

DAFTAR ISI

HALAMAN SAMPUL	i
HALAMAN PERSETUJUAN	iii
HALAMAN PENGESAHAN TESIS.....	iv
PERNYATAAN BEBAS PLAGIASI	v
PRAKATA.....	vi
DAFTAR ISI	viii
DAFTAR GAMBAR.....	xi
DAFTAR TABEL.....	xiv
INTISARI	xv
ABSTRACT.....	xvi
BAB I PENDAHULUAN	1
1.1 Latar Belakang Masalah	1
1.2 Rumusan Masalah	3
1.3 Batasan Masalah.....	3
1.4 Tujuan Penelitian.....	3
1.5 Manfaat Penelitian.....	3
BAB II TINJAUAN PUSTAKA.....	4
BAB III LANDASAN TEORI	9
3.1 <i>Distributed System</i>	9
3.2 <i>Physical Environment</i>	11
3.3 <i>Virtual Environment</i>	12
3.4 <i>Virtual Machine</i>	14
3.5 <i>Cluster Node</i>	15
3.6 <i>Komponen Big Data</i>	16
3.7 <i>Apache Hadoop</i>	18
3.8 <i>MapReduce</i>	20
3.9 <i>Unstructured Data</i>	22
3.10 <i>TestDFSIO</i>	23
	viii

3.11	<i>Genetic Algorithm</i>	24
BAB IV METODOLOGI PENELITIAN		26
4.1	Tahapan Penelitian	26
4.2	Analisis Kebutuhan	27
4.3	Alat dan Bahan	28
4.4	Perancangan Arsitektur Sistem	30
4.5	Proses Distribusi Data	34
4.6	Skenario Pengujian	36
BAB V IMPLEMENTASI		42
5.1	Perangkat Sistem	42
5.1.1	Perangkat Keras	42
5.1.2	Perangkat Lunak	45
5.2	Deskripsi Pengujian	45
5.3	Implementasi Sistem	46
5.3.1	Konfigurasi <i>Physical Environment</i>	46
5.3.2	Konfigurasi <i>Virtual Environment</i>	47
5.3.3	Konfigurasi Secure Shell Protocol (SSH)	48
5.3.4	Instalasi <i>Java OpenJDK</i>	50
5.3.5	Konfigurasi Hadoop Multiple Node	51
5.3.6	Konfigurasi <i>Hadoop MapReduce</i>	55
5.3.7	Menjalankan <i>Hadoop MapReduce</i>	58
5.3.8	Mengakses Dashboard Namenode Information	59
5.4	Proses Distribusi Data	60
5.5	Implementasi Metode <i>TestDFSIO</i>	62
BAB VI HASIL DAN PEMBAHASAN		63
6.1	Hasil Pengujian <i>TestDFSIO</i> Pada <i>Physical Environment</i>	63
6.2	Hasil Pengujian <i>TestDFSIO</i> Pada <i>Virtual Environment</i>	70

6.2.1 Hasil Pengujian <i>TestDFSIO</i> Modifikasi <i>GenAL</i> Pada <i>Virtual Environment</i>	77
6.3 Perbandingan Hasil Pengujian	80
BAB VII KESIMPULAN DAN SARAN	87
7.1 Kesimpulan	87
7.2 Saran	88
DAFTAR PUSTAKA	89
LAMPIRAN	92

DAFTAR GAMBAR

Gambar 3.1 <i>Distributed System</i> (Splunk dkk., 2018).....	9
Gambar 3.2 <i>Physical Environment</i> (Rob Bastiaansen, 2021)	11
Gambar 3.3 <i>Virtual Environment</i> (Limantara, 2014).....	12
Gambar 3.4 <i>Virtual Machine</i> (Chandra Henny, 2022).....	14
Gambar 3.5 <i>Cluster Node</i> (Miljković, 2015).....	15
Gambar 3.6 <i>Komponen Big Data</i> (Susanto, 2018)	16
Gambar 3.7 <i>Karakteristik Big Data</i> (Excelsior, 2022).....	17
Gambar 3.8 <i>Ekosistem Hadoop</i> (Susanto, 2018).....	18
Gambar 3.9 <i>MapReduce</i> (Susanto, 2018).....	20
Gambar 3.10 <i>Unstructured Data</i> (Eberendu, 2016).....	22
Gambar 3.11 <i>TestDFSIO</i> (Noll G Michael, 2011).....	23
Gambar 3.12 <i>Genetic Algorithm</i> (Andries P Engelbrecht, 2018).....	24
Gambar 4.1 <i>Tahapan Penelitian</i>	26
Gambar 4.2 <i>Arsitektur Physical Environment</i>	31
Gambar 4.3 <i>Arsitektur Virtual Environment</i>	32
Gambar 4.4 <i>Arsitektur Multiple Node Cluster</i>	33
Gambar 4.5 <i>Distribusi Data</i>	34
Gambar 4.6 <i>Alur Skenario Pengujian</i>	38
Gambar 5.1 <i>Computer Node</i>	42
Gambar 5.2 <i>Switch</i>	43
Gambar 5.3 <i>Server Virtual Machine</i>	44
Gambar 5.4 <i>Physical Environment</i>	46
Gambar 5.5 <i>Virtual Environment</i>	47
Gambar 5.6 <i>Konfigurasi SSH</i>	48
Gambar 5.7 <i>Bashrc</i>	48
Gambar 5.8 <i>Keygen</i>	49
Gambar 5.9 <i>Authorized Keys</i>	49
Gambar 5.10 <i>SSH Localhost</i>	49

Gambar 5.11 <i>Install Java</i>	50
Gambar 5.12 <i>Java Version</i>	50
Gambar 5.13 Unduh <i>Hadoop</i>	51
Gambar 5.14 <i>Hadoop Env</i>	51
Gambar 5.15 Konfigurasi <i>Java</i>	51
Gambar 5.16 Konfigurasi <i>Environment OS</i>	52
Gambar 5.17 Konfigurasi <i>Environment</i>	52
Gambar 5.18 Verifikasi <i>IP Address</i>	52
Gambar 5.19 Konfigurasi <i>IP Host</i>	53
Gambar 5.20 <i>Reboot OS</i>	53
Gambar 5.21 <i>SSH Keygen</i>	54
Gambar 5.22 <i>SSH Copy Keygen</i>	54
Gambar 5.23 Konfigurasi <i>Core Site</i>	55
Gambar 5.24 Kode Konfigurasi <i>Core Site</i>	55
Gambar 5.25 Konfigurasi <i>HDFS Site</i>	55
Gambar 5.26 Kode Konfigurasi <i>HDFS Site</i>	56
Gambar 5.27 Konfigurasi <i>Workers</i>	56
Gambar 5.28 Konfigurasi <i>Slave Node</i>	57
Gambar 5.29 Konfigurasi <i>Yarn</i>	57
Gambar 5.30 Konfigurasi <i>Yarn Site</i>	57
Gambar 5.31 Kode Konfigurasi <i>Yarn Site</i>	57
Gambar 5.32 <i>Format Namenode</i>	58
Gambar 5.33 <i>Jalankan HDFS</i>	58
Gambar 5.34 <i>Jalankan YARN</i>	58
Gambar 5.35 Cek <i>JPS</i>	59
Gambar 5.36 <i>Dashboard Hadoop</i>	59
Gambar 5.37 <i>Hadoop Cluster</i>	60
Gambar 5.38 Mengupload <i>Dataset</i> ke <i>HDFS</i>	60
Gambar 5.39 Melihat <i>Directory</i> pada <i>HDFS</i>	61
Gambar 5.40 Kapasitas <i>HDFS</i>	61
Gambar 5.41 <i>Command Write TestDFSIO nrFiles 1</i>	62

Gambar 5.42 <i>Command Read TestDFSIO nrFiles 1</i>	62
Gambar 6.1 Grafik <i>Throughput Write</i>	64
Gambar 6.2 Grafik <i>Throughput Read</i>	65
Gambar 6.3 Grafik <i>Average IO Rate Write</i>	66
Gambar 6.4 Grafik <i>Average IO Rate Read</i>	66
Gambar 6.5 Grafik <i>IO Rate Deviation Write</i>	67
Gambar 6.6 Grafik <i>IO Rate Deviation Read</i>	68
Gambar 6.7 Grafik <i>Test Execution Time Write</i>	68
Gambar 6.8 Grafik <i>Test Execution Time Read</i>	69
Gambar 6.9 Grafik <i>Throughput Write</i>	71
Gambar 6.10 Grafik <i>Throughput Read</i>	72
Gambar 6.11 Grafik <i>Average IO Rate Write</i>	72
Gambar 6.12 Grafik <i>Average IO Rate Read</i>	73
Gambar 6.13 Grafik <i>IO Rate Deviation Write</i>	74
Gambar 6.14 Grafik <i>IO Rate Deviation Read</i>	74
Gambar 6.15 Grafik <i>Test Execution Time Write</i>	75
Gambar 6.16 Grafik <i>Test Execution Time Read</i>	76
Gambar 6.17 Grafik Perbandingan <i>Throughput Write</i>	80
Gambar 6.18 Grafik Perbandingan <i>Throughput Read</i>	81
Gambar 6.19 Grafik Perbandingan <i>Average IO Rate Write</i>	82
Gambar 6.20 Grafik Perbandingan <i>Average IO Rate Read</i>	83
Gambar 6.21 Grafik Perbandingan <i>IO Rate Deviation Write</i>	84
Gambar 6.22 Grafik Perbandingan <i>IO Rate Deviation Read</i>	84
Gambar 6.23 Grafik Perbandingan <i>Test Execution Time Write</i>	85
Gambar 6.24 Grafik Perbandingan <i>Test Execution Time Read</i>	86

DAFTAR TABEL

Tabel 2.1 Tinjauan Pustaka	4
Tabel 4.1 Spesifikasi Perangkat Keras	29
Tabel 4.2 Spesifikasi <i>Physical Environment</i>	29
Tabel 4.3 Spesifikasi <i>Virtual Environment</i>	29
Tabel 4.4 Daftar <i>Hyperparameter</i>	36
Tabel 4.5 Variabel <i>Output</i>	37
Tabel 6.1 Hasil Dari <i>Physical Environment</i>	63
Tabel 6.2 Hasil Dari <i>Virtual Environment</i>	70
Tabel 6.3 Hasil Generasi Pertama.....	77
Tabel 6.4 Hasil Generasi Kedua	78
Tabel 6.5 Hasil Generasi Ketiga	78
Tabel 6.6 Hasil Generasi Keempat	79