The bridge to possible

AI-Powered Network Optimization: Transforming Operations

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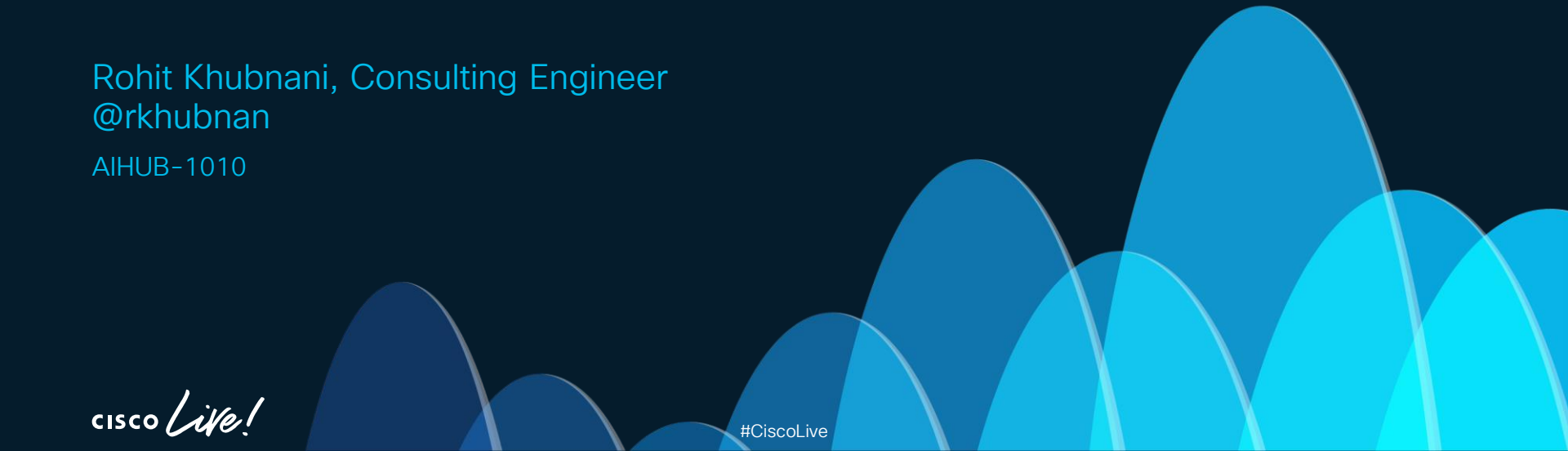
AIHUB-1010



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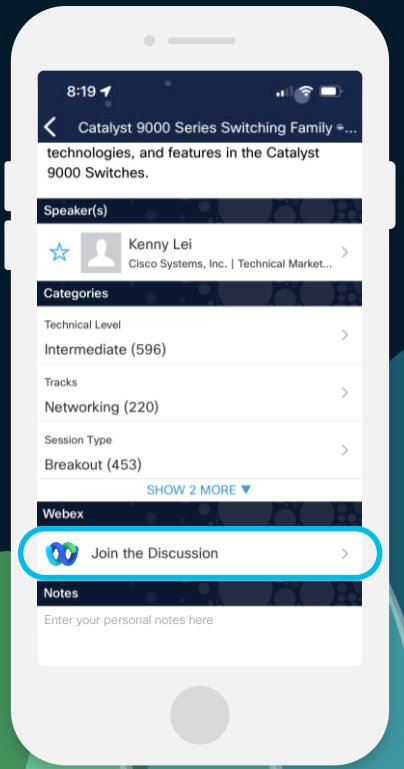
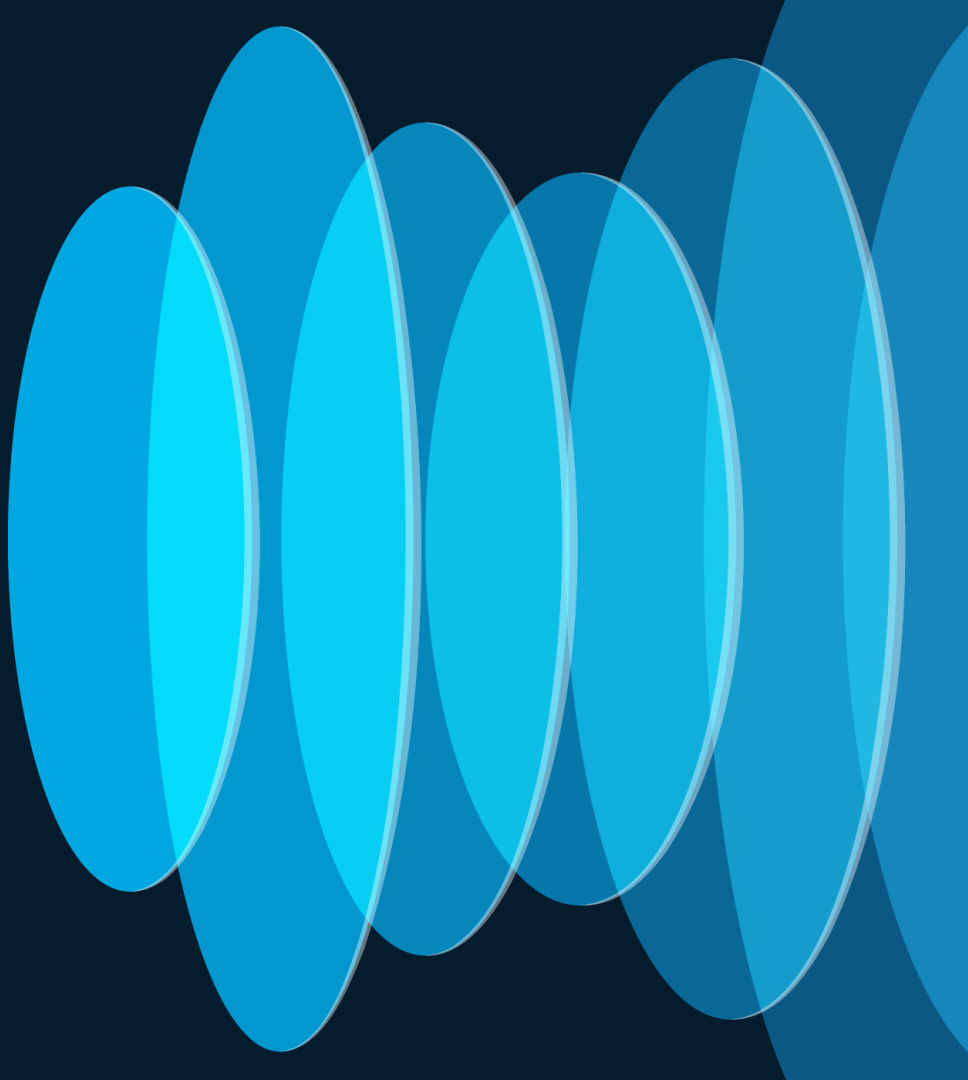


Agenda

- Understanding AI in Networking
- AI-Powered Predictive Analysis
- Streamlining Management with AI
- AI-Enhanced Troubleshooting
- Conclusion and Key Takeaways
- Audience Engagement and Q&A

Understanding AI in Networking



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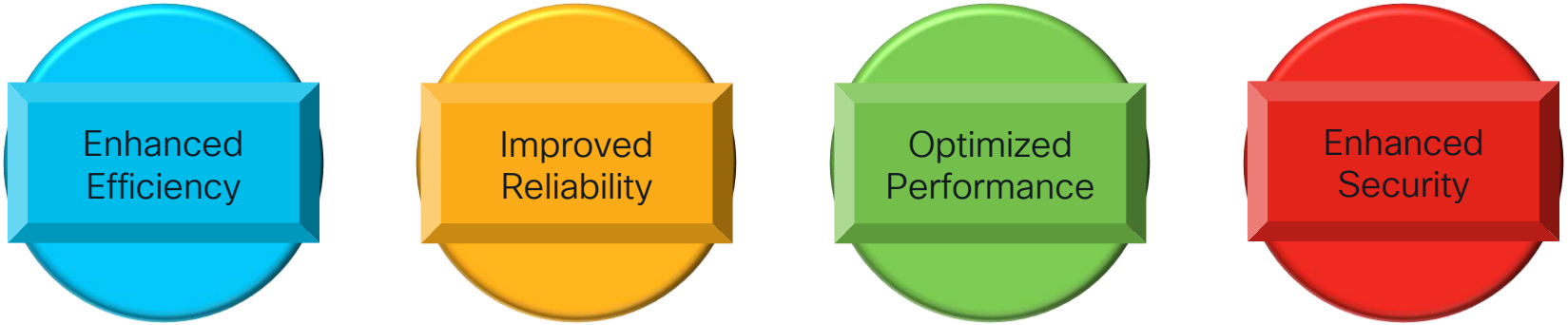
AI-driven Networking Transformation

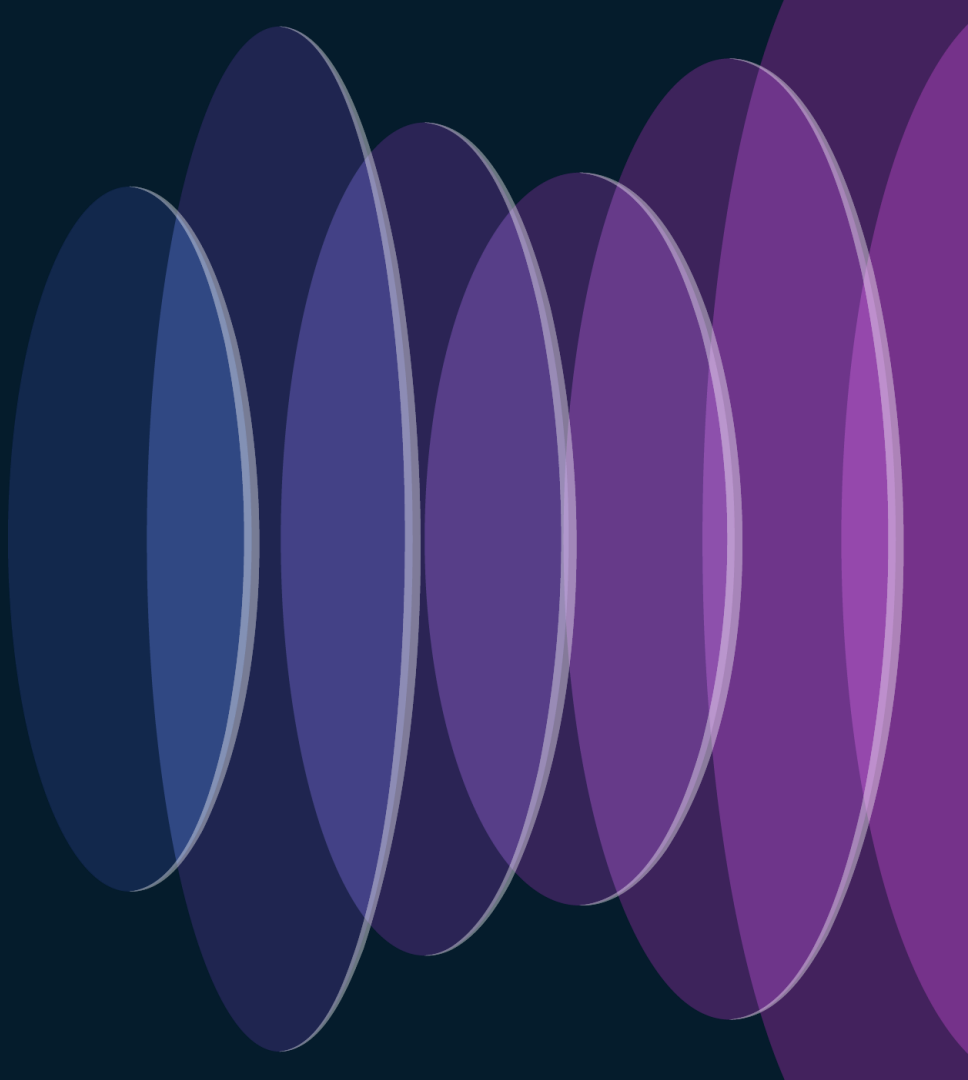
- Traditionally, network management relied heavily on manual configurations and reactive troubleshooting.
- With the introduction of AI, we have transcended these limitations by enabling:
  - Predictive Analysis
  - Automated Decision-making
- AI manage and optimize networks by harnessing the power of:
  - Data-driven Insights
  - Intelligent Algorithms

AI's Impact on Networking

From predicting network failures before they occur to dynamically optimizing traffic flow, AI empowers networks with:

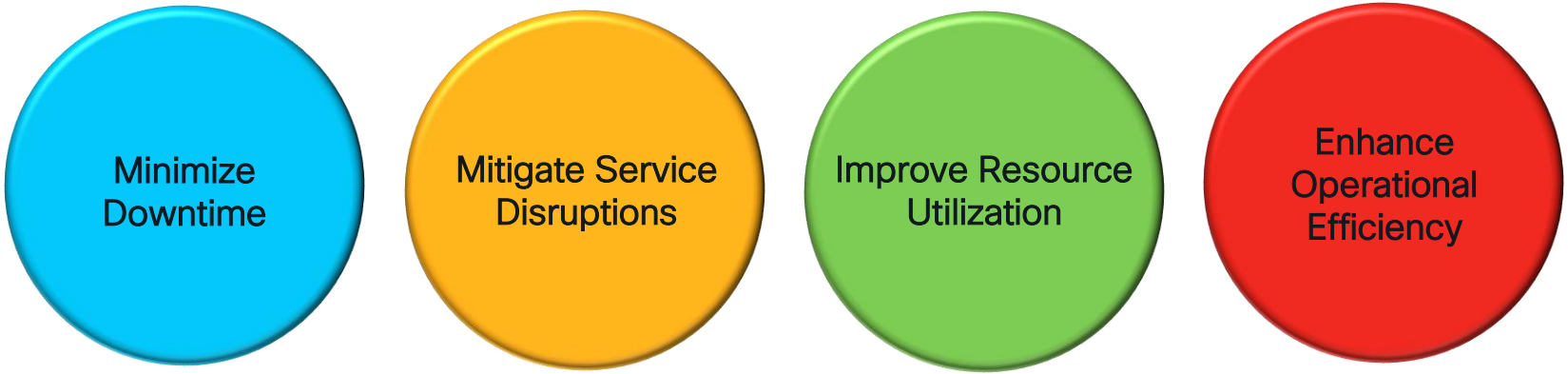


AI-Powered Predictive Analysis



Driving Proactive Maintenance

- Goal of predictive analysis is to drive proactive maintenance.
- Shift from reactive to proactive maintenance.



Harnessing Data Insights

- AI algorithms continuously analyze vast amounts of network data in real-time, identifying:
  - Patterns and Trends
  - Anomalies that signal issues or opportunities for optimization
- By harnessing these data insights, AI enables network administrators to make informed decisions.
- Taking preemptive actions to ensure network stability and performance.

Identifying Patterns and Anomalies

- Goes beyond traditional monitoring approaches by detecting subtle patterns and anomalies in network behavior.
- Detection of Issues - Sudden spike in traffic, a deviation from normal user activity, or a recurring performance bottleneck.
- Proactive Response - AI algorithms can flag these issues early on, allowing administrators to investigate and address them proactively.
- Minimizes the risk of service disruptions and downtime, enhancing overall network reliability.

Anticipating Future Events

- Empowers network management teams to anticipate future events based on historical data and predictive models.
- Analyze past network performance metrics and correlate them with environmental factors and application usage patterns.
- Forecast potential network congestion, capacity shortages, or security threats.
- Armed with these insights, organizations can implement preventive measures and optimize resource allocation to mitigate risks and ensure seamless network operations.

Proactive Capacity Planning

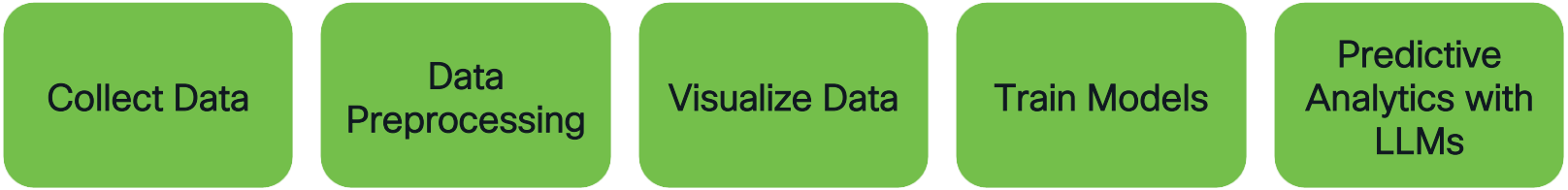
Scenario: A multinational corporation (Company X) operates in various regions globally. With a rapidly growing user base and expanding digital infrastructure, Company X anticipates challenges in managing network capacity to meet increasing demands.

Challenge: Without effective capacity planning, Company X risks facing network congestion, and performance degradation during peak hours of operation.

Proactive Capacity Planning

Solution: Leveraging predictive analytics, Company X adopts a proactive approach to capacity planning. By analyzing historical data on network usage and application traffic, they identified periods of high demand and potential bottlenecks in their network infrastructure to forecast future network bandwidth demands accurately.

Implementation:



Proactive Capacity Planning

Collect Data

- Combination of network monitoring tools and logging systems were used to collect extensive data on network usage, traffic patterns, application usage, and user behavior.
- Data is stored in databases in a structured format.

Proactive Capacity Planning

Data Preprocessing

- We use Python libraries Pandas and NumPy to clean and normalize data.

Proactive Capacity Planning

Visualize Data

- We use Python libraries Matplotlib and Seaborn for initial visualizations.

Proactive Capacity Planning

Train Models

- We use machine learning models fbprophet for time series forecasting and anomaly detection.

Proactive Capacity Planning

Predictive Analytics with LLMs

We use an LLM, in this case Llama 2

- For interpreting and summarizing the predictive analytics results.
- Providing insights and recommendations based on predictive analytics.

Proactive Capacity Planning

"Analyze the following data and predict future network capacity requirements: \n" + str(data.tail(100))

"Based on the following forecasted data, provide recommendations for network capacity planning: \n" + str(forecast.tail(100))

Preventive Maintenance for Network Equipment

Scenario: A multinational corporation (Company Y) operates a vast network infrastructure consisting of critical routers and switches. With network downtime having severe repercussions on business operations, it recognizes the importance of preventive maintenance to mitigate the risk of hardware failures and service disruptions.

Challenge: Company Y faces the challenge of minimizing unplanned outages and ensuring the reliability of their network infrastructure. Reactive maintenance approaches often lead to downtime, impacting productivity, revenue, and customer satisfaction.

Preventive Maintenance for Network Equipment

Solution: Leveraging predictive analytics, Company Y adopts a proactive approach to maintenance, focusing on preventive measures to address potential hardware failures before they occur.

Implementation:

Preventive Maintenance for Network Equipment

Telemetry Data Collection

- We collected telemetry data from network devices, capturing information on performance metrics, error logs, and health indicators.
- Data was cleaned, normalised and stored into database in a structured format.

Preventive Maintenance for Network Equipment

Predictive Maintenance Models

- We leveraged machine learning using random forest algorithm model to predict equipment failures and evaluated the model's performance using sklearn library to identify early indicators of hardware failure.

Preventive Maintenance for Network Equipment

Risk Assessment

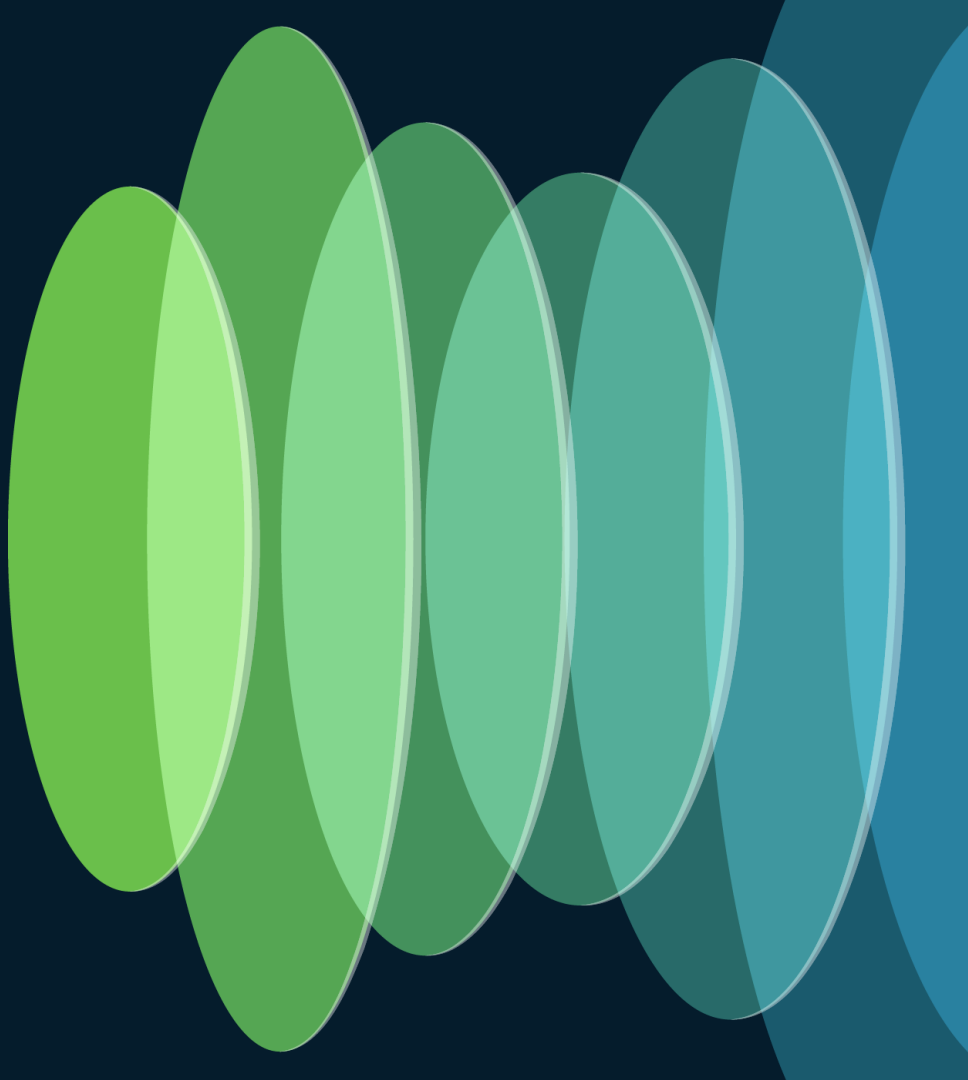
- Health and performance of critical network devices were continuously monitored, by using predictive maintenance models.
- We prioritize devices and components that showed higher risk score.

Preventive Maintenance for Network Equipment

Pre-emptive Maintenance Actions

- Based on predictive insights company schedules maintenance window, replacing hardware identified as at-risk or nearing end-of-life, minimizing the likelihood of unplanned outages.

Streamlining Management with AI



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Automated Provisioning and Configuration

AI-driven Automation - Predefine templates and policies to automate the provisioning process, ensuring standardized configurations.

Scenario : Deploying a new branch office with dozens of network devices.

Solution : AI-driven Automation.

- Define desired configuration parameters and policies
- Within minutes, all devices are provisioned and configured according to the predefined policies, eliminating manual effort and minimizing the risk

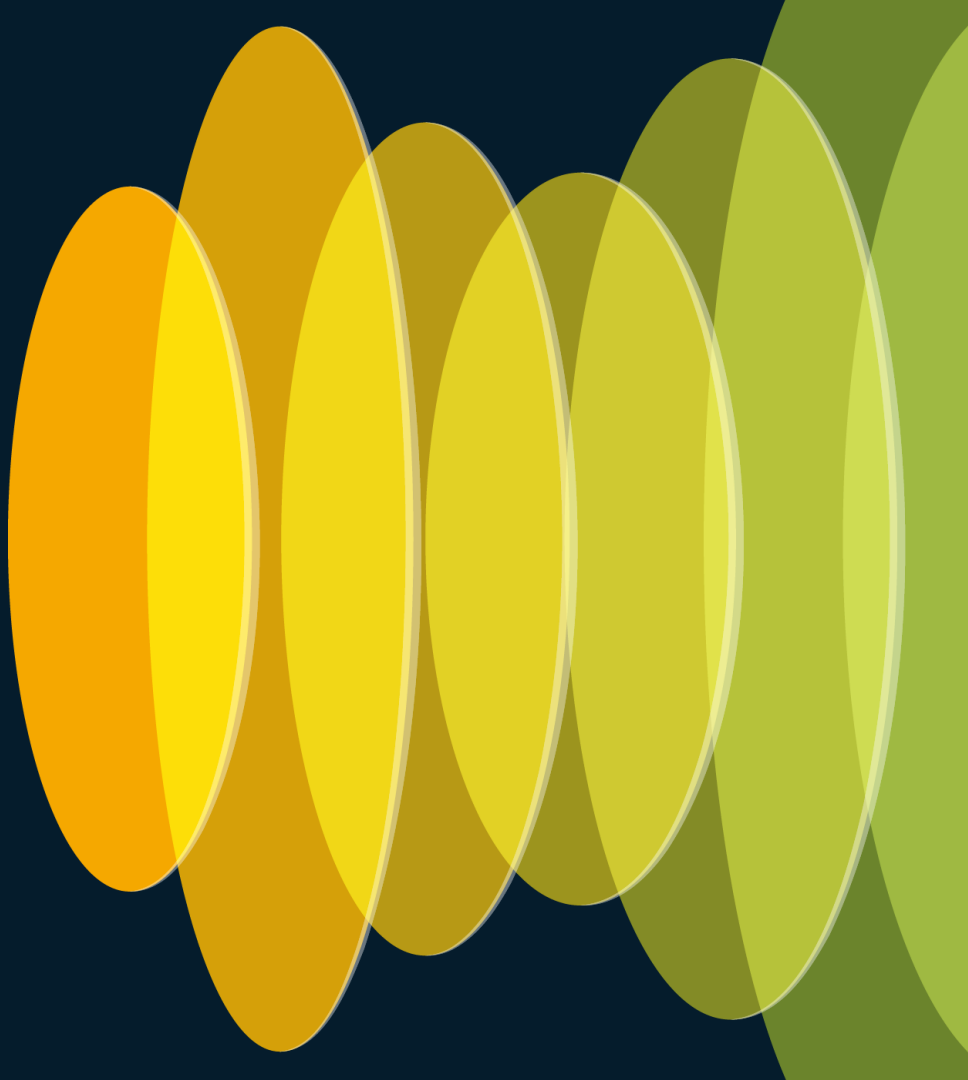
Dynamic Network Optimization

AI-driven Automation - Networks can dynamically adjust parameters based on real-time telemetry data to optimize the performance.

Scenario : Sudden surge in network traffic due to a high-profile event.

Solution : AI-driven Automation can intelligently detect the increased demand and dynamically optimize bandwidth allocation, ensuring optimal performance for critical applications without human intervention.

AI-Enhanced Troubleshooting



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Automated Anomaly Detection

AI-Enhanced Troubleshooting - Analyze vast amounts of telemetry data in real-time, flagging anomalies and deviations from normal network patterns automatically.

Scenario : Sudden spike in network latency occurred during peak usage hours.

Solution : AI algorithm detect the anomaly instantly by recognizing the deviation of traffic and latency levels from the normal patterns.

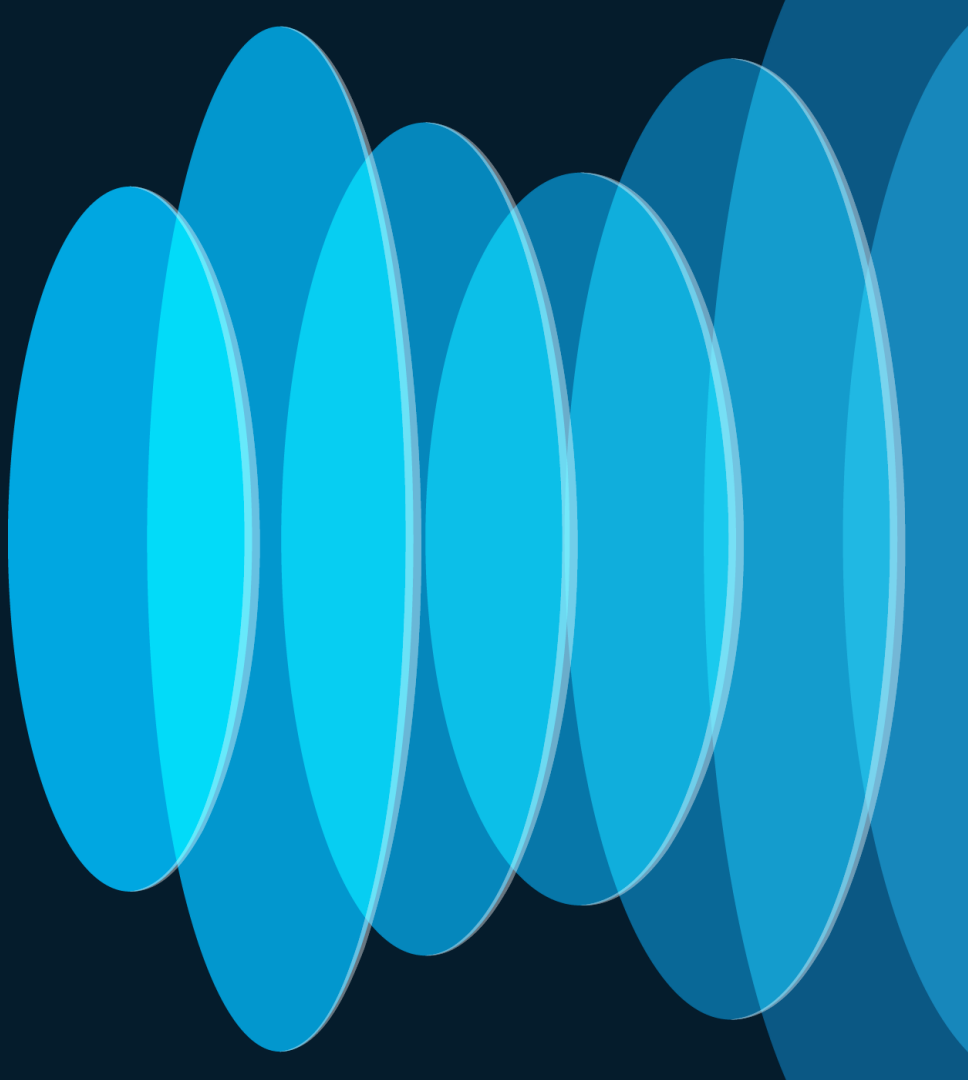
Intelligent Root Cause Analysis

AI-Enhanced Troubleshooting - Correlate diverse data sources, such as network traffic, device configuration, network logs, user behavior, to identify the underlying cause of a network issue.

Scenario : Critical application experiences intermittent connectivity issues.

Solution : AI algorithm analyze entire network ecosystem and correlate to identify potential misconfigurations, routing issues, resource constraints or performance bottlenecks that contribute to problem.

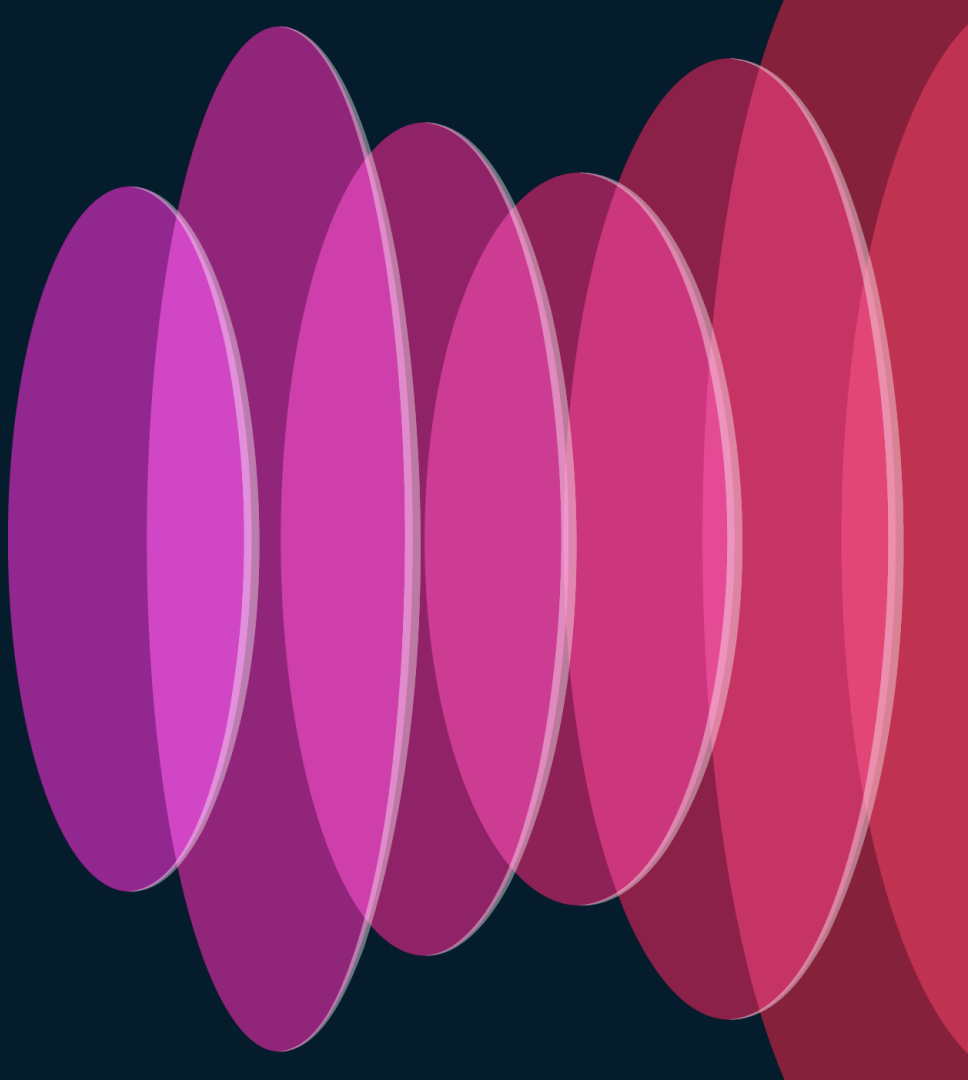
Conclusion and Key Takeaways



Conclusion and Key Takeaways

- AI relevance in networking to enhance efficiency, reliability, security, and performance across the network infrastructure.
- AI-Powered Predictive Analysis
  - Proactive Capacity Planning
  - Preventive Maintenance for Network Equipment
- Application of AI in automated management, and dynamic traffic optimization.
- AI aids in faster and more accurate network troubleshooting through automated anomaly detection, and intelligent RCA.

Audience Engagement and Q&A



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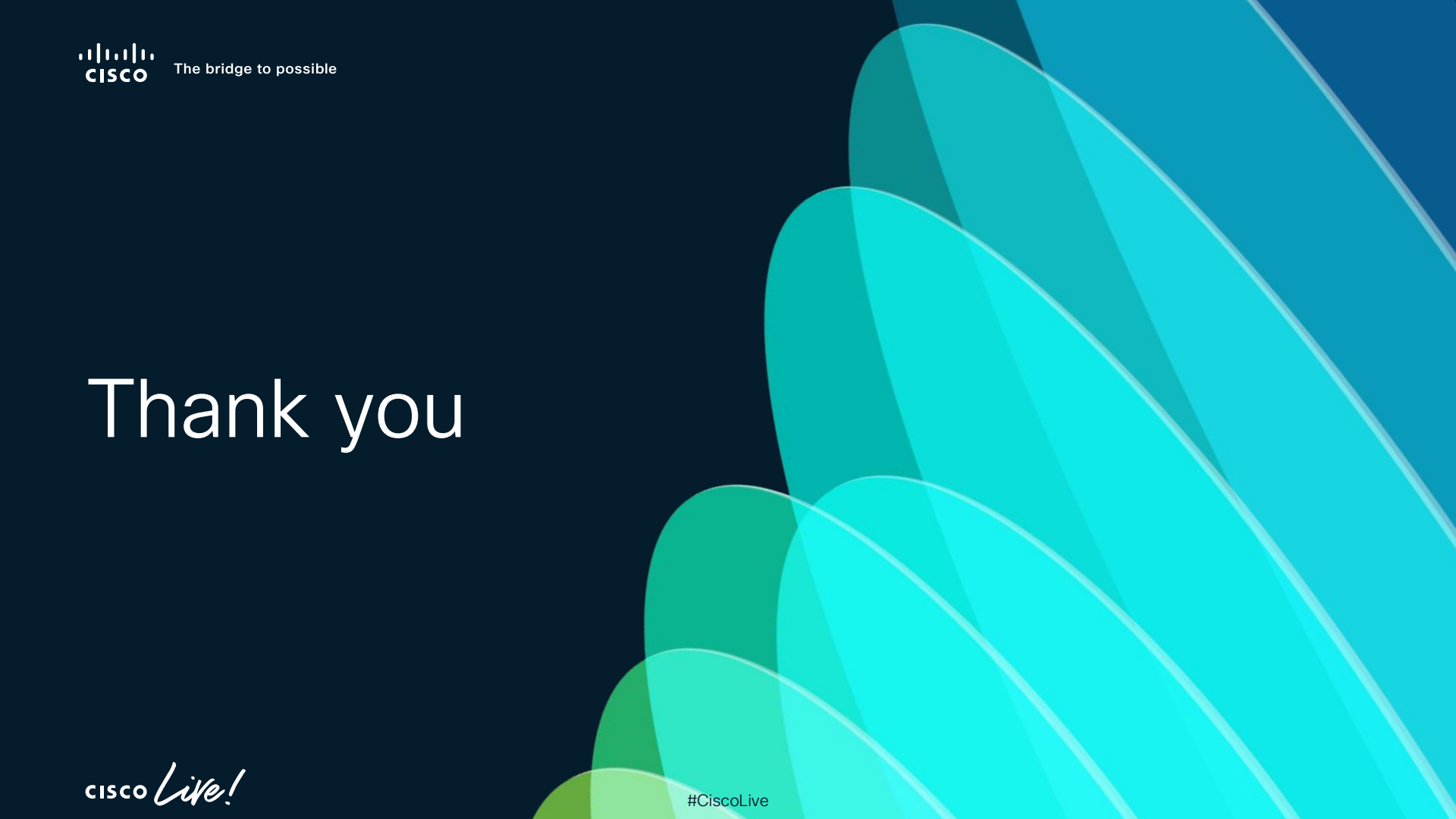
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