Transpiler: `for_loop` (even with static loops) cannot be (directly) transpiled #10501

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Closed **ANONYMOUS AUTHOR** opened this issue 5 days ago · 2 comments

ANONYMOUS AUTHOR commented 5 days ago

Environment

- **Qiskit Terra version**: 0.43.1 meta package, terra 0.24.1
- **Python version**: 3.10
- **Operating system**: docker continuumio/miniconda3

What is happening?

Transpiling a circuit with a `for_loop` (with statically known amount of loops) as described here leads to a an error: `qiskit.transpiler.exceptions.TranspilerError: "The control-flow construct 'for_loop' is not supported by the backend."` error.

How can we reproduce the issue?

Run this python script:

```
from qiskit import QuantumCircuit
qc = QuantumCircuit(2)
with qc.for_loop(range(10)):
    qc.h(qc.qubits)
print(qc.draw())

from qiskit import transpile, Aer, execute
transpile(qc, optimization_level=0)
```

Produces this output and error:

```
     ┌─────────────┐
q_0: ┤0            ├
     │  For_loop   │
q_1: ┤1            ├
     └─────────────┘
Traceback (most recent call last):
  File "myfile.py", line 8, in <module>
    execute(qc, Aer.get_backend('qasm_simulator')).result().get_counts()
  File "...qiskit/utils/deprecation.py", line 182, in wrapper
    return func(*args, **kwargs)
  File "...qiskit/utils/deprecation.py", line 182, in wrapper
    return func(*args, **kwargs)
  File "...qiskit/execute_function.py", line 302, in execute
    experiments = transpile(
  File "...qiskit/compiler/transpiler.py", line 380, in transpile
    _serial_transpile_circuit(
  File "...qiskit/compiler/transpiler.py", line 462, in _serial_transpile_circuit
    result = pass_manager.run(circuit, callback=callback, output_name=output_name)
  File "...qiskit/transpiler/passmanager.py", line 537, in run
    return super().run(circuits, output_name, callback)
  File "...qiskit/transpiler/passmanager.py", line 231, in run
    return self._run_single_circuit(circuits, output_name, callback)
  File "...qiskit/transpiler/passmanager.py", line 292, in _run_single_circuit
    result = running_passmanager.run(circuit, output_name=output_name, callback=callback)
  File "...qiskit/transpiler/runningpassmanager.py", line 125, in run
    dag = self._do_pass(pass_, dag, passset.options)
  File "...qiskit/transpiler/runningpassmanager.py", line 173, in _do_pass
    dag = self._run_this_pass(pass_, dag)
  File "...qiskit/transpiler/runningpassmanager.py", line 227, in _run_this_pass
    pass_.run(FencedDAGCircuit(dag))
  File "...qiskit/transpiler/passes/utils/error.py", line 62, in run
    raise TranspilerError(msg)
qiskit.transpiler.exceptions.TranspilerError: "The control-flow construct 'for_loop' is not supported by the ba
```

The variant where I manually unroll the loop works fine.

```
# ...
from qiskit.transpiler.passes import UnrollForLoops
qc_unroll = UnrollForLoops()(qc)
res = transpile(qc_unroll, optimization_level=0)
print(res.draw())
```

Assignees
No one assigned

Labels
bug

Projects
None yet

Milestone
No milestone

Development
No branches or pull requests

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Output:

```
     ┌─────────────┐
q_0: ┤0            ├
     │  For_loop   │
q_1: ┤1            ├
     └─────────────┘

     ┌───┐┌───┐┌───┐┌───┐┌───┐┌───┐┌───┐┌───┐┌───┐┌───┐
q_0: ┤ H ├┤ H ├┤ H ├┤ H ├┤ H ├┤ H ├┤ H ├┤ H ├┤ H ├┤ H ├
     ├───┤├───┤├───┤├───┤├───┤├───┤├───┤├───┤├───┤├───┤
q_1: ┤ H ├┤ H ├┤ H ├┤ H ├┤ H ├┤ H ├┤ H ├┤ H ├┤ H ├┤ H ├
     └───┘└───┘└───┘└───┘└───┘└───┘└───┘└───┘└───┘└───┘
```

Wheras, assigning a backend does not remove the error:

```
transpile(qc, optimization_level=0, backend=Aer.get_backend('qasm_simulator'))
```

Changing the optimization level to 2 or 3, gives another similar but different message, so here the limitation seems to be the optimizer rather than the backend:

```
qiskit.transpiler.exceptions.TranspilerError: 'The optimizations in optimization_level=2 do not yet support con

### What should happen?

I would have expected the transpiler to unroll the loop automatically if the amount of loops is statically know

### Any suggestions?

If I understood it correctly, even to simulate a circuit with a `for_loop` with static number of loops, the loo
Perhaps, adding this pass to the `transpile` function would be enough, since accoriding to the documentation:

https://github.com/Qiskit/qiskit-terra/blob/07b06f9a0d27c2c09bea608a22df1ab8f169d686/qiskit/transpiler/passes/u
```

+ Add tasklist

ANONYMOUS AUTHOR added the bug label 5 days ago

jakelishman commented 5 days ago — Member

Not a bug: please read the error messages here.

jakelishman closed this as completed 5 days ago

jakelishman commented 5 days ago — Member

We aren't doing arbitrary classical optimisations within Terra - a backend needs to support `for` loops in general for transpilation to them to succeed. They *then* may choose to unroll the loops, but that's not our responsibility. O2 and O3 don't support control-flow ops in Terra 0.24 but will in 0.25.

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