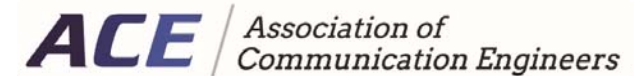


Network Monitoring and Management

Benjamin Pidek, PE
Mid-State Consultants



Why Monitor?

- Network Reliability
 - Troubleshooting Device Failures and Configuration Issues
- Service Level Agreements
- Security Threats
 - Hackers
 - Malware Infected Devices
- Congestion on the Network
 - Ever Increasing Data Traffic on the Network
 - Oversubscription and Peak Time Traffic



Are There Some Gremlins Hiding in There?



Future Growth in IP Traffic

- New Services Continue to Drive IP Traffic Growth
- Some of the Potentially Biggest are Still In There Infancy
 - 4K Ultra HD Streaming Services
 - Netflix, Hulu, Amazon, YouTube, UltraFlix, Fandango, Vudu, Sony Ultra
 - Cloud Services
 - DropBox, iCloud, SaaS Applications, Video Sharing
 - Internet of Things (IOT) Devices
 - Not yet defined, but how about connecting everyday objects to collect data

4K UHD Streaming Services

- Netflix best looking HD content currently requires 7 Mbps
- TVs streaming Netflix Super HD utilize H.265 HEVC Codec
 - Stream bit rate of 15.6 Mbps

NETFLIX

[Help Center](#) > Internet Connection Speed Recommendations

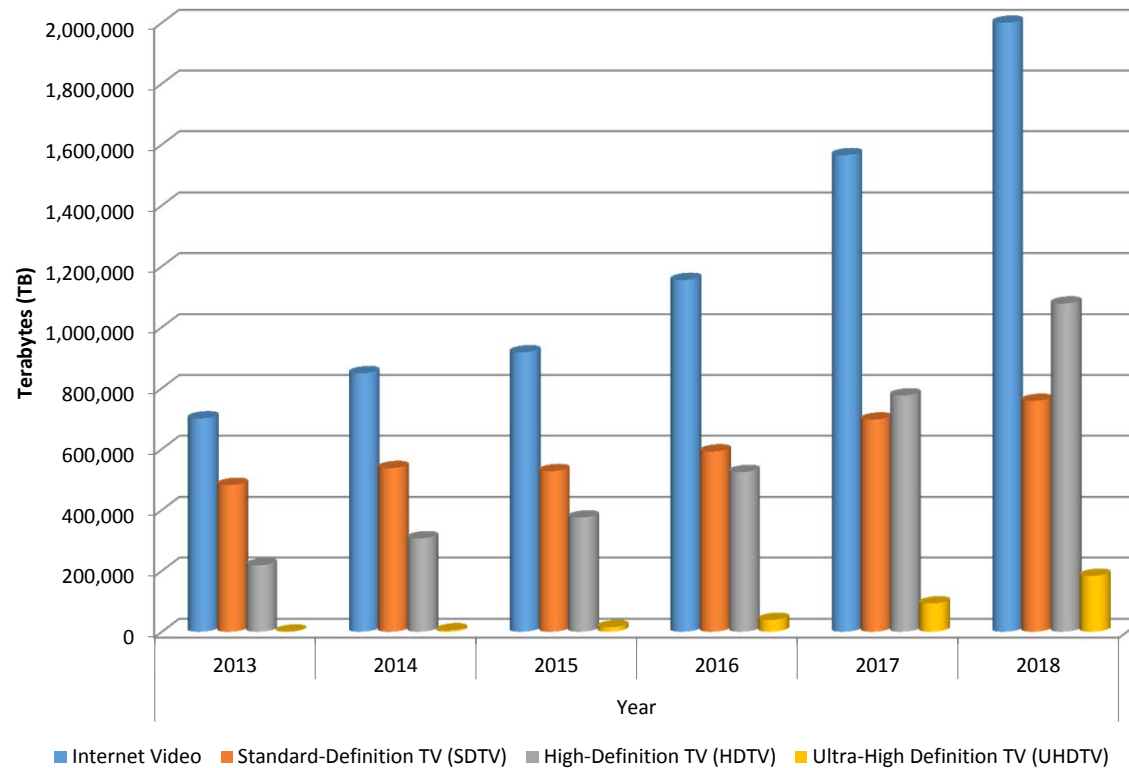
Internet Connection Speed Recommendations

Below are the Internet download speed recommendations per stream for playing movies and TV shows through Netflix.

- 0.5 Megabits per second - Required broadband connection speed
- 1.5 Megabits per second - Recommended broadband connection speed
- 3.0 Megabits per second - Recommended for SD quality
- 5.0 Megabits per second - Recommended for [HD](#) quality
- 25 Megabits per second - Recommended for [Ultra HD](#) quality

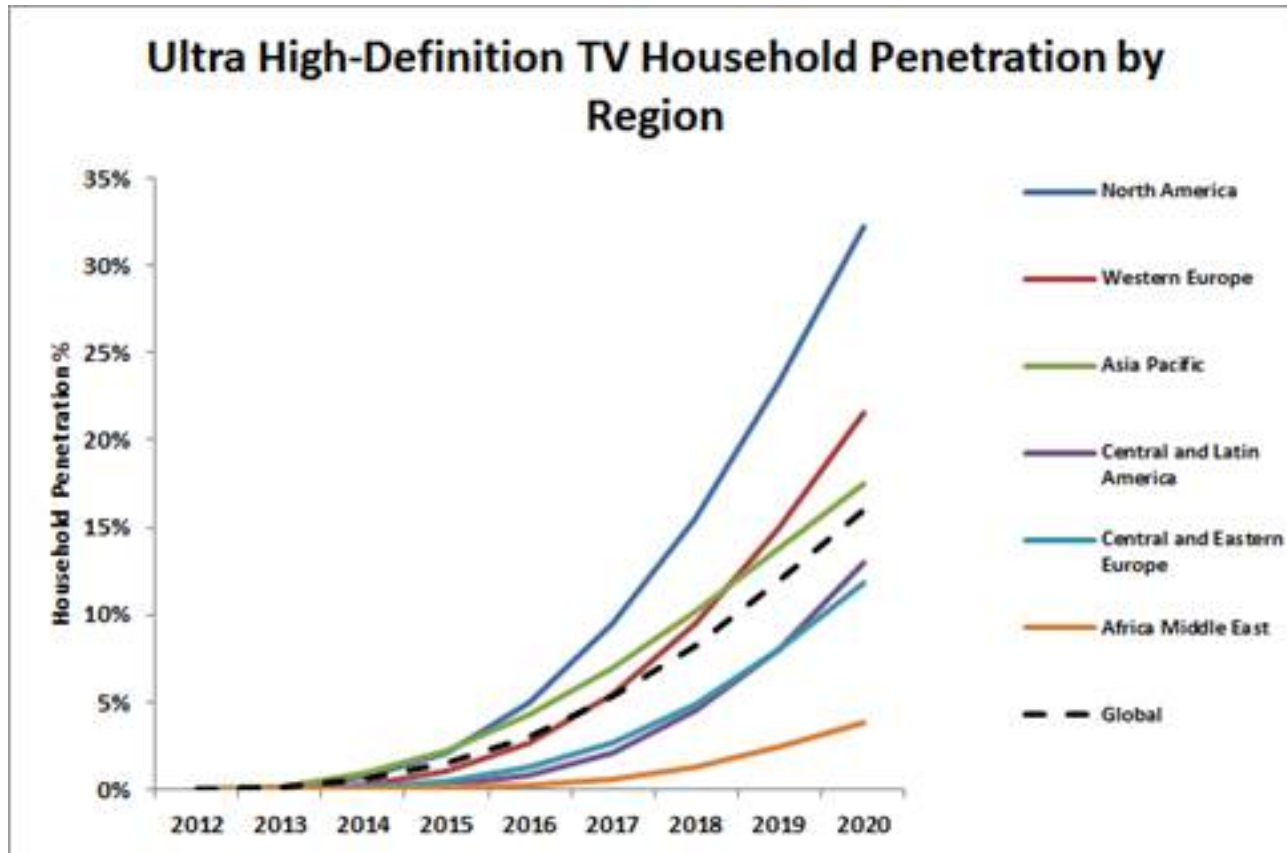
4K UHD Impact

Telco Monthly Subscriber Internet Video Traffic



Cisco Virtual Networking
Index – CT Span Tool

4K UHD Sets



Source: **STRATEGYANALYTICS**
Research, Experts, and Analytics

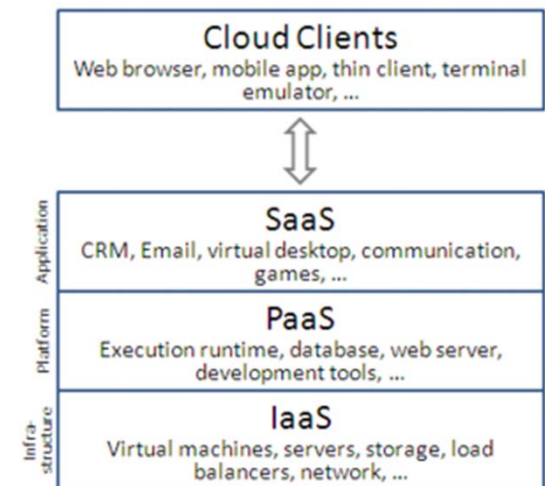
Cloud Services Growth

SaaS, IaaS and PaaS Growth Forecast – Public Cloud



Source: Cisco Global Cloud Index, 2014–2019

SaaS – Software-as-a-Service
IaaS – Infrastructure-as-a-Service
PaaS – Platform-as-a-Service



Cloud Services Growth (Cont.)

Personal Cloud Storage – Growth in Users



Source: Cisco Global Cloud Index, 2014–2019; Juniper Research

IOT – Connecting Everyday Objects to Collect Data

Currently, there are 5-7 Billion Connected Devices Connected
(i.e, smart phones, computers, tablets, etc.)

How do the projections for IOT devices add to this?

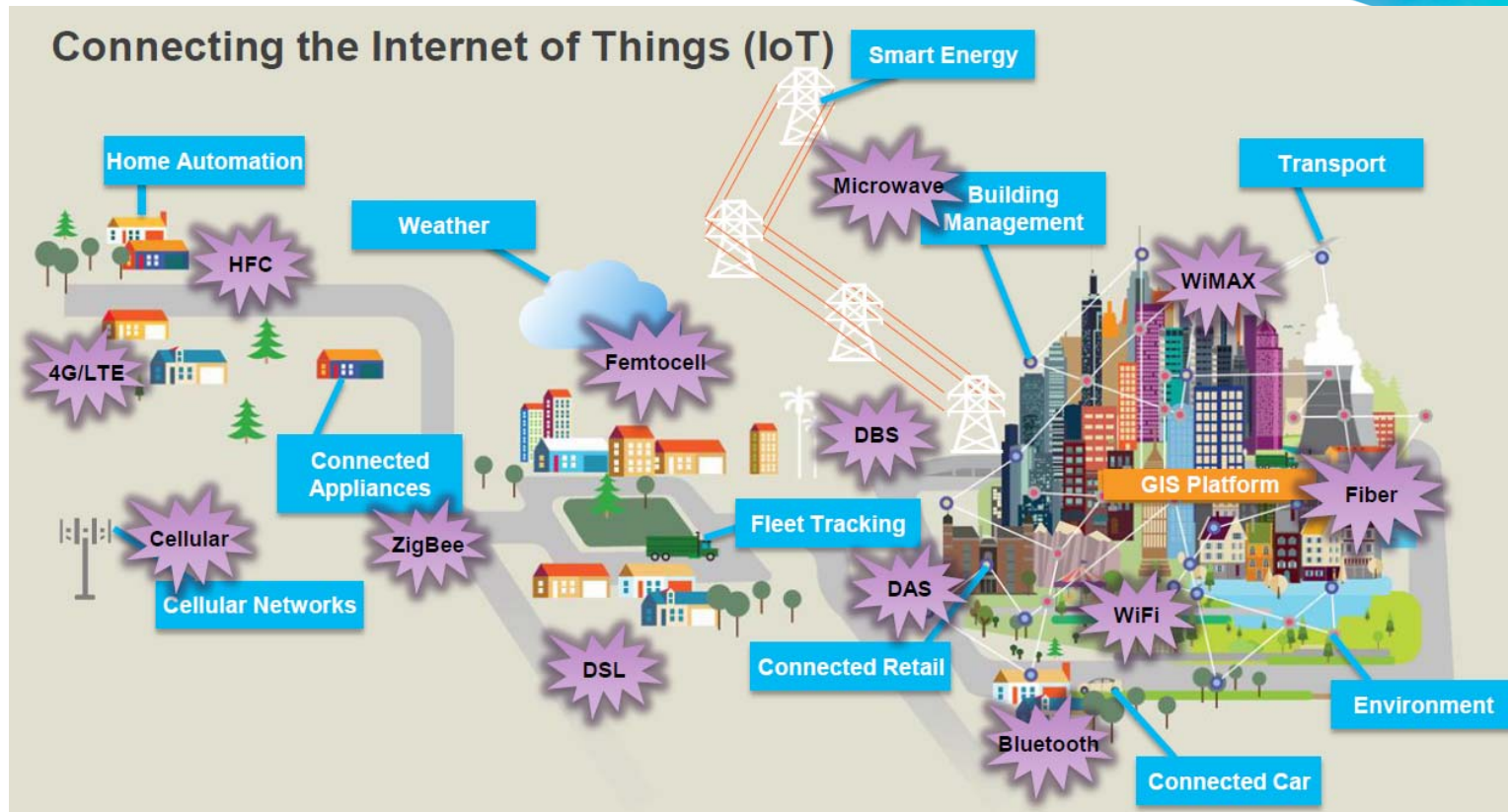
Cisco – 24 Billion connected devices by 2019

ESRI – 50 Billion connected devices by 2020

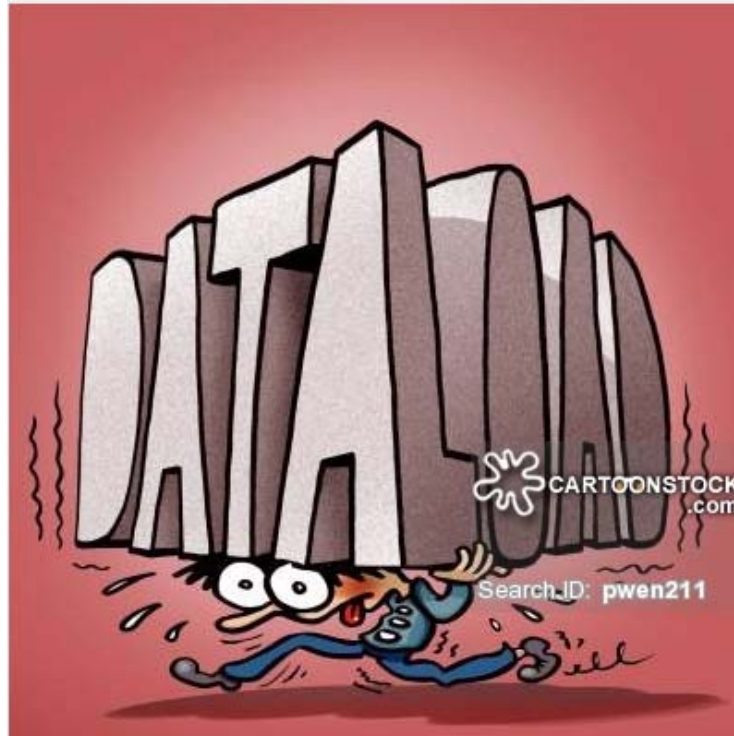
Morgan Stanley – 75 Billion connected devices by 2020

Huawei – 100 Billion connected devices by 2025

IOT – Promise of a Hyper Connected Life



Network Impact?



IT Staff – Ouch!!!!

Types of Network Traffic Monitoring

- Hardware Probes (Not Common Anymore)
 - Tend to be Bulky and Expensive
 - Limited Scope for Monitoring
 - Space and Maintenance Constraints
- Packet Analyzers
 - Large Amounts of Data
 - Speed of the Analysis Impacted for Large Volumes
 - Significant Amount of Redundant Information
- Flow-based Monitoring Tools (Likely the Best Option)
 - Web Based
 - No Additional Infrastructure Incurred
 - Combines Functionality of Hardware Probe and Packet Analyzer



What Should You Look for:

- Web Based Tool
 - Easy and Convenient to Access
 - Accessible from Anywhere
- Report Generation
 - Troubleshooting
 - Useful for root/cause analysis
 - Good Search Options
- Alert Generation
- Integration with Existing Equipment
- Integration with Larger Network Monitoring/Management Platform



An Example of Flow – Cisco NetFlow

- Proprietary to Cisco Devices
- Available Versions: v5 (Traditional) and v9 (Flexible)
- Contains a significant amount of information about the network
- Data Needs to be Collected and Analyzed by a Tool
- Needs to Be Enabled in Cisco Routers and Switches
- No Additional Hardware is Required

Other Types of Flow Information

Types of Flows

- sFlow
- Jflow
- Cflowd
- IPFIX
- NetStream
- Appflow
- OpenFlow

Other Common Monitoring Elements

- SNMP Polling
- Management Information Base (MIB)
- Syslog Monitoring

What Should It Do?

- Useful Dashboards that are Customizable
- Zoom-able Graphs of Captured Data
- Accurate and Real-time Traffic Reporting
- Application Identification
- Trend Analysis and Capacity Planning Reports
- Support for Multiple Flow Formats and Multiple Vendor Network Equipment
- Wide Platform Support (Windows, Linux, etc.)
- Network Behavior Analysis (Alerts and Security)
- Provides SLA and QoS Metrics

Network Management Platforms (A Few Options)

- Tivoli (IBM)
- CA Spectrum
- HP Network Node Manager
- Calix Compass Flow Analyzer
- ManageEngine
- SolarWinds
- Incognito Bandwidth Analyzer
- LogicMonitor

It's A Balancing Act

- IT Budgets are Tight – Most often have to make due with current personnel and resources
- At the same time, network traffic continues to increase
- Need to Balance End User Experience with Cost
 - Which Links are Most Congested?
 - How Long Does Congestion Last: Seconds, Minutes, Hours?
 - Is Congestion Due to business use or personal/social use?
 - Can an increase in bandwidth be justified for any link experiencing congestion

ROI From Monitoring

- Save Troubleshooting/Problem Solving Time
- Quicker Recovery from Network Sluggishness or Failure
- Single Tool Rather Than Multiple Tools from Multiple Venders
 - Greater Simplicity in Implementation and Reduction in Learning Curve
- Optimize Resource Usage
- Minimize Downtime
- Minimize Truck Rolls for Customer Network Complaints
- Improved Service Levels
- Bandwidth Up-sell

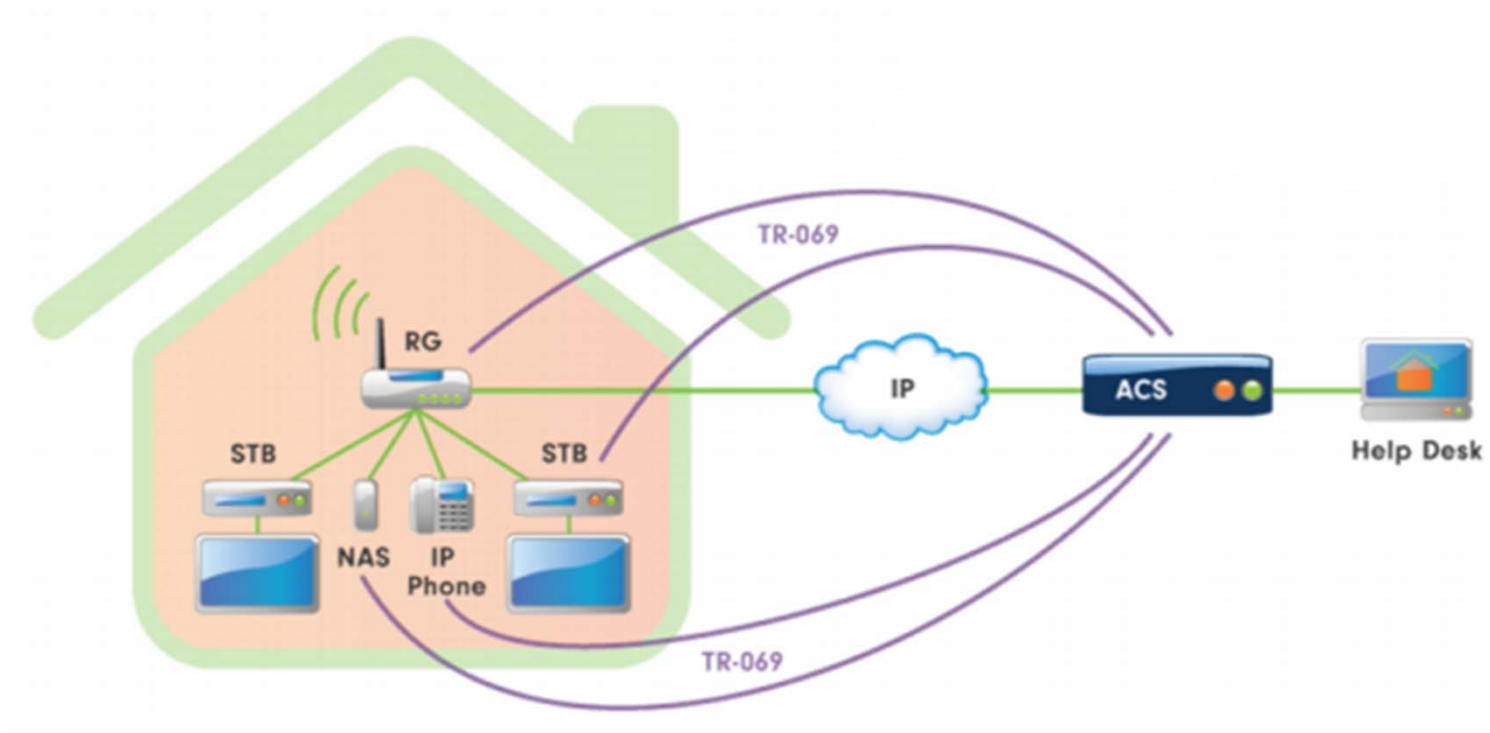
TR-069

- Suite of Protocols Published by The Broadband Forum (2004)
- Known as CPE WAN Management Protocol (CWMP)
 - Simplifies Device Management Through Use of an Auto Configuration Server (ACS) to Perform Remote, Centralized Management of CPEs
 - Standard Communication Mechanism for Remote Management of End-User Devices
 - Defines a Protocol for Auto-Configuration of a TR-069 Compliant Device – Defines how CPEs Communicate with ACS and How ACS Manages CPEs
 - Incorporates Management Functions Into a Common Framework
- Approximately 350 Million TR-069 Capable Devices

TR-069 Supports

- Auto-Configuration and Dynamic Service Provisioning Across Many Different Types of Access Technologies (PON, DSL, WiMAX, HFC)
- Software/Firmware Management
- Status and Performance Monitoring
- Diagnostics
- Integration with OSS and BSS Systems

TR-069



Some Benefits of TR-069

- Remote Provisioning of CPE
- Increased Visibility and Control of CPE Which Helps Better Manage the Network
- Can Collect Data on Network Usage and Activity, Home Network Characteristics and Service Utilization
- Allows the Opportunity to Manage the Connected Home
- Improve Customer Service With Better Diagnostics, Monitoring and Firmware Management
- Reduce Truck Rolls and Support Calls Through Remote Management

TR-069 Solution Providers

- Calix Consumer Connect
- Incognito Auto Configuration Service
- ETI Solutions Overture ASC (formerly NetMania)
- Zcorum
- GenieACS
- Cisco Prime Home
- HP Intelligent Management

TR-069 Cautions

- TR-069 Devices are Accessible From the Internet and Need to Be Secured and Can Be Compromised
 - Use Secure Transport Over TLS
 - Like Any Web Service, It's Important to Ensure That TR-069 Be Run Over a Secure Connection
 - Lock Away TR-069 Configuration Options From User's Interface
 - Ensure That You Don't Leave Any Exposed Ports or Applications on the TR-069 Enabled Devices (Routers, Set-top Boxes, etc.)
 - Testing Tools are Available for This
 - Use Only TR-069 CPE Certified Devices
 - Broadband Forum Has a Testing/Certification Program.

Thoughts to Ponder

How TR-069 specifications manage the connected premises

May 28, 2013

From the May, 2013 Issue of Cabling Installation & Maintenance Magazine



Standard enables service providers to remotely provision, manage, monitor and control a wide range of devices at the customer premises.

By Robin Mersh, the broadband forum

As we construct a world with billions of devices connecting us to new services and applications, and as machines begin to interact directly with other machines (machine-to-machine or m²M), finding ways to manage this complex environment has never been more important. With so many different forms of access, from cable to fiber to wireless, the importance of a single management protocol that can handle all these technologies is a major priority.

Across the industry the Broadband Forum's Customer Premises Equipment Wide Area Network Management Protocol—CPE WAN Management Protocol (CWMP)—is recognized as the gold standard of remote management. It enables service providers to correctly and cost-effectively remotely provision, manage, monitor and control the wide range of devices and systems in the home or business. So much so that a 2011 study by Ovum shows widespread use of TR-069 on all continents, confirming 150 million devices managed by TR-069. And that number is growing rapidly.

Summary

- Traffic on the Network Will Continue to Grow Exponentially
 - IT Staffs Need a Way to Better Analyze and Manage Network Traffic Without a Significant Increase in Budget
 - Flow Analyzers and TR-069 Have the Potential to Simplify Network Monitoring and Management Thereby Reducing OpEx
 - There are ROI Opportunities From Investment in a Network Management Platform
 - Network Monitoring Tools Resource
 - Stanford Linear Accelerator Center
- <https://www.slac.stanford.edu/xorg/nmtf/nmtf-tools.html#nmp>

Q&A

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