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Title: A universal Turing machine can run on a cluster of Colossi.
Author: Benjamin Wells

Abstract:
Colossus, the first electronic digital computer, was not a stored-program general purpose computer in the modern sense, although there are printed claims to the contrary. At least one of these asserts Colossus was a Turing machine. Certainly, an appropriate Turing machine can simulate the operation of Colossus. That is hardly an argument for generality of computation. But this is: a universal Turing machine (UTM) could have been implemented on a clustering of the ten Colossus machines installed at Bletchley Park, England, by the end of WWII in 1945. The hardware modifications required to link the machines and control a paper tape reader-punch device are straightforward and could have been performed routinely at the time. We can conveniently base our UTM on Watanabe's 5-state, 4-symbol, 18-quintuple machine [1]. The tape does not support erasing, so a tape controller, about 7 times larger than the UTM code proper, copies and updates the just-used part of the tape onto the blank tail at each Watanabe cycle. Technical results concern signaling and representation on the tape, multitype TMs, and ring mapping. New research seeks to optimize speed and cluster size, and to implement this UTM on Colossus simulators.

[1] http://www.ipsj.or.jp/members/Magazine/Eng/1309/article002.html