Detailed System Activity Monitoring Report: Prometheus, Node Exporter, and Grafana

Summary:

This report details the implementation of a robust system activity monitoring solution utilizing Prometheus, Node Exporter, and Grafana. The system provides real-time insights into critical resource utilization, including CPU, memory, network, and disk performance. Grafana dashboards offer a user-friendly, visual representation of collected metrics, facilitating proactive system management and performance analysis.

System Architecture:

The monitoring architecture comprises three key components:

1. **Prometheus:**
    - Serves as the central monitoring and alerting system.
    - Scrapes metrics from Node Exporter at user-defined intervals (1 second in this case).
    - Stores collected data in a time-series database for efficient querying and analysis.
    - Configuration: prometheus.yml specifies the target endpoint (localhost:9100) for Node Exporter metrics.
2. **Node Exporter:**
    - Acts as an agent that exposes system-level metrics in a format compatible with Prometheus.
    - Collects metrics related to CPU, memory, disk, and network usage.
    - Lightweight and efficient, minimizing system overhead.
3. **Grafana:**
    - Provides a powerful visualization platform for Prometheus data.
    - Creates interactive dashboards with customizable panels to display system metrics.
    - Enables real-time data analysis and performance monitoring.

Grafana Dashboard: "Task Manager"

The "Task Manager" dashboard offers a comprehensive overview of system performance through the following panels:

1. **CPU Utilization:**
    - **Metric:**

        - Per-core CPU utilization: avg by(cpu) (rate(node_cpu_seconds_total{mode!="idle"}[1m]))
        - Total CPU utilization: avg(sum by(mode) (rate(node_cpu_seconds_total{mode!="idle"}[1m])))
    - **Visualization:** Time-series graph displaying individual core usage and overall CPU load, highlighting potential bottlenecks.
2. **Memory Usage:**
    - **Metric:**
        - Used memory: node_memory_MemTotal_bytes - node_memory_MemFree_bytes
        - Total memory: node_memory_total_bytes
        - Swap memory usage: node_memory_SwapTotal_bytes - node_memory_SwapFree_bytes
    - **Visualization:** Time-series graph illustrating used, total, and swap memory, enabling memory leak detection and resource planning.
3. **Network I/O:**
    - **Metric:**
        - Download speed: sum by(device) (rate(node_network_receive_bytes_total[1m]))
        - Upload speed: sum by(device) (rate(node_network_transmit_bytes_total[1m]))
    - **Visualization:** Time-series graph showing network traffic, facilitating bandwidth monitoring and troubleshooting network issues.
4. **Available Disk Storage:**
    - **Metric:**
        - Total disk space per device: sum by(device) (node_filesystem_size_bytes)
    - **Visualization:** Donut chart displaying disk capacity distribution, providing a quick overview of storage usage.
5. **Free Disk Space:**
    - **Metric:**
        - Free disk space percentage: sum by(device) (node_filesystem_free_bytes) / sum by(device) (node_filesystem_size_bytes)
    - **Visualization:** Gauge panels displaying free disk space percentage per device, enabling proactive storage management and preventing disk space exhaustion.
6. **Disk Read Activity:**
    - **Metric:**
        - Disk read rate: sum by(device) (rate(node_disk_read_bytes_total[5m]))
    - **Visualization:** Time-series graph depicting disk read activity, aiding in

identifying disk I/O bottlenecks.

7. **Disk Write Activity:**
    - **Metric:**
        - Disk write rate: sum by(device) (rate(node_disk_written_bytes_total[5m]))
    - **Visualization:** Time-series graph illustrating disk write activity, facilitating performance analysis and troubleshooting disk I/O issues.

Key Dashboard Features:

- **Real-time data:** Automatic dashboard refresh ensures up-to-date metric visualization.
- **Customization:** Flexible panel configuration to tailor visualizations to specific monitoring needs.
- **Interactive legends:** Enables selective metric display for focused analysis.
- **Threshold alerts:** Visual cues (e.g., red highlights) for critical metric values, facilitating immediate attention.
- **Responsive design:** Optimized layout for seamless viewing across various screen sizes.

Conclusion:

This project successfully establishes a comprehensive system activity monitoring solution using Prometheus, Node Exporter, and Grafana. The "Task Manager" dashboard provides a clear and intuitive interface for real-time performance analysis. This setup is valuable for system administrators and developers seeking to maintain system health, optimize performance, and proactively address potential issues.