

Autonomous Network Configuration by Negotiation: Problem Statement & Requirements

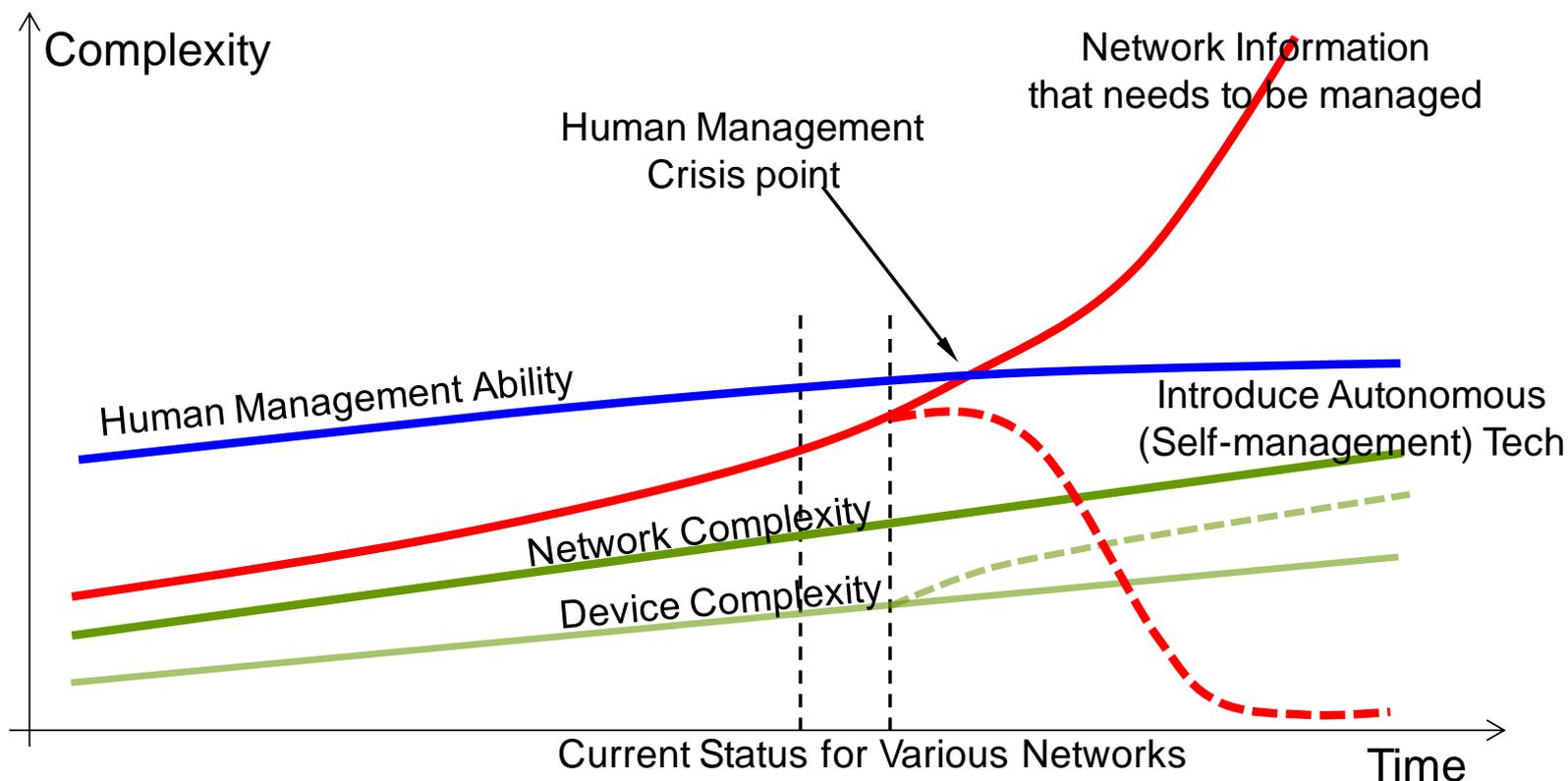
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Motivation for Autonomous Network

- Many ISP networks contain >100k network devices
 - Devices are often managed by different staffs
- Configuration, management, maintenance, troubleshooting and recovery of these devices is a major OPEX burden
 - Substantial staff training and coordination
 - More directly coordination among devices is desired
- Autonomy of configuration would be a major benefit
 - “Plug and play for the ISP”
 - Network devices decide configurations by themselves
 - Network devices need to “talk” and “negotiate” with each other directly

Autonomous: Network Managed by Itself



- Human-based management cannot handle the more and more complex network
- The automation of network could simplify the human management, reduce the human error and the cost of network maintenance
- Autonomous also requires network devices become more intelligent and complex

The Missing Part: Device Negotiation Ability

- In routing protocols, distributed autonomous configuration is a well established mechanism
 - Mainly one-way information announcement model
- The question is how to extend autonomy to cover all kinds of distributed configuration
 - needs to be less hierarchical and less dependent on human operators than a traditional NMS
- Negotiation ability between network devices is needed
 - The network devices need to know more information from the relevant devices
 - The configuration should be decided in coordination model

Brief Look at Negotiation Requirements

- Able to manage any type of information about a node, flow, link, VPN, tunnel or security setting
- No human intervention
- Support of forecasting or "dry run" before changing configuration
- When a new user/device appears, able to set up coincidence resources or configuration on multiple other devices
- Automatic recovery (renegotiation) after faults
- Strong authentication

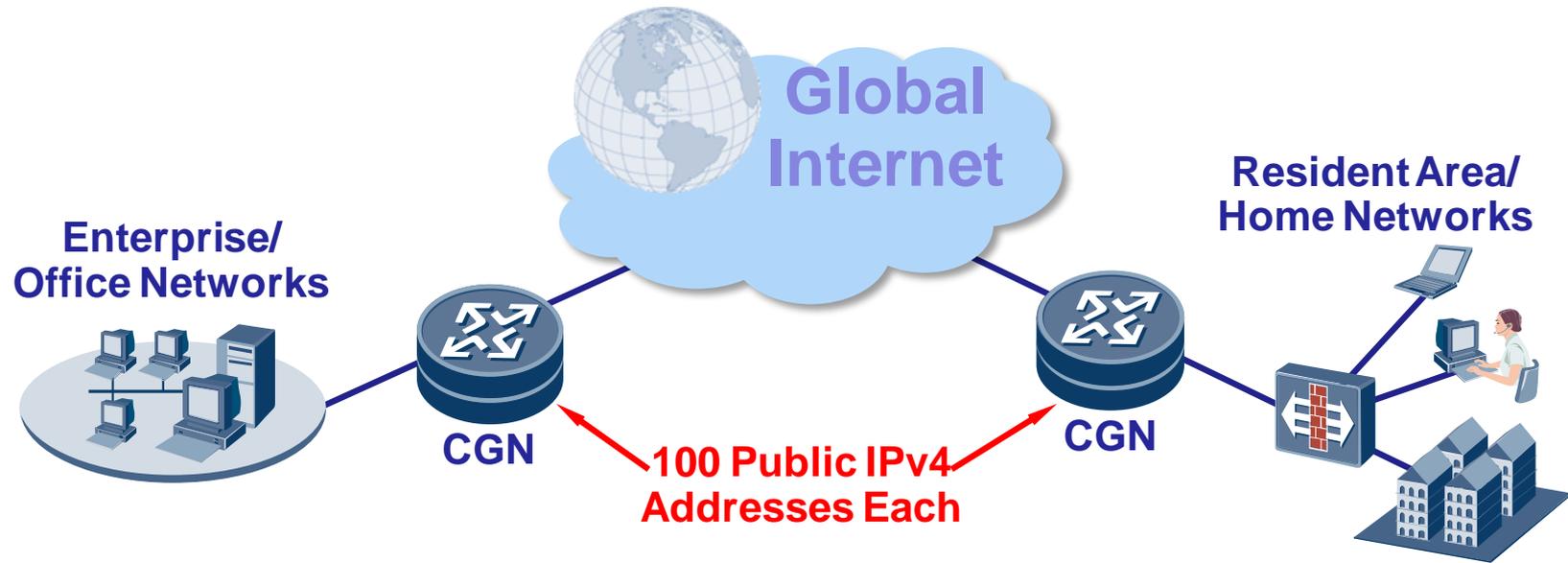
Brief Look at Negotiation-enabled Autonomous Scenarios

- Classical: negotiation between downstream and upstream network devices
 - Typically when a new device or customer connects
 - Particularly when downstream devices trigger the upstream devices to create/modify a corresponding configuration, or allocate/change corresponding resources
 - When dynamically optimizing coincidence configuration interactively

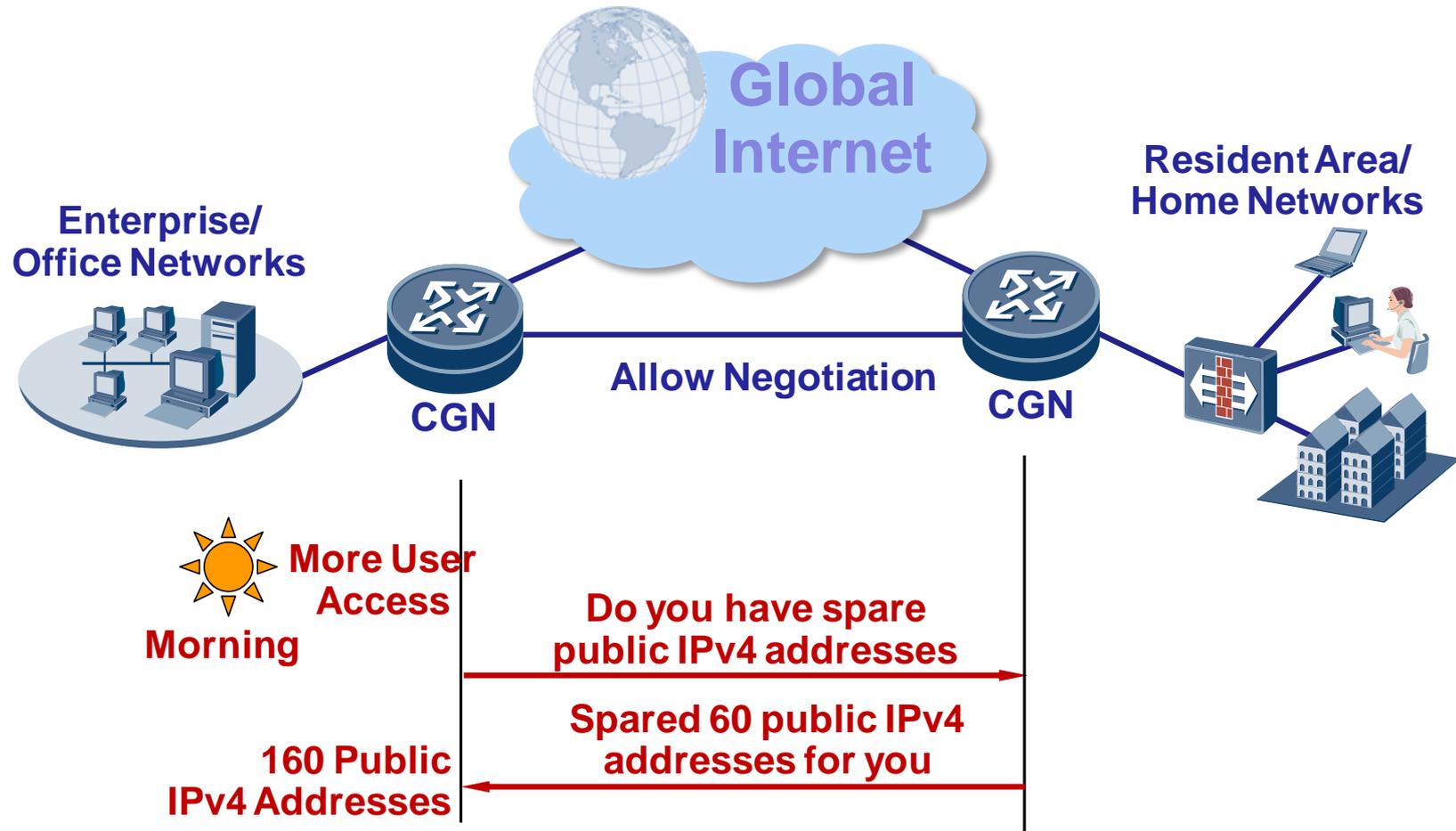
Brief Look at Negotiation-enabled Autonomous Scenarios (2)

- Negotiation between peer network devices
 - Typically when a new customer-to-customer flow arises, or a faulty node has to be bypassed
 - When sharing limited resource among peer network devices
- Negotiation between networks
 - Typically when a change in traffic engineering settings is needed (multiple connections)
 - Dynamic establishment and adjustment of differentiated service classes to support Service Level Agreements
 - Better coordination among networks

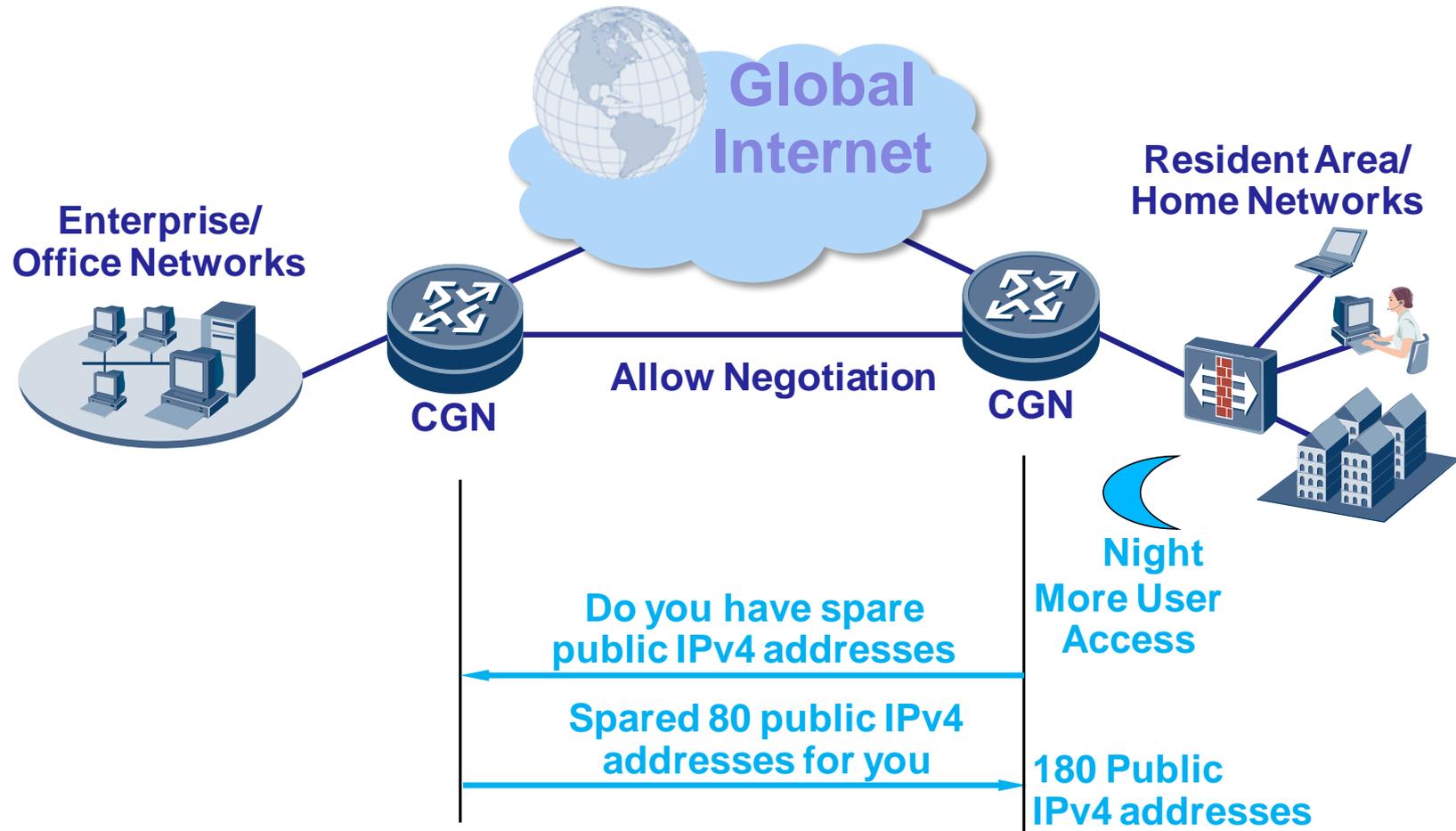
A Simple Autonomous Example With Device Negotiation



A Simple Autonomous Example With Device Negotiation



A Simple Autonomous Example With Device Negotiation



Contents of draft-jiang-config-negotiation-ps

- Analysis of requirements for a generic negotiation protocol
- Analysis of scenarios
- Considerations for detailed design requirements
- Brief review of some existing protocols
 - We have not found one that does what we want
- Possible protocol behavior model
- **draft-jiang-config-negotiation-protocol-00**
 - **Configuration Negotiation Protocol for Network Devices**

Questions? Discussion?

Thanks!