Modeling from informal diagrams: selecting the best staffing level for a claims process at an insurance company

- A personal claims department in an insurance company handles claims made by their clients. Figure on the next page, is a non-BPMN process map depicting the personal claims process in terms of swimlanes.

- The first lane corresponds to work done by a claims handler (CH) located at the client's local service center. Upon arrival of a claim, the assessor determines if the client has a valid policy. If no (5% of all cases), then the case is terminated; otherwise (95% of all cases), the assessor enters the appropriate information in the system.

- In the second lane, an assessor located at the service center (ASC) receives data from the claims handler. The assessor first determines if the claim is covered by the client's policy. If not (5% of cases), the case is terminated; otherwise (95% of cases), the assessor approves the preliminary estimate of the damage. If the damage exceeds $2,000 (35% of cases), the claim is sent to an assessor at headquarters for approval; otherwise (65% of cases), it is sent directly to a Senior Assessor.

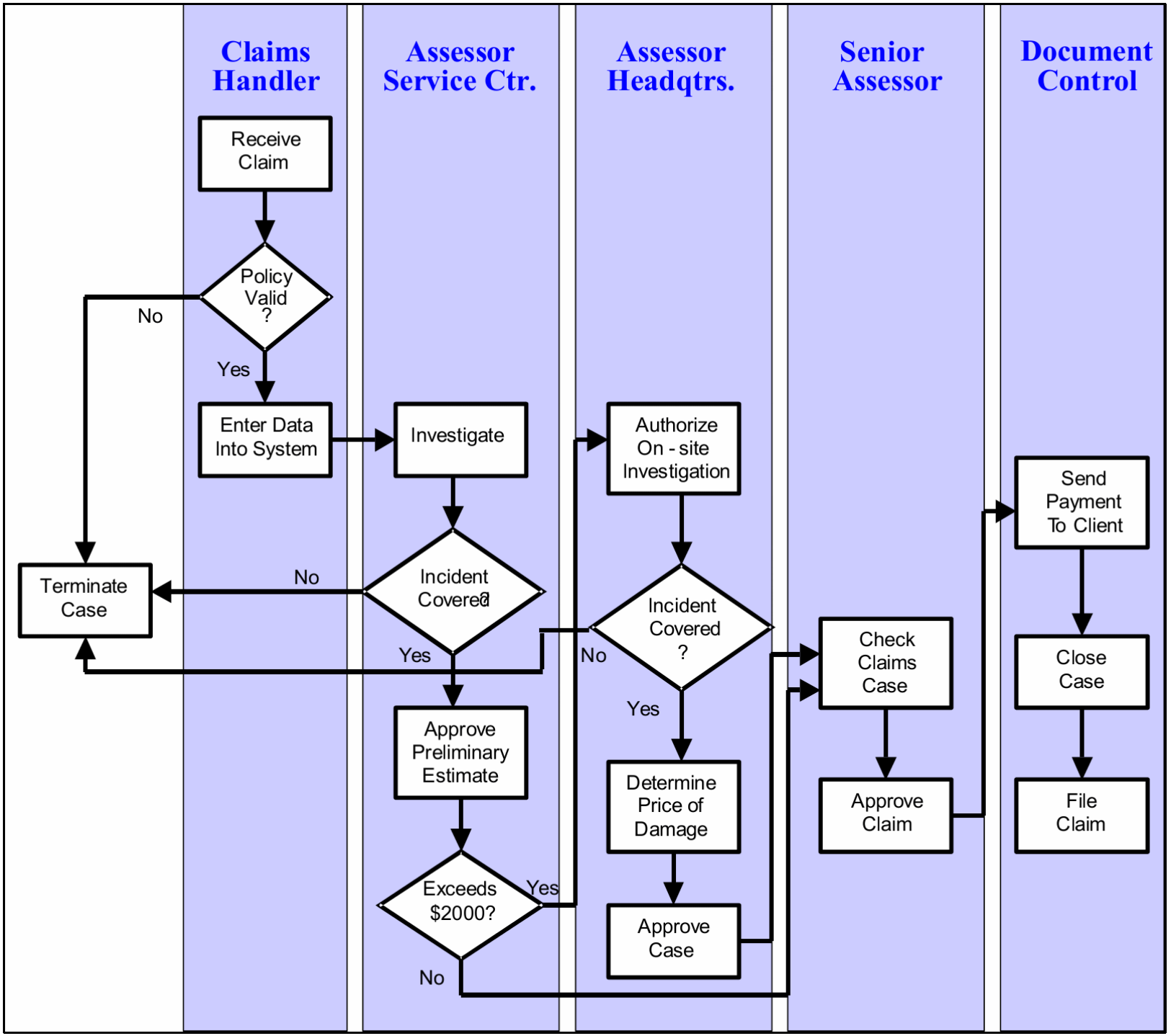
- Lane 3 corresponds to the assessor at headquarters (AHQ). The assessor first authorizes the on-site investigation of the accident. If the investigation determines that the incident is not covered by the client's policy (2% of cases), then the case is terminated; otherwise (98% of cases), a final price is determined and the case is approved.

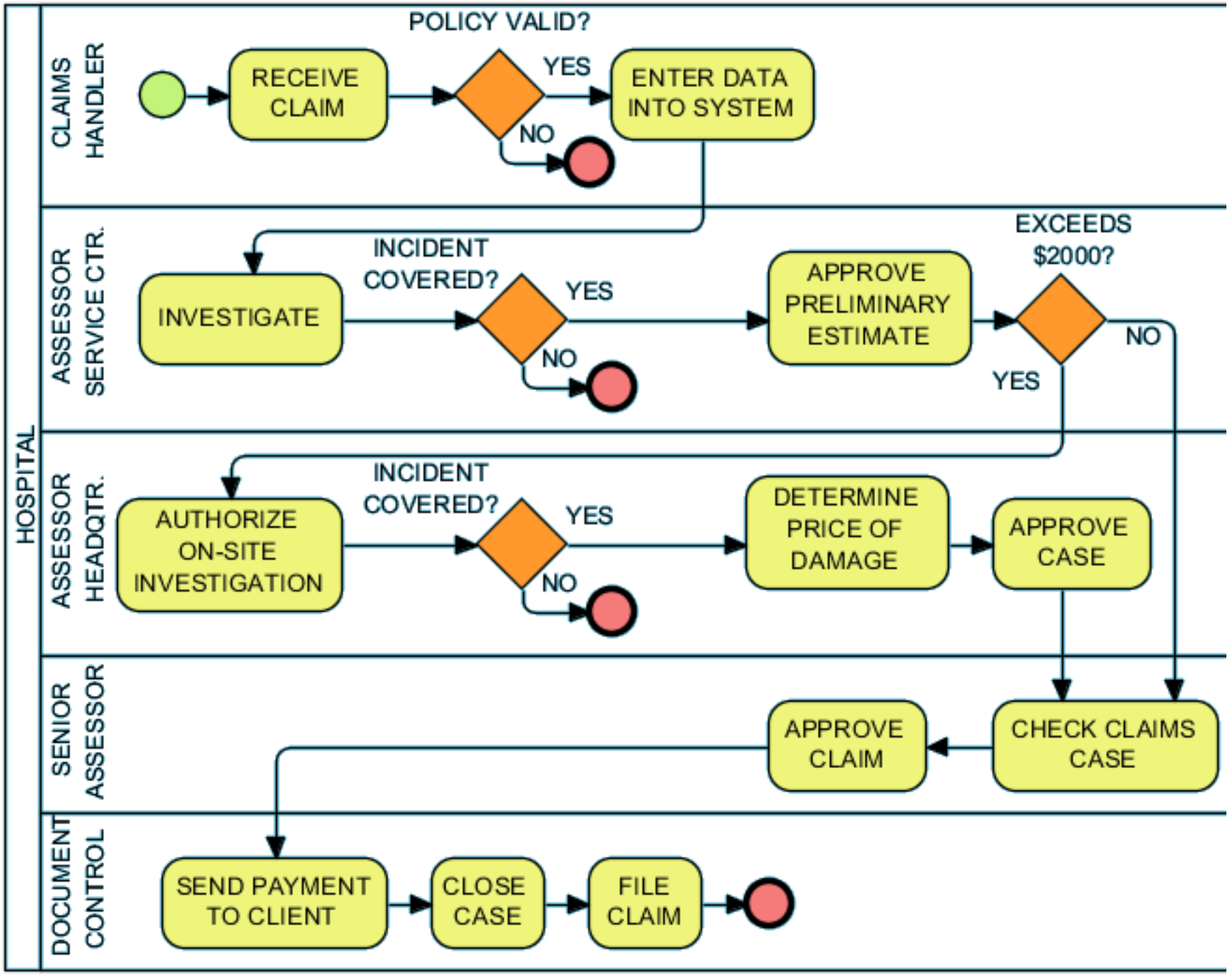
- In lane 4, the senior assessor (SA) receives the claim, checks it, completes it, and provides the final approval. Once the claim is approved, it is sent to documentation control.

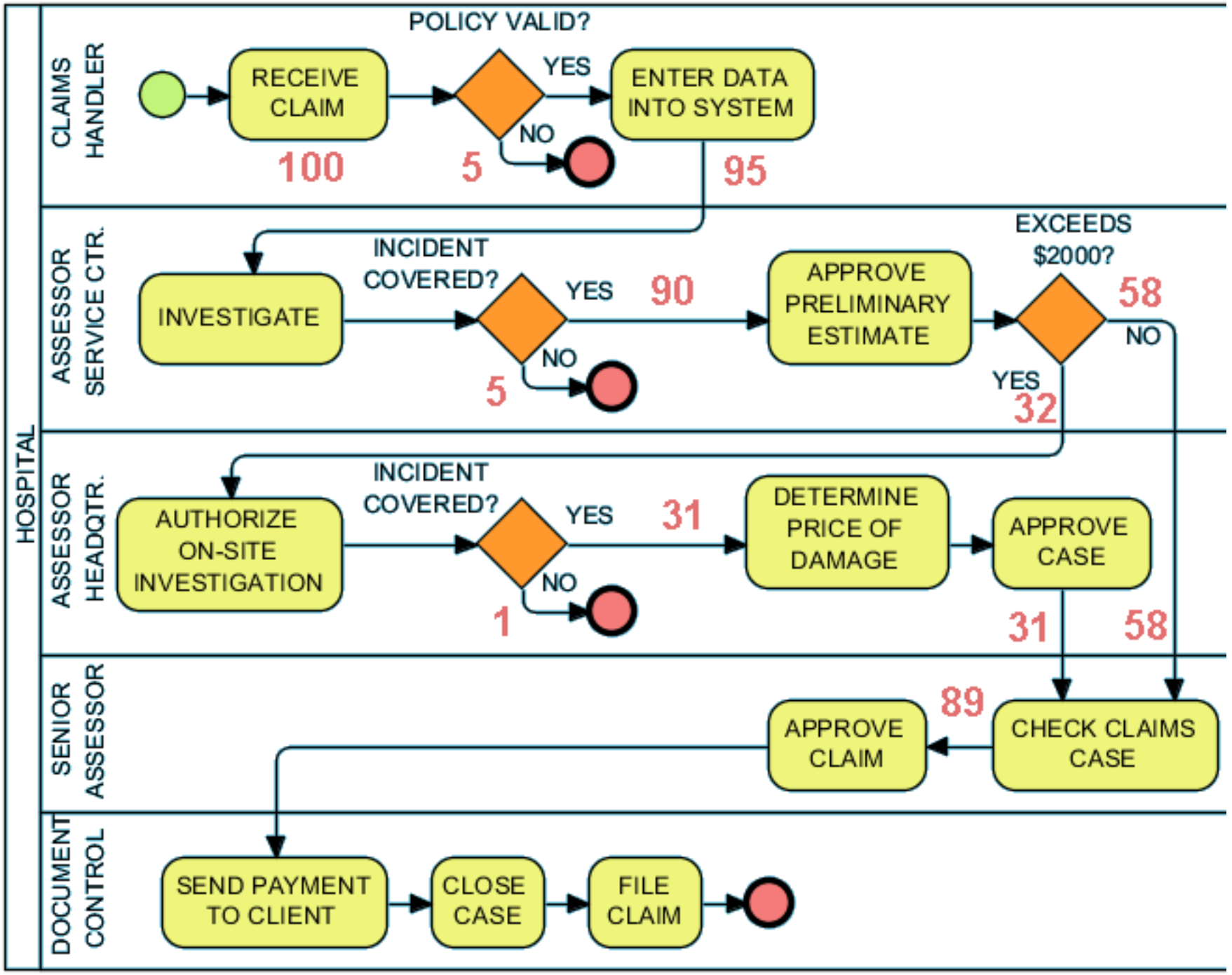
- Documentation control (DC), in lane 5, is in charge of processing the payment to the client, closing the case, and, finally, filing the claim.

- The problem in this example is to find the most efficient staffing levels for each of the five resource types. Each resource type has a maximum limit of 20 people, and the overall headcount in the process cannot exceed 70. For 100 claims in a peak scenario, the total duration should be lower than 200 minutes

- Perform a what-if analysis of possible solutions to this problem. To decide which configuration best aligns with service levels and process goals, analyze the trade-offs between headcount and total duration. Finally, consider also **sensitivity**: which type of resource produces a lower difference in total duration when reduced by a unit.


Claims Handler
Assessor Service Ctr.
Assessor Headqtrs.
Senior Assessor
Document Control
Receive Claim
Policy Valid ?
No
Yes
Enter Data Into System
Investigate
Authorize On - site Investigation
Send Payment To Client
Terminate Case
No
Incident Covered?
Incident Covered ?
No
Yes
Check Claims Case
Close Case
Yes
Approve Preliminary Estimate
Determine Price of Damage
Approve Claim
File Claim
Exceeds $2000?
Yes
Approve Case
No


HOSPITAL
CLAIMS HANDLER
POLICY VALID?
RECEIVE CLAIM
YES
NO
ENTER DATA INTO SYSTEM
ASSESSOR SERVICE CTR.
INVESTIGATE
INCIDENT COVERED?
YES
NO
APPROVE PRELIMINARY ESTIMATE
EXCEEDS $2000?
NO
YES
ASSESSOR HEADQTR.
AUTHORIZE ON-SITE INVESTIGATION
INCIDENT COVERED?
YES
NO
DETERMINE PRICE OF DAMAGE
APPROVE CASE
SENIOR ASSESSOR
APPROVE CLAIM
CHECK CLAIMS CASE
DOCUMENT CONTROL
SEND PAYMENT TO CLIENT
CLOSE CASE
FILE CLAIM


HOSPITAL
CLAIMS HANDLER
POLICY VALID?
RECEIVE CLAIM
100
YES
NO
5
ENTER DATA INTO SYSTEM
95
ASSESSOR SERVICE CTR.
INVESTIGATE
INCIDENT COVERED?
YES
NO
5
90
APPROVE PRELIMINARY ESTIMATE
EXCEEDS $2000?
58
NO
YES
32
ASSESSOR HEADQTR.
AUTHORIZE ON-SITE INVESTIGATION
INCIDENT COVERED?
YES
NO
1
31
DETERMINE PRICE OF DAMAGE
APPROVE CASE
31
58
SENIOR ASSESSOR
APPROVE CLAIM
89
CHECK CLAIMS CASE
DOCUMENT CONTROL
SEND PAYMENT TO CLIENT
CLOSE CASE
FILE CLAIM

- Scenarios

SCENARIO	N. OF CASES
1) POL-NOT-VAL	5
2) POL-VAL & INC-NOT-COV	5
3) POL-VAL & INC-COV & >2000 & INC-NOT-COV	1
4) POL-VAL & INC-COV & >2000 & INC-COV	31
5) POL-VAL & INC-COV & <2000	58
TOTAL CASES	**100**

- Duration

ACTIVITY	**AVG. DURATION**
RECEIVE CLAIM	2m 12s
ENTER DATA INTO SYSTEM	10m 32s
INVESTIGATE	19m 28s
APPROVE PRELIMINARY ESTIMATE	3m 54s
AUTHORIZE ON-SITE INVESTIGATION	2m 46s
DETERMINE PRICE OF DAMAGE	37m 16s
APPROVE CASE	2m 10s
CHECK CLAIMS CASE	3m 38s
APPROVE CLAIM	1m 18s
SEND PAYMENT TO CLIENT	7m 11s
CLOSE CASE	1m 46s
FILE CLAIM	3m 22s

- Optimization problem: minimize the headcount, i.e., the total number of lane instances, under the following constraints: (i) each lane type has a maximum limit of 20; (ii) the total number of lane instances in the process cannot exceed 70; (iii) the total duration should be lower than 200 minutes.

- An experiment with 20 instances available for all lanes (20, 20, 20, 20, 20) produces a total duration of **3h 26m 5s** (206 minutes).

- The longest queues are located in the second lane (Fig.1, *investigate*, *approve preliminary estimate*), i.e., "Assessor Service Ctr". Moreover, the second lane exploits all 20 instances for a considerable amount of time (Fig.2, green line). Thus, a reduction of the available instances of the second lane may produce a substantial increase in the total duration. **Second lane => 20 instances**.

- Queues in the second lane may also depend on the inter-arrival time, which is determined by resources in the first lane. There could be a positive effect in the reduction of some resource in the first lane:

Inst.	19	18,17,15	16	14	13,12	11	10	**9**	8
Dur.	3:18:55	3:11:05 (191m)	3:12:13	3:13:17	3:15:29	3:14:55	3:12:05	**3:11:59 (192m)**	3:24:01

- **First lane => 9 instances** (9, 20, 20, 20, 20). New results are shown in Fig. 4, 5, 6.

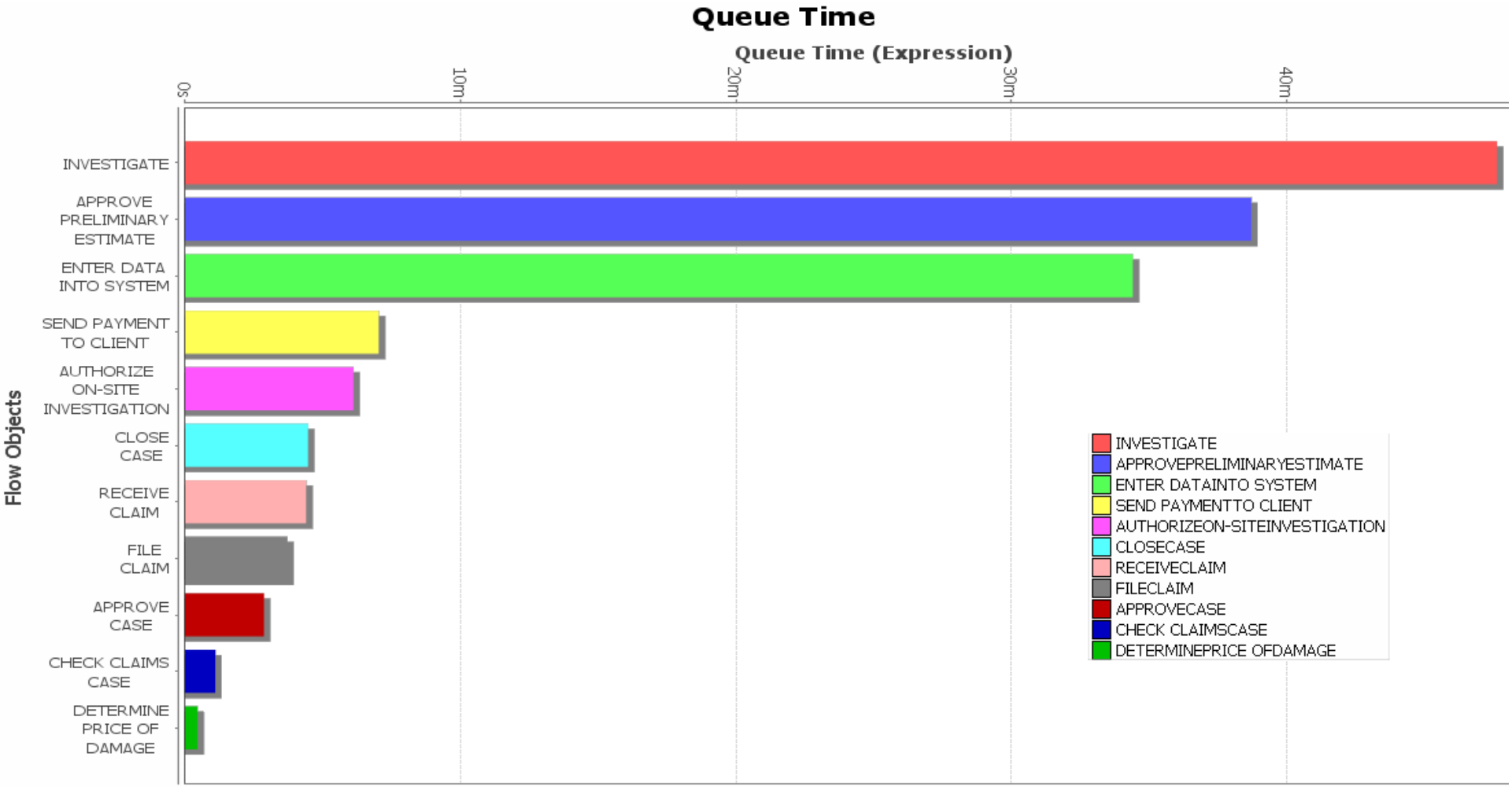


Fig. 1 – Queue Time with (20, 20, 20, 20, 20) instances

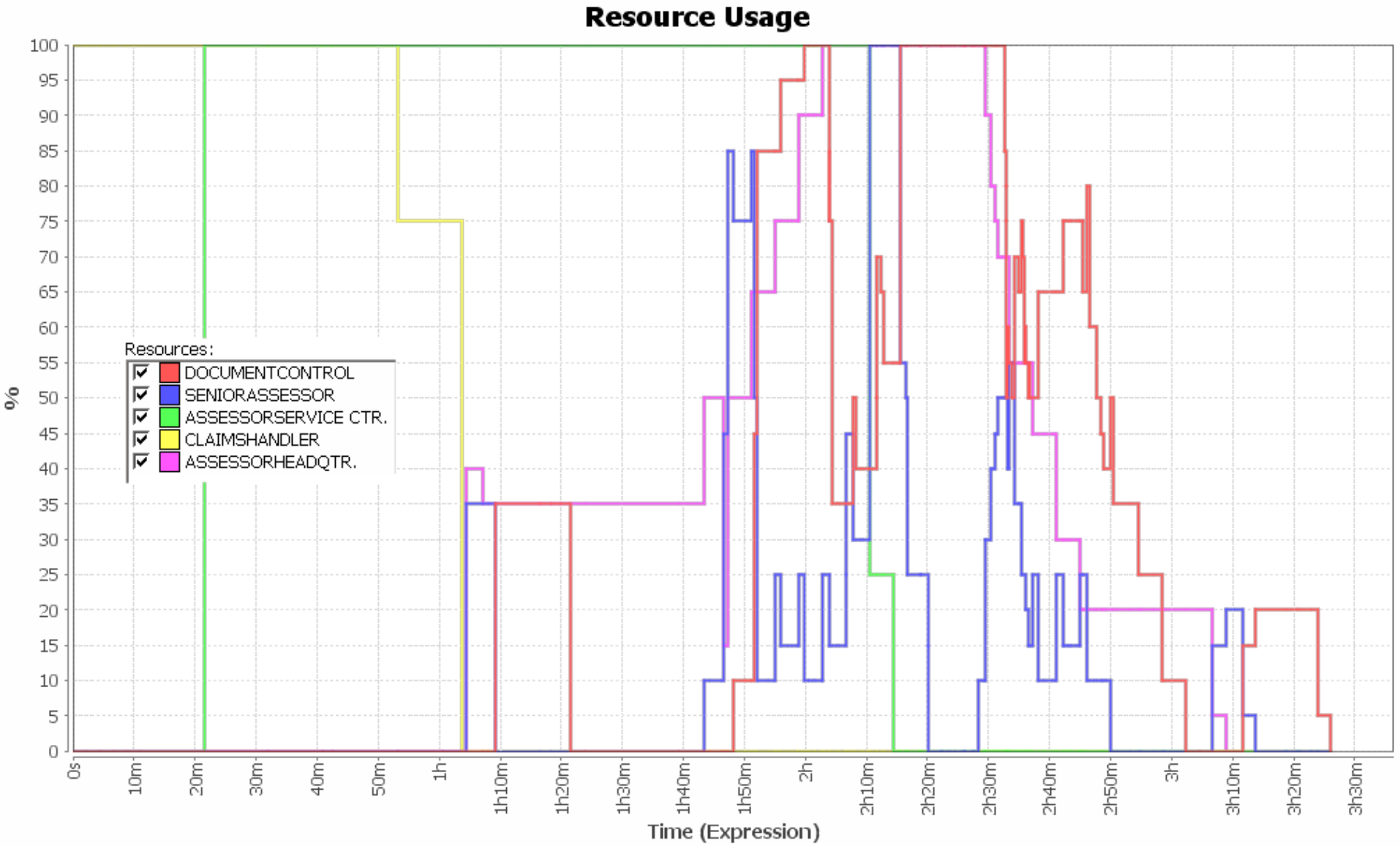


Fig. 2 – Resource Usage with (20, 20, 20, 20, 20) instances

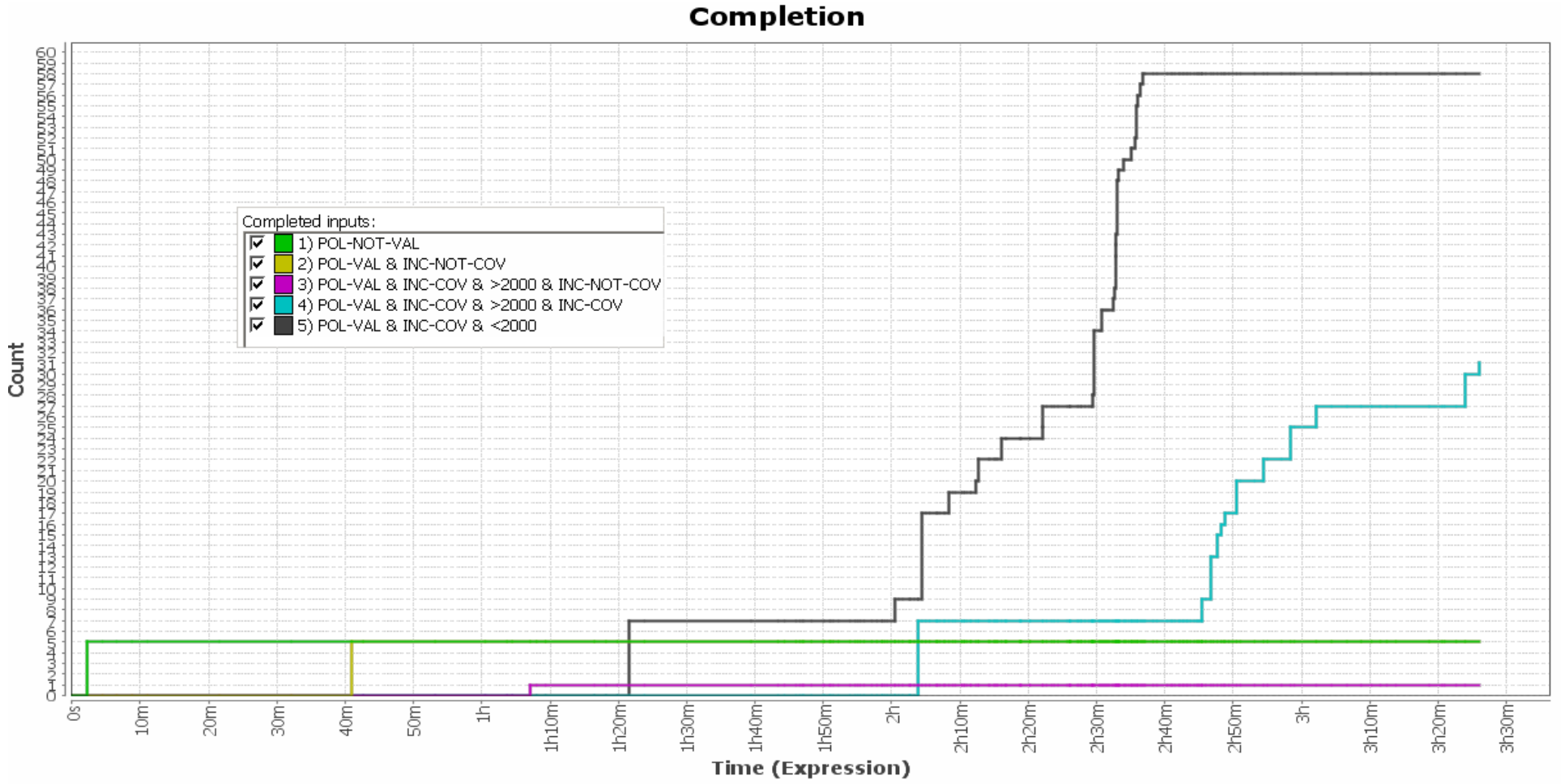


Fig. 3 – Completion Time with (20, 20, 20, 20, 20) instances

Note that scenarios 4 and 5 (the most relevant in terms of tokens) cannot be carried out in parallel: when there is an increase in the completed instances of a scenario, the other scenario is stationary, and vice versa.

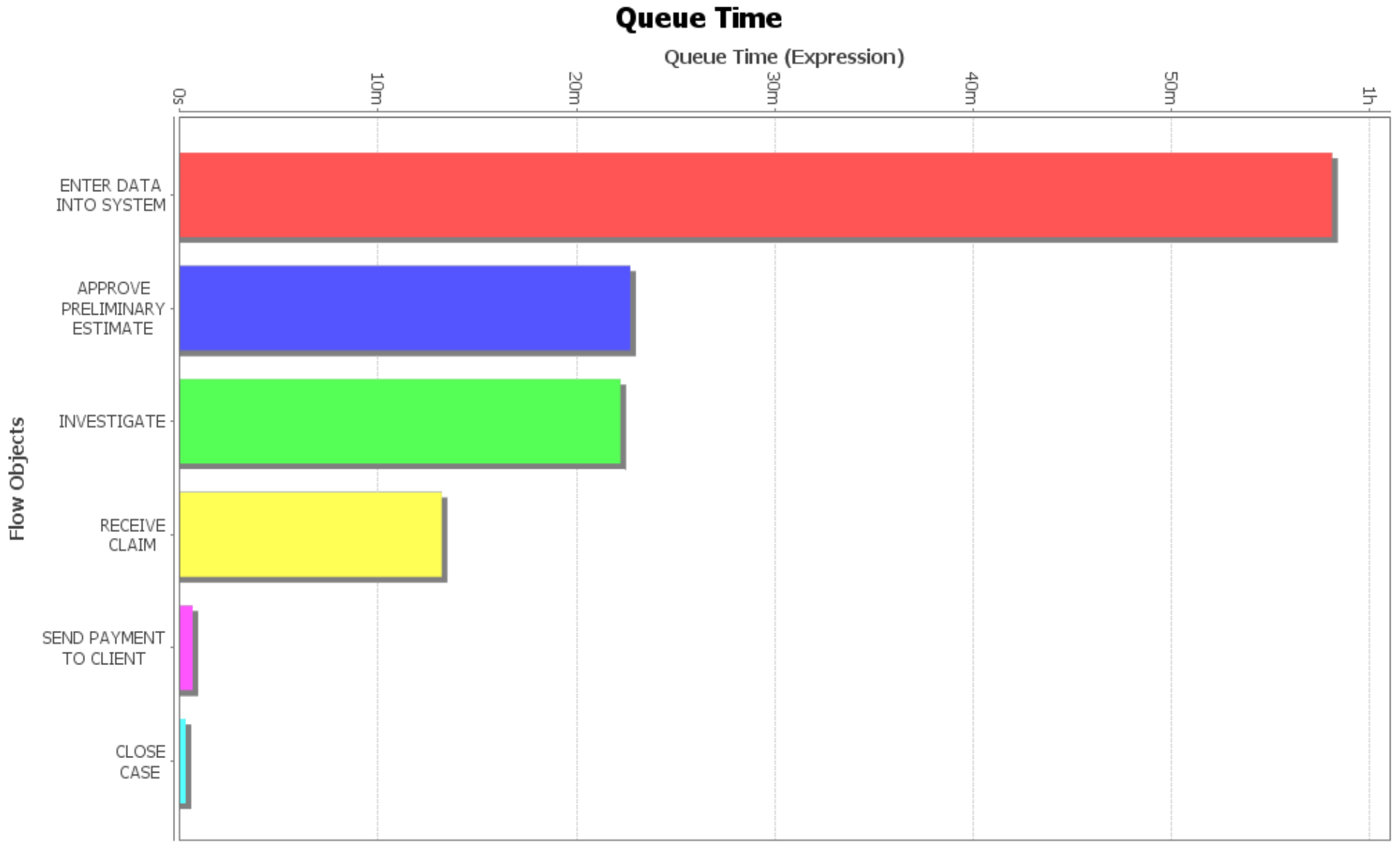


Fig. 4 – Queue Time with (9, 20, 20, 20, 20) instances

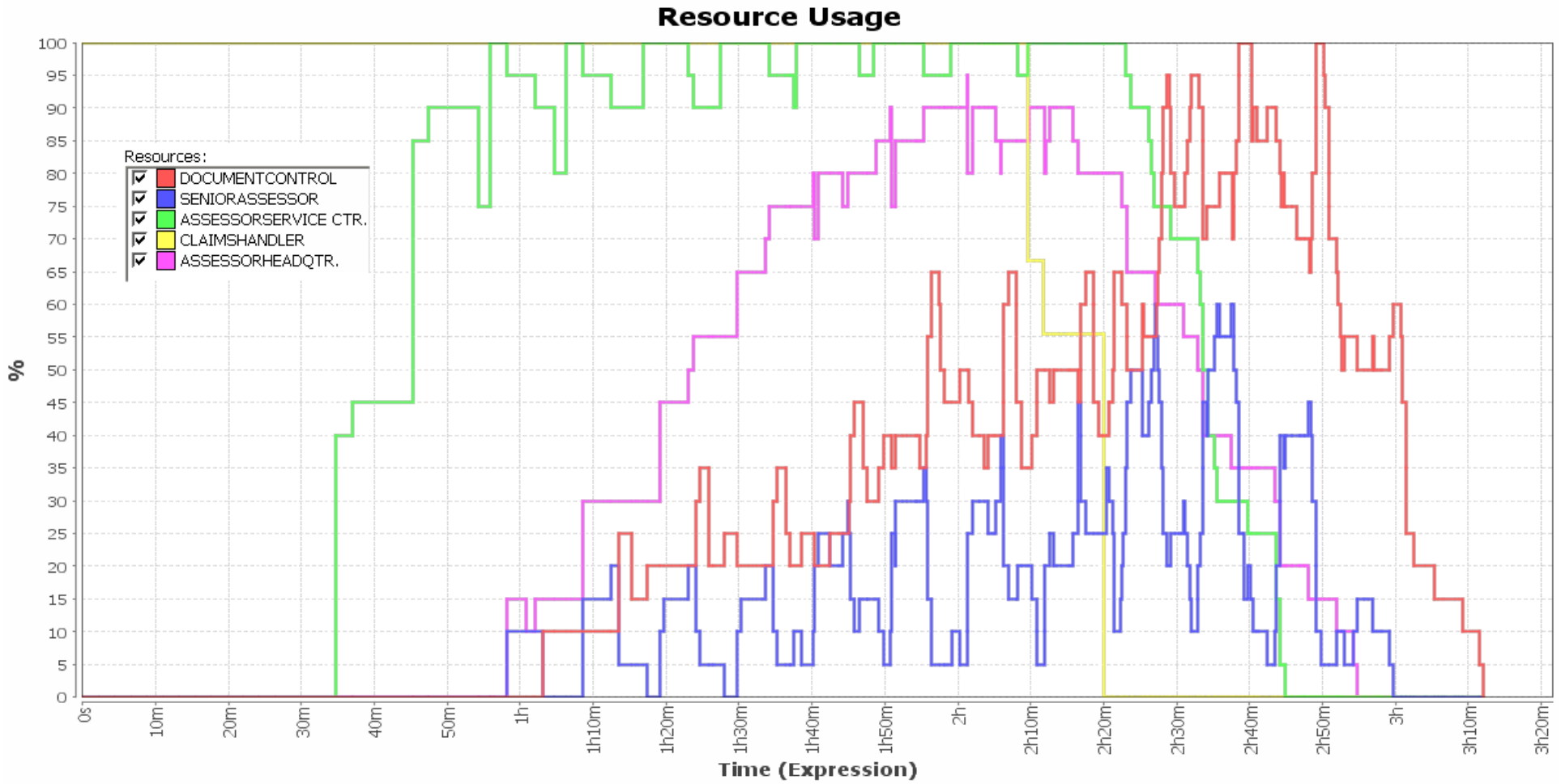


Fig. 5 – Resource usage with (9, 20, 20, 20, 20) instances

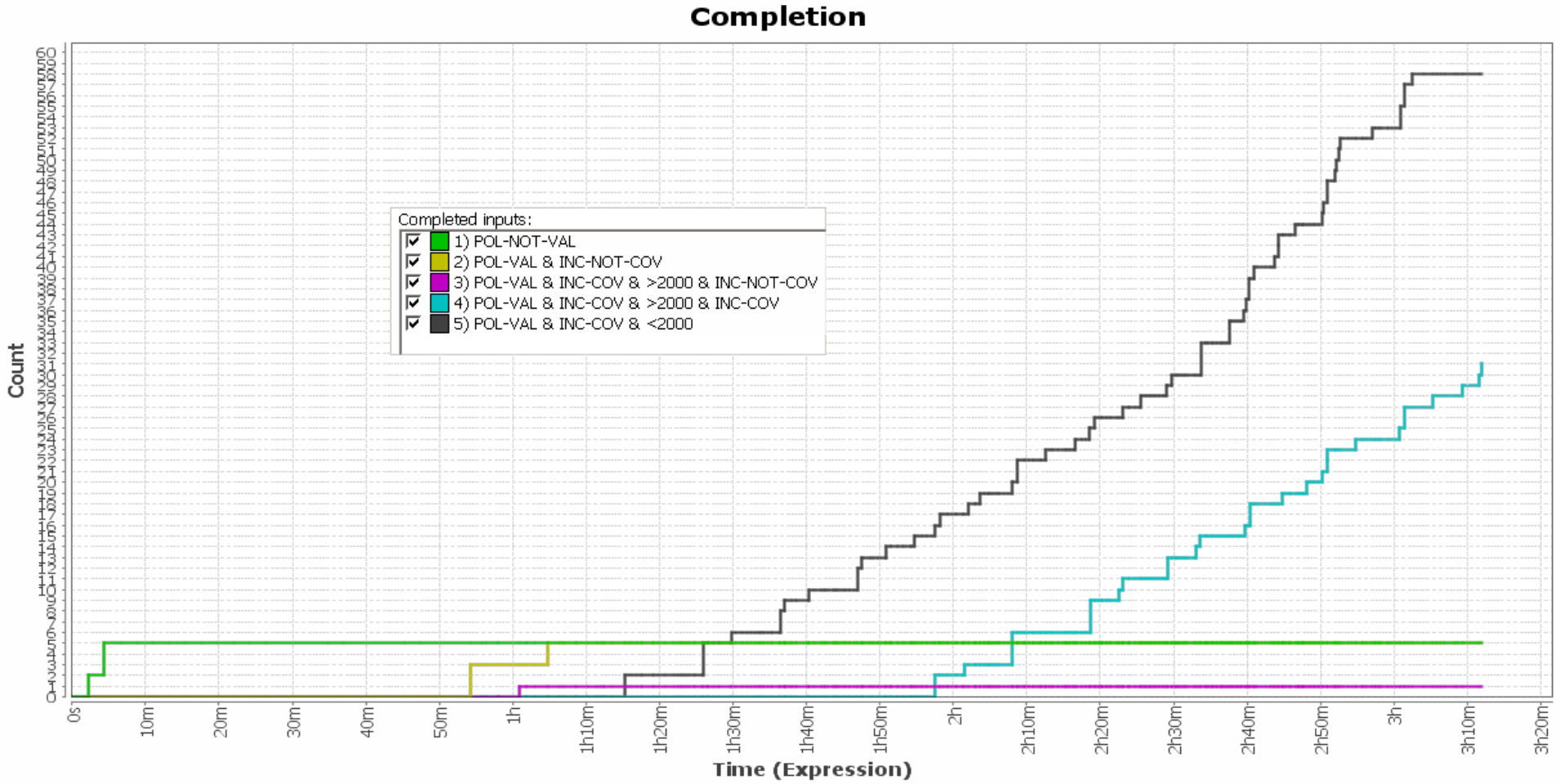


Fig. 6 – Completion Time with (9, 20, 20, 20, 20) instances

Note that scenarios 4 and 5 (the most relevant in terms of tokens) can be carried out in parallel: both scenarios can increase the completed instances.

- The activities included in the IV lane (Senior Assessor) do not produce significant queues and the maximum resource usage is 55-60% (Fig.5). Thus, we can reduce the available instances without effects on the total duration:

Instances	19,…,**6**	5
Duration	**3:11:59**	3:15:53

- **Fourth lane => 6 instances** (9, 20, 20, 6, 20).
- Similarly, the maximum resource usage of the III lane (Assessor Headqtr) is about 90% (Fig.5). Thus, we can reduce the available instances without effects on the total duration:

Instances	19,**18**	17
Duration	**3:11:59**	3:13:05

Third lane => 18 instances (9, 20, 18, 6, 20).

- Again, the maximum resource usage of the V lane (Document Control) is about 85% (Fig.5). Thus, we can reduce the available instances without effects on the total duration:

Instances	**19,..16**	15
Duration	**3:11:59**	3:12:36

- **Fifth lane => 16 instances** (9, 20, 18, 6, 16). Total duration **3:11:59**

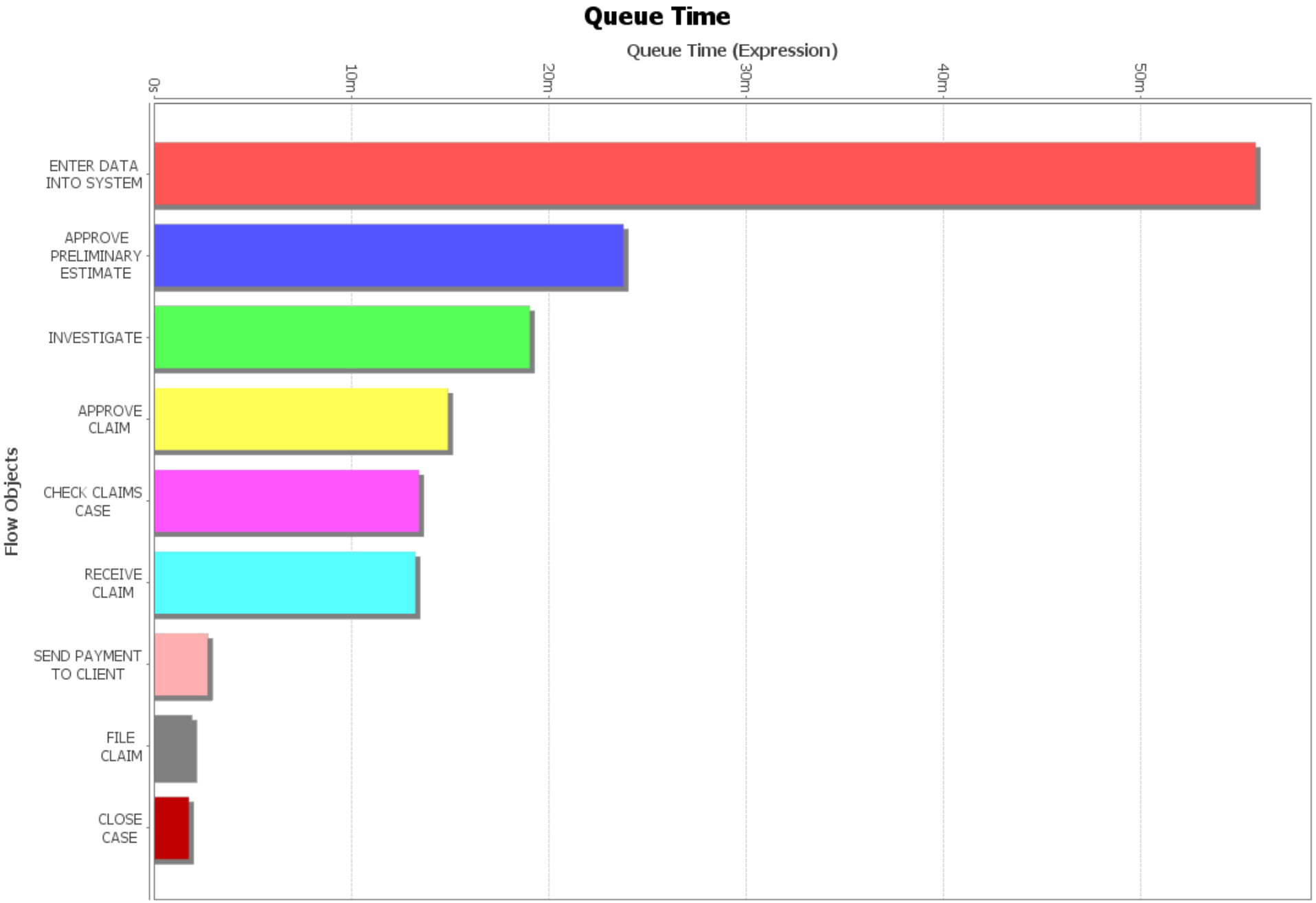


Fig. 7 – Queue Time with (9, 20, 18, 6, 16) = 69 instances

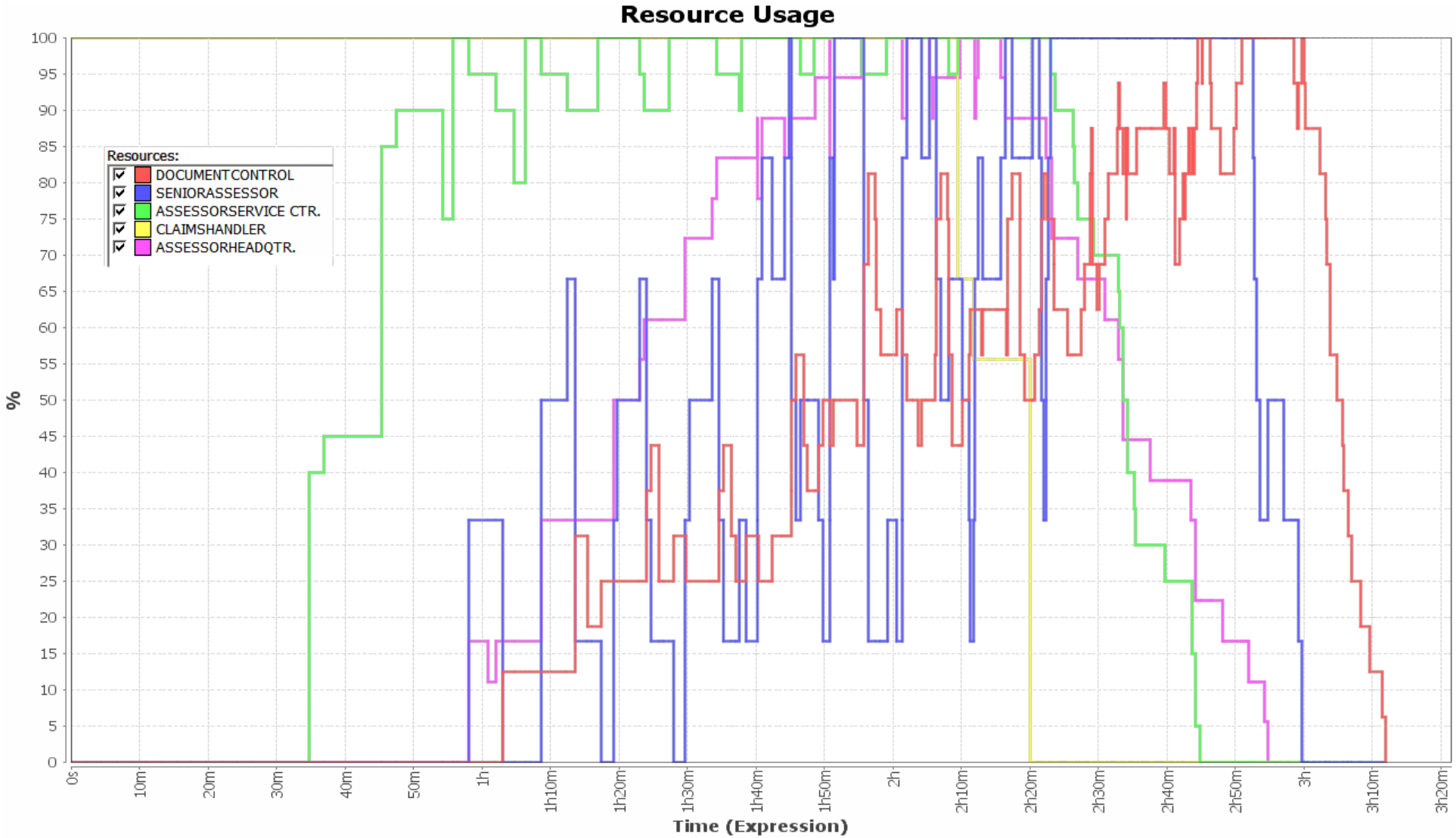


Fig. 8 – Resource usage with (9, 20, 18, 6, 16) = 69 instances

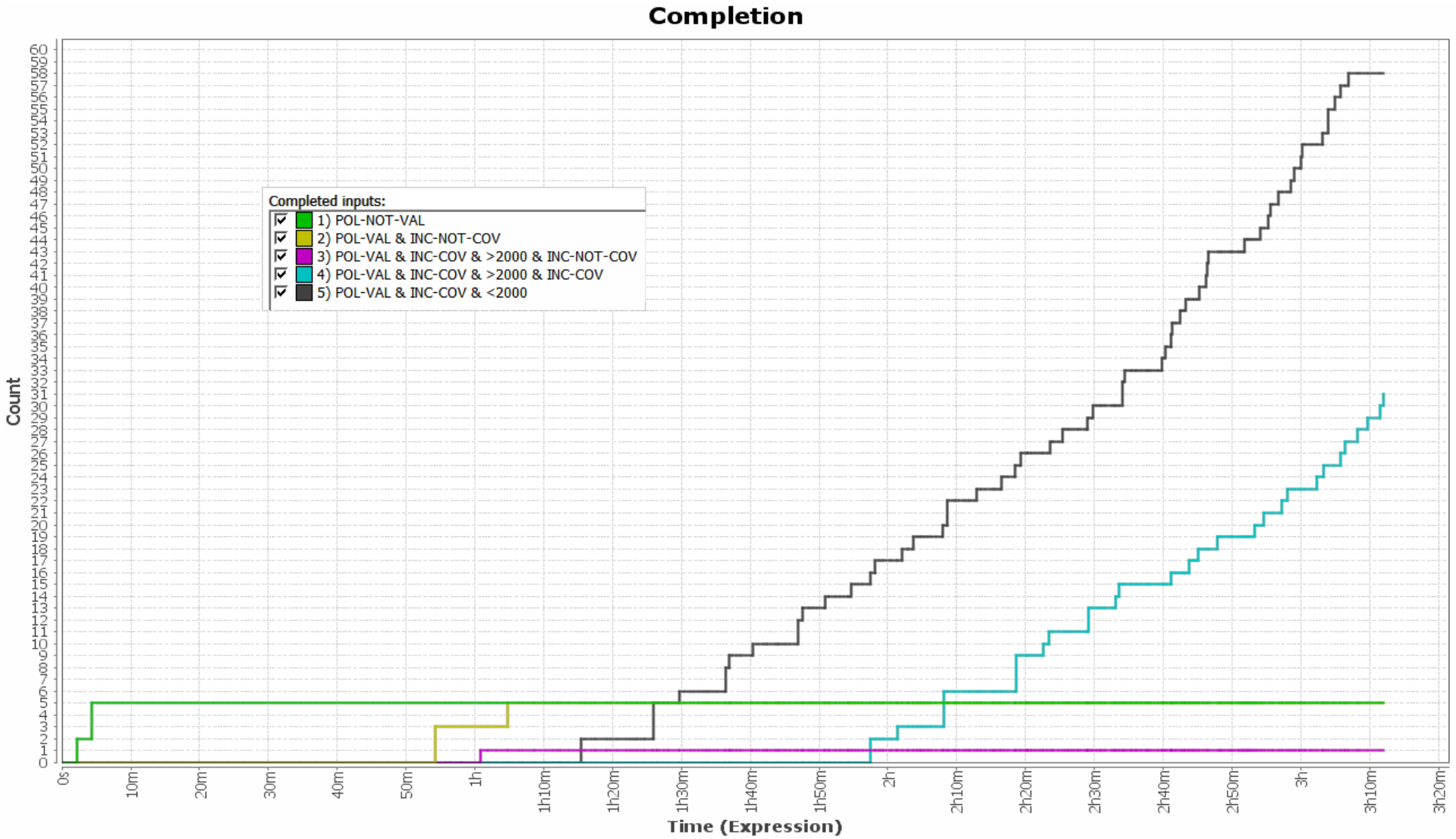


Fig. 9 – Completion Time with (9, 20, 18, 6, 16) = 69 instances

- Compare the **parameters sensitivity**, i.e., the outcome variation with respect to the unit variation of the parameter. Starting from (9, 20, 18, 6, 16), decrease a resource by one unit and assess the total duration.

Resources	**Total Duration**	**Difference w.r.t 3:11:59 (192m)**
(**8**, 20, 18, 6, 16)	3:24:01	+12:02 => NO (more than 200m)
(9, **19**, 18, 6, 16)	3:22:05	+10:06 => NO "
(9, 20, **17**, 6, 16)	3:13:05	+01:06 => YES (less than 200m)
(9, 20, 18, **5**, 16)	3:16:12	+04:13 => YES "
(9, 20, 18, 6, **15**)	3:12:36	+00:37 => YES "