Stateful PCE

draft-tang-pce-stateful-pce-02.txt

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A Problem without Stateful PCE
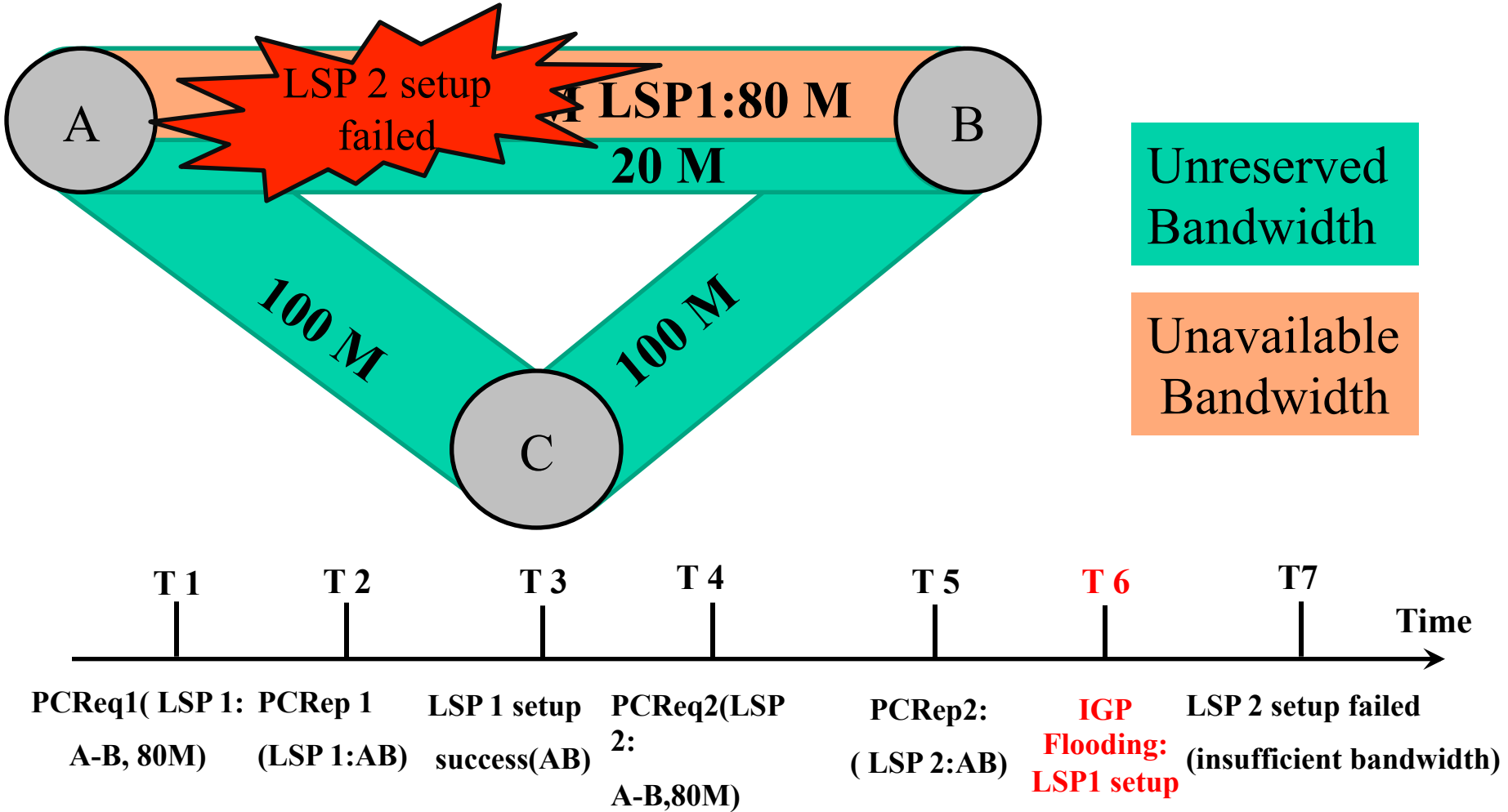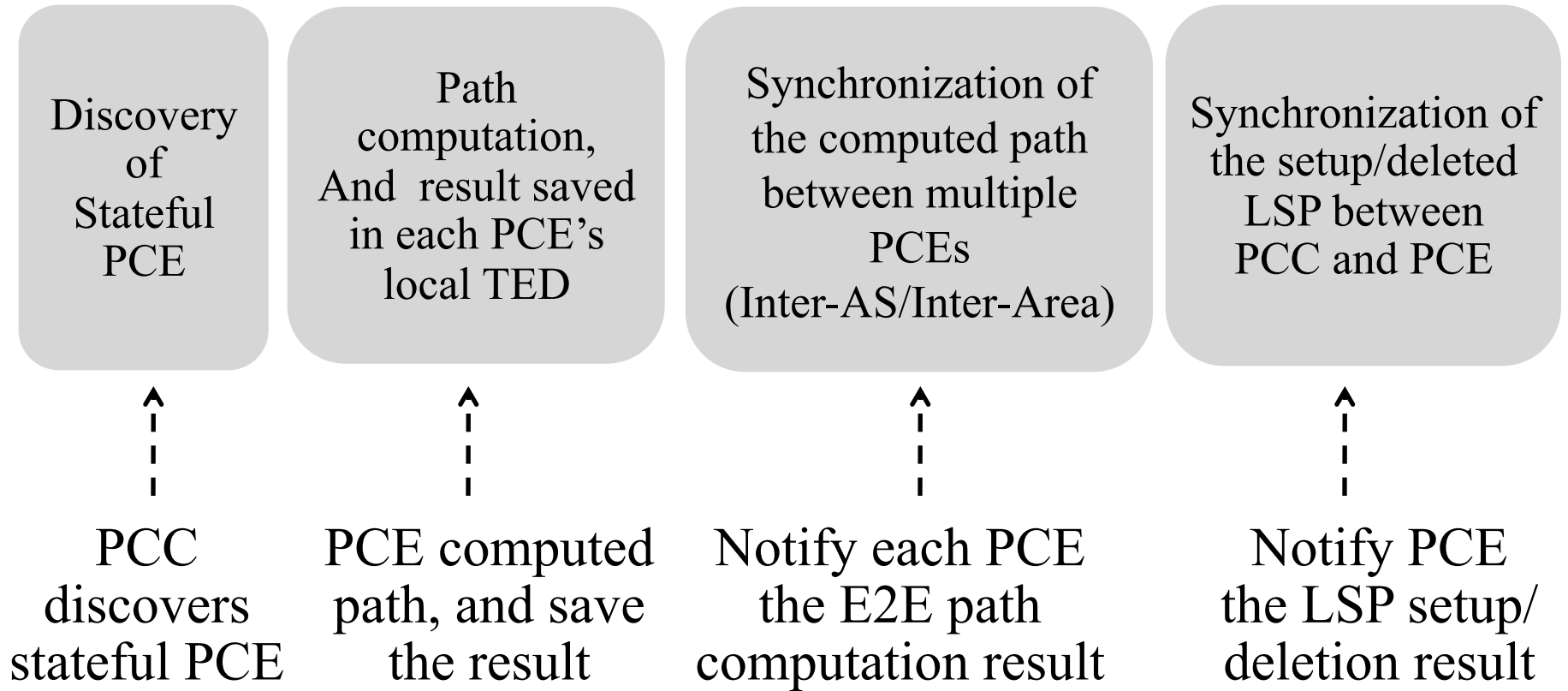

Figure 1: Sequence of events with stateless PCE

Realization of stateful PCE

Discovery of Stateful PCE	Path computation, And result saved in each PCE's local TED	Synchronization of the computed path between multiple PCEs (Inter-AS/Inter-Area)	Synchronization of the setup/deleted LSP between PCC and PCE
↑	↑	↑	↑
PCC discovers stateful PCE	PCE computed path, and save the result	Notify each PCE the E2E path computation result	Notify PCE the LSP setup/ deletion result

PCED Extension

Extended PCED TLV(RFC 5088), defined a new capability flag

Bit	Capabilities
0	Path computation with GMPLS link constraints
1	Bidirectional path computation
2	Diverse path computation
3	Load-balanced path computation
4	Synchronized path computation
5	Support for multiple objective functions
6	Support for additive path constraints (max hop count, etc.)
7	Support for request prioritization
8	Support for multiple requests per message
9	P2MP path computation
TBD	**Stateful PCE**
10-31	Reserved for future assignments by IANA

New PCE Capability Flag of PCE-CAP-FLAG

With the stateful PCE capability flag, the PCC can select which PCE to be used.

Protocol Extensions: PCEP

- Notification-type=**TBD**: LSP Status
  - Notification-value=1/2: end-to-end path computation success/ failure
  - Notification-value=3/4: LSP setup success/ failure.
  - Notification-value=5: LSP deletion success.

- <PCNtf Message>::=<Common Header><notify-list>
  <notify-list>::=<notify> [<notify-list>]
  <notify>::=[<request-id-list>]<notification-list>
  <request-id-list>::=<RP>[<**path**>][<request-id-list>]
  <path>:=<ERO><attribute-list>
  <attribute-list>::=[<LSPA>][<BANDWIDTH>][<metric-list>][<IRO>]
  <notification-list> ::=<NOTIFICATION>[<notification-list>]

Synchronization between PCC/PCE and PCE/PCE

PCC/PCE	PCE/PCE
Path setup result : PCC sends the path setup result to the PCE: Notification-value=3/4 •Success: PCE saved the resources for the \<path\> carried in the PCNtf •Failed:PCE removed the resources for the \<path\> carried in the PCNtf	End-to-End Path Computation Result: PCE of the first domain Sends PCNtf to each PCE in the PCE chain: Notification-value=1/2 •Success: Each PCE released resources except those belong to the \<path\> carried in the PCNtf •Failed:Each PCE released all the resources saved for the LSP in TED
Path deletion result: Notification-value=5 Deletion Success: removed the resources of the deleted LSP in its local TED.	(Note: When path setup/deletion result sent from PCC to PCE, the PCE that received the notify message play the role of PCC, and notify the next PCE, as PCC/ PCE synchronization.)

Stateful PCE Avoid Resource Conflict

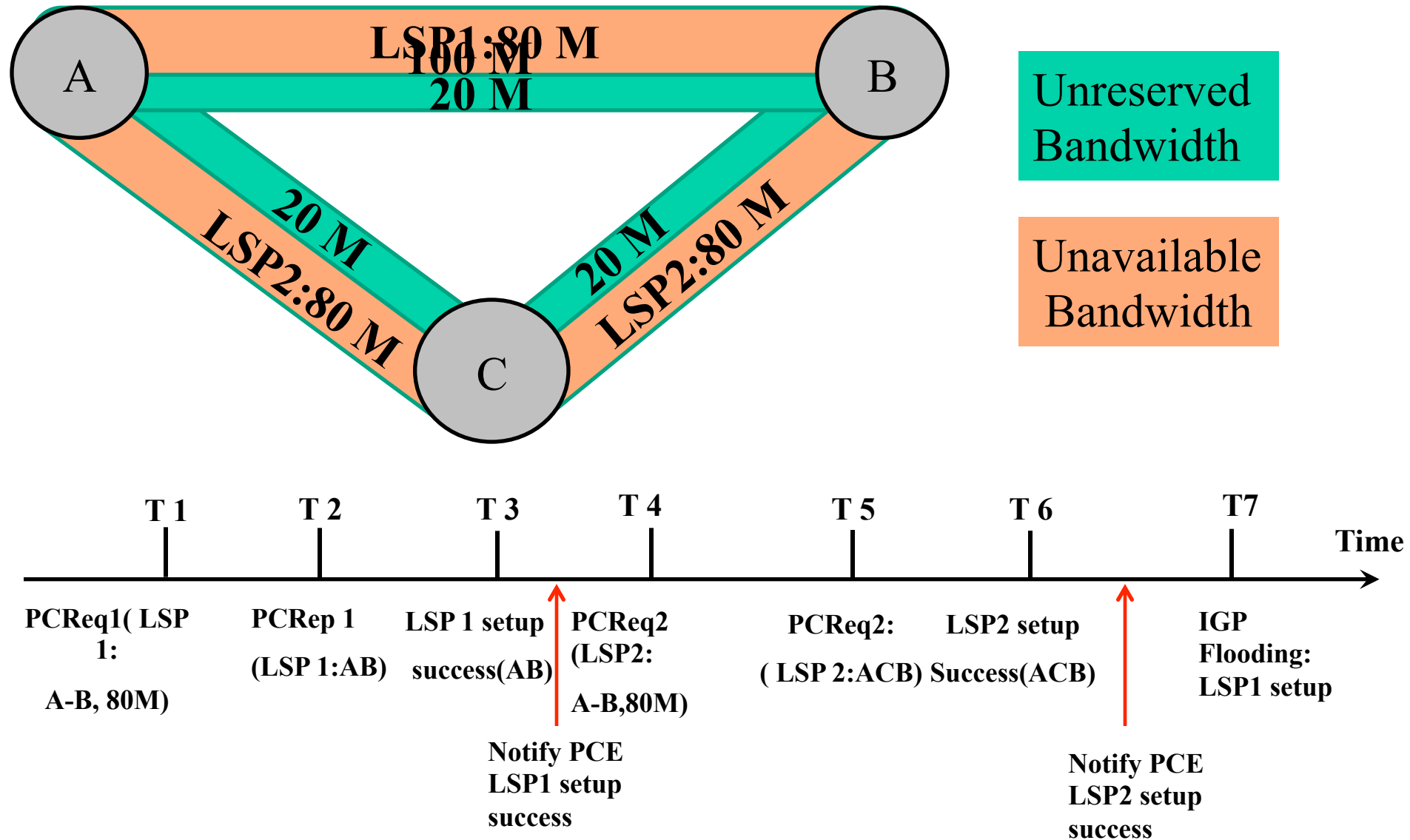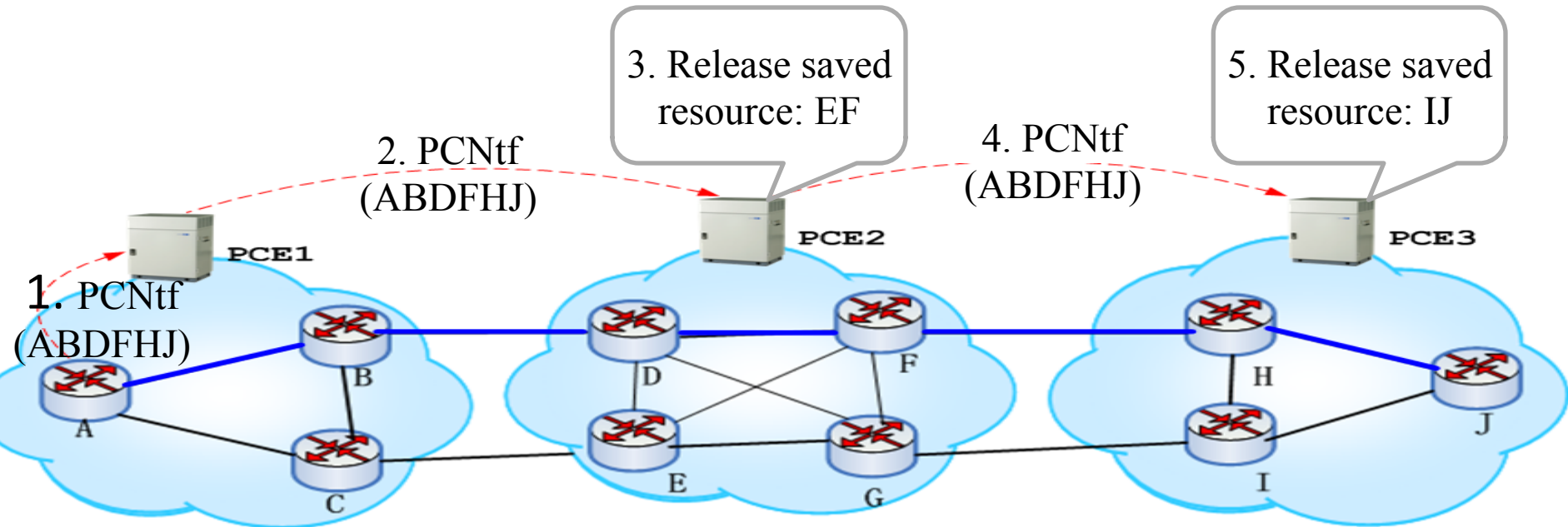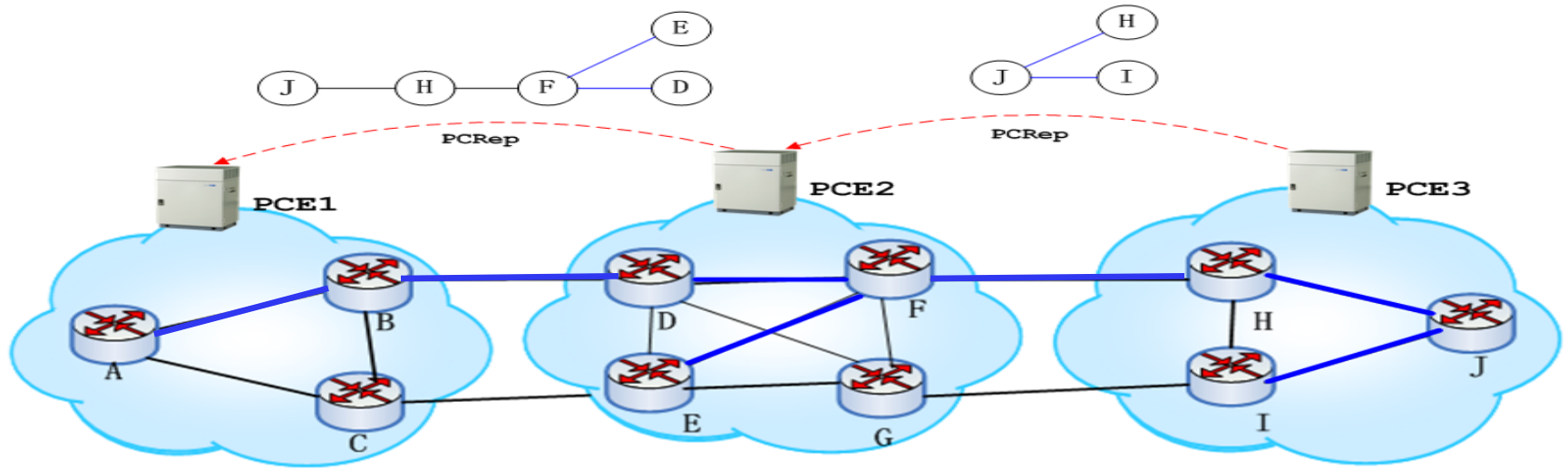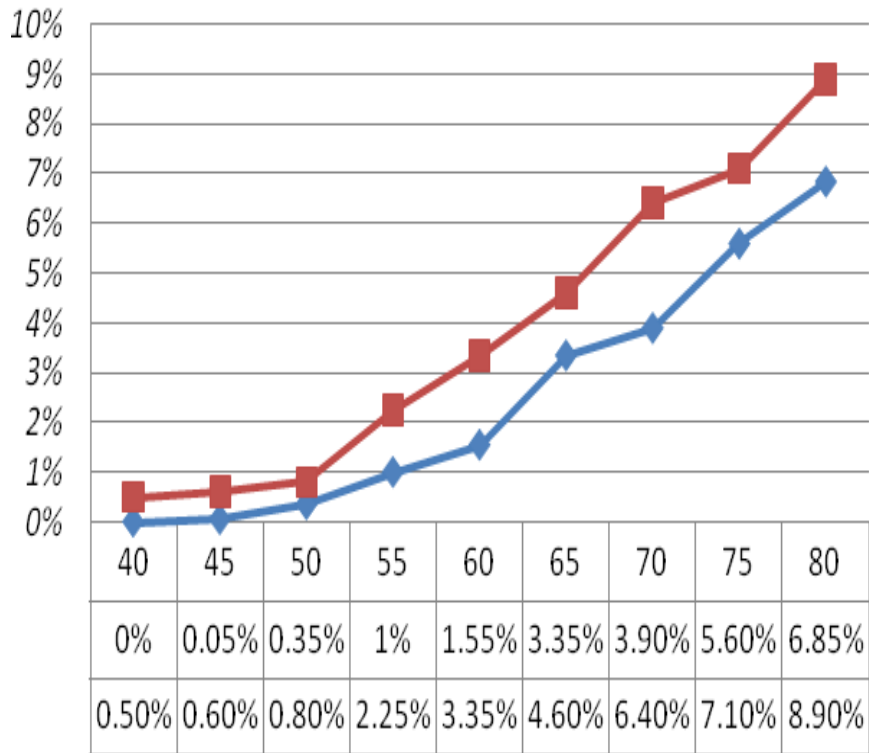

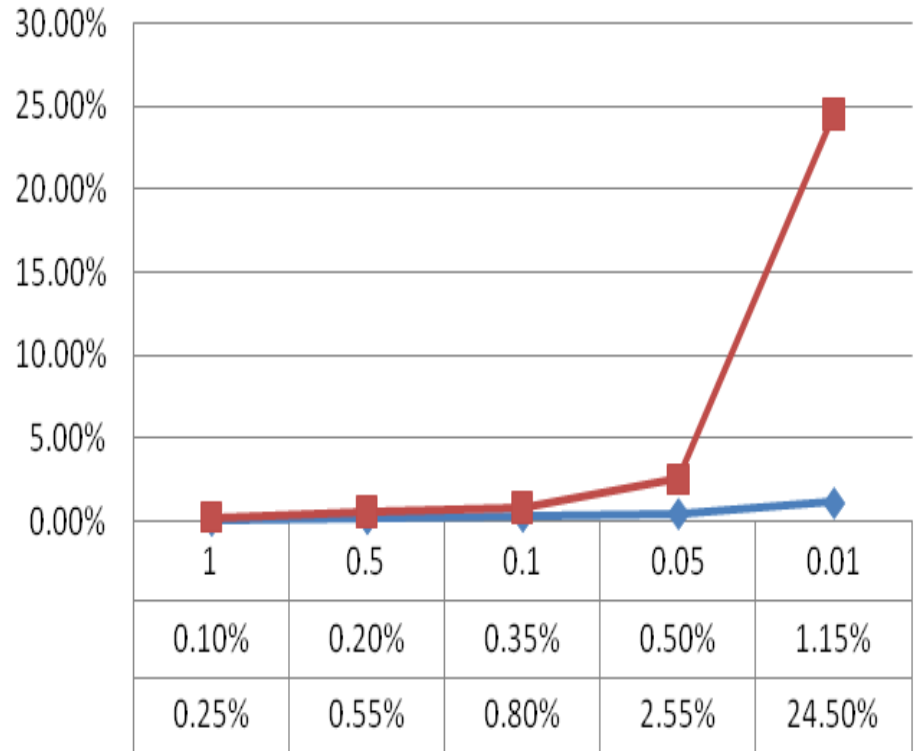Figure 2:Sequence of events with stateful PCE

BRPC compute Inter-area/AS path

3. Release saved resource: EF

5. Release saved resource: IJ

2. PCNtf (ABDFHJ)

4. PCNtf (ABDFHJ)

1. PCNtf (ABDFHJ)

Stateful vs Stateless PCE in RWA

40	45	50	55	60	65	70	75	80
0%	0.05%	0.35%	1%	1.55%	3.35%	3.90%	5.60%	6.85%
0.50%	0.60%	0.80%	2.25%	3.35%	4.60%	6.40%	7.10%	8.90%

Wavelength block rate under different network load

1	0.5	0.1	0.05	0.01
0.10%	0.20%	0.35%	0.50%	1.15%
0.25%	0.55%	0.80%	2.55%	24.50%

Wavelength block rate with different PCReq interval

━◆━ **Stateful PCE**   ━■━ **Stateless PCE**

Next Steps

- Refine it according to the feedback from the meeting or mailing list.

- More emulation under different condition.

Comments?

Thank You！♪