Hierarchical Node Management for Future Networks

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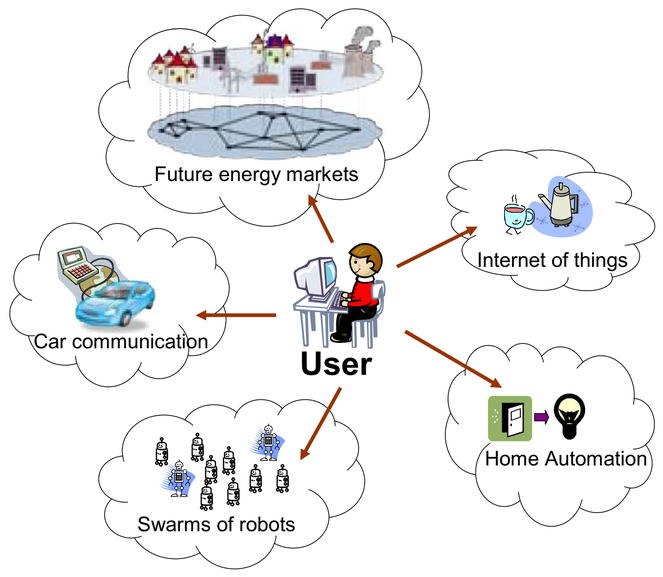
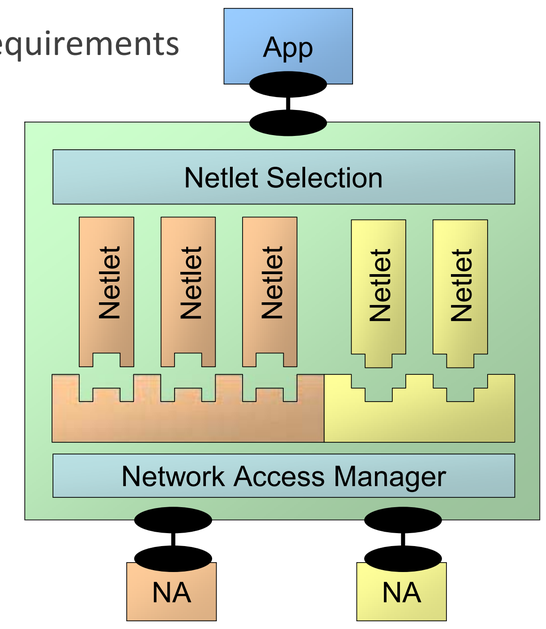
Future Internet Vision: Application-tailored Networks

- Application-tailored networks
  - Optimized for different use cases and applications
  - Diverse network architectures, communication paradigms (content-centric, DTNs,…) and properties (e.g., high/low data rates, mobility, wireless/wired,…)
  - Communication provided by application-tailored protocols
- Nodes operate a node architecture to…
  - Hide network details from applications and users
  - Connect concurrently to a multitude of networks at runtime
  - Maintain multitude of application-tailored protocols and network architectures
  - Select appropriate protocols based on application requirements and network properties
  - Adapt selected protocols to dynamic network properties



Our Approach

- Netlet-based Node Architecture (NENA)
  - Requirement-based Application Interface
  - Loading and execution of application-tailored protocols as so-called Netlets
  - Description of application requirements and Netlet properties
  - Selection of appropriate Netlet based on
    - Application requirements
    - Available Netlets
    - Network condition
  - Adaptation of selected Netlets to changing network properties
  - Attachment to networks via Network Adapters (NA)

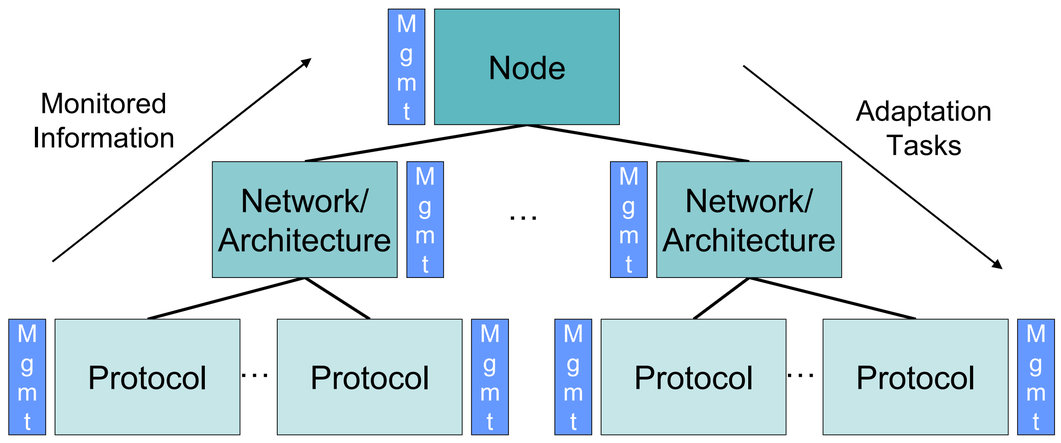


- Node Management System for NENA
  - Gathering of information about network conditions
    - Enable protocol selection based on network properties
    - Allow for runtime adaptation or Netlets
  - Adaptation of selected Netlets
    - Compensation of varying network properties
    - Efficient utilization of available node resources
    - Examples:
      - Compensation of network transmission errors by enabling/adapting Forward Error Correction
      - Saving energy by modifying protocol parameters
  - Allocation of node resources to active protocols and network architectures on a node
  - Consideration of user policies

Hierarchical Node Management

- Node Management in the Future Internet vision requires
  - Extensibility: Addition of new protocols/network architectures at runtime without modification of the management system
  - Flexibility: Enables management of changing set of active protocols and exploitation of management capabilities

→ Hierarchical Node Management



- Management structure
  - Protocol-specific management component in each Netlet
    - Knowledge about protocol details
  - Network-specific management component coupled with each network a node is connected to
    - Knowledge about the network/architectural details
  - Central Node-wide Management component in NENA
    - Global, coarse-grained view on the whole node
- Management components on each level
  - Individually perform monitoring, adaptation and resource management
  - Aggregate information and pass them from lower to higher levels
  - Delegate adaptation task from higher to lower levels

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