

OPTIMASI PERFORMA WEBSITE PADA WEB PASAR HASIL BUMI MENGUNAKAN ALGORITMA *GRAPH PRUNING* DAN *LIST VIRTUALIZATION*

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ABSTRAK

Transformasi digital pada sektor pertanian melalui platform "Pasar Hasil Bumi" menghadapi kendala infrastruktur, di mana perangkat admin Kelompok Wanita Tani (KWT) umumnya memiliki spesifikasi komputasi rendah. Manipulasi data inventaris dalam jumlah besar (>1000 entitas) pada framework Next.js standar membebani *Main Thread* peramban akibat mekanisme reconciliation dengan kompleksitas linear $O(N)$, menyebabkan tingginya *Total Blocking Time* (TBT) dan *Interaction to Next Paint* (INP) yang memicu minimnya interaktivitas pada setiap interaksi. Untuk mengatasi masalah skalabilitas rendering tersebut, penelitian ini mengimplementasikan algoritma *List Virtualization* melalui teknik *Windowing* untuk membatasi node DOM aktif berdasarkan koordinat visual, serta algoritma *Graph Pruning* melalui teknik *Memoization* untuk memangkas jalur re-render komponen yang redundan. Efektivitas kedua algoritma dievaluasi menggunakan metode eksperimental secara langsung (on-device testing) pada lingkungan perangkat keras low-end (Intel Core i3 Gen 10) dengan membandingkan empat skenario arsitektur. Hasil pengujian menunjukkan bahwa *List Virtualization* secara dominan menurunkan TBT dari 1175.5 ms (*Baseline*) menjadi 697.25 ms, mengubah kompleksitas rendering menjadi konstan relatif terhadap layar. Sementara itu, *Graph Pruning* terbukti efektif menurunkan latensi pada interaksi lokal, namun menimbulkan overhead memori jika diterapkan secara tunggal pada pemuatan awal. Skenario Gabungan terbukti menjadi solusi paling optimal, menghasilkan latensi interaksi terendah serta meningkatkan skor System Usability Scale (SUS) secara signifikan dari kategori Poor menjadi Excellent.

Kata Kunci: *List Virtualization*, *Graph Pruning*, Optimasi Performa Web, *Core Web Vitals*, Next.js

**WEBSITE PERFORMANCE OPTIMIZATION ON "PASAR HASIL BUMI"
WEB USING GRAPH PRUNING AND LIST VIRTUALIZATION
ALGORITHMS**

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ABSTRACT

Digital transformation in the agriculture sector through the "Pasar Hasil Bumi" platform faces infrastructure constraints, where the devices used by the Women Farmers Group (Kelompok Wanita Tani or KWT) admins generally have low computational specifications. Large-scale inventory data manipulation (>1000 entities) on the standard Next.js framework burdens the browser's Main Thread due to the reconciliation mechanism with linear complexity $O(N)$, causing high Total Blocking Time (TBT) and Interaction to Next Paint (INP), which triggers minimal interactivity during interactions. To address these rendering scalability issues, this research implements the List Virtualization algorithm through List Virtualization techniques to limit active DOM nodes based on visual coordinates, and the Graph Pruning algorithm through Memoization techniques to prune redundant component re-render paths. The effectiveness of both algorithms was evaluated using an experimental method on an actual low-end device environment (Intel Core i3 10th Gen) by comparing four architectural scenarios. Test results showed that List Virtualization predominantly reduced TBT from 1175.5 ms (Baseline) to 697.25 ms, changing the rendering complexity to be constant relative to the viewport. Meanwhile, Graph Pruning proved effective in reducing latency in local interactions but caused memory overhead if applied individually during the initial load. The Combined Scenario proved to be the most optimal solution, yielding the lowest interaction latency and significantly improving the System Usability Scale (SUS) score from the Poor to Excellent category.

Keywords: *List Virtualization, Graph Pruning, Web Performance Optimization, Core Web Vitals, Next.js*