



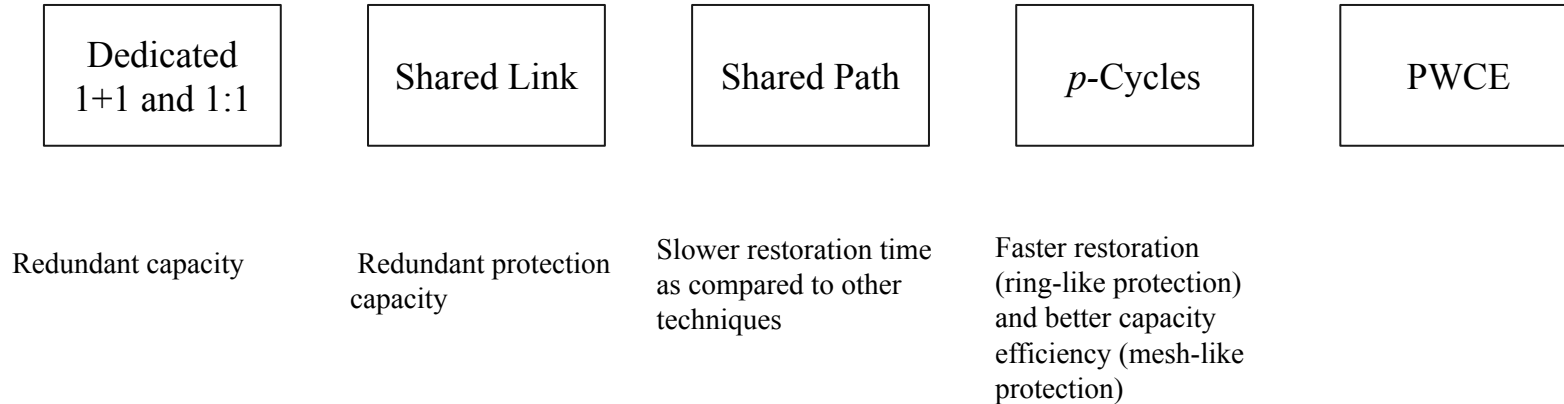
Discussion Meeting- **19/01/2022**

Resource Provisioning and Protection related issues in Spatial Domain-EON



- Objectives
 - Adaptive Routing, Core and Spectrum Assignment (RCSA) in Space Division Multiplexed- Elastic Optical Network (Multiple Core Fibers)
 - Switching-granularity based protection mechanism in SDM-EON using link protection and path protection
- What I have been working on
 - Testing some basic RCSA algorithms (Fragmentation Aware and Crosstalk Aware)
 - Protection Techniques- Link protection vs Path Protection.

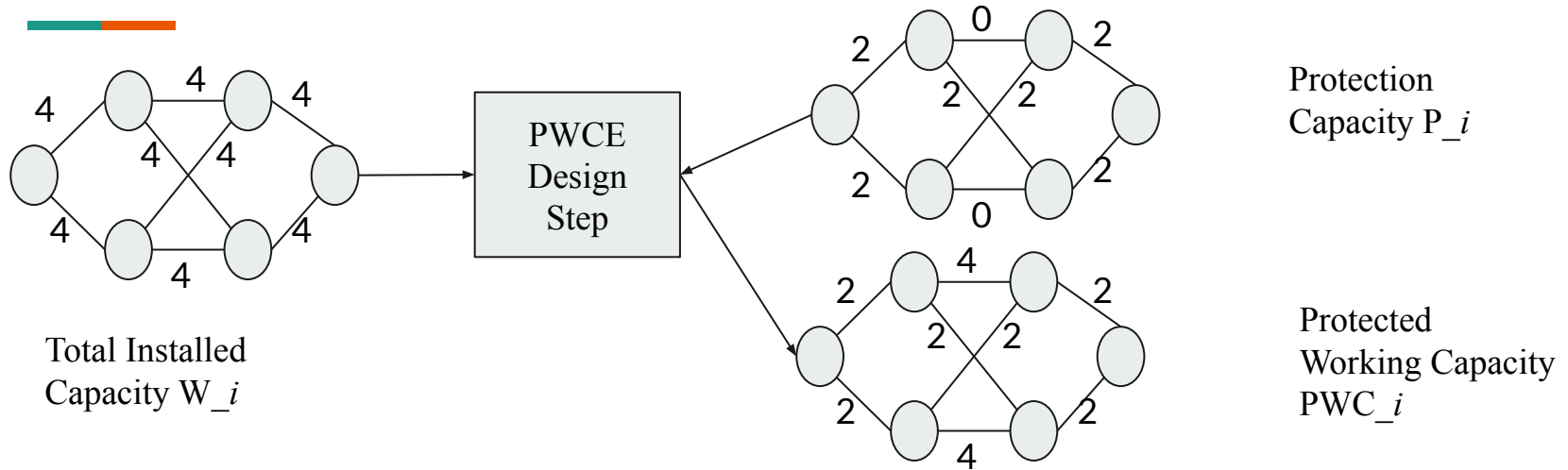
Protection Techniques in Optical Network



Working Capacity- The fraction of total fiber capacity used by the connection requests to actually transmit information

Protection Capacity- The fraction of the total fiber capacity used to provide backup to the active connection requests in any event of failure.

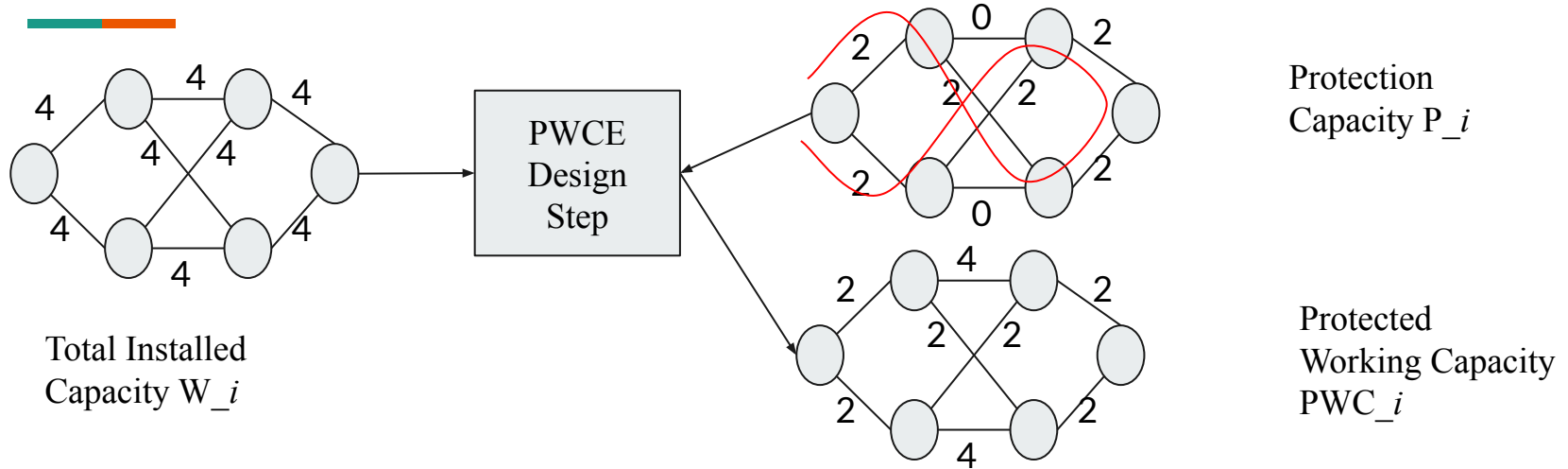
Protected Working Capacity Envelope



The protection capacity is deployed ahead of any working capacity or network failure event.

In dynamic provisioning the working path is selected from the PWCE, which is inherently protected by the reserved backup capacity.

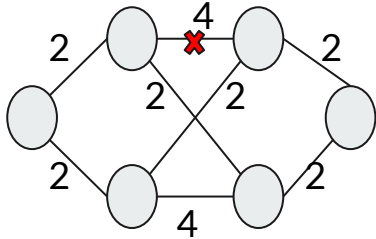
Protected Working Capacity Envelope



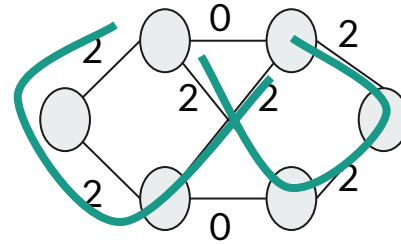
PWCE provides *provisioning over inherently protected capacity, as opposed to explicitly provisioning protection for every service.*

PWCE saves the efforts on computing the protection structures for each connection request and reduces the computation complexity.

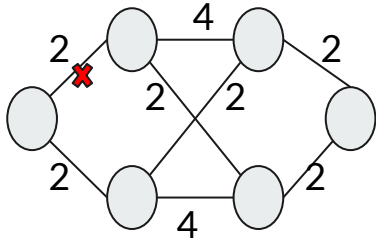
Protected Working Capacity Envelope



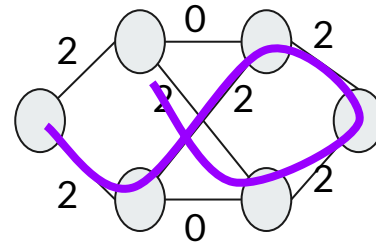
Protected
Working Capacity
 PWC_i



Protection
Capacity P_i




Protected
Working Capacity
 PWC_i



Protection
Capacity P_i

SPP vs PWCE*



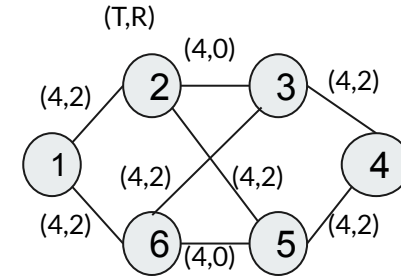
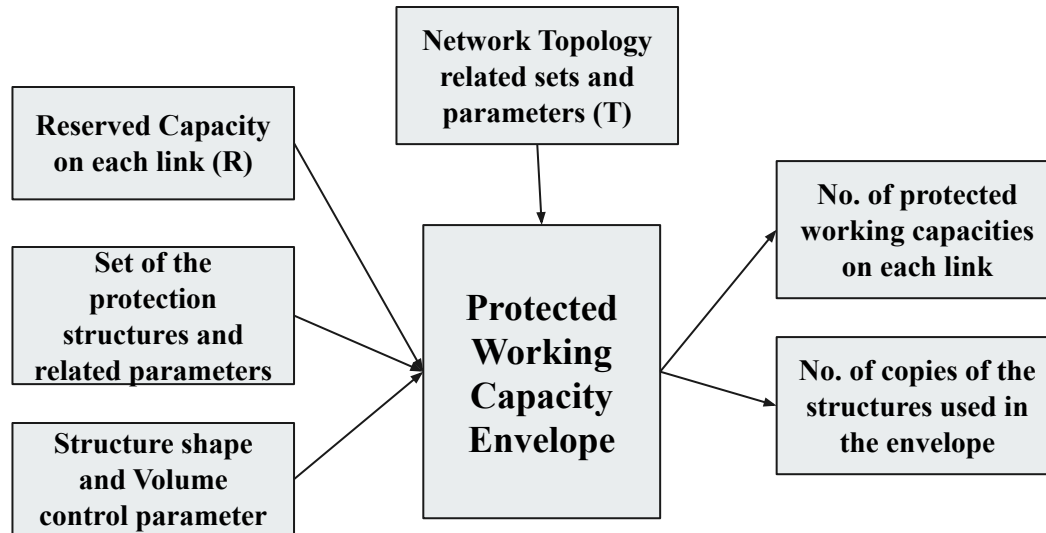
<i>Properties</i>	<i>SPP</i>	<i>PWCE</i>
Protection Mechanism	End to end path switchover to the backup route.	As Local span Protection, p-cycles, where switchover takes place at the end nodes of the failed link.
Protection Speed	150-300 ms (estimated).	30-80 ms (estimated).
Demand Dynamism	Entire network must be updated before the next connection arrival can be safely executed.	Independent provisioning actions are possible till the upper bound of the envelope is reached.
Protection Capacity Efficiency	High (40-60% estimate)	Low as compared to SBPP (10-20%)
Onset of Blocking	Abrupt and unpredictable	Predictable, because of envelope operating margins

*Wayne D. Grover, “The Protected Working Capacity Envelope Concept: An Alternate Paradigm for Automated Service Provisioning”, IEEE Communications Magazine, pp. 62-69, January 2004.

PWCE capacity Design

An important property of PWCE based protection is **Statistical Stationarity**.

It means that it takes a large shift in statistics of the incoming demand pattern to change the shape and the size of the PWC envelope.



Protection structures (cycles)
1-2-3-4-5-6-1
1-2-3-6-1
1-2-5-6-1
3-4-5-6-3
2-3-4-5-2
1-2-5-4-3-6-1



Current Work:

- Efficient Protection Mechanism in SDM-EON using Class of Services
 - Class of services can be defined by using two values:
 - Single hop or multihop
 - High-Priority Bandwidth (Streaming multimedia or Mission Critical) or Low-Priority Bandwidth (Voice or Video)
 - Link Protection -using PWCE
 - Path Protection- dedicated protection using waveband converters.
- Protection Granularity Levels : WaveBand Switching, Core Switching, Fiber Switching.