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## Next Generation Applications

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President and CEO of AT&T Labs



# *The way it was ...*

*The Next Generation Network is adopted and deployed world-wide, displacing legacy networks. The performance of existing applications improve, and a new generation of applications slowly emerge as the NGN is deployed.*

# *The way it is ...*

*Next Generation Applications debut and are adopted world-wide. Networks must rapidly respond to the changing nature of traffic in the way they route, transport and support the new applications.*

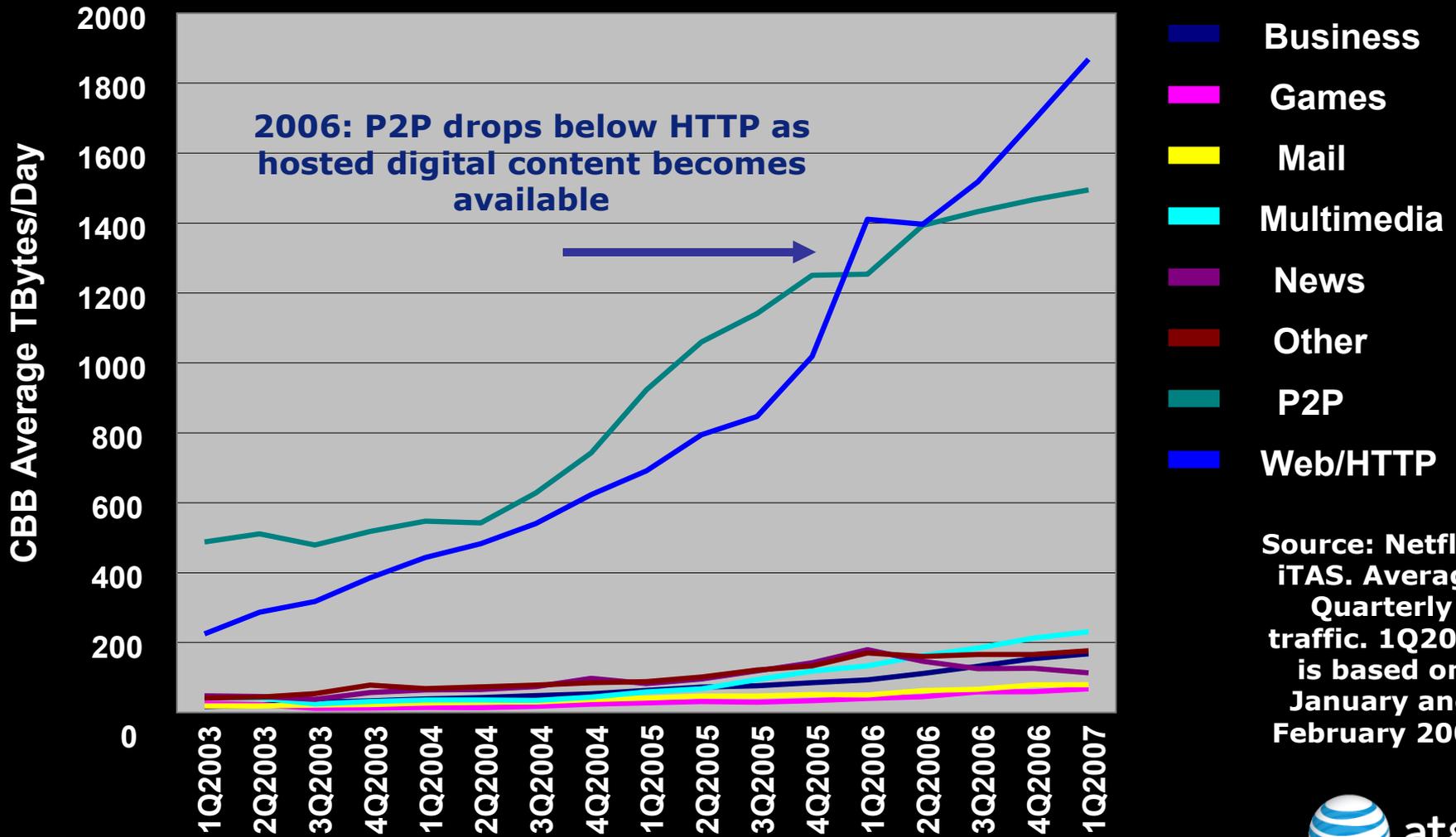
# Elements of Transformation

Networks transform in response to the changing nature of traffic.

The nature of traffic is rapidly evolving, driven by

- multi-media traffic
- the number and types of devices
- access technologies
- mobility

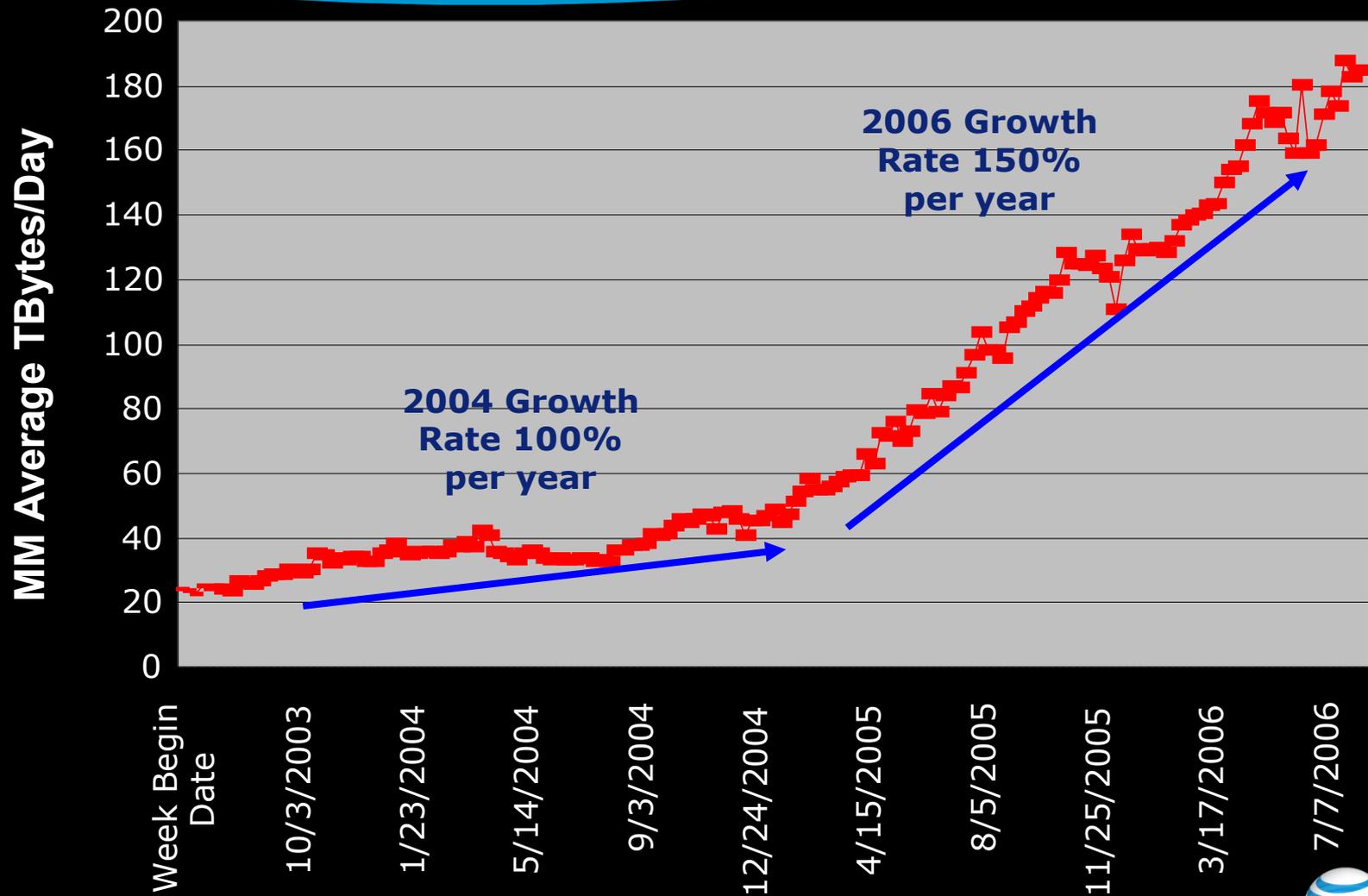
# The Changing Nature of Traffic



Source: Netflow iTAS. Average Quarterly traffic. 1Q2007 is based on January and February 2007



# Multimedia Traffic Growth



# Multimedia Enablement

## The Number and Types of Devices

- **Multimedia Personal Computer**
- **Multimedia Cell Phone**
- **HDTV**
- **PDAs and Blackberry**
- **iPOD and iPhone**
- **IP Phones**
- **Digital Camera**
- **Digital Camcorder**

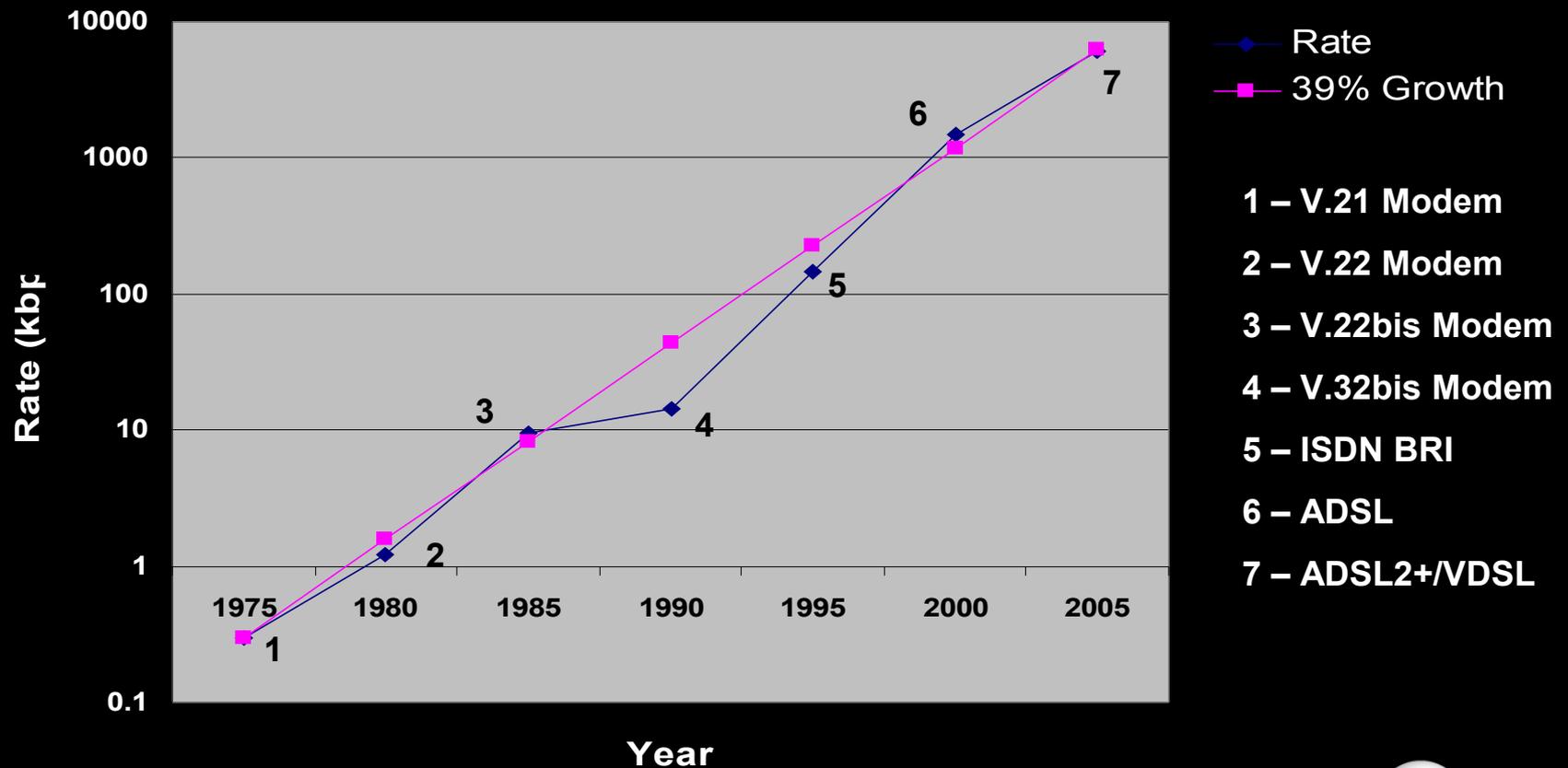
# Multimedia Enablement

## Access Technologies

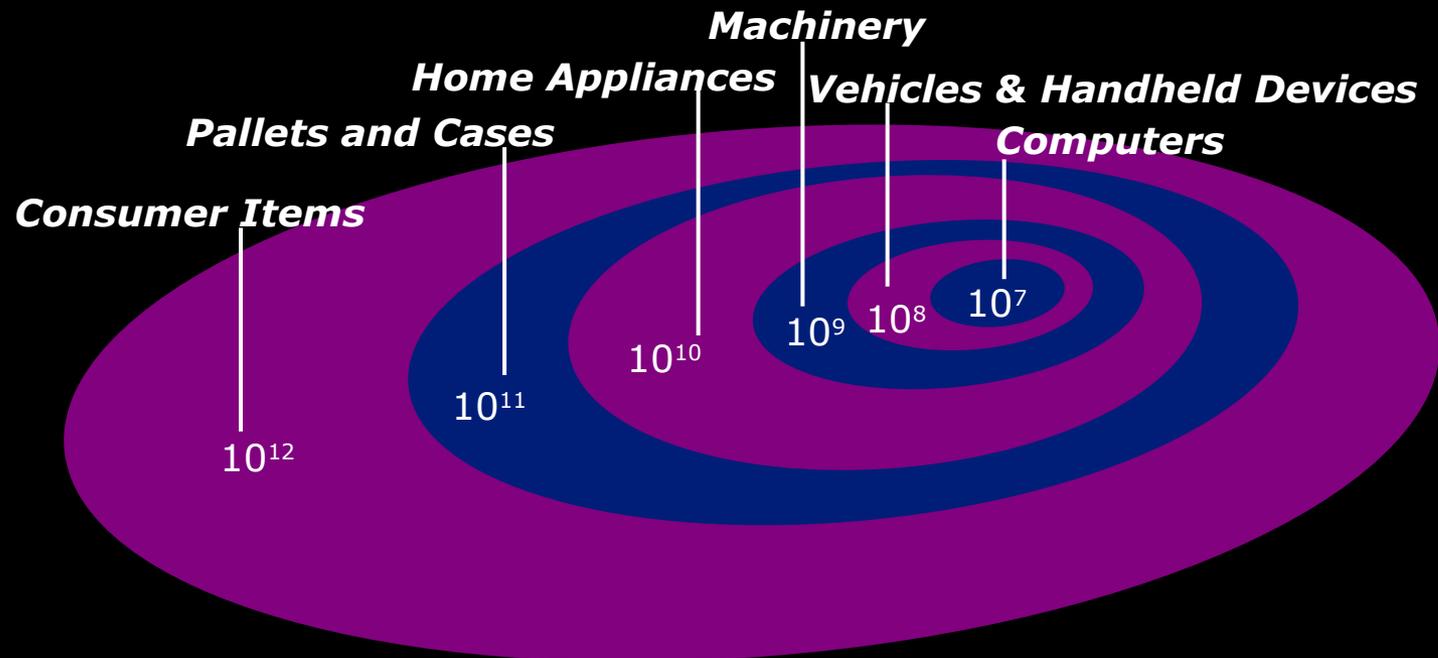
- **ADSL & ADSL2+**
- **DOCSIS 2.x & 3.0**
- **FTTN – VDSL2**
- **FTTP – BPON, GPON, ENET**
- **EVDO & HSDPA**
- **WiFi – Municipal Deployments**
- **WiMax**
- **Ethernet Access**

# Consumer Access Data Rates

## Consumer Data Rates



# Devices That Can Be Networked & Are IP Addressable



## Invisible Computing

- **Consumer Items**
- **Pallets and Cases**
- **Home Appliances**
- **Machinery**
- **Vehicles and Handheld Devices**

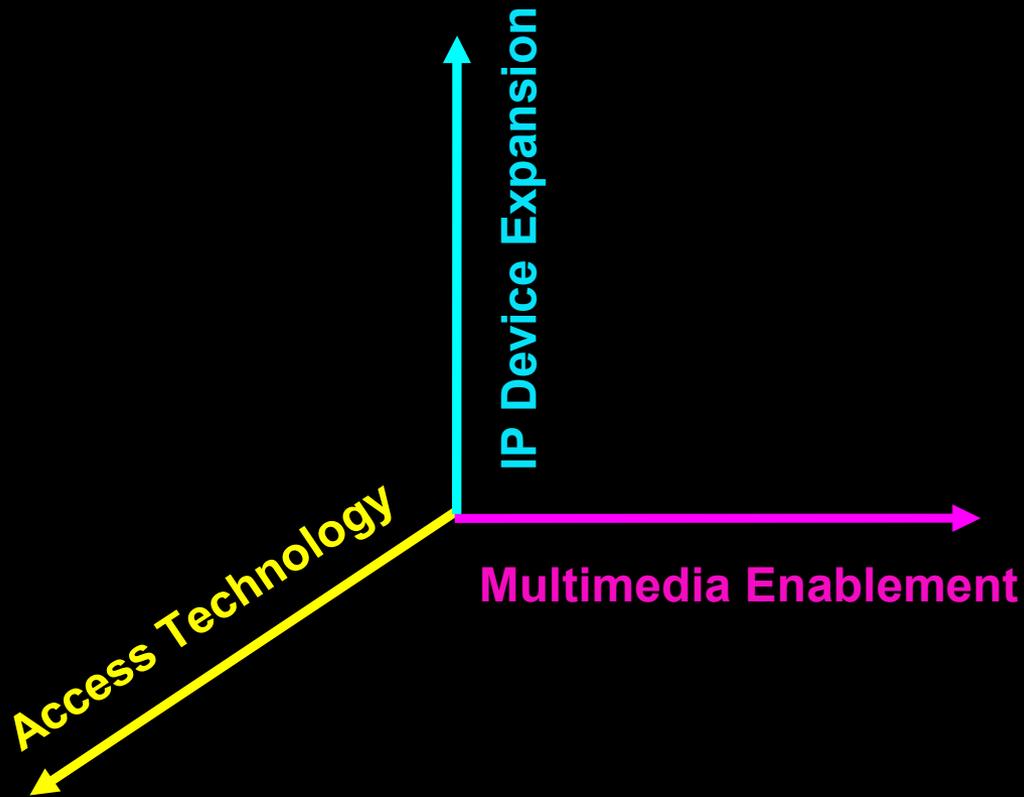
**Will Far outnumber current IT Devices**

# Impediments to IP Device Expansion

- Access Bandwidth
  - FTTN, 3G Wireless, DOCSIS 3.0 and FTTP deployments are underway
- IPV4 Limitations
  - IPV6 will be deployed on an application basis
  - Private domain management will evolve
- Security

# The Changing Nature of Traffic

## The Quantitative View



# The Changing Nature of Traffic

## The Qualitative View – It's not only bandwidth

Applications requiring low latency, low packet loss and low jitter are increasing

- VoIP
- Gaming
- Streaming video
  - IPTV
  - Video conferencing
  - Video sharing
- VPN services

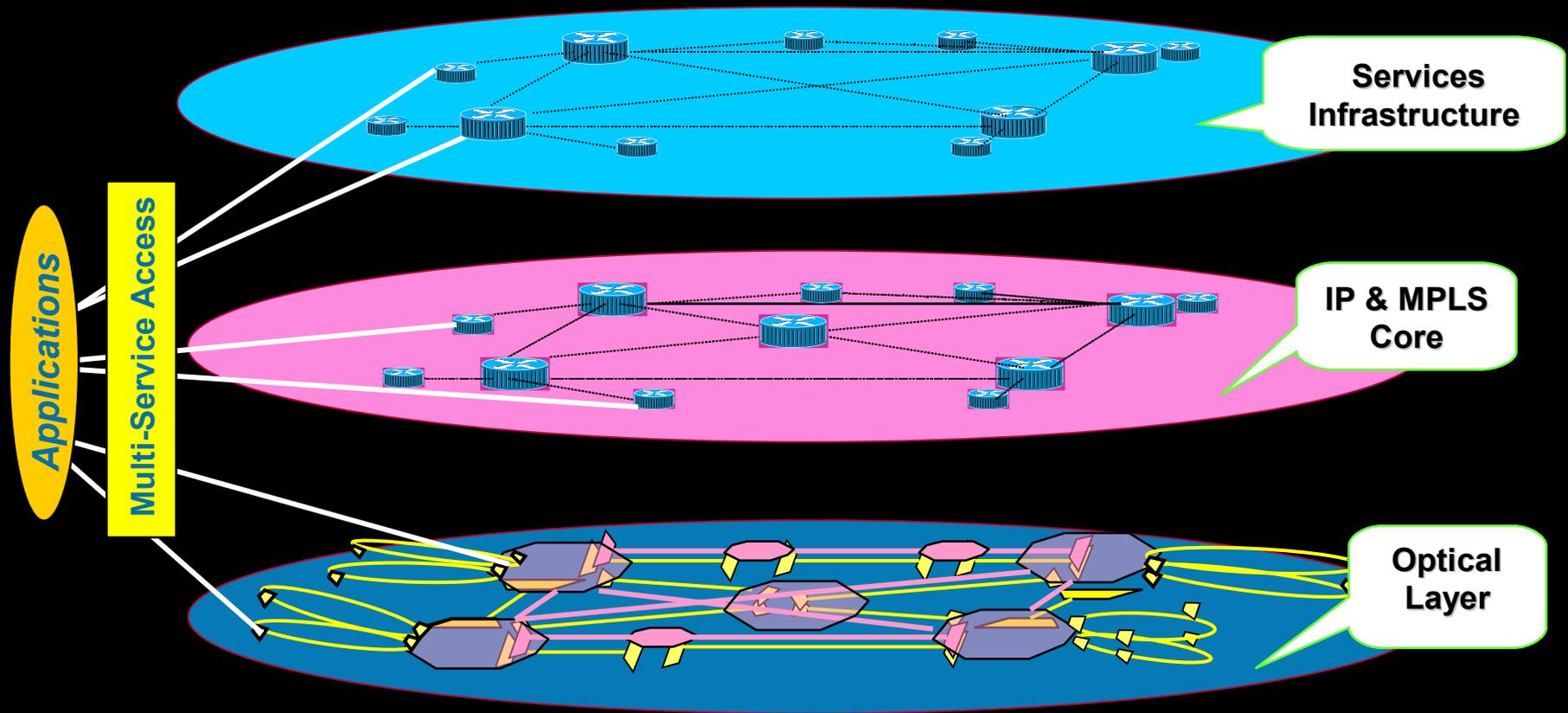
# Meeting the Demand

## The Current Approach

- Transition to a common backbone infrastructure
- Use technology transformation to expand core backbone capacity
- Implement QoS mechanisms to meet qualitative requirements
- Provide local relief through increased investment

# Network Transformations Are Multi-Dimensional

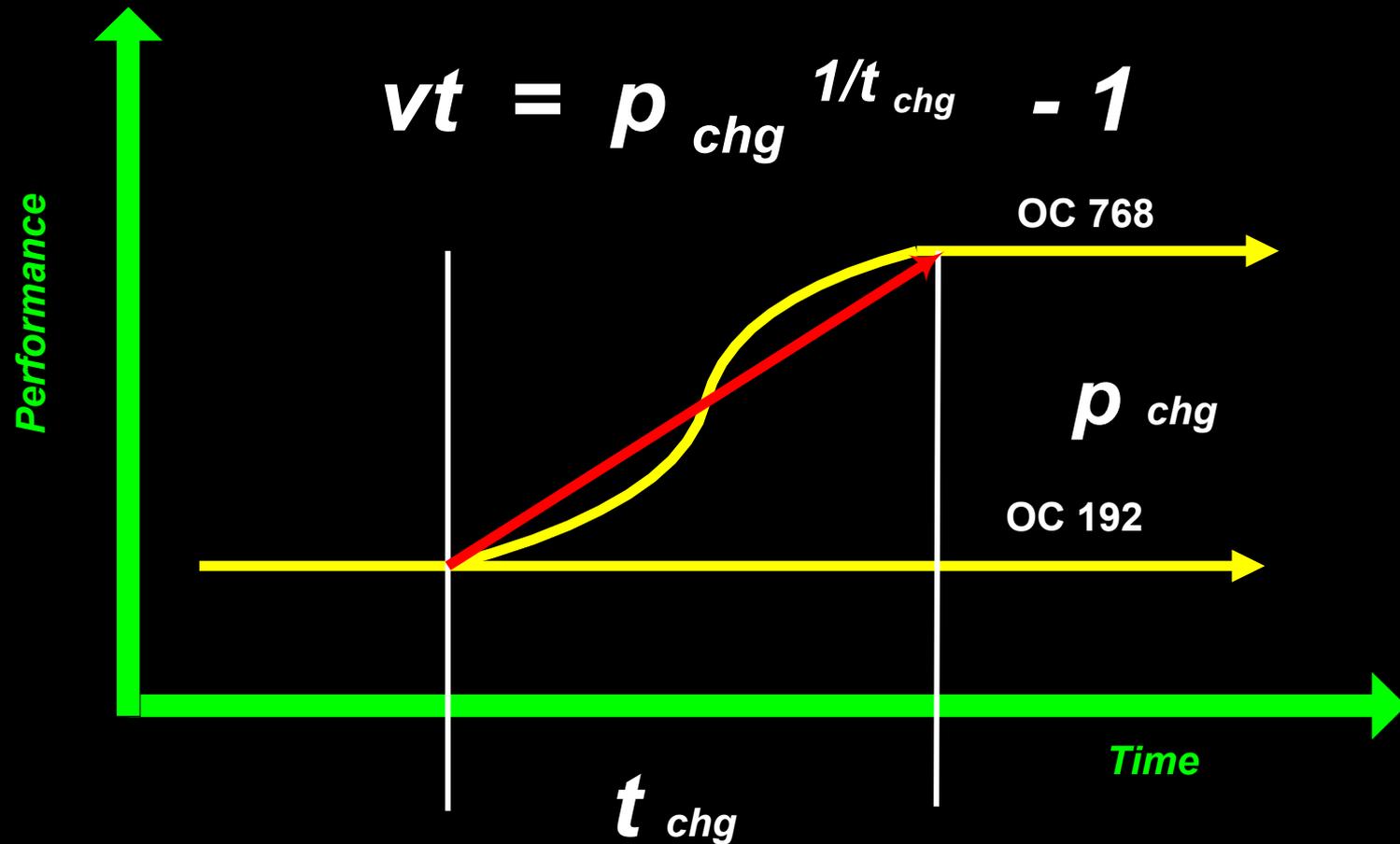
Local investment is targeted to meet local demand



**Full network transformation often requires all layers of the core and much of the access to be upgraded.**

# The Velocity of Transformation

The Rate of Technological Shift



# Velocity of Transformation

## A Comparative View

- Processing – 2x in 1.5 years
  - Moore's Law
  - $vt = \underline{.58}$
- Applications
  - All apps (2X in 1.5 years) -  $vt = \underline{.58}$
  - Multimedia apps (1.5 in 1 year) -  $vt = \underline{1.5}$
- Network Technology – 4x in 6 years
  - OC 192 – 2001
  - OC 768 – 2007
  - velocity of transformation -  $vt = \underline{.26}$

# Transformational Velocity Conclusions

- Applications are outpacing networks and processing.
- Processing is moving more rapidly than networks, and processing improves with local investment.
- Spare network capacity accumulated during the late 90's is being consumed as the velocity of application transformation exceeds that of networks.
- We need to find ways to improve vt for networks
  - We cannot achieve a 4X improvement by local investment
  - Improve the rate of network technology advancement
  - Change the way networks operate

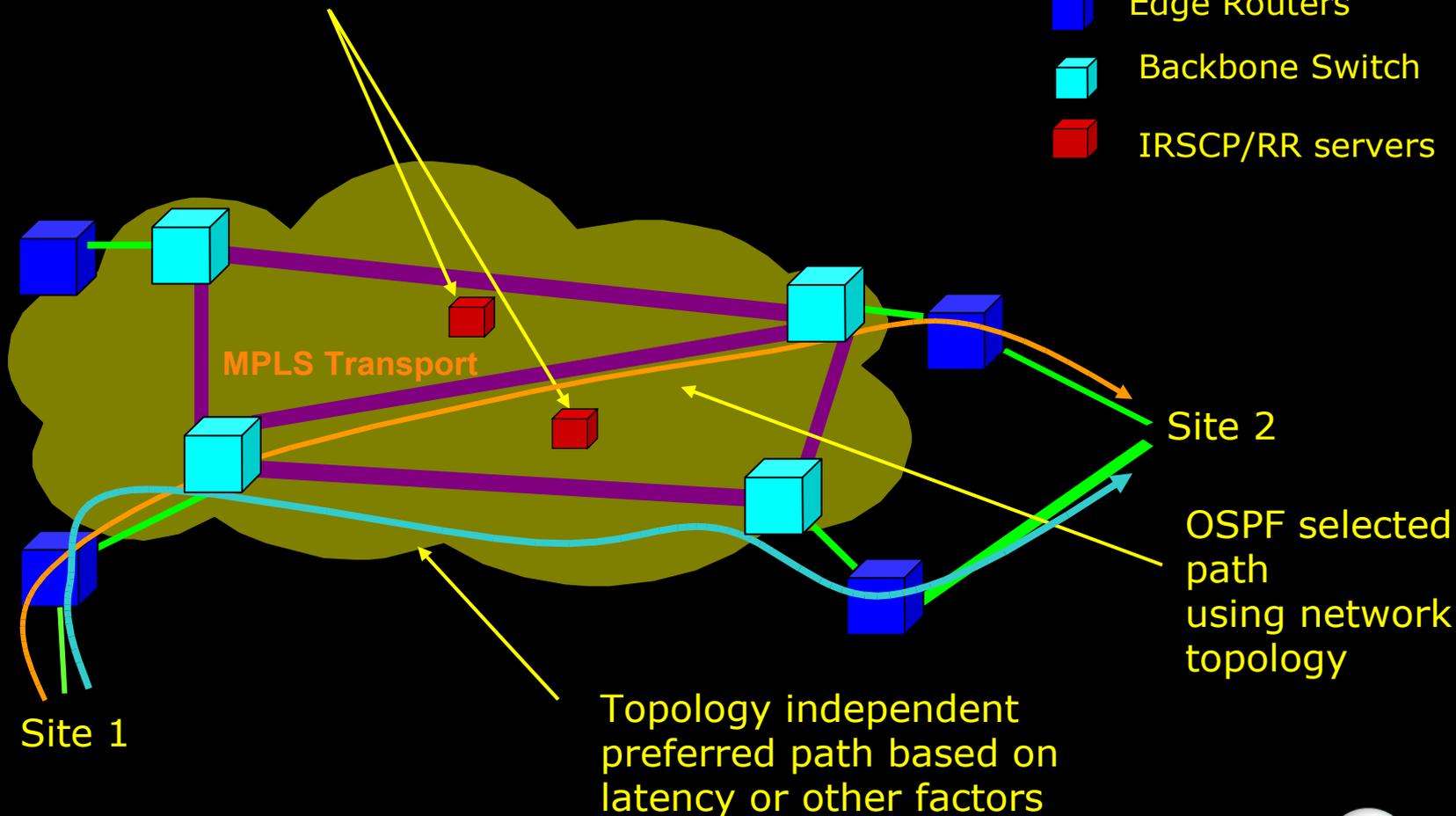
# Changing the way Networks Operate

- Use processing and adaptive computing to improve network performance
  - advances in routing control
  - better application of distribution protocols
  - develop network-based content management
- Improve network – application communication
  - networks respond to applications
  - applications respond to network conditions

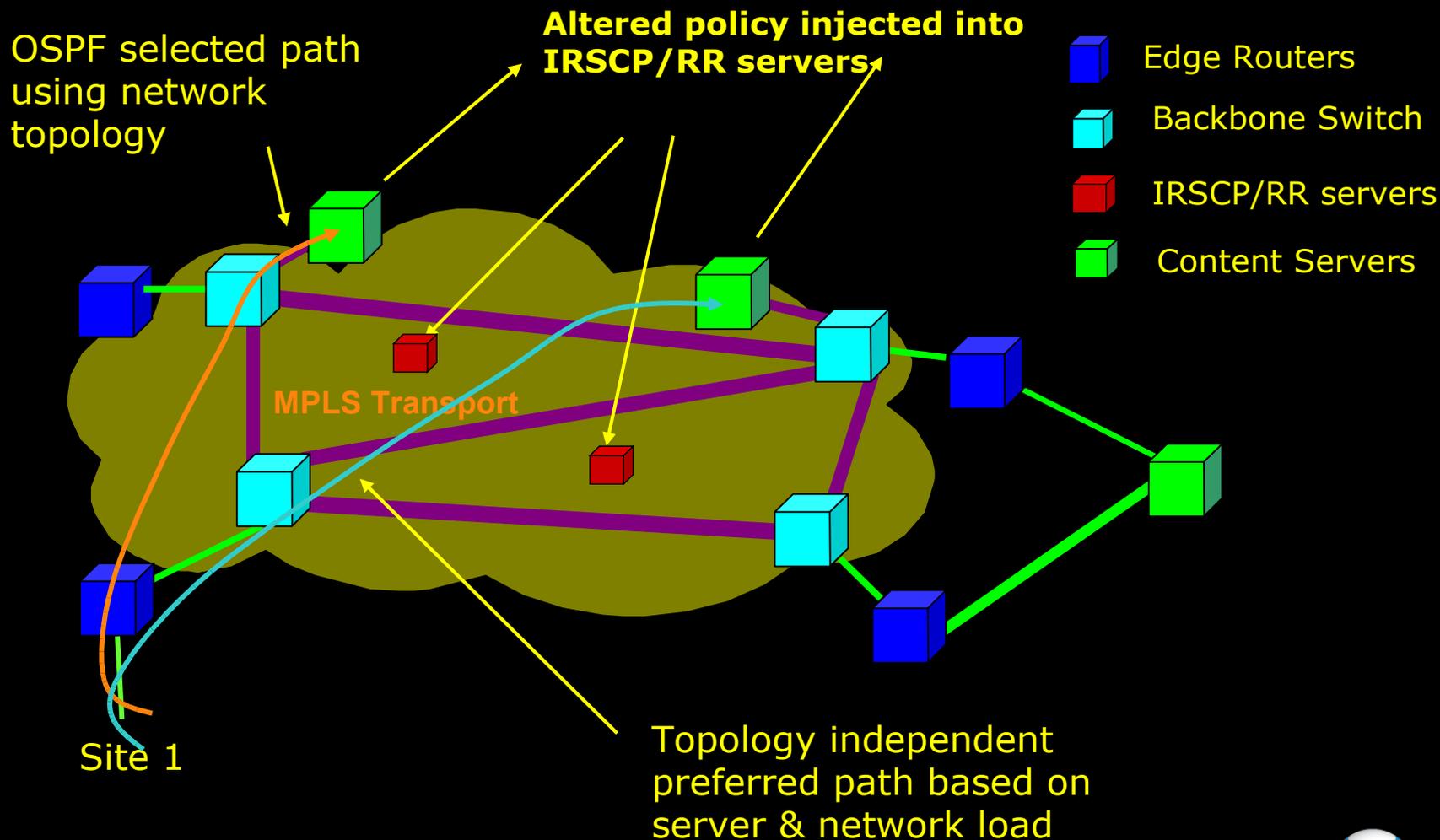
# Intelligent Routing Service Control Point (IRSCP) Network Aware – Load Balancing

## Altered policy injected into IRSCP/RR servers

- Edge Routers
- Backbone Switch
- IRSCP/RR servers



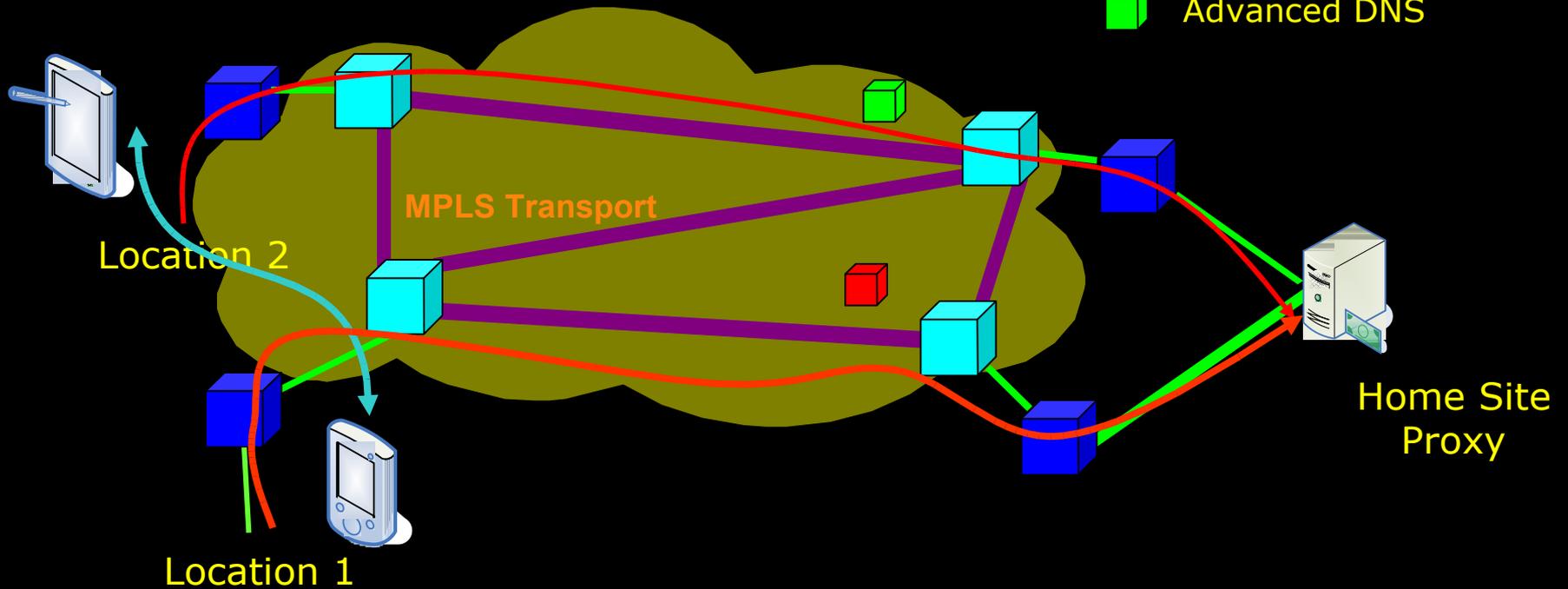
# Intelligent Routing Service Control Point (IRSCP) Network & Application Aware – Load Balancing



# Mobile Peer to Peer Services

## True Mobile Peer to Peer

- Edge Routers
- Backbone Switch
- Advanced DHCP
- Advanced DNS



# Network Adaptation Layer

- Network-based Content Management
- Adaptive Computing
- Mobility Management
- Published APIs and Application Guides
- Intelligent Routing iRSCP
  - Network Aware
  - Application Aware
- Other Infrastructure Changes
  - iDNS, iDHCP
  - Management Systems
  - Traffic Engineering

**NAL**

Applications

Adaptive App Mgmt

iRSCP, iDNS, iDHCP

Network

Thank You