanced Mobility with SRV6



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