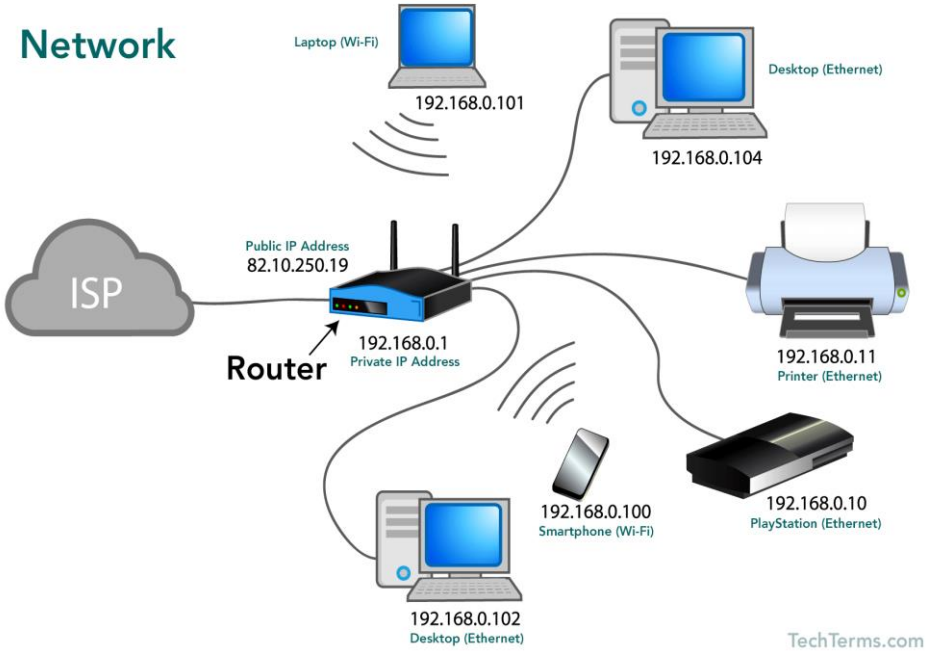
SG13 Regional workshop for Africa

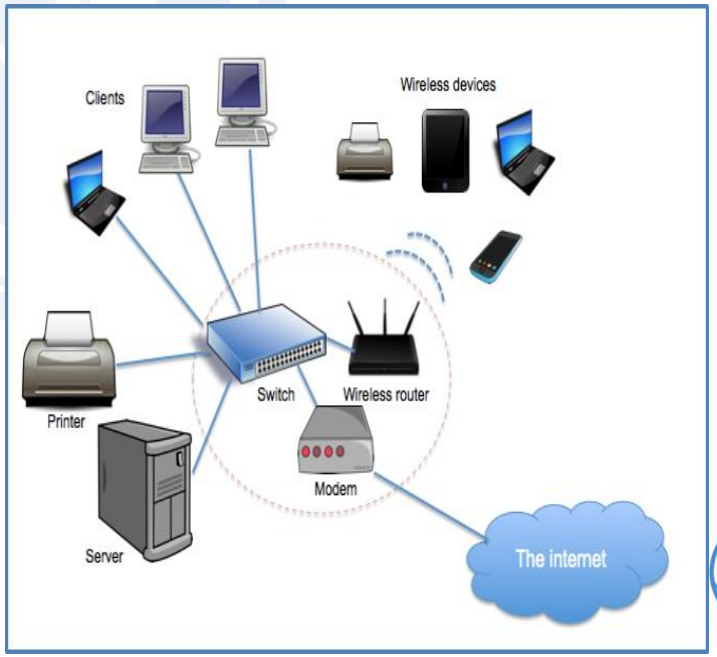
The Role of AI and ML in Network Management

By:
Engr. B. K. Nuhu, FUTMinna, Nigeria

The Concept of a Network

- Network: Several (Tens to Thousands) components (nodes), interacting and sharing (data, information, resources) between each other. They could be wired, wireless or the combination of the two





Network Failure

- Components (Nodes) failure
- Malfunction, Overload, Misconfiguration
- Causing disruptions, loss or degradation in connectivity,
- Poor communication and performance.

Consequences of Network Failure

- Security Vulnerabilities to organizations
- Affects productivity(loss of confidence, time wastage)
- Financial loss
- Affects Data Integrity
- Reputational damage
- Legal and Regulatory consequences
- Component Damage
- Software Damage
- Backup and Restoration failure

Network Management

- The use of applications, tools and processes to provision, operate, maintain, administer and secure network infrastructure.
- Ensure network resources are efficiently, effectively and quickly available to network users
- To deliver a secure, reliable, and high-performing network to end-users

AI and Machine Learning

- AI is the science and engineering of making ‘intelligent systems’.
- AI is a way of making a system have the ability to mimic cognitive functions associated with human intelligence
- ML is a subset of AI that automatically enables a machine or system to learn and improve from experience.

Features of AI and ML in Network Management

- Maximize Operational Speed
- Making Intelligent Decisions (Through Intelligent Network Components)
- Secure Data (Ensures Data Integrity)
- Manages Crucial Data
- Intelligent Traffic Control

Application Areas of AI and ML in Network Management

- AI and ML has proliferated in network management. They are currently used to process and analyze huge network data, drive better decision-making, generate recommendations and insights in real time, and create accurate forecasts and predictions.
- All is driven by large data availability and the flexibility of ML models.

Application Areas of AI and ML in Network Management

Application areas in network management include:

- Network Administration
- Network Maintenance (Intelligent Troubleshooting)
- Network Provisioning (Capacity Planning)
- Network Security
- Network Automation (Optimization)

Pending Issues in the use of ML in networks

- Data source and Characteristics
- Model Selection Dilemma
- Dataset Separation
- Adversarial Influence
- Experiment Design and Implementation
  - Hammerschmidt *et al.*, 2017

Conclusion

- Although, the challenges in network management is as dynamic as the network itself. AI & ML solutions has and will continue to provide optimal solutions.
- It is often difficult to address all the issues simultaneously, It is important to prioritize and tailor solutions to the specific challenge of your network.
- Some pending issues requires a continuous research from the communities, industries and institutes.

Consulted Resources

- What is Network Failure? Complete Guide - Veloce (velocenetwork.com)
- What is Network Management? | OpenText (microfocus.com)
- Hammerschmidt, C. A., Garcia, S., Verwer, S., & State, R. (2017, October). Reliable machine learning for networking: Key issues and approaches. In *2017 IEEE 42nd Conference on Local Computer Networks (LCN)* (pp. 167-170). IEEE.
- Wang, M., Cui, Y., Wang, X., Xiao, S., & Jiang, J. (2017). Machine learning for networking: Workflow, advances and opportunities. *Ieee Network*, *32*(2), 92-99.
- Aidarous, S., Plevyak, T., America, N. E. C., & Atlantic, B. (1994). Principles of Network Management. *IEE Telecommunications Series*, *30*, 1-1.
- AI vs. Machine Learning: How Do They Differ? | Google Cloud