

Intelligent Control Plane Architectures

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Proposed topics

1. DiffServ-Traffic Engineering for MPLS networks.
2. Dynamic provisioning of intra-domain GMPLS LSPs;
3. Recovery techniques for GMPLS;
4. Inter-domain aspects of GMPLS;
5. Migration techniques from MPLS to GMPLS;

DiffServ - Traffic Engineering for MPLS networks.



- MPLS DiffServ-TE makes MPLS-TE aware of CoS.
 - resource reservation with CoS granularity.
 - fault-tolerance properties of MPLS at a per-CoS level.
- Requires still policing and admission control,
- Application:
 - Limiting the Proportion of Traffic from a Particular Class on a Link
 - Maintain Relative Proportions of Traffic on Links
 - Guaranteed Bandwidth Services
- Develop QoS services for end customers based on ***signalled*** rather than ***provisioned*** QoS

DiffServ - Traffic Engineering for MPLS networks.



RFC 3564 - Requirements for Diff-Serv-aware TE

Protocol extension for DS-TE

- draft-ietf-tewg-diff-te-proto

Bandwidth allocation models

- draft-ietf-tewg-diff-te-mam
- draft-ietf-tewg-diff-te-mar
- draft-ietf-tewg-diff-te-russian

DiffServ - Traffic Engineering for MPLS networks.



Possible test topics:

- Alternate solution for the “ideal-network” premium services ?
- Inter vendor tests
 - “Slight” differences have been observed between implementations

Dynamic provisioning of intra-domain GMPLS LSPs

GMPLS design goals:

- Reduction of the number of switching layers
- Reuse of the label switching paradigm
- Reuse of the MPLS-TE protocol suite and mechanism
- Reuse of the IP addressing scheme

GMPLS innovations:

- LSP hierarchies
- Bi-directional LSPs
- Enhanced IGP-TE
 - Unnumbered links
 - Link-bundling
 - Forwarding adjacencies (FA)
- Link management protocol

Dynamic provisioning of intra-domain LSPs

Architecture

- RFC 3945 GMPLS Architecture;

Signalling

- RFC 3471 GMPLS Signaling Functional Description;
- RFC 3473 GMPLS Signaling - RSVP-TE Extensions;
- RFC 3472 GMPLS Signaling - CR-LDP Extensions;

Routing

- draft-ietf-ccamp-gmpls-routing
- draft-ietf-ccamp-ospf-gmpls-extensions;
- draft-ietf-isis-gmpls-extensions;

Dynamic provisioning of intra-domain LSPs

Possible test topics:

- Single layer tests
 - Basic configurations;
 - GMPLS familiarization;
- Multi layer tests
 - More switching layers involved;
 - Advanced functions (FA, link bundling, loose paths, LSP re-grooming);
- Implication on the management of a network with GMPLS vs legacy management.

Recovery techniques for GMPLS

Focus on data/transport plane failures.

Protection and Restoration at the TDM, LSC and FSC layers.

Intra-area P&R (horizontal) & Intra-layer P&R (vertical)

Mesh and ring-like topologies

Recovery techniques for GMPLS

Protection

one or more dedicated protection LSP is fully established to protect one or more working LSP(s)

- 1+1
- 1:N ($N \geq 1$)
- M:N ($M, N > 1, N \geq M$)

Restoration

relies on signalling protocols to coordinate switching actions during recovery, and may involve simple re-provisioning, i.e., signalling only at the time of recovery; or pre-signalling, i.e., signalling prior to recovery

- Pre-planned LSP restoration
 - Shared-mesh restoration
- LSP re-routing
 - Hard LSP restoration (break-before-make)
 - Soft LSP restoration (make-before-break)

Recovery techniques for GMPLS

Recovery IDs:

draft-ietf-ccamp-gmpls-recovery-functional
draft-ietf-ccamp-gmpls-recovery-e2e-signaling
draft-ietf-ccamp-gmpls-segment-recovery
draft-ietf-ccamp-gmpls-recovery-analysis
draft-ietf-ccamp-gmpls-recovery-terminology

Recovery techniques for GMPLS

Possible tests topics:

- E2E LSP, LSP Segment and Span Recovery
- Robustness.
- Resource optimization.
- Multi-layer recovery.

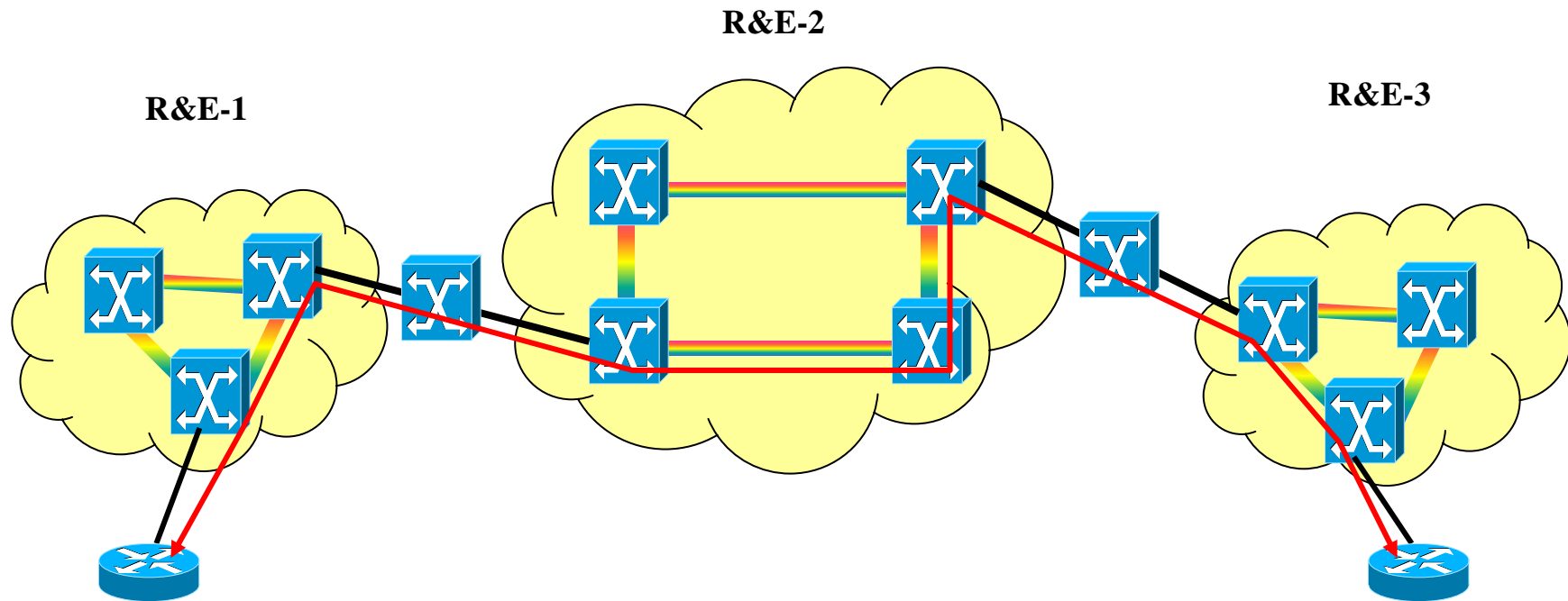
Inter-domain aspects of GMPLS

Framework has identified three distinct options for signalling TE LSP across multiple domains:

- Contiguous LSP;
- LSP Stitching;
- LSP nesting;

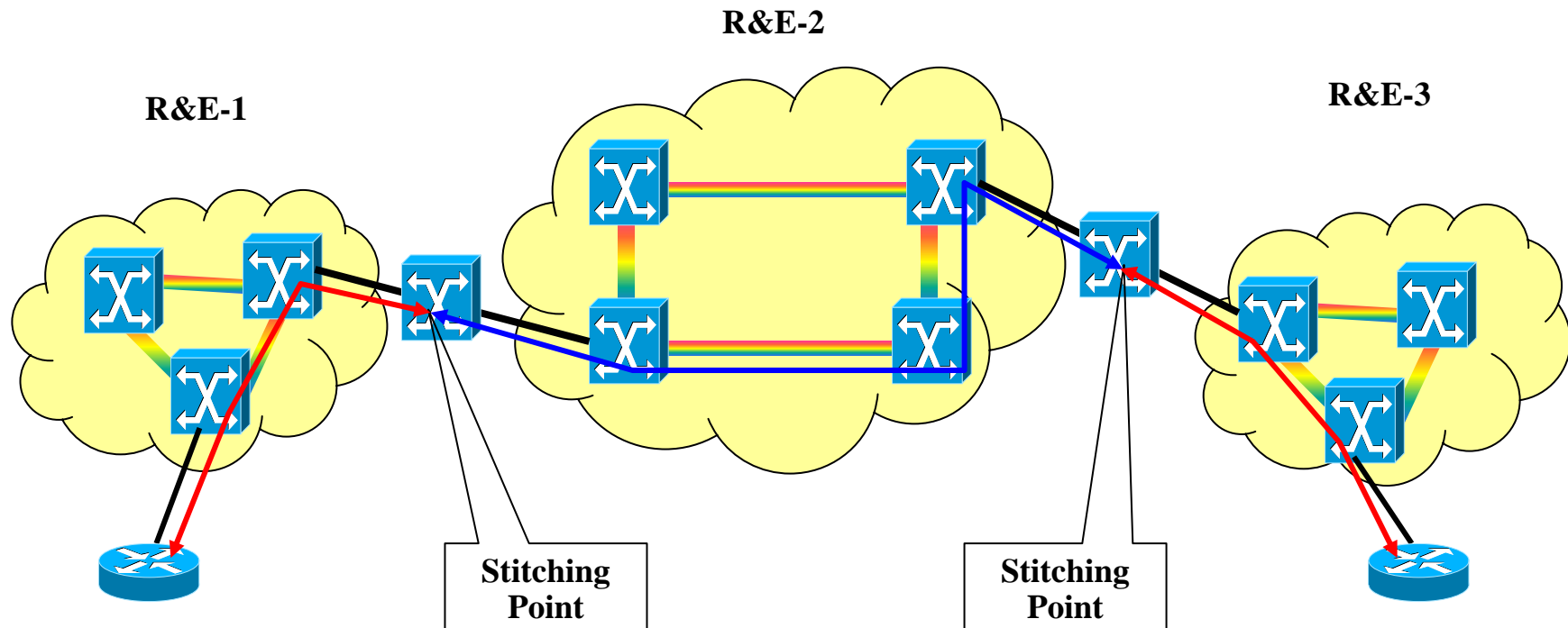
Inter-domain aspects of GMPLS

Contiguous LSP;



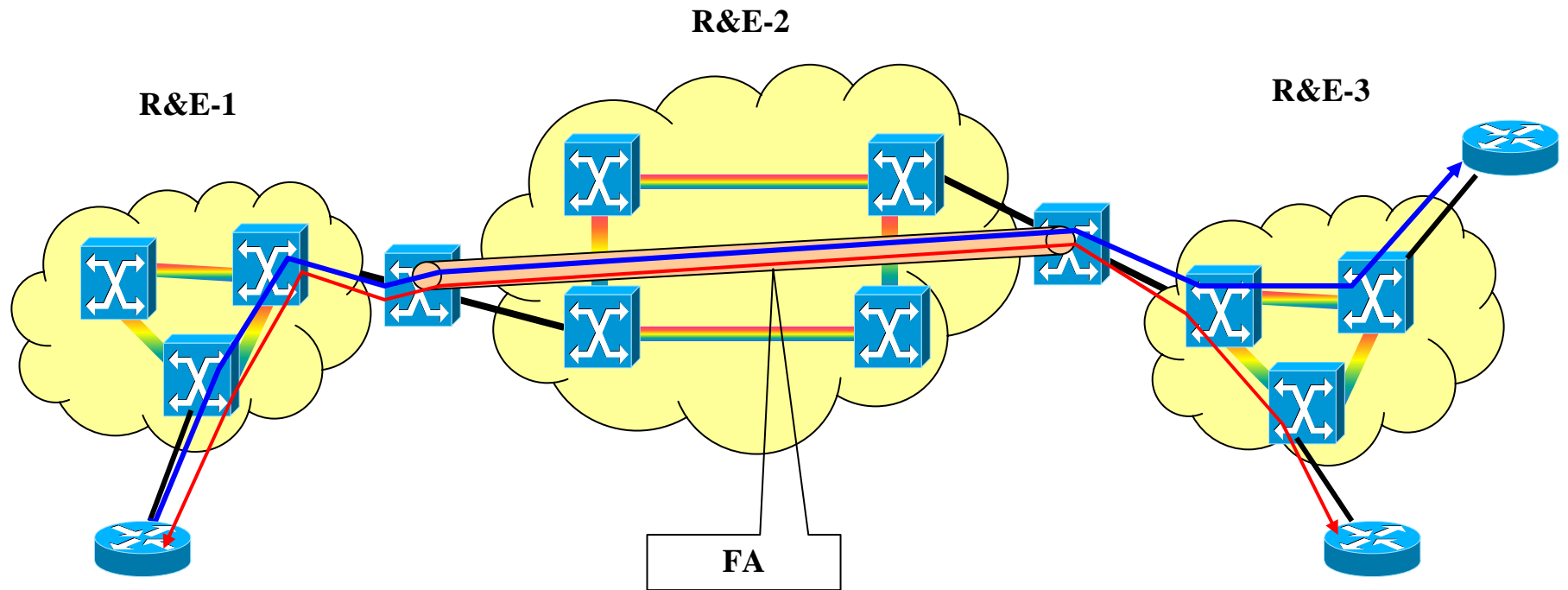
Inter-domain aspects of GMPLS

LSP Stitching;



Inter-domain aspects of GMPLS

LSP Nesting;



Inter-domain aspects of GMPLS



- **Requirements for inter-area and inter-AS developed in the TE-WG (WG concluded)**
 - draft-ietf-tewg-interarea-mpls-te-req
 - draft-ietf-tewg-interas-mpls-te-req
- **Framework**
 - draft-ietf-ccamp-inter-domain-framework
- **Signalling extension**
 - draft-ietf-ccamp-inter-domain-rsvp-te
- **Mechanisms:**
 - draft-ietf-ccamp-lsp-stitching
 - draft-ietf-mpls-lsp-hierarchy
- **Resource optimization**
 - draft-ietf-ccamp-crankback

Inter-domain aspects of GMPLS

Possible tests topics

- Stitching
 - used/deployed in GÉANT for MPLS.
 - Got good experience in MPLS, probable reusable for other switching techniques;
 - Experience/testing is needed for other layers.
- Contiguous LSP
 - Experiences to some extent in GÉANT for MPLS.
 - Looking forward for more control on transit domains (RSVP filtering?!)
 - Experience/testing is needed for other layers.
- LSP Nesting
 - good ground for testing opportunities.



Migration techniques from MPLS to GMPLS

- GMPLS is a superset of MPLS
 - Some objects are though different.
- Migration techniques/BCPs not defined yet in IETF.
- Could become hot topic in the future.

Conclusion

- Where is OIF-UNI ? G.ASON?
- New topics are welcomed !
- Volunteers and anybody interested are welcomed to join the work-group (otto@dante.org.uk).
- Need vendors involvement for support and hardware/software loan/donation.
- Test should start soon as two topics were already proposed as possible tests for GN2-JRA4.

Questions ...