Dissertação de Mestrado em Engenharia Eletrónica e Telecomunicações

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Desenvolvimento de Heurísticas para o Modo de Transporte Opaco em Redes Óticas de Transporte

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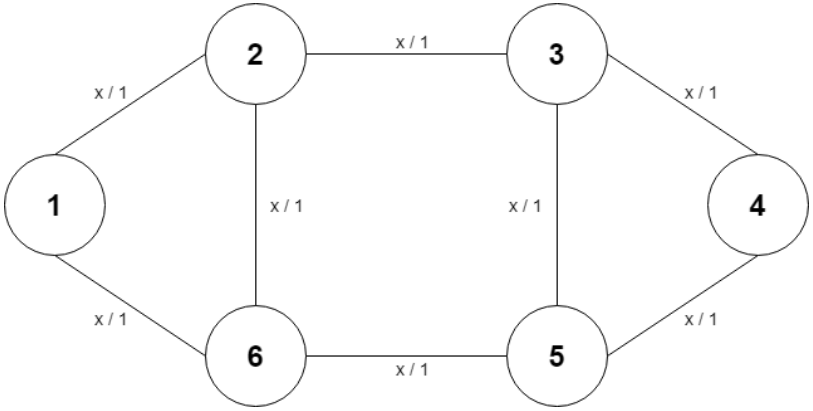
Modo de Transporte Opaco

- Realiza conversões OEO (Ótico-Elétrico-Ótico) em todos os nós intermédios desde a origem até ao destino
- Topologia lógica e topologia ótica são iguais



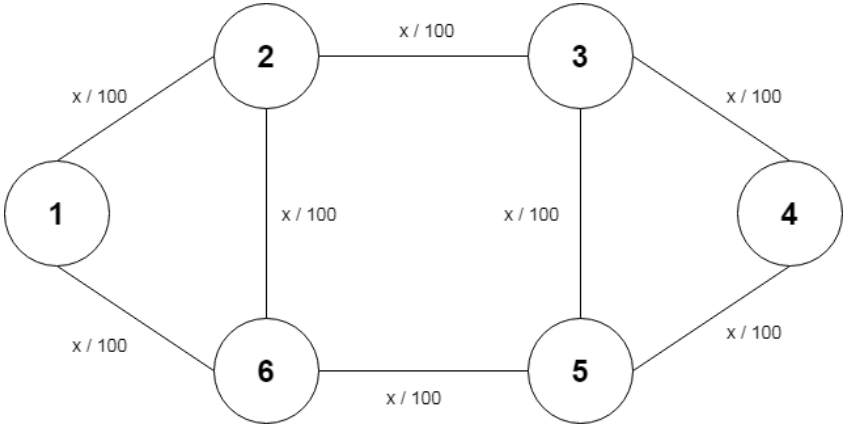
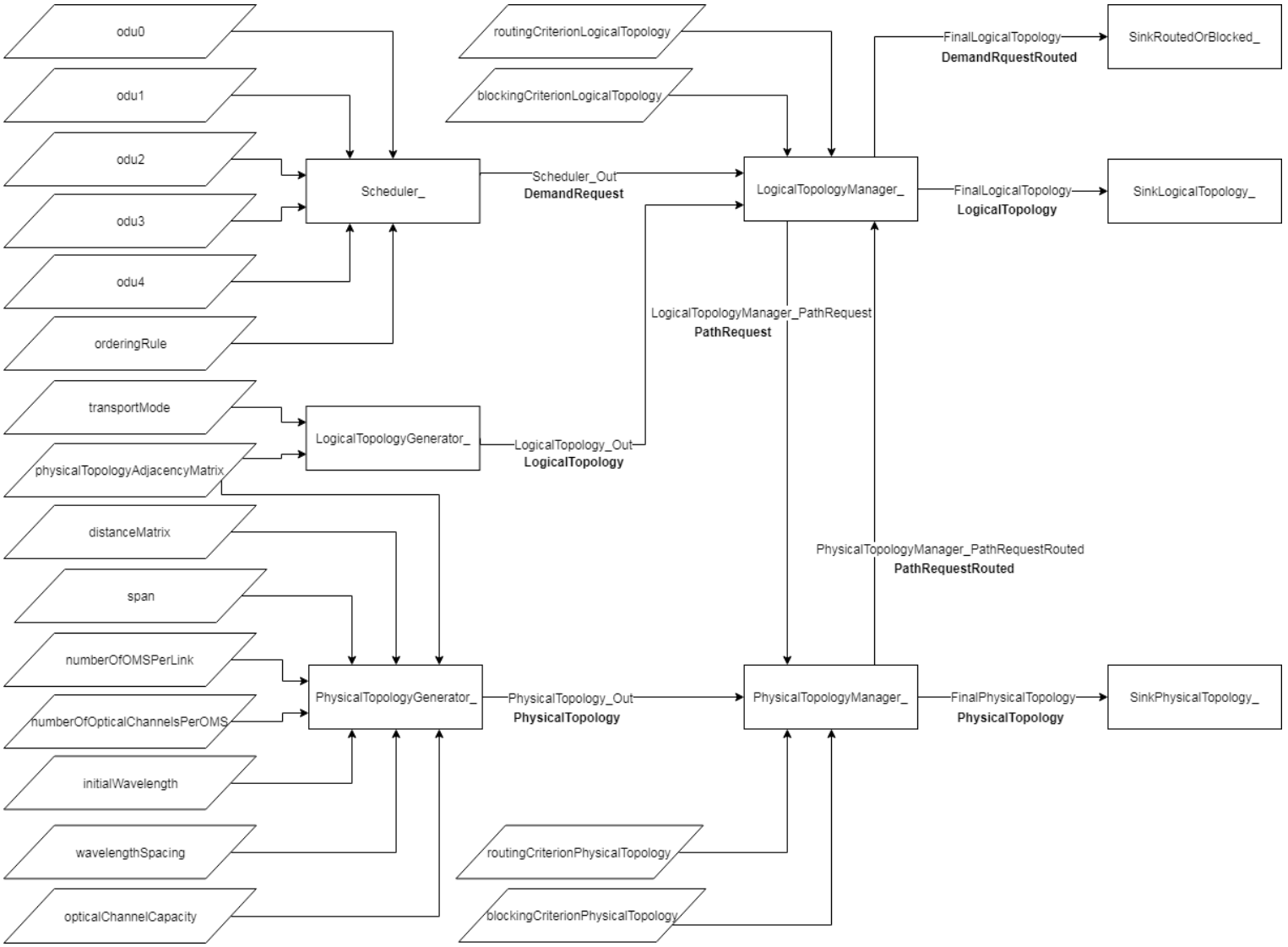


Diagrama do Sistema



Parâmetros de Entrada do Sistema

Input Parameter	Default Value	Description
odu0	[0]	ODU0 demands matrix
odu1	[0]	ODU1 demands matrix
odu2	[0]	ODU2 demands matrix
odu3	[0]	ODU3 demands matrix
odu4	[0]	ODU4 demands matrix
orderingRule	descendingOrder	Demands ordering rule: descendingOrder - ODU4 to ODU0 ascendingOrder - ODU0 to ODU4
transportMode	opaque	Transport mode: opaque transparent translucent
physicalTopologyAdjacencyMatrix	[0]	Adjacency matrix of the physical network
distanceMatrix	[0]	Matrix with the distance (km) between adjacent nodes
span	100	Fiber span length (Km)
numberOfOMSPerLink	1	Number of OMS per link
numberOfOpticalChannelsPerOMS	100	Number of optical channels per OMS
opticalChannelCapacity	80	Capacity of each optical channel in ODU0s
routingCriterionLogicalTopology	hops	Shortest path type: hops km
blockingCriterionLogicalTopology	3	Maximum number of short paths tested between a pair of nodes
routingCriterionPhysicalTopology	hops	Shortest path type: hops km
blockingCriterionPhysicalTopology	3	Maximum number of short paths tested between a pair of nodes

```
// Input parameters for opaque transport mode example

odu0 =
0 0 0 0 0 0
0 0 0 0 0 0
0 0 0 0 0 0
0 0 0 0 0 0
0 0 0 0 0 0
0 0 0 0 0 0
odu1 =
0 0 0 0 0 0
0 0 0 0 0 0
0 0 0 0 0 0
0 0 0 0 0 0
0 0 0 0 0 0
0 0 0 0 0 0
odu2 =
0 0 0 0 0 0
0 0 0 0 0 0
0 0 0 0 0 0
0 0 0 0 0 0
0 0 0 0 0 0
0 0 0 0 1 0
odu3 =
0 0 0 0 0 0
0 0 1 0 0 0
0 0 0 0 0 0
0 0 0 0 0 0
0 0 0 0 0 0
0 2 1 0 0 0
odu4 =
0 3 0 0 0 0
0 0 0 0 0 0
0 0 0 0 0 0
0 0 0 0 0 0
0 0 0 0 0 0
0 0 0 0 0 0
orderingRule = descendingOrder
transportMode = opaque
physicalTopologyAdjacencyMatrix =
0 1 0 0 0 1
0 0 1 0 0 0
0 0 0 0 1 0
0 0 1 0 0 0
0 0 0 1 0 1
0 1 0 0 0 0
distanceMatrix =
0 460 663 0 0 0
460 0 75 684 0 0
663 75 0 0 890 0
0 684 0 0 103 764
0 0 890 103 0 361
0 0 0 764 361 0
span = 100
numberOfOMSPerLink = 1
numberOfOpticalChannelsPerOMS = 2
initialWavelength = 1550
wavelengthSpacing = 0.8
opticalChannelCapacity = 80
routingCriterionLogicalTopology = hops
blockingCriterionLogicalTopology = 3
routingCriterionPhysicalTopology = hops
blockingCriterionPhysicalTopology = 3
```

Estrutura dos Tipos de Sinais

LogicalTopology

logicalTopologyAdjacencyMatrix

Node	1	...	...	N
1	0	0/1	0/1	0/1
...	0/1	0	0/1	0/1
...	0/1	0/1	0	0/1
N	0/1	0/1	0/1	0

paths

pathIndex	sourceNode	destinationNode	capacity (ODU0s)	numberOfLightPaths	lightPathsIndex
0...∞	1...N	1...N	0...80	1...∞	[lp0, lp1,...]

lightPaths

lightPathIndex	sourceNode	destinationNode	capacity (ODU0s)	numberOfOpticalChannels	opticalChannelsIndex
0...∞	1...N	1...N	1...80	1...100	[och0,och1,...]

opticalChannels

opticalChannelIndex	sourceNode	destinationNode	wavelength	capacity (ODU0s)	numberOfDemands	demandsIndex
0...∞	1...N	1...N	1550,1550.8,...	1...80	0...∞	[d0,d1,...]

Estrutura dos Tipos de Sinais

PhysicalTopology

physicalTopologyAdjacencyMatrix

Node	1	...	...	N
1	0	0/1	0/1	0/1
...	0/1	0	0/1	0/1
...	0/1	0/1	0	0/1
N	0/1	0/1	0/1	0

opticalMultiplexSection

OMSIndex	sourceNode	destinationNode	maximumNumberOfWavelengths	wavelengths	availableWavelengths
0	1...N	1...N	OC	[1550,1550.8,...]	[0/1,0/1,...]
⋮	⋮	⋮	⋮	⋮	⋮
∞	1...N	1...N	OC	[1550,1550.8,...]	[0/1,0/1,...]

DemandRequest

demandIndex	sourceNode	destinationNode	oduType	survivabilityMethod
0...∞	1...N	1...N	0...4	none protection_1_plus_1 restoration

Estrutura dos Tipos de Sinais

DemandRequestRouted

demandIndex	routed	pathsIndex
0...∞	true or false	0...∞

PathRequest

requestIndex	sourceNode	destinationNode	numberOfIntermediateNodes	intermediateNodes
0...∞	1...N	1...N	0...N-2	[1, 2, ...]

PathRequestRouted

pathInformation

requestIndex	routed	numberOfLightPaths
0...∞	true or false	1...∞

lightPathsTable

sourceNode	destinationNode	numberOfIntermediateNodes	intermediateNodes	wavelength
1...N	1...N	0...N-2	[1, 2, ...]	1550,1550.8,...

LogicalTopologyManager e PhysicalTopologyManager