Multiple Forking: Deconstructed, Unified

Sanjit Chatterjee and Chethan Kamath

Indian Institute of Science, Bangalore

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Elementary Forking (1 RO, 1 Fork)
Elementary Forking (1 RO, 1 Fork)

\[ \text{Cost: } O(q) \]
Elementary Forking (1 RO, 1 Fork)

Cost: $O(q)$
Multiple Forking (2 ROs, 1 Fork)
Multiple Forking (2 ROs, 1 Fork)

Cost: $O(q^2)$
Multiple Forking (2 ROs, 1 Fork)

Cost: $O(q^2)$
Multiple Forking (2 ROs, 1 Fork)

Cost: $O(q^2)$
Multiple Forking (2 ROs, \( n \) Forks)

Cost: \( O(q^2 n) \)
Cost: $O(q^{2n})$
Applications

1. Proxy Signatures [BPW12]
2. Identity-Based Signatures [GG09]
3. ZK Arguments [CMW13]
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Can we improve on $O(q^{2n})$?
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Can we improve on $O(q^{2n})$?

Reduction to $O(q^n)$
Observation 1: Index Independence
Observation 1: Index Independence
Observation 2: R-O Dependence
Observation 2: R-O Dependence

“R-O binding”
Result

Index Independence + RO Dependence

Cost per fork: down from $O(q^2)$ to $O(q)$
Total cost: down from $O(q^{2n})$ to $O(q^n)$
Result

Index Independence + RO Dependence

Cost per fork: down from $O(q^2)$ to $O(q)$
Total cost: down from $O(q^{2n})$ to $O(q^n)$

Optimal, can be extended to arbitrary $r$ ROs
Unified Model for Multiple Forking
Thank you!

What did the annoyed forking algorithm tell the adversary?
Thank you!

What did the annoyed forking algorithm tell the adversary?

Fork you.
Thank you!

What did the annoyed forking algorithm tell the adversary?

Fork you.

Well, let me get my coat.