

Developer Days

Automation

Commit

Queues, Nano
Services, and
LSA

Performance Focus

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Software Engineering Technical Leader

2023-12-05

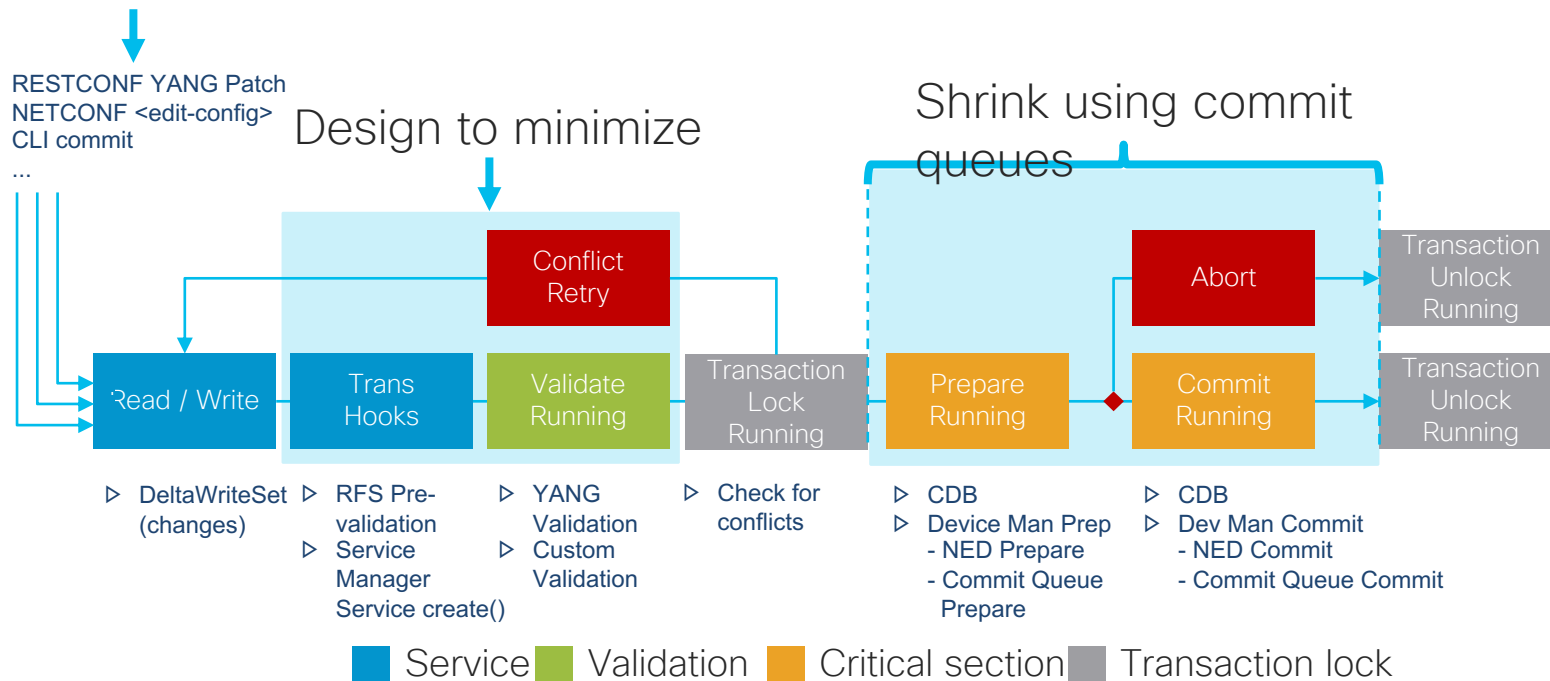


The bridge to possible

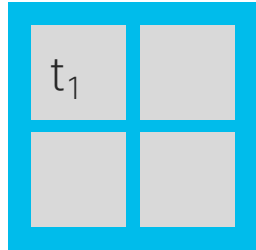


NSO 6.x Transaction Performance

Concurrent transactions



NSO 6.x Transaction Concurrency

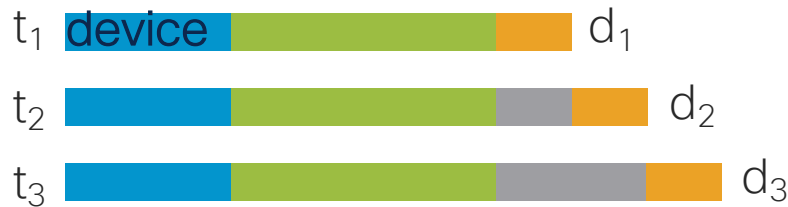
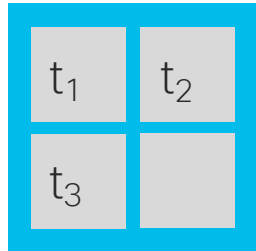


One transaction to all devices (network elements)



Simple option if wall-clock performance and transaction throughput is not a concern

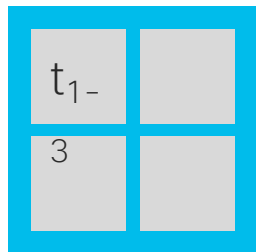
One transaction per



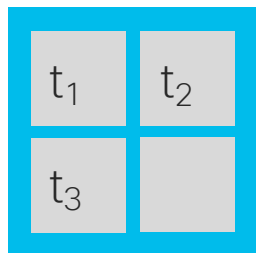
time

Multi-core processor Service Validation Critical section Transaction lock wait

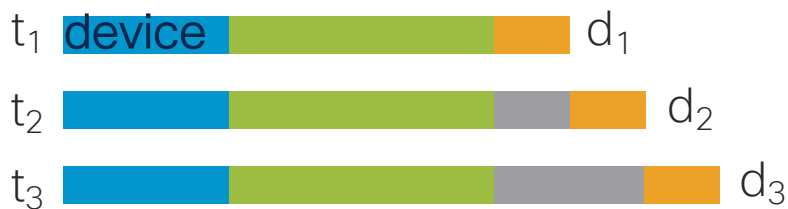
NSO 6.x Transaction Concurrency



One CPU core for all



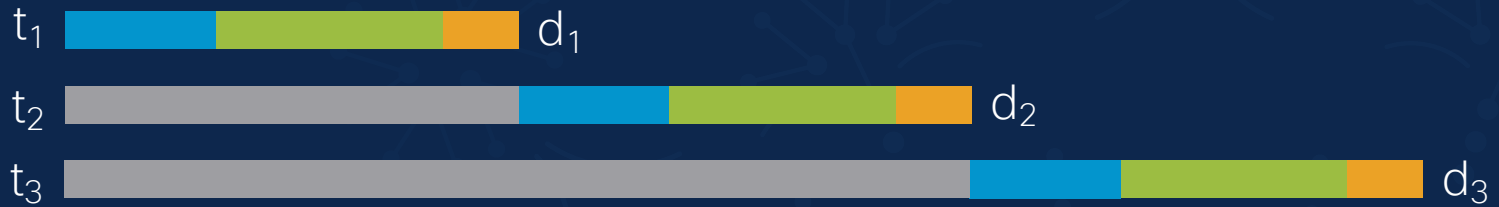
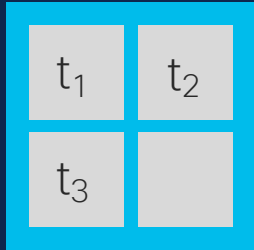
One transaction per core and



time

Multi-core processor Service Validation Critical section Transaction lock wait

NSO <= 5.x Transaction Sequential



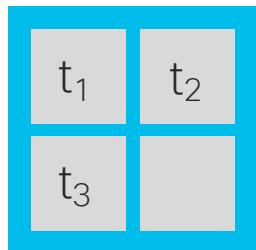
No concurrent:

- Service creation or validation
- Commit dry-run or service check-sync

time →

Multi-core processor Service Validation Critical section Transaction lock wait

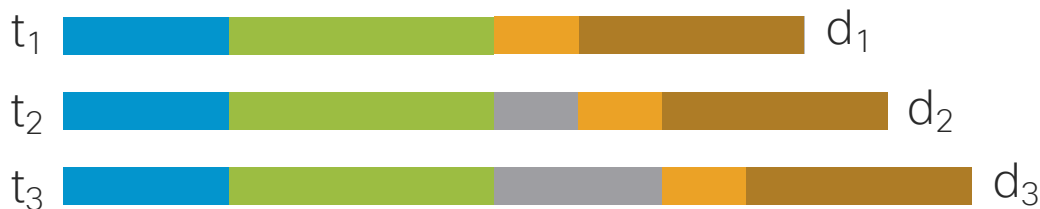
Commit Queues – Transaction Performance Use Case



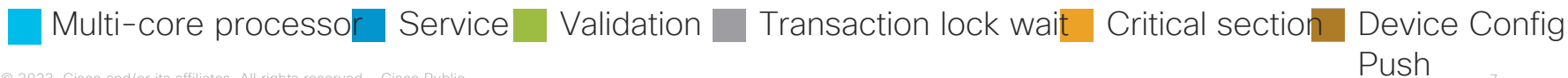
No commit queues



Commit queues



time



Progress trace with two transactions

Progress Trace logs/t3-oIrcv50.csv

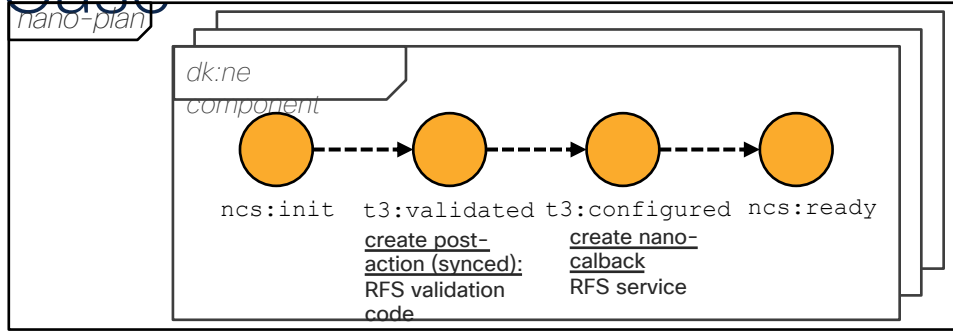
Trace ID	Event [Transaction ID]	Duration	Span 7466.824 ms
b1d7ba520e9c	restconf edit 93	7424.986	
cc9303c6d177	restconf edit 94	7421.469	
cc9303c6d177	applying transaction 94	6320.241	
cc9303c6d177	waiting to apply 94	0.070	
b1d7ba520e9c	applying transaction 93	6342.100	
b1d7ba520e9c	waiting to apply 93	0.039	
cc9303c6d177	validate 94	6300.262	
cc9303c6d177	creating rollback checkpoint 94	0.096	
b1d7ba520e9c	validate 93	6325.537	
b1d7ba520e9c	creating rollback checkpoint 93	0.097	
cc9303c6d177	creating rollback file 94	1.621	
b1d7ba520e9c	creating rollback file 93	2.108	
cc9303c6d177	creating pre-transform checkpoint 94	0.067	
cc9303c6d177	run pre-transform validation 94	0.380	
b1d7ba520e9c	creating pre-transform checkpoint 93	0.108	
cc9303c6d177	creating transform checkpoint 94	0.111	
b1d7ba520e9c	run pre-transform validation 93	0.308	
cc9303c6d177	run transforms and transaction hooks 94	3146.149	
b1d7ba520e9c	creating transform checkpoint 93	0.088	
b1d7ba520e9c	run transforms and transaction hooks 93	3145.844	
cc9303c6d177	taking service write lock 94	0.045	
cc9303c6d177	holding service write lock 94	6316.518	
b1d7ba520e9c	taking service write lock 93	0.054	
b1d7ba520e9c	holding service write lock 93	6338.204	
cc9303c6d177	creating service 94	3144.581	
b1d7ba520e9c	creating service 93	3144.480	
cc9303c6d177	creating validation checkpoint 94	0.119	
b1d7ba520e9c	creating validation checkpoint 93	0.088	
cc9303c6d177	mark inactive 94	0.189	
b1d7ba520e9c	mark inactive 93	0.188	
cc9303c6d177	pre validate 94	0.227	
b1d7ba520e9c	pre validate 93	0.252	
cc9303c6d177	run validation over the changeset 94	3147.652	
b1d7ba520e9c	run validation over the changeset 93	3149.172	
cc9303c6d177	run dependency-triggered validation 94	0.655	
cc9303c6d177	check configuration policies 94	0.218	
cc9303c6d177	check for read-write conflicts 94	0.075	
b1d7ba520e9c	run dependency-triggered validation 93	0.267	
cc9303c6d177	taking transaction lock 94	0.103	
cc9303c6d177	holding transaction lock 94	20.825	
b1d7ba520e9c	check configuration policies 93	0.146	
cc9303c6d177	check for read-write conflicts 94	0.117	
b1d7ba520e9c	check for read-write conflicts 93	0.076	
cc9303c6d177	applying service meta-data 94	0.555	
b1d7ba520e9c	taking transaction lock 93	25.238	
cc9303c6d177	write-start 94	1.509	
cc9303c6d177	match subscribers 94	0.046	
cc9303c6d177	create pre commit running 94	0.081	
cc9303c6d177	write changeset 94	0.191	
cc9303c6d177	check data kickers 94	0.049	
cc9303c6d177	prepare 94	6.284	
cc9303c6d177	commit 94	11.919	
cc9303c6d177	switch to new running 94	1.210	
cc9303c6d177	commit through queue	1097.882	
cc9303c6d177	commit queue item waiting	0.398	
cc9303c6d177	commit queue item executing	1097.382	
b1d7ba520e9c	holding transaction lock 93	16.896	
b1d7ba520e9c	check for read-write conflicts 93	0.066	
b1d7ba520e9c	applying service meta-data 93	0.264	
b1d7ba520e9c	write-start 93	1.537	
b1d7ba520e9c	match subscribers 93	0.039	
b1d7ba520e9c	create pre commit running 93	0.080	
b1d7ba520e9c	write changeset 93	0.179	
b1d7ba520e9c	check data kickers 93	0.054	
b1d7ba520e9c	prepare 93	6.242	
cc9303c6d177	push configuration	1083.585	
b1d7ba520e9c	commit 93	8.475	
b1d7ba520e9c	switch to new running 93	1.384	
b1d7ba520e9c	commit through queue	1082.021	
b1d7ba520e9c	commit queue item waiting	0.328	
b1d7ba520e9c	commit queue item executing	1081.545	
b1d7ba520e9c	push configuration	1067.645	

Progress trace with a single transaction

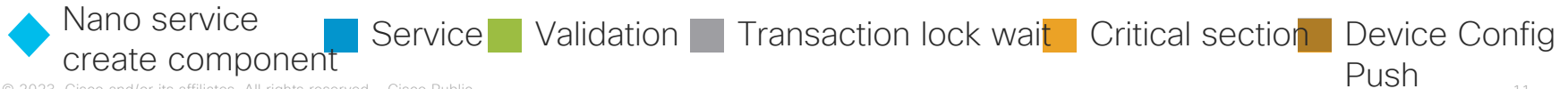
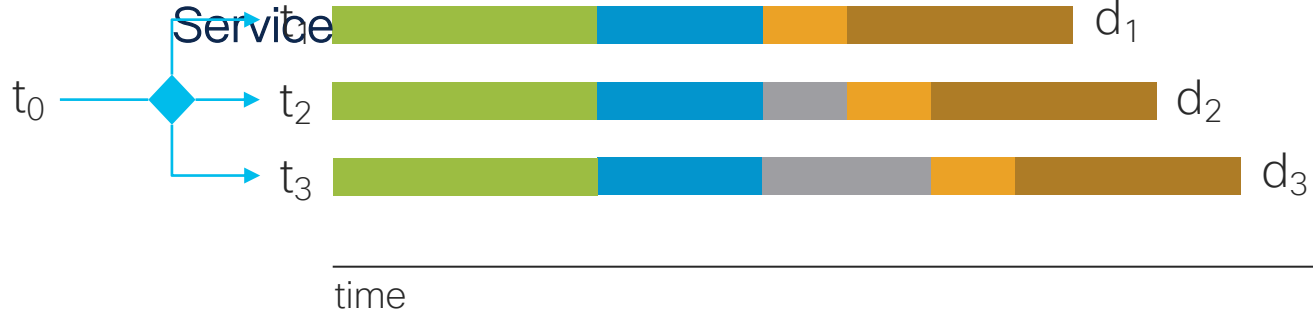
Progress Trace logs/t3-EJL9IA.csv

Trace ID	Event [Transaction ID]	Duration	Span 13485.411 ms
20dd9b6d7620	restconf edit 391	13443.592	
20dd9b6d7620	applying transaction 391	13442.546	
20dd9b6d7620	waiting to apply 391	0.055	
20dd9b6d7620	validate 391	12312.309	
20dd9b6d7620	creating rollback checkpoint 391	0.078	
20dd9b6d7620	creating rollback file 391	1.232	
20dd9b6d7620	creating pre-transform checkpoint 391	0.062	
20dd9b6d7620	run pre-transform validation 391	0.259	
20dd9b6d7620	creating transform checkpoint 391	0.060	
20dd9b6d7620	run transforms and transaction hooks 391	6158.611	
20dd9b6d7620	taking service write lock 391	0.043	
20dd9b6d7620	holding service write lock 391	13439.739	
20dd9b6d7620	modifying service 391	6157.484	
20dd9b6d7620	evaluate delayed when expressions 391	0.079	
20dd9b6d7620	creating validation checkpoint 391	0.179	
20dd9b6d7620	mark inactive 391	0.213	
20dd9b6d7620	pre validate 391	0.249	
20dd9b6d7620	run validation over the changeset 391	6148.849	
20dd9b6d7620	run dependency-triggered validation 391	0.308	
20dd9b6d7620	check configuration policies 391	0.087	
20dd9b6d7620	check for read-write conflicts 391	0.064	
20dd9b6d7620	taking transaction lock 391	0.080	
20dd9b6d7620	holding transaction lock 391	1130.777	
20dd9b6d7620	check for read-write conflicts 391	0.079	
20dd9b6d7620	applying service meta-data 391	0.446	
20dd9b6d7620	write-start 391	1.737	
20dd9b6d7620	match subscribers 391	0.047	
20dd9b6d7620	create pre commit running 391	0.197	
20dd9b6d7620	write changeset 391	0.190	
20dd9b6d7620	check data kickers 391	0.035	
20dd9b6d7620	prepare 391	1086.009	
20dd9b6d7620	push configuration 391	1083.604	
20dd9b6d7620	push configuration 391	1082.423	
20dd9b6d7620	commit 391	42.033	
20dd9b6d7620	switch to new running 391	3.050	

Nano Services – Transaction Performance Use Case

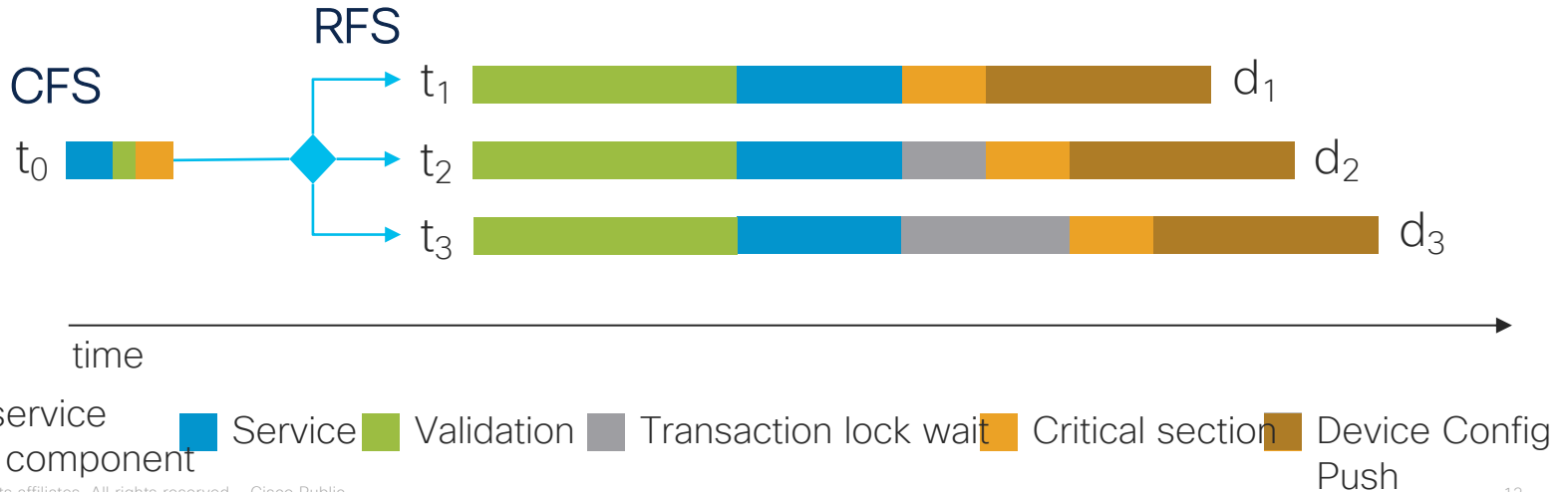


Resource Facing Nano

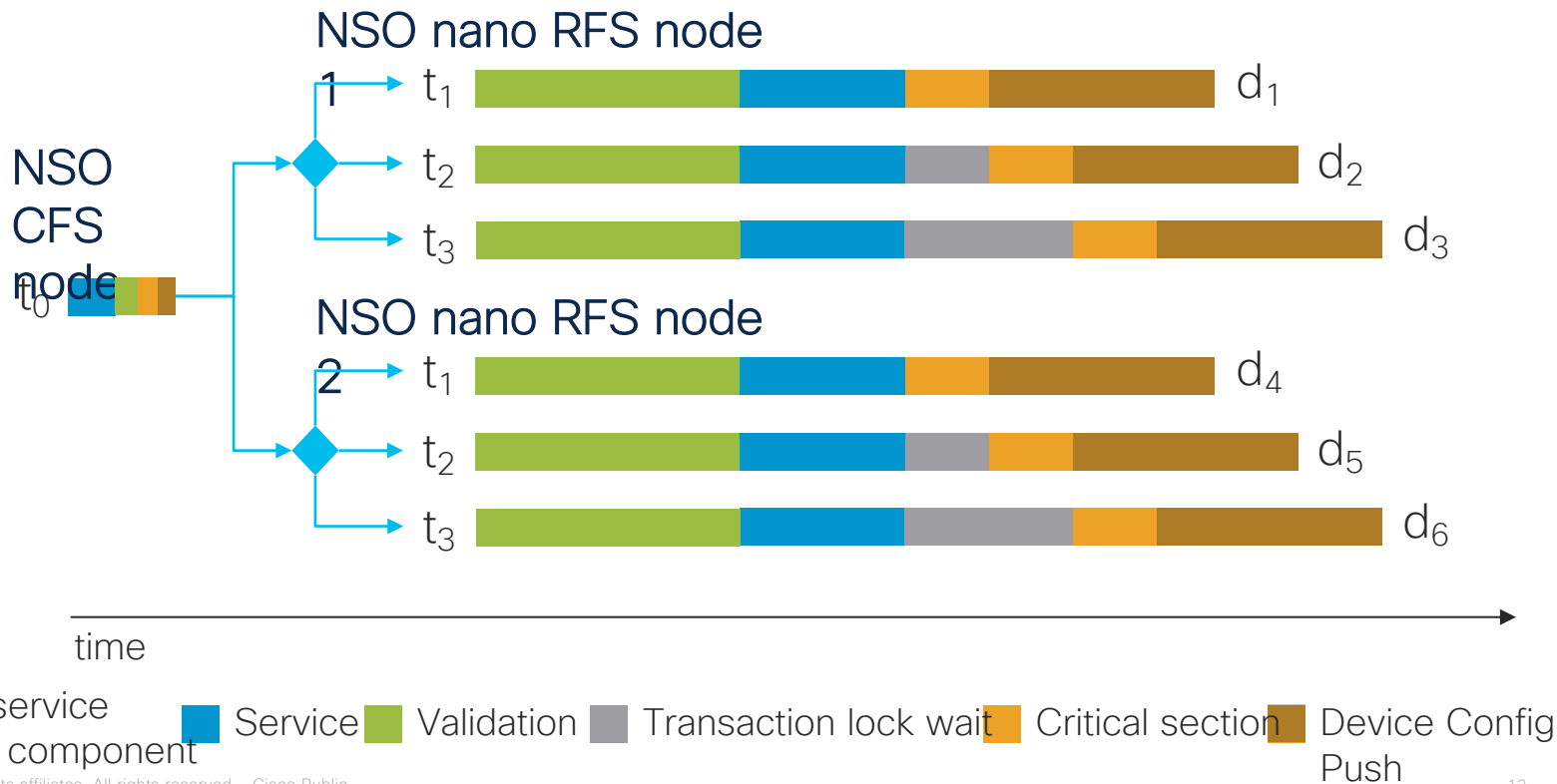


Stacked Service – Transaction Performance Use Case

NSO node



Layered Service – Transaction Performance Use Case



Further Learning

- Workshop Thursday December 7
 - **Service design and test for performance**
- NSO example set:
 - `examples.ncs/development-guide/concurrency-model`
 - `perf-trans`, `perf-stack`, `perf-lsa` examples
 - <https://developer.cisco.com/codeexchange/github/repo/CiscoDevNet/NSO-Playground-Local-Install/>
- NSO Development Guide chapters:
 - Scaling and Performance Optimization
 - NSO Concurrency Model
- NSO User Guide chapter:
 - The NSO Device Manager: Commit Queue
- NSO Layered Service Architecture Guide



The bridge to possible