Results

November 8, 2020

1 General Informations

Run type: sequential.
Number of elements in the topology: 378.
Number of LPs used in the simulation: 8.
Simulation duration: 0.848 seconds.
Average memory usage: -nan GB.
Peak memory usage: 70.85 MB.
All elements reached stability in the simulation.

1.1 Topology Informations

There is one Central node, between the Central node and the Regional layer there is one WAN. Between each regional and its Locals there is a WAN.
There are 8 regional nodes, each of them has 5 local nodes. In total 40 local nodes.
Each local node has 1 LANs below. Each LAN has:

- 5 sensors sending telemetries with rate: 0.0002,.
- 1 sensors sending transitions with rate: 0.0005.
- 1 actuators sending trasitions with rate: 0.0005,.

In total there are 240 total sensors and 40 total actuators.

2 Detailed view

2.1 Central node 0

This element finished the simulation at simulation time: 2508207.474545.

2.1.1 Given parameters

S_t	S_e	S_c	S_b	$aggr_t$	$aggr_e$	$aggr_c$	$aggr_b$
1.5	1	1	0.5	3	3	4	6

2.1.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0.00444	0.04	0	0

D_t	D_e	D_c	D_b
1.5	1	0	0

U_t	U_e	U_c	U_b
0.00667	0.04	0	0

Total Utlization Factor = 0.0467

R_t	R_e	R_c	R_b
1.57	1.05	0	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0.00444	0.0402	0	0

D_t	D_e	D_c	D_b
1.5	0.998	0	0

U_t	U_e	U_c	U_b
0.00665	0.0402	0	0

Total Utlization Factor = 0.0469

R_t	R_e	R_c	R_b
1.55	1.05	0	0

2.2 Central storage of Node 0

2.2.1 Given parameters

S_t	S_e	S_c	S_b
1.5	1	1	0.5

2.2.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0.00444	0.04	0	0

D_t	D_e	D_c	D_b
1.5	1	0	0

U_t	U_e	U_c	U_b
0.00667	0.04	0	0

Total Utlization Factor = 0.0467

R_t	R_e	R_c	R_b
1.57	1.05	0	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0.00444	0.0402	0	0

D_t	D_e	D_c	D_b
1.5	0.998	0	0

U_t	U_e	U_c	U_b
0.00665	0.0402	0	0

Total Utlization Factor = 0.0469

R_t	R_e	R_c	R_b
1.55	1.05	0	0

2.3 Regional node 1

This element finished the simulation at simulation time: 2508097.032037.
This node has its computed parameters λ, utilization factor, service demand and response time similar by 20.0% to these other nodes: **2; 3; 4; 5; 6; 7; 8;**

2.3.1 Given parameters

S_t	S_e	S_c	S_b	$aggr_t$	$aggr_e$	$aggr_c$	$aggr_b$
0.5	0.2	0.3	0.2	3	3	4	6

2.3.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0.00167	0.005	0.0005	0

D_t	D_e	D_c	D_b
0.5	0.4	0.3	0

U_t	U_e	U_c	U_b
0.000833	0.002	0.00015	0

Total Utlization Factor = 0.00298

R_t	R_e	R_c	R_b
0.501	0.401	0.301	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0.00168	0.00498	0.000494	0

D_t	D_e	D_c	D_b
0.494	0.408	0.287	0

U_t	U_e	U_c	U_b
0.000831	0.00203	0.000142	0

Total Utlization Factor = 0.003

R_t	R_e	R_c	R_b
0.494	0.41	0.312	0

2.4 Local node 9

This element finished the simulation at simulation time: 2508095.240164.
This node has its computed parameters λ, utilization factor, service demand and response time similar by 20.0% to these other nodes: **10; 11; 12; 13; 14; 15; 16; 17; 18; 19; 20; 21; 22; 23; 24; 25; 26; 27; 28; 29; 30; 31; 32; 33; 34; 35; 36; 38; 39; 40; 41; 42; 43; 44; 45; 46; 47; 48;**

2.4.1 Given parameters

S_t	S_e	S_c	S_b	$aggr_t$	$aggr_e$	$aggr_c$	$aggr_b$
1.5	1	1	0.5	3	3	4	6

2.4.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0.001	0.001	0.0001	0

D_t	D_e	D_c	D_b
1.5	2	1	0

U_t	U_e	U_c	U_b
0.0015	0.002	0.0001	0

Total Utlization Factor = 0.0036

R_t	R_e	R_c	R_b
1.51	2.01	1	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0.00103	0.00103	0.000104	0

D_t	D_e	D_c	D_b
1.51	1.97	0.947	0

U_t	U_e	U_c	U_b
0.00155	0.00203	$9.85e-05$	0

Total Utlization Factor = 0.00368

R_t	R_e	R_c	R_b
1.51	1.99	0.952	0

2.5 Local node 37

This element finished the simulation at simulation time: 2507901.183195.

2.5.1 Given parameters

S_t	S_e	S_c	S_b	$aggr_t$	$aggr_e$	$aggr_c$	$aggr_b$
1.5	1	1	0.5	3	3	4	6

2.5.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0.001	0.001	0.0001	0

D_t	D_e	D_c	D_b
1.5	2	1	0

U_t	U_e	U_c	U_b
0.0015	0.002	0.0001	0

Total Utlization Factor = 0.0036

R_t	R_e	R_c	R_b
1.51	2.01	1	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0.000975	0.00102	$8.56e-05$	0

D_t	D_e	D_c	D_b
1.53	1.99	0.951	0

U_t	U_e	U_c	U_b
0.00149	0.00204	$8.14e-05$	0

Total Utlization Factor = 0.00361

R_t	R_e	R_c	R_b
1.53	2	0.951	0

2.6 Actuator 55

This element finished the simulation at simulation time: 2503362.643359.
This actuator has its computed parameters λ, utilization factor, service demand and response time similar by 20.0% to these other nodes: **62; 69; 76; 83; 97; 104; 111; 125; 132; 139; 146; 153; 160; 167; 174; 188; 202; 209; 216; 223; 244; 258; 265; 272; 279; 300; 314; 321; 328;**

2.6.1 Given parameters

S_t	S_e	S_c	S_b
0	0	0.6	0

2.6.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0	0	0.0001	0

D_t	D_e	D_c	D_b
0	0	0.6	0

U_t	U_e	U_c	U_b
0	0	$6e-05$	0

Total Utlization Factor = $6e-05$

R_t	R_e	R_c	R_b
0	0	0.6	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0	0	0.000104	0

D_t	D_e	D_c	D_b
0	0	0.635	0

U_t	U_e	U_c	U_b
0	0	$6.6e-05$	0

Total Utlization Factor = $6.6e-05$

R_t	R_e	R_c	R_b
0	0	0.635	0

2.7 Actuator 90

This element finished the simulation at simulation time: 2507887.241475.

2.7.1 Given parameters

S_t	S_e	S_c	S_b
0	0	0.6	0

2.7.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0	0	0.0001	0

D_t	D_e	D_c	D_b
0	0	0.6	0

U_t	U_e	U_c	U_b
0	0	$6e-05$	0

Total Utlization Factor = $6e-05$

R_t	R_e	R_c	R_b
0	0	0.6	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0	0	$9.37e-05$	0

D_t	D_e	D_c	D_b
0	0	0.569	0

U_t	U_e	U_c	U_b
0	0	$5.33e-05$	0

Total Utlization Factor = $5.33e-05$

R_t	R_e	R_c	R_b
0	0	0.571	0

2.8 Actuator 118

This element finished the simulation at simulation time: 2506417.012596.

2.8.1 Given parameters

S_t	S_e	S_c	S_b
0	0	0.6	0

2.8.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0	0	0.0001	0

D_t	D_e	D_c	D_b
0	0	0.6	0

U_t	U_e	U_c	U_b
0	0	$6e-05$	0

Total Utlization Factor = $6e-05$

R_t	R_e	R_c	R_b
0	0	0.6	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0	0	$9.66e-05$	0

D_t	D_e	D_c	D_b
0	0	0.529	0

U_t	U_e	U_c	U_b
0	0	$5.12e-05$	0

Total Utlization Factor = $5.12e-05$

R_t	R_e	R_c	R_b
0	0	0.529	0

2.9 Actuator 181

This element finished the simulation at simulation time: 2506214.487769.

2.9.1 Given parameters

S_t	S_e	S_c	S_b
0	0	0.6	0

2.9.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0	0	0.0001	0

D_t	D_e	D_c	D_b
0	0	0.6	0

U_t	U_e	U_c	U_b
0	0	$6e-05$	0

Total Utlization Factor = $6e-05$

R_t	R_e	R_c	R_b
0	0	0.6	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0	0	$9.25e-05$	0

D_t	D_e	D_c	D_b
0	0	0.547	0

U_t	U_e	U_c	U_b
0	0	$5.06e-05$	0

Total Utlization Factor = $5.06e-05$

R_t	R_e	R_c	R_b
0	0	0.547	0

2.10 Actuator 195

This element finished the simulation at simulation time: 2507925.054443.

2.10.1 Given parameters

S_t	S_e	S_c	S_b
0	0	0.6	0

2.10.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0	0	0.0001	0

D_t	D_e	D_c	D_b
0	0	0.6	0

U_t	U_e	U_c	U_b
0	0	$6e-05$	0

Total Utlization Factor = $6e-05$

R_t	R_e	R_c	R_b
0	0	0.6	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0	0	$9.17e-05$	0

D_t	D_e	D_c	D_b
0	0	0.592	0

U_t	U_e	U_c	U_b
0	0	$5.43e-05$	0

Total Utlization Factor = $5.43e-05$

R_t	R_e	R_c	R_b
0	0	0.592	0

2.11 Actuator 230

This element finished the simulation at simulation time: 2505758.0.

2.11.1 Given parameters

S_t	S_e	S_c	S_b
0	0	0.6	0

2.11.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0	0	0.0001	0

D_t	D_e	D_c	D_b
0	0	0.6	0

U_t	U_e	U_c	U_b
0	0	$6e-05$	0

Total Utlization Factor = $6e-05$

R_t	R_e	R_c	R_b
0	0	0.6	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0	0	$9.79e-05$	0

D_t	D_e	D_c	D_b
0	0	0.536	0

U_t	U_e	U_c	U_b
0	0	$5.25e-05$	0

Total Utlization Factor = $5.25e-05$

R_t	R_e	R_c	R_b
0	0	0.536	0

2.12 Actuator 237

This element finished the simulation at simulation time: 2506488.595584.

2.12.1 Given parameters

S_t	S_e	S_c	S_b
0	0	0.6	0

2.12.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0	0	0.0001	0

D_t	D_e	D_c	D_b
0	0	0.6	0

U_t	U_e	U_c	U_b
0	0	$6e-05$	0

Total Utlization Factor = $6e-05$

R_t	R_e	R_c	R_b
0	0	0.6	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0	0	$8.95e-05$	0

D_t	D_e	D_c	D_b
0	0	0.568	0

U_t	U_e	U_c	U_b
0	0	$5.08e-05$	0

Total Utlization Factor = $5.08e-05$

R_t	R_e	R_c	R_b
0	0	0.568	0

2.13 Actuator 251

This element finished the simulation at simulation time: 2506283.0.

2.13.1 Given parameters

S_t	S_e	S_c	S_b
0	0	0.6	0

2.13.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0	0	0.0001	0

D_t	D_e	D_c	D_b
0	0	0.6	0

U_t	U_e	U_c	U_b
0	0	$6e-05$	0

Total Utlization Factor = $6e-05$

R_t	R_e	R_c	R_b
0	0	0.6	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0	0	$8.61e-05$	0

D_t	D_e	D_c	D_b
0	0	0.579	0

U_t	U_e	U_c	U_b
0	0	$4.99e-05$	0

Total Utlization Factor = $4.99e-05$

R_t	R_e	R_c	R_b
0	0	0.579	0

2.14 Actuator 286

This element finished the simulation at simulation time: 2507158.0.

2.14.1 Given parameters

S_t	S_e	S_c	S_b
0	0	0.6	0

2.14.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0	0	0.0001	0

D_t	D_e	D_c	D_b
0	0	0.6	0

U_t	U_e	U_c	U_b
0	0	$6e-05$	0

Total Utlization Factor = $6e-05$

R_t	R_e	R_c	R_b
0	0	0.6	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0	0	0.000102	0

D_t	D_e	D_c	D_b
0	0	0.52	0

U_t	U_e	U_c	U_b
0	0	$5.31e-05$	0

Total Utlization Factor = $5.31e-05$

R_t	R_e	R_c	R_b
0	0	0.52	0

2.15 Actuator 293

This element finished the simulation at simulation time: 2507333.0.

2.15.1 Given parameters

S_t	S_e	S_c	S_b
0	0	0.6	0

2.15.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0	0	0.0001	0

D_t	D_e	D_c	D_b
0	0	0.6	0

U_t	U_e	U_c	U_b
0	0	$6e-05$	0

Total Utlization Factor = $6e-05$

R_t	R_e	R_c	R_b
0	0	0.6	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0	0	$9.32e-05$	0

D_t	D_e	D_c	D_b
0	0	0.529	0

U_t	U_e	U_c	U_b
0	0	$4.93e-05$	0

Total Utlization Factor = $4.93e-05$

R_t	R_e	R_c	R_b
0	0	0.529	0

2.16 Actuator 307

This element finished the simulation at simulation time: 2507683.0.

2.16.1 Given parameters

S_t	S_e	S_c	S_b
0	0	0.6	0

2.16.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0	0	0.0001	0

D_t	D_e	D_c	D_b
0	0	0.6	0

U_t	U_e	U_c	U_b
0	0	$6e-05$	0

Total Utlization Factor = $6e-05$

R_t	R_e	R_c	R_b
0	0	0.6	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0	0	0.000102	0

D_t	D_e	D_c	D_b
0	0	0.512	0

U_t	U_e	U_c	U_b
0	0	$5.2e-05$	0

Total Utlization Factor = $5.2e-05$

R_t	R_e	R_c	R_b
0	0	0.512	0

2.17 Lan IN 338

This element finished the simulation at simulation time: 2508092.816252.
This LAN has its computed parameters λ, utilization factor, service demand and response time similar by 20.0% to these other nodes: **339; 340; 341; 342; 343; 344; 346; 347; 348; 349; 350; 351; 352; 353; 354; 355; 356; 357; 358; 359; 361; 362; 363; 364; 365; 367; 368; 369; 370; 371; 372; 373; 374; 375; 376; 377;**

2.17.1 Given parameters

S_t	S_e	S_c	S_b
0	0	0.1	0

2.17.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0	0	0.0001	0

D_t	D_e	D_c	D_b
0	0	0.1	0

U_t	U_e	U_c	U_b
0	0	$1e-05$	0

Total Utlization Factor = $1e-05$

R_t	R_e	R_c	R_b
0	0	0.1	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0	0	0.000101	0

D_t	D_e	D_c	D_b
0	0	0.0992	0

U_t	U_e	U_c	U_b
0	0	$1.01e-05$	0

Total Utlization Factor = $1.01e-05$

R_t	R_e	R_c	R_b
0	0	0.0992	0

2.18 Lan OUT 338

2.18.1 Given parameters

S_t	S_e	S_c	S_b
0.2	0.2	0	0

2.18.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0.001	0.001	0	0

D_t	D_e	D_c	D_b
0.2	0.2	0	0

U_t	U_e	U_c	U_b
0.0002	0.0002	0	0

Total Utlization Factor = 0.0004

R_t	R_e	R_c	R_b
0.2	0.2	0	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0.00103	0.00104	0	0

D_t	D_e	D_c	D_b
0.205	0.207	0	0

U_t	U_e	U_c	U_b
0.000211	0.000214	0	0

Total Utlization Factor = 0.000425

R_t	R_e	R_c	R_b
0.205	0.207	0	0

2.19 Lan IN 345

This element finished the simulation at simulation time: 2507460.781695.

2.19.1 Given parameters

S_t	S_e	S_c	S_b
0	0	0.1	0

2.19.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0	0	0.0001	0

D_t	D_e	D_c	D_b
0	0	0.1	0

U_t	U_e	U_c	U_b
0	0	$1e-05$	0

Total Utlization Factor = $1e-05$

R_t	R_e	R_c	R_b
0	0	0.1	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0	0	$9.71e-05$	0

D_t	D_e	D_c	D_b
0	0	0.0831	0

U_t	U_e	U_c	U_b
0	0	$8.07e-06$	0

Total Utlization Factor = $8.07e-06$

R_t	R_e	R_c	R_b
0	0	0.0831	0

2.20 Lan OUT 345

2.20.1 Given parameters

S_t	S_e	S_c	S_b
0.2	0.2	0	0

2.20.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0.001	0.001	0	0

D_t	D_e	D_c	D_b
0.2	0.2	0	0

U_t	U_e	U_c	U_b
0.0002	0.0002	0	0

Total Utlization Factor = 0.0004

R_t	R_e	R_c	R_b
0.2	0.2	0	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0.000982	0.00101	0	0

D_t	D_e	D_c	D_b
0.195	0.203	0	0

U_t	U_e	U_c	U_b
0.000192	0.000206	0	0

Total Utlization Factor = 0.000398

R_t	R_e	R_c	R_b
0.196	0.203	0	0

2.21 Lan IN 360

This element finished the simulation at simulation time: 2508146.152545.

2.21.1 Given parameters

S_t	S_e	S_c	S_b
0	0	0.1	0

2.21.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0	0	0.0001	0

D_t	D_e	D_c	D_b
0	0	0.1	0

U_t	U_e	U_c	U_b
0	0	$1e-05$	0

Total Utlization Factor = $1e-05$

R_t	R_e	R_c	R_b
0	0	0.1	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0	0	0.000117	0

D_t	D_e	D_c	D_b
0	0	0.114	0

U_t	U_e	U_c	U_b
0	0	$1.33e-05$	0

Total Utlization Factor = $1.33e-05$

R_t	R_e	R_c	R_b
0	0	0.114	0

2.22 Lan OUT 360

2.22.1 Given parameters

S_t	S_e	S_c	S_b
0.2	0.2	0	0

2.22.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0.001	0.001	0	0

D_t	D_e	D_c	D_b
0.2	0.2	0	0

U_t	U_e	U_c	U_b
0.0002	0.0002	0	0

Total Utlization Factor = 0.0004

R_t	R_e	R_c	R_b
0.2	0.2	0	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0.001	0.001	0	0

D_t	D_e	D_c	D_b
0.196	0.2	0	0

U_t	U_e	U_c	U_b
0.000197	0.0002	0	0

Total Utlization Factor = 0.000397

R_t	R_e	R_c	R_b
0.196	0.2	0	0

2.23 Lan IN 366

This element finished the simulation at simulation time: 2507900.536137.

2.23.1 Given parameters

S_t	S_e	S_c	S_b
0	0	0.1	0

2.23.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0	0	0.0001	0

D_t	D_e	D_c	D_b
0	0	0.1	0

U_t	U_e	U_c	U_b
0	0	$1e-05$	0

Total Utlization Factor = $1e-05$

R_t	R_e	R_c	R_b
0	0	0.1	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0	0	$8.43e-05$	0

D_t	D_e	D_c	D_b
0	0	0.0978	0

U_t	U_e	U_c	U_b
0	0	$8.24e-06$	0

Total Utlization Factor = $8.24e-06$

R_t	R_e	R_c	R_b
0	0	0.0978	0

2.24 Lan OUT 366

2.24.1 Given parameters

S_t	S_e	S_c	S_b
0.2	0.2	0	0

2.24.2 Computed parameters

Analytical Model

λ_t	λ_e	λ_c	λ_b
0.001	0.001	0	0

D_t	D_e	D_c	D_b
0.2	0.2	0	0

U_t	U_e	U_c	U_b
0.0002	0.0002	0	0

Total Utlization Factor = 0.0004

R_t	R_e	R_c	R_b
0.2	0.2	0	0

Simulated Model

λ_t	λ_e	λ_c	λ_b
0.000976	0.00101	0	0

D_t	D_e	D_c	D_b
0.206	0.203	0	0

U_t	U_e	U_c	U_b
0.000201	0.000206	0	0

Total Utlization Factor = 0.000407

R_t	R_e	R_c	R_b
0.206	0.203	0	0