

# Network Traffic and Capacity

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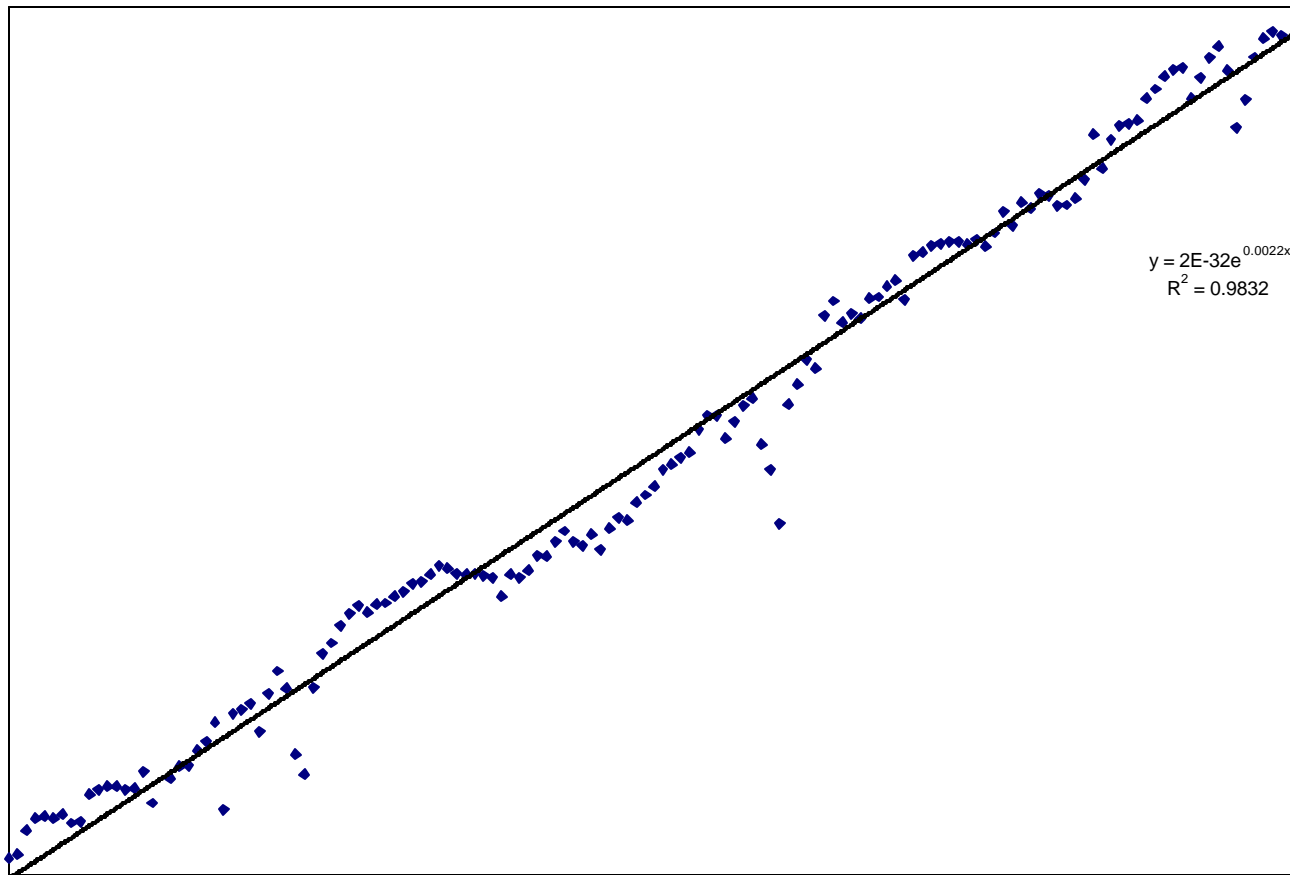
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## Some Traffic Characteristics that Drive Network Capacity

- Total traffic demand and growth rate
- Time of day variations
- Geographic distribution
- Short time scale behavior

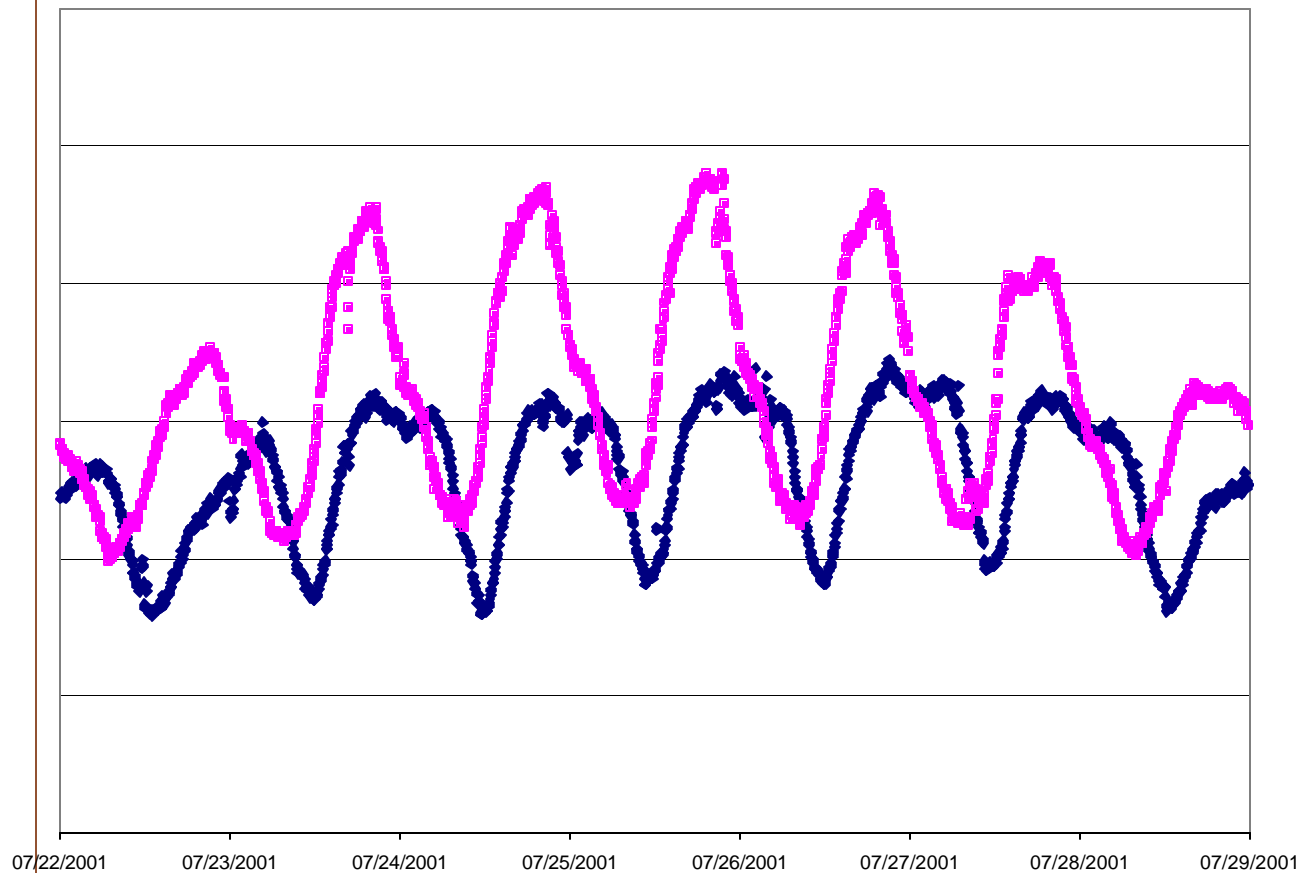
# Total traffic demand and growth rate



Edge traffic on Genuity domestic IP network

- Exponential traffic growth for past few years
- More than doubling annually
- Some slowdown in first half of 2001
- Correlation with “Total Internet Traffic” dependent on many factors
- For capacity planning, future traffic projected from both historical trends and sales forecasts

# Time of day variations



- Avg traffic used in models for computational convenience
- Peak traffic drives design thresholds
- Traffic at any time generates revenue
- Changing TOD behavior would alter economics

# Geographic Distribution

- Capacity is Gbps-miles, not Gbps
- Average distance between entry and exit points drives capacity
- Some factors affecting this relationship
  - nature of customer and application (e.g., communities of interest)
  - fraction of traffic exchanged with other providers
  - caching and content distribution

# Short time scale behavior

- Performance is determined by short time scale behavior
- Many different models have been proposed for traffic characteristics at these scales
- Empirically, packet loss on high speed router links is rare until very high utilizations
- Need better models connecting network performance characteristics to end-user experience

## Some problems of interest

- Implications of Internet traffic characteristics for link-level queuing
  - models relating network performance metrics to end-user experience
- Optimization of routing link weights for network designs and traffic engineering
  - can we improve on heuristic approaches without sacrificing speed
- Real-time control in a high-bandwidth, latency-sensitive environment
  - need for fast, distributed, predictive(?) algorithms