

# GMPLS Signaling Extensions for G.709-v3

(draft-khuzema-ccamp-gmpls-signaling-g709-01.txt )

Rajan Rao ( [r Rao@infinera.com](mailto:r Rao@infinera.com) )

Khuzema Pithewan ( [kpithewan@infinera.com](mailto:kpithewan@infinera.com) )

Ashok Kunjidhpatham ( [akunjidhpatham@infinera.com](mailto:akunjidhpatham@infinera.com) )

Mohit Misra ( [mmisra@infinera.com](mailto:mmisra@infinera.com) )

Biao Lu ( [blu@infinera.com](mailto:blu@infinera.com) )

Lyndon Ong ( [lyong@ciena.com](mailto:lyong@ciena.com) )

# Outline

- Proposal Summary
- Multi-stage Label Examples
- Comparison with Zhang-draft-v7
- Limitations of RFC 4328

# Proposal

A model to support signaling for:

- Fixed size ODU containers (G.709-v1 & v3)
- Flexible ODU containers
- Different Time-Slot granularities (1.25G & 2.5G)
- Complete muxing hierarchy of G.709-v3
- VCAT services
- Potential evolution of OTN standards

# Proposal

## **New Label Format defined to:**

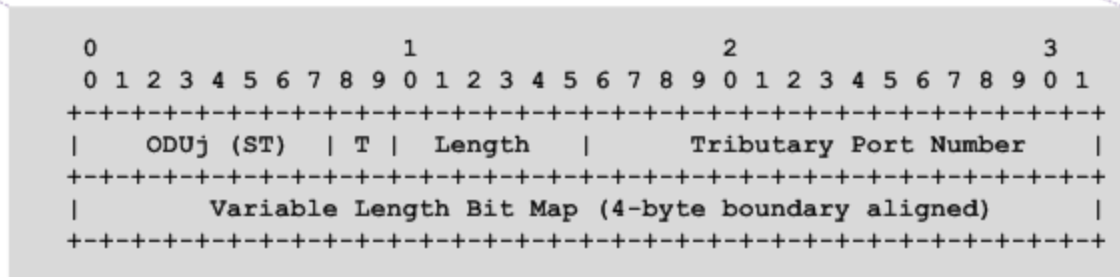
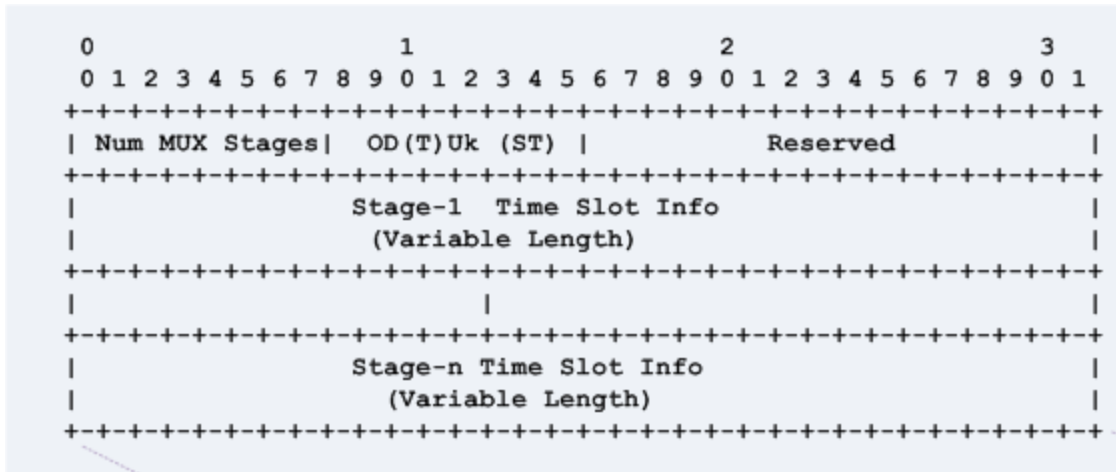
- Encode TSs as bit map
- Allow specification of complete muxing hierarchy (G.709-v3)
- Support TS-Granularities & TPN

## **Extensions to RFC-4328: G.709 traffic params redefined**

- Tolerance encoded in NMC field
- Bit-rate encoded in reserved field

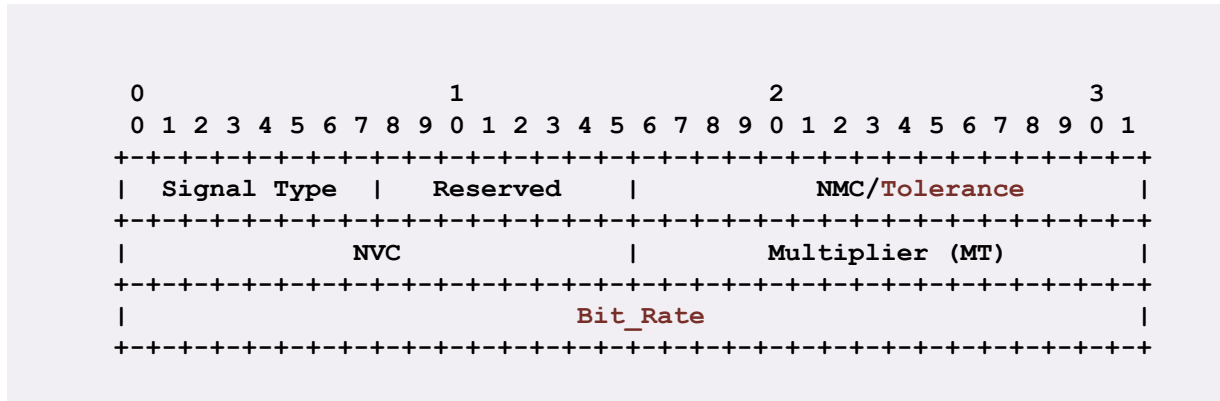
# New Label Format for OTN

## Generalized Label Format



# Proposed Extensions to RFC-4328

## G.709 Traffic Parameters (TSPEC)



### **NMC/Tolerance :**

- NMC is Used only with the Old Label Format (Backwards Compatibility)
- For ODUflex SignalType, this field is interpreted as Tolerance

### **Bit\_Rate:**

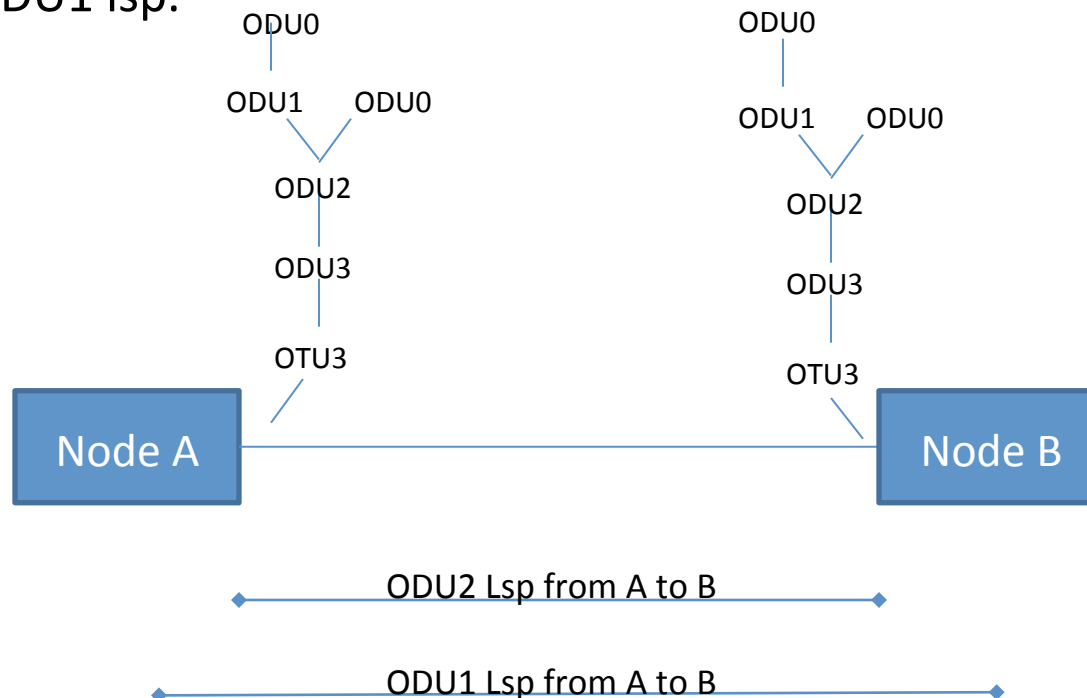
- Used only for ODUflex SignalType
- For other signal types it is set to zero and not interpreted on the receiving nodes

# Changes from Previous Version

- Explained single-stage , multi-stage multiplexing in terminology section.
- Added scenarios to exemplify the usage of multi-stage label
- Label distribution rules section is clarified with examples for
  - OTUk,
  - Single stage ODUk<-ODUj
  - Multi-stage ODUk<-ODUj<-ODUh

# Example

- Over a point-to-point OTU3 link between Node A and B, ODU1 LSP requires a ODU2 FA-TELink to be setup because of restrictive multiplexing hierarchy.
- The ODU2 FA-Telink can be either setup manually or automatically while setting up ODU1 lsp.

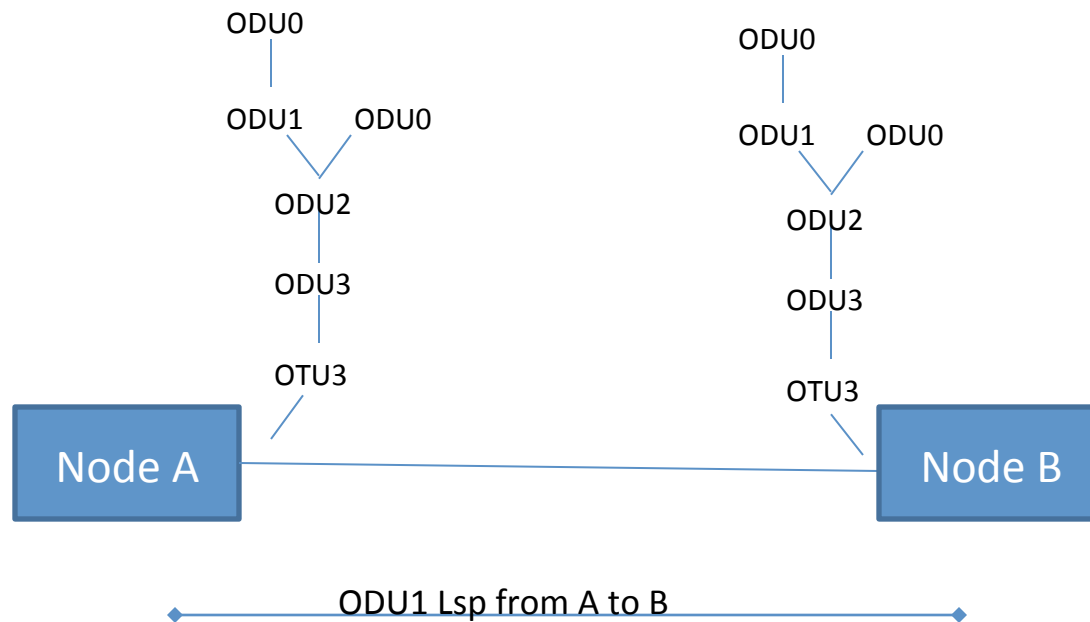




# Example (Cont'd)

## Multi-Stage Label avoids FAs

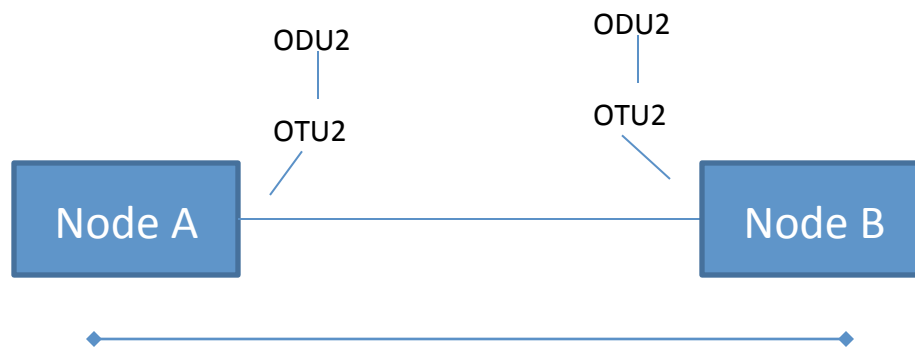
- Multi-stage label is useful when switching of a ODU layer requires terminating more than one HO-ODU/OTU.
- It eliminates the need of FA creation by carrying 2 timeslot information of 2 layers in one label.



Stage-1 Label: ODU3<-ODU2/TPN/Trib Slots  
Stage-2 Label: ODU2<-ODU1/TPN/Trib Slots

# Multi-stage label with single stage

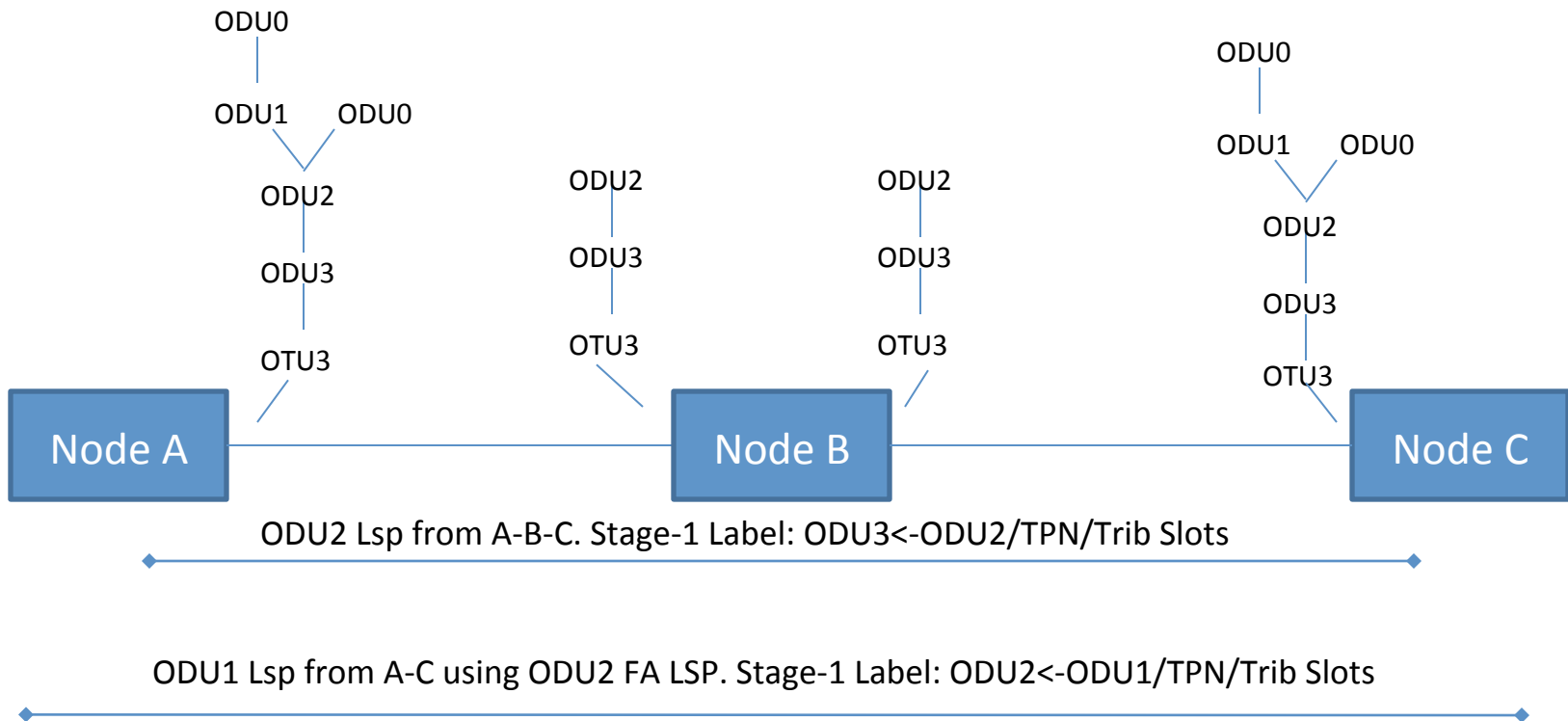
- Same Generalized format can be used for single stage.
- Example: ODU2 LSP from A to B over OTU2 link doesn't require any ODU multiplexing. Only single stage is required here.



ODU2 Lsp from A-B. Stage-1 Label: OTU3<-ODU2/TPN/Trib Slots

# Multi-Stage Label with FA

- Multi-stage label doesn't really eliminates the need of FA creation when span of FA is more than one link.
- This scheme doesn't prevent FA creation, even if it is desirable to create one in point-to-point case



# Comparison with Zhang-draft-v7

- TPN Field
  - Zhang draft has come closer to this draft as it has added TPN field in label in comparison to its version 6.
- G.709 Traffic Spec
  - This draft preserves a reserved field for future growth, where as Zhang draft has consumed all the reserved fields.
- Multi-stage Label
  - Zhang draft continues to support single stage label, mandating creation of FAs even in simple case of point to point links

# Comments Received and Responses

- Comment: Use GPID instead of Signal Type in Label definition.
  - Response: GPID (ref: draft-ashok-ccamp-gmpls-ospf-g709-03.txt ) in Label would confuse with the GPID in Label Request. As the names are same, but values would be different. The multiplexing hierarchy conveyed by GPID is not mandatory in Label, as the timeslot specified in the label are for a particular stage and the order of stage in the multi-stage label is conveyed by the order of appearance of the stage in Generalized label.
- Comment: Support for Hitless Resizing of ODUFlex
  - Response: This is still under discussion, but authors believe if there is a need to add any additional field in Traffic Spec, there is one byte reserved.
- Comment: Why RFC4328 method of specifying label, which lists the time slot values instead of bitmap doesn't work
  - Response: RFC4328 label has specified 10 bits for ODU3, ODU2 and ODU1 signal rates. Now with evolving OTN standards, 32 bits in a label may not be sufficient (see next slide for details). That's the reason of adapting more flexible variable size bitmap field to encode label time slots.

# Label Encoding as per RFC 4328

Signal Type	Total number of Bits required	Remarks	
ODUFlex	1	<i>Current Standards</i>	
ODU2e	1		
ODU0	1		
ODU1	2		Support 1 signal type: ODU0 (t1: as per rfc4328 #bits is 1)
ODU2	5		Supports 3 signal types: ODU0, ODU1, ODUFlex at both 1.25G and 2.5G TSG (t2: as per rfc4328 #bits is 3)
ODU3	8		Supports 5 signal types: ODU0, ODU1, ODU2, ODU2e, ODUFlex at both 1.25G and 2.5G TSG (t3: as per rfc4328 #bits is 6)
ODU4	9		Supports 6 signal types: ODU0, ODU1, ODU2, ODU2e, ODU3, ODUFlex at 2.5G TSG
ODU3e2	6		Supports ODU2e
ODU3e1	5		Supports ODU2e
ODU1e	1	<i>Future Standards</i>	

- Current Standards considering 1.25G and 2.5G TSG, will consume 27 bits.
- Future Standards as listed above may require additional 12 bits.
- This doesn't account TPN values
- Assumes single stage multiplexing

**BACKUP SLIDES**

# Limitations of RFC-4328

## ➤ **G.709 Traffic Parameters (TSPEC)**

- No support for new SignalTypes defined in G.709v3 – ODU0, ODU4, ODU2e and ODUflex.
- ODUflex needs Bit-Rate and Tolerance to be signaled instead of number of TSs.
- NMC parameter is not valid for end-to-end Traffic Specification as number of TS required for ODU<sub>j</sub> could vary on different ODU<sub>k</sub>s along the LSP path.
  - Eg: ODU2e requires 9 TS on ODU3 and 8 TS on ODU4.

## ➤ **Generalized Label Format**

- Not scalable for specifying large number of Timeslots (ODU4 requires 80 1.25G TSs and ODU3 requires 32 1.25G TSs).
- Multi-stage multiplexing enforces hierarchical label format which is not supported in the current Label format.
- No support for multiple TS Granularities (1.25G and 2.5G).



# Backwards compatibility



## Link A-B:

- G.709-v1 version (2001) based OTUk link
- TSG=2.5G;
- Label format as per RFC 4328

## Link B-C:

- G.709-v3 version based OTUk link (12/09)
- TSG=1.25G;
- Used New label format proposed

## Example: For an ODU2 connection going from A-C:

- On link A-B : NMC=4 is applicable
- On link B-C : NMC is not used;
  - # of TSs used is 8
  - Could involve multi-stage multiplexing – i.e. label for each mux layer

# Backwards compatibility

Interoperability with Older version of signaling stack

- Neighbors should exchange their signaling stack version information ahead of service creation.
- On a given span, if one of the neighbor is found to be running older version of signaling stack, Label format defined in RFC-4328 must be used.
- If both the neighbors are running newer version of signaling stack, new Label format must be used.