

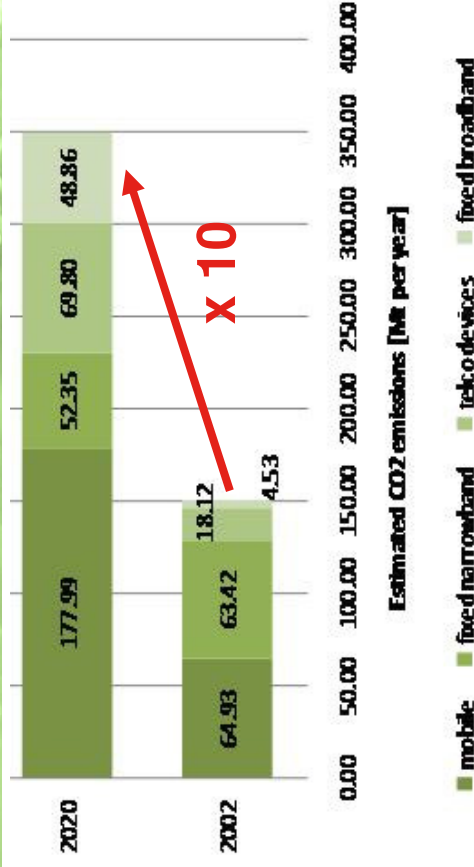


low Energy COnsumption NETworks (ECONET)

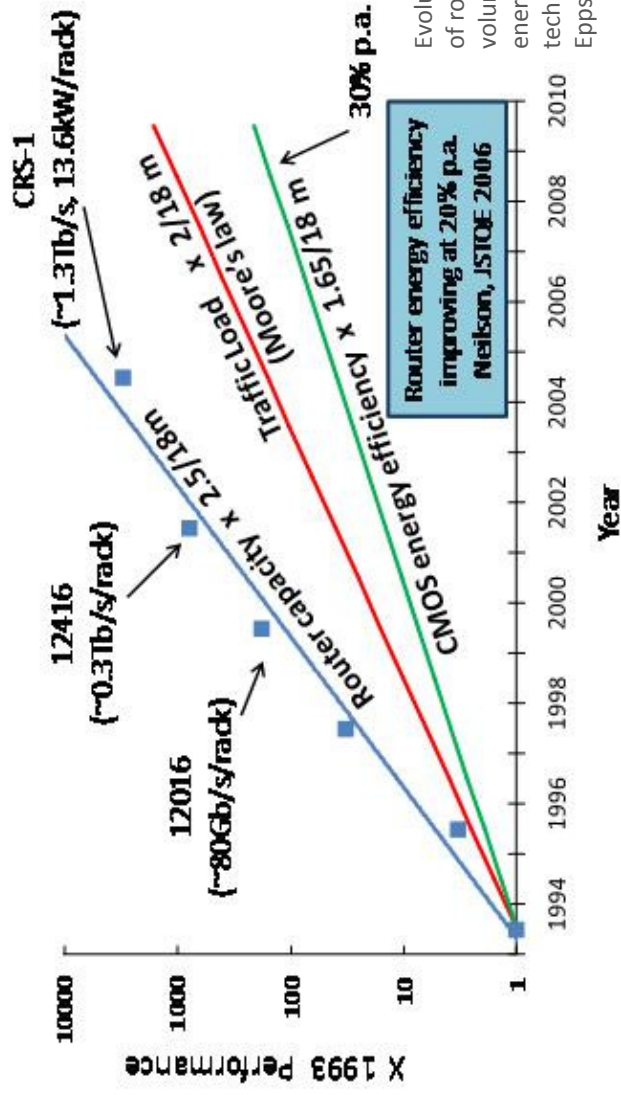
Smart power management for fixed network
devices



The Project Motivations and Focus



Greenhouse gas emission estimation according to GeSI

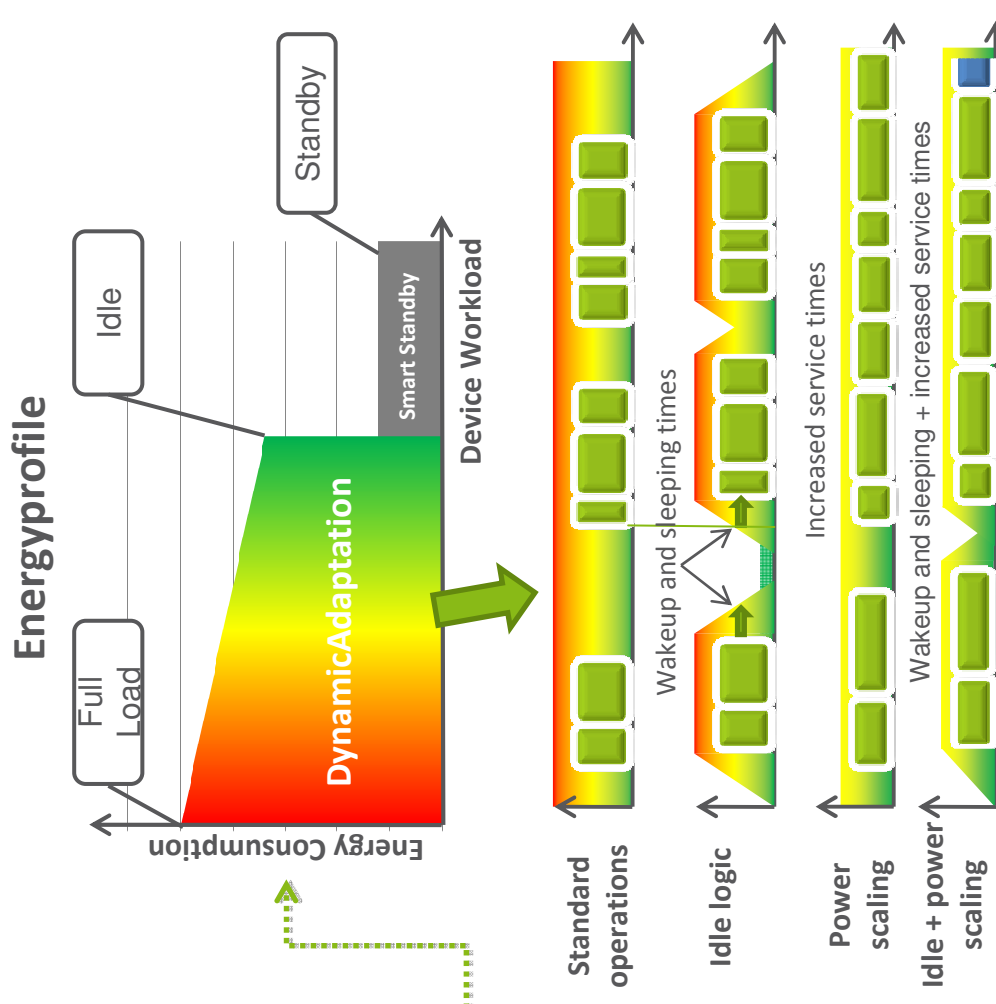
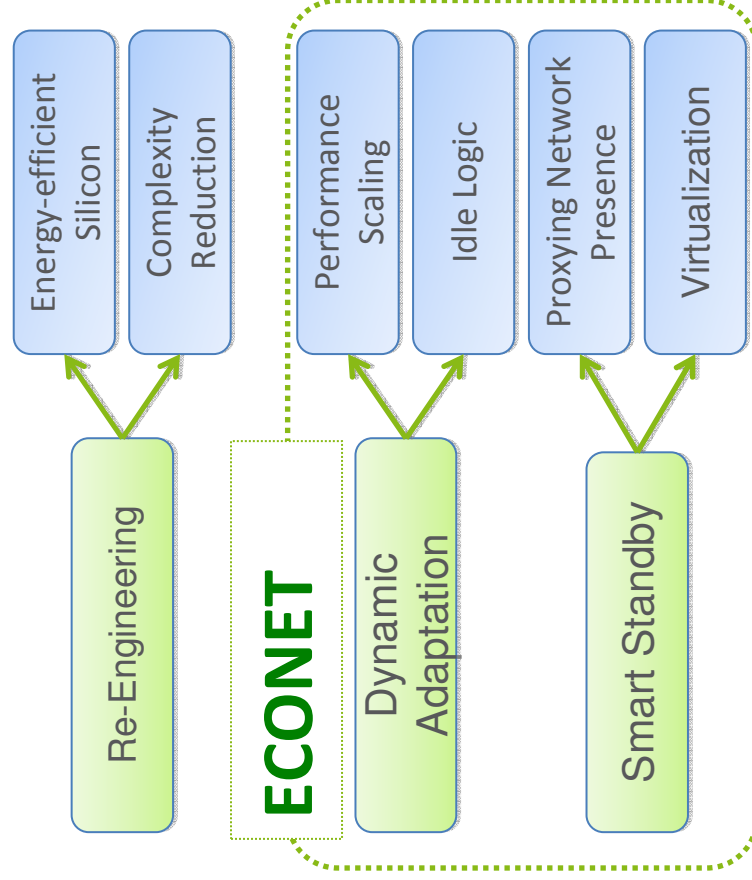


Evolution from 1993 to 2010 of routers capacity vs. traffic volumes (Moore's law) and energy efficiency in silicon technologies. SOURCE: G. Epps, Cisco Systems, 2006.

Static energy efficiency enhancement is not sufficient.

Dynamic power management is required.

Technology focus

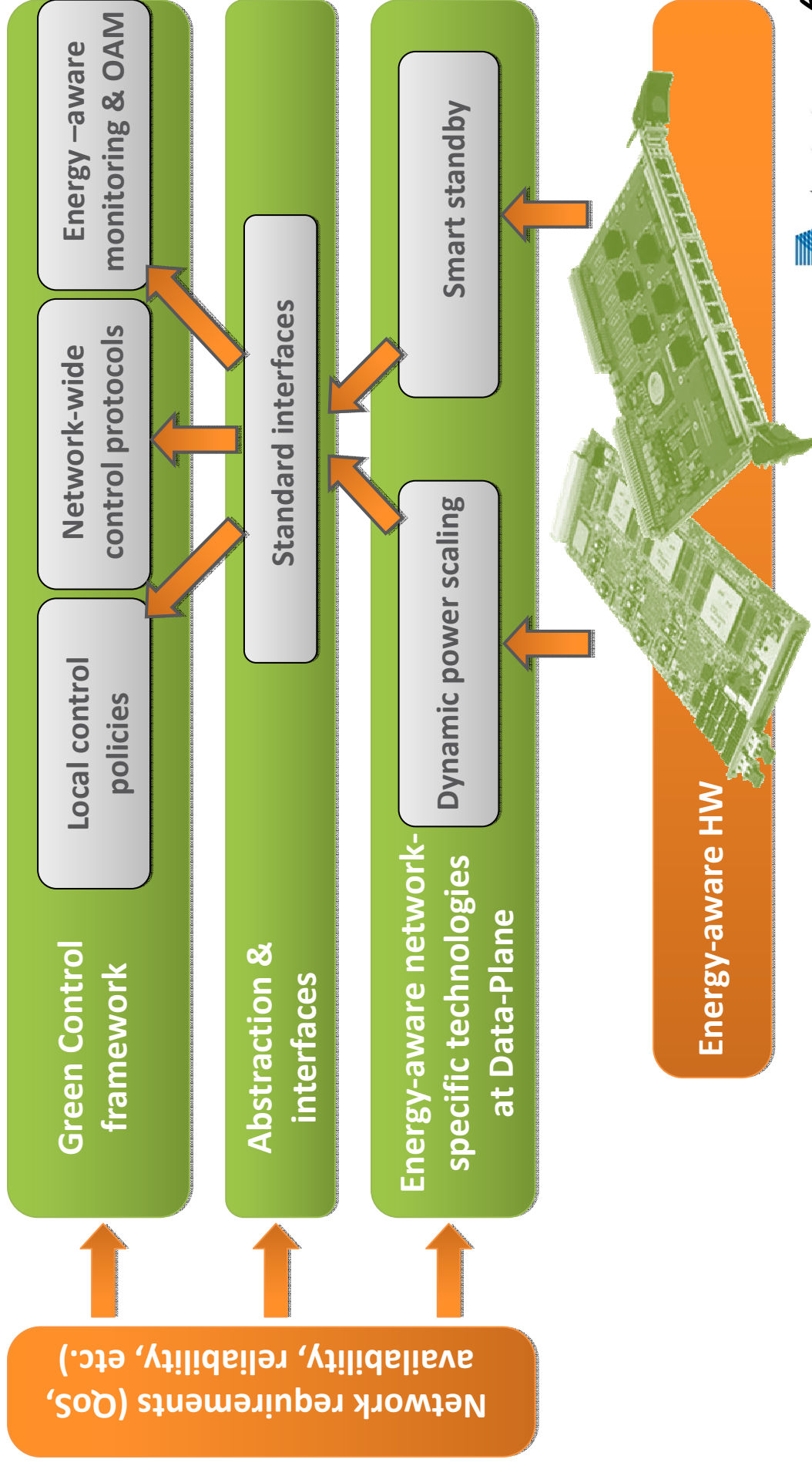


R. Bolla, R. Bruschi, F. Cucchietti, F. Davoli, "Energy Efficiency in the Future Internet: A Survey of Existing Approaches and Trends in Energy-Aware Fixed Network Infrastructures", IEEE Commun. Surveys & Tut., accepted for the publication, 2010

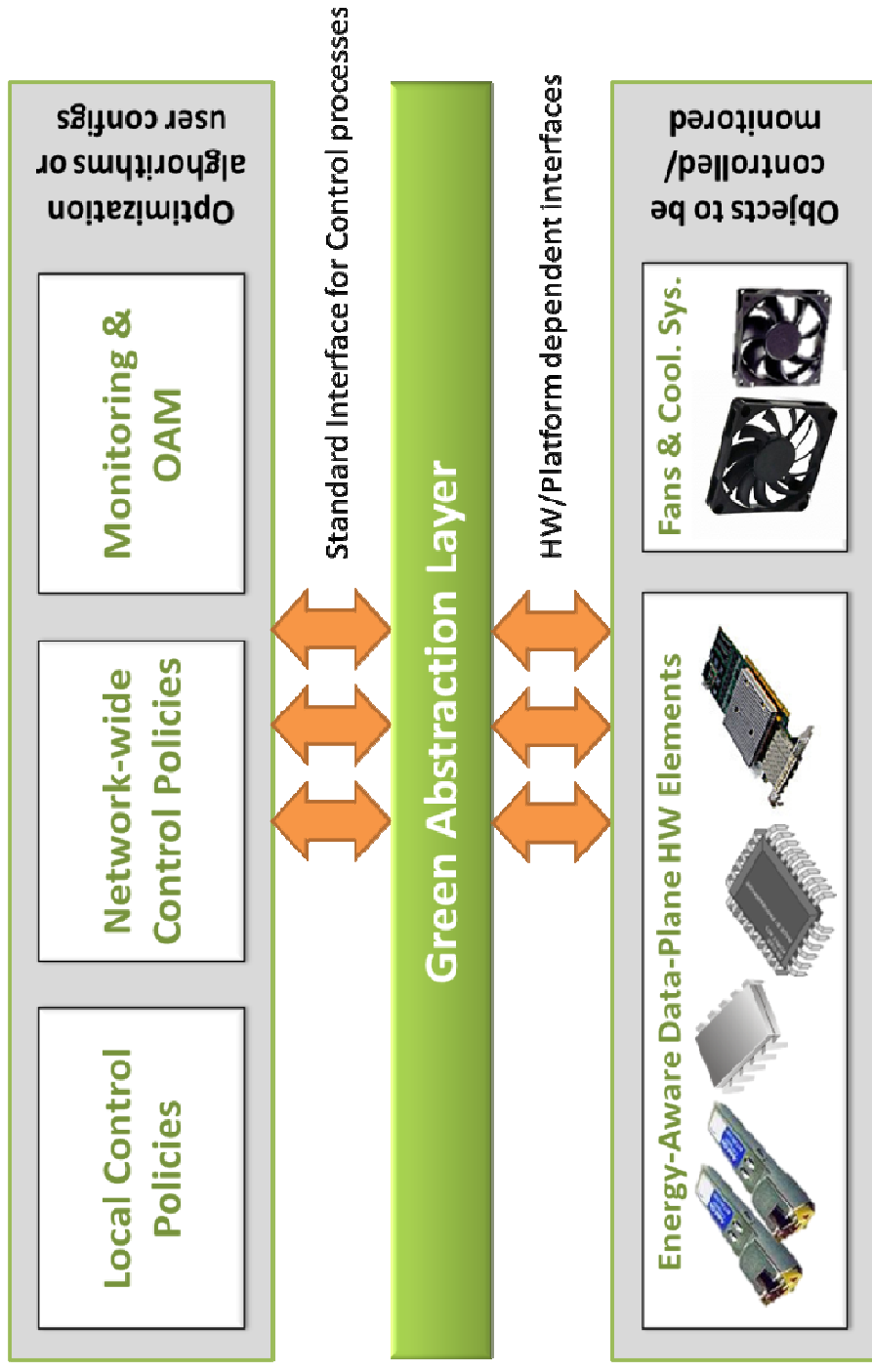
ECONET and related green ICT fields



ECONET - Vision and research threads

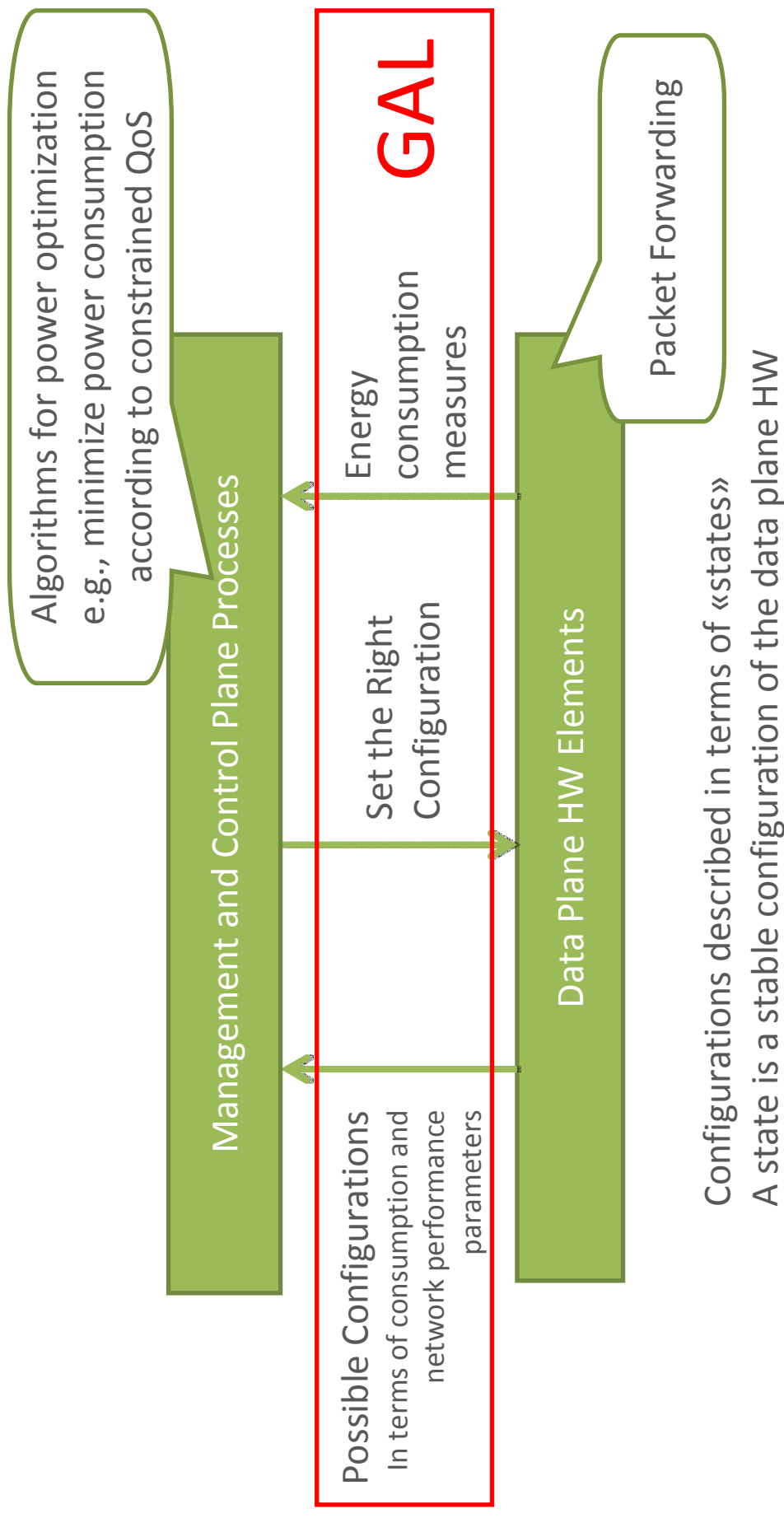


GAL - Key Enabler

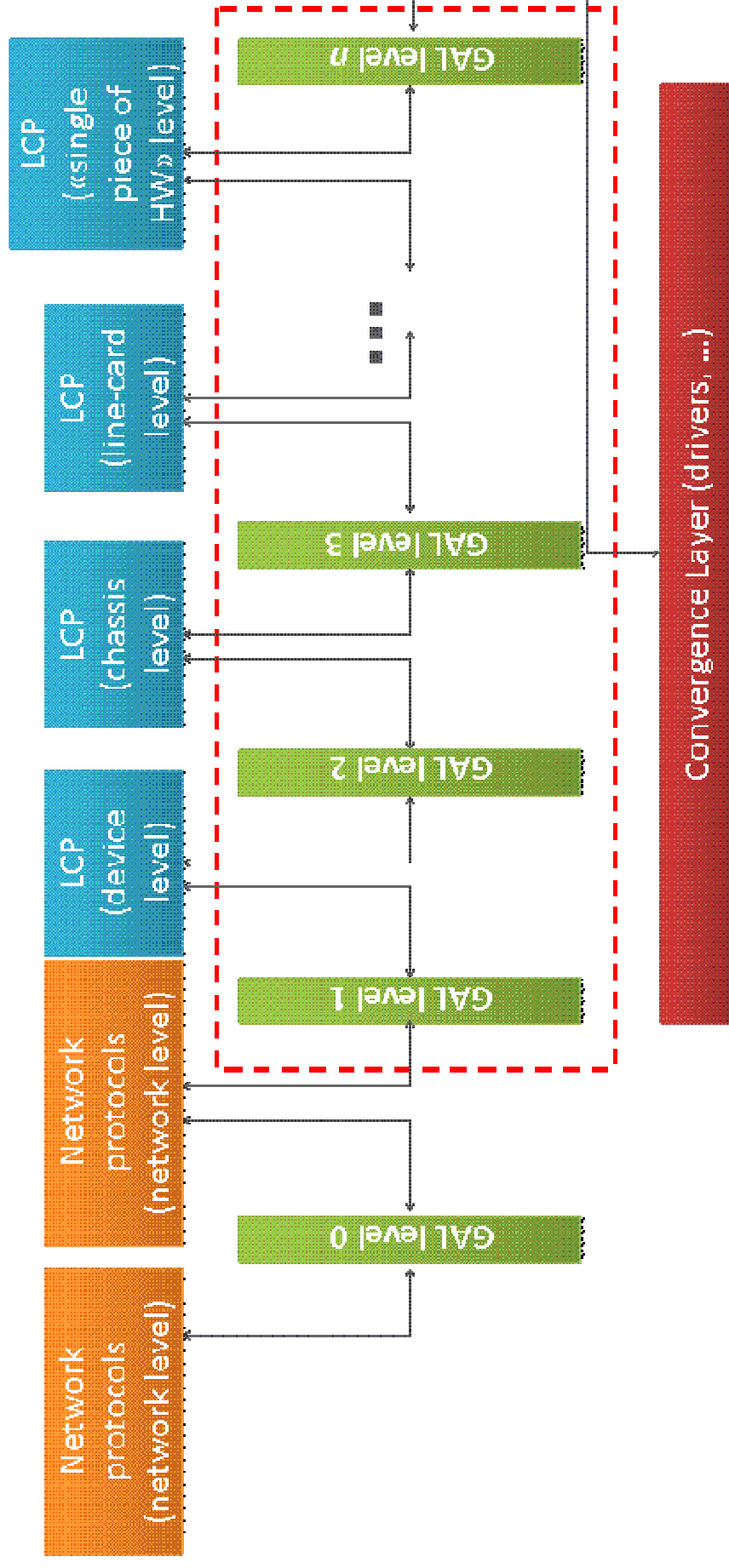


Smart standardization is required to enable efficient and network-wide dynamic power management

GAL - An example



The GAL Hierarchical Architecture



GAL - Standardisation challenge



- A suitable standard definition of the GAL must consider:
 - The presence and the main features of **multiple and heterogeneous internal components** with energy adaptation and monitoring capabilities;
 - **Heterogeneous and modular architectures** where these internal components are usually embedded, and, consequently how they may depend and interact among themselves;
 - Providing methodologies for aggregating all the information **from single internal components at a number of given resolution levels** (e.g., single component, link-, line-card-, chassis-, node- and network-level);
 - **Characterizing** the effect of putting components in a certain energy configuration in terms of power consumption and network performance;
 - Defining how **local control strategies** acting at various levels (network processor-, line-card-, chassis-level, etc.) have to be managed with respect to the GAL itself, and other typologies of control frameworks.

The GAL Standardisation: proposed areas



- Power Management Capabilities
 - Power Scaling
 - Adaptive Rate (AR), Low Power Idle (LPI)
 - Standby
- Operational Behaviors
 - The energy-aware capabilities can have different operational behaviors. Some aspects may be managed by control processes external to the entity, some others by the entity itself in an autonomic way depending on its workload.
 - Data-Plane Autonomic (DPA), Control-Plane Controllable (CPC)
- Definition of Energy-aware States
 - Energy-aware states are represented by a complex data type, which contains indications on the power consumption, the performance, the available functionalities, and the responsiveness of the entity when working in such configuration.

