

Neural TCP

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Objetivos

- Apresentar as bases da Linha de Pesquisa.
- Divulgar as atividades realizadas ao longo da pesquisa.
- Colher Críticas e Sugestões (feedback).

Sumário I

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Introdução

- Controle de Congestionamento - Regulador.
- Deve ser intenso ou comedido em função do estado da rede.
- Faz isso sem conhecimento da topologia.
- “Problema em aberto.”¹

¹Arun, Venkat, et al. "Toward formally verifying congestion control behavior." Proceedings of the 2021 ACM SIGCOMM 2021 Conference. 2021.

Motivação - MTO

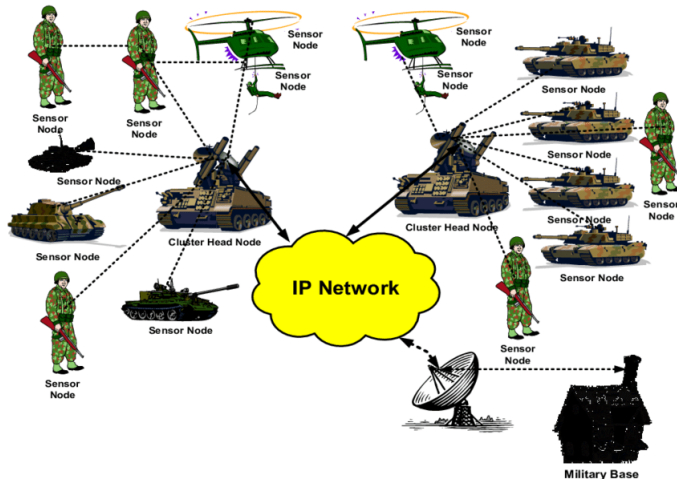


Figura: Conceito MTO

Revisão Histórica

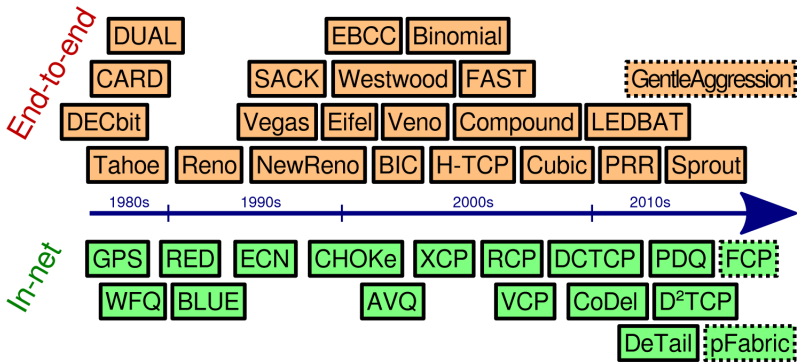


Figura: Marcha do TCP

Revisão Histórica

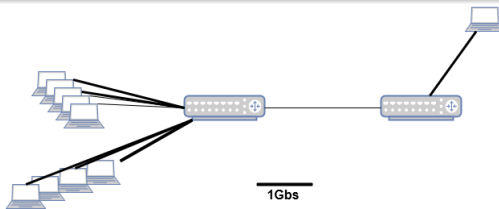
- Baseados em Reinforcement Learning (Remy)
- `ack_ewma`; `send_ewma`; `rtt_ratio`
- CNN, RNN, (LSTM)

Contribuição

Contribuição

Capacidade de mapear o estado da rede por meio de uma Deep Neural Network, treinada a partir do buffer de um roteador “Gargalo”

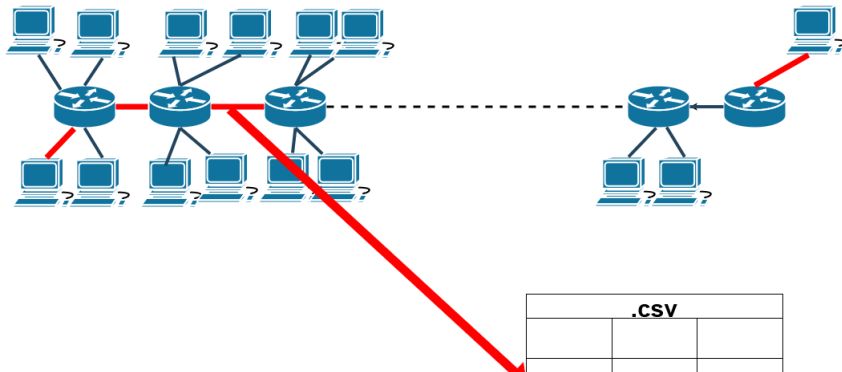
- Simplicidade
- Pró-atividade



Datamining

Script ns3

Extrair parâmetros de um fluxo TCP, em qualquer topologia, com total liberdade de configuração.



Exemplo csv

	10_0_0_2to10_1_0_2_L_Tue Jun 27 20_06_43 .csv	91,7 kB	T
	10_0_2_2to10_1_0_2_L_Tue Jun 27 20_06_43 .csv	86,4 kB	T
	10_0_3_2to10_1_0_2_S_Tue Jun 27 20_06_43 .csv	2,3 kB	T
	10_0_4_2to10_1_0_2_L_Tue Jun 27 20_06_43 .csv	92,2 kB	T
	10_0_6_2to10_1_0_2_L_Tue Jun 27 20_06_43 .csv	90,2 kB	T
	10_0_7_2to10_1_0_2_S_Tue Jun 27 20_06_43 .csv	2,1 kB	T
	10_0_8_2to10_1_0_2_L_Tue Jun 27 20_06_43 .csv	90,4 kB	T
	10_0_10_2to10_1_0_2_L_Tue Jun 27 20_06_43 .csv	91,3 kB	T
	10_0_11_2to10_1_0_2_S_Tue Jun 27 20_06_43 .csv	3,1 kB	T

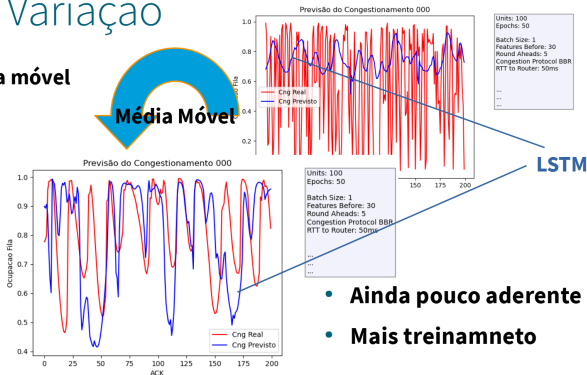
Exemplo csv

#Ack	ack_ewma(ms)	send_ewma(ms)	rtt_ratio	cwnd (Bytes)	Last Router Occupation	Ack Arriaval(Packets)
477201	141.767	81.4028	2106	24820		0.65
477201	136.046	71.2274	2202	26280		0.68
477201	159.165	62.324	2523	27740		0.73
477201	140.77	54.5335	2535	29200		0.73
477201	126.174	47.7168	2559	30660		0.77
477201	132.527	41.7522	2736	32120		0.77
477201	129.461	36.5332	2844	1460		0.79
477201	156.778	31.9665	3192	5840		0.97
512241	171.272	205.749	1268	20440		0.72
512241	151.863	180.03	1284	5840		0.79
512241	153.88	157.526	1452	5840		0.84
512241	143.645	137.836	1524	5840		0.85
512241	130.19	120.606	1560	5840		0.87
512241	116.916	105.53	1584	5840		0.87
512241	105.301	92.339	1608	5840		0.85
512241	95.1387	80.7966	1632	5840		0.83
512241	84.7464	70.6971	1644	5840		0.81
512241	81.6531	61.8599	1704	5840		0.81
541861	137.821	252.798	636	11680		0.93
563761	208.443	97.6552	2372	11680		0.98
563761	223.418	43.8272	3776	7300		0.99
563761	225.49	38.3488	4016	8760		0.94

Fase de Modelagem

Grande Variação

Tomar a Média móvel

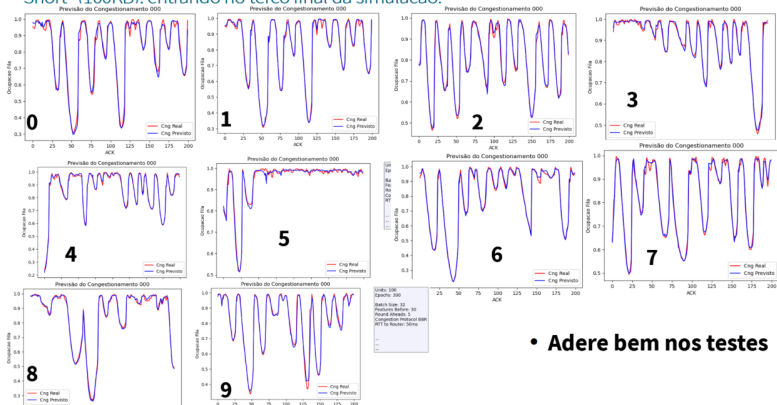


- Ainda pouco aderente
- Mais treinamneto

Figura: Variação Fila Roteador

Fase de Modelagem

Mais treino: 09 Simulações (30 min) - Terminais: 40, 20 longos (4GB), 10 "Very Short" (10KB) e 10 "Short" (100KB). entrando no terço final da simulação.

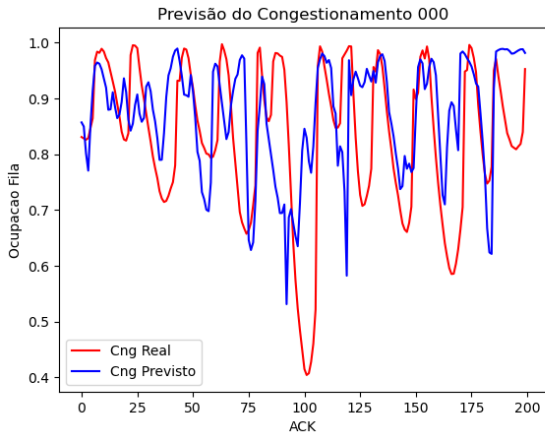


• Adere bem nos testes

Figura: Testes Sequenciais

Fase de Modelagem

Ainda com baixa aderência



Units: 100
Epochs: 50

Batch Size: 1
Features Before: 30
Round Aheads: 5
Congestion Protocol BBR
RTT to Router: 50ms

...
...
...

Fase de Modelagem

Ainda com baixa aderência

Aplicando sobre os mesmos dados

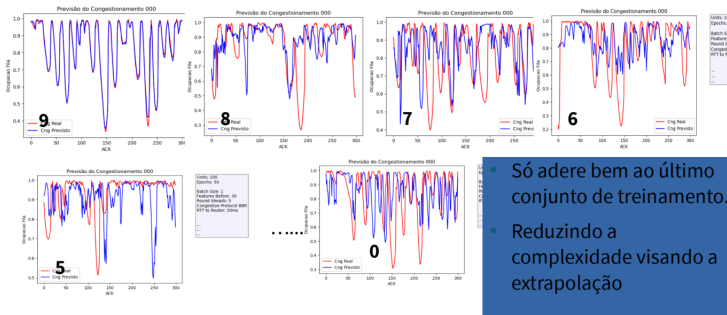


Figura: Aderência Reversa

...Vale o modelo do Momento!

Fase de Modelagem

Aprendizado Online – LSTM com Shift

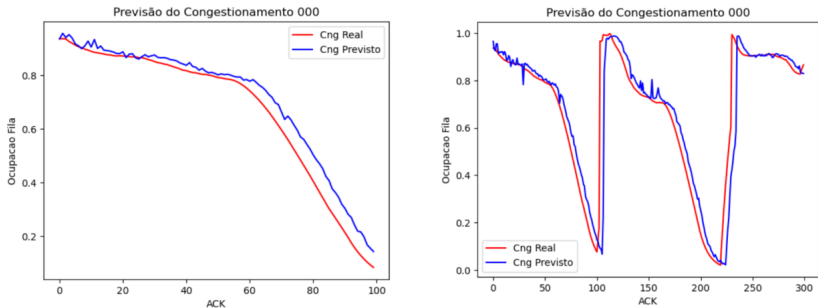


Figura: Aderência Reversa

Mas por quanto tempo??

Fase de Modelagem

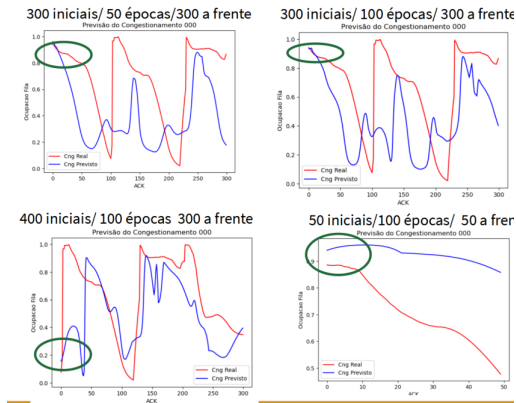
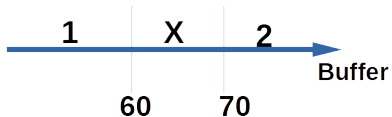


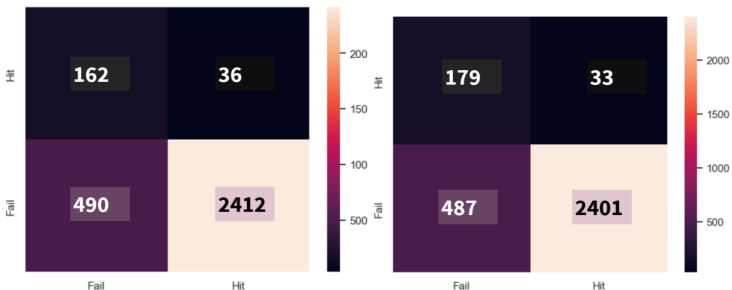
Figura: Memória

Modelo não guarda sazonalidades...

Fase de Modelagem



Modelo não recorrente – Dados de teste no mesmo fluxo



Fase de Modelagem

Modelo não recorrente – Dados de teste em fluxos distintos



Figura: Aderência modelo não recorrente - Fluxos Distintos

Testes

Arquitetura Testes

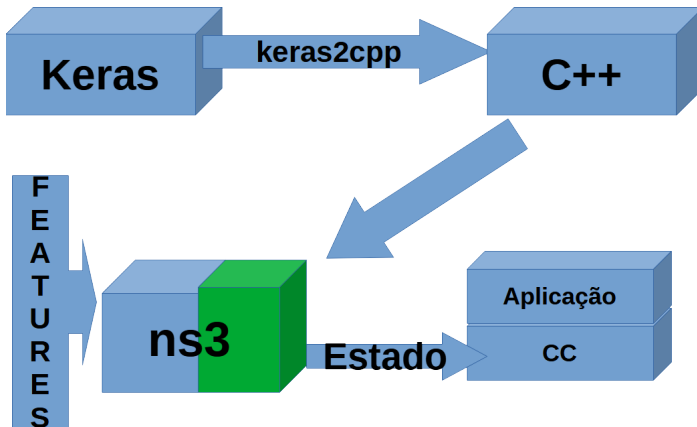
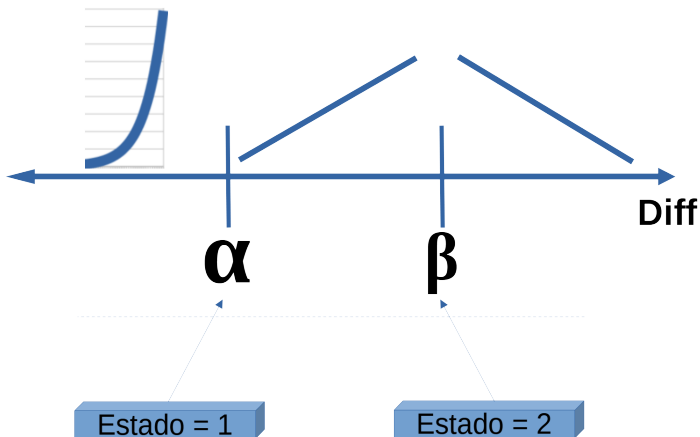


Figura: Arquitetura Testes

Testes

Arquitetura Testes - Vegas



Testes

Topologia - Simulação 20min - Média 5 simulações

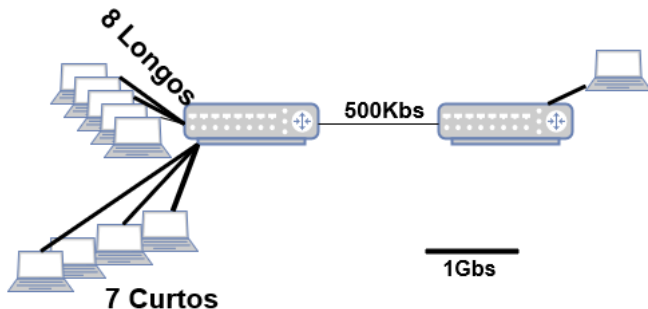


Figura: Topologia Testes

Testes

Resultados

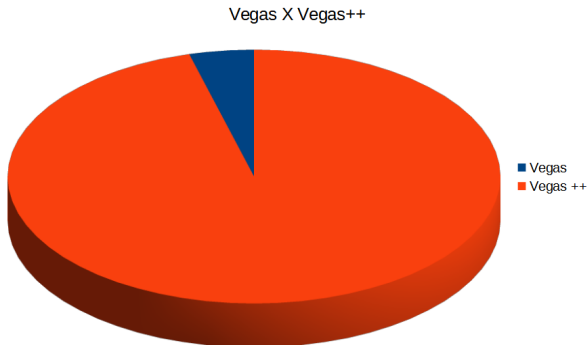


Figura: Resultados Testes

Conclusões

- Resultados preliminares promissores
- Teste com outras topologias principalmente dinâmicas
- Confrontar com outras variantes



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Dúvidas?