



The KING Research Project Overview

Cornelis Hoogendoorn

Würzburg, 18th July 2005

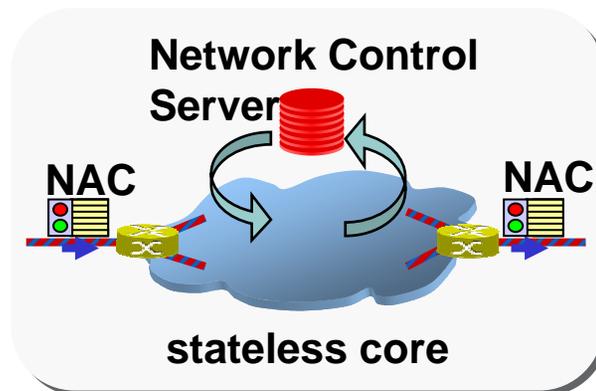
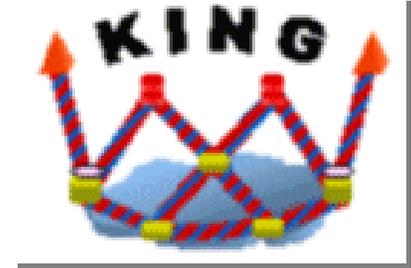
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KING Research Project Objective: Future IP platform for Next Generation Networks

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The goal of the research project KING* is to establish a comprehensive carrier class solution that complies with the three major requirements

- Quality of Service
- Network Reliability
- Efficient Network Management



- KING started in October 2001 with term of 3 years. Extended by 6 months until March 2005.
- KING was carried out by SAG jointly with 2 research institutes and 5 universities
- KING was 50% funded by the German Ministry of Education and Research (BMBF)

* Key Components for the Internet of Next Generation

Our partners in KING



**Fraunhofer-Gesellschaft,
Institute for Communication Systems, Munich**



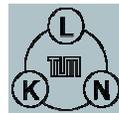
**Fraunhofer-Gesellschaft,
Institute for Open Communication Systems, Berlin**



**University of Duisburg-Essen, Institute for Experimental
Mathematics, Computer Network Technology Group**



**University of Karlsruhe (TH),
Institute of Telematics**



**Technical University of Munich,
Institute of Communication Networks**

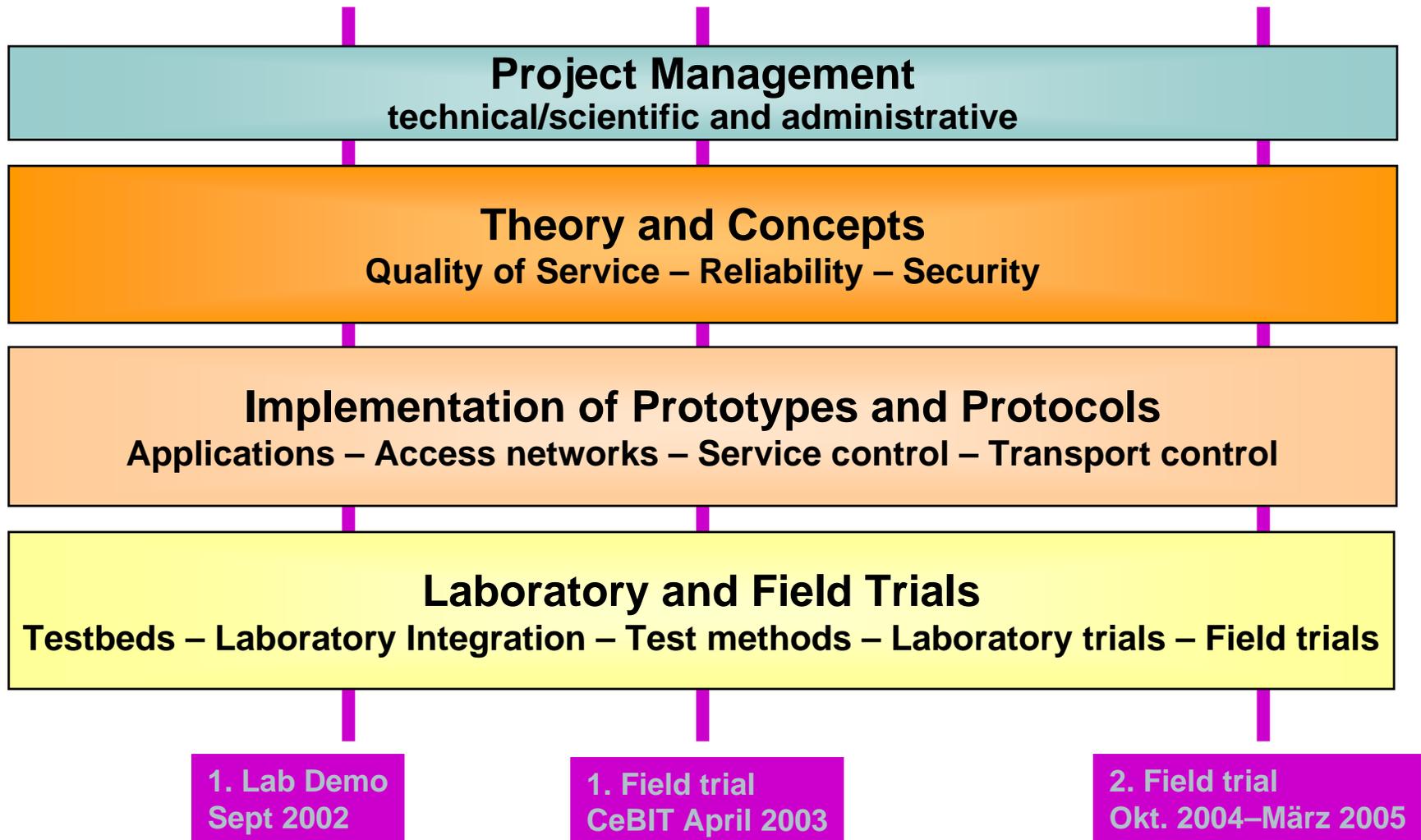


**University of Stuttgart, Institute of
Communication Networks and Computer Engineering**



**University of Würzburg, Institute of Computer Science,
Department of Distributed Systems**

Project Organization and Planning



NGN requires both QoS and resilience in the IP network

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convergent services

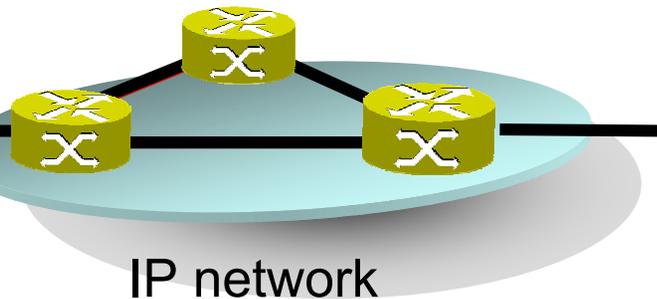
Support for broadband, real-time, interactive service

QoS

Qualified SLA

In case of failure, preserve QoS (subsecond range)

Resilience



Network support for fast fail-over and service differentiation

- ▶ KING (first concepts)
- ▶ RESIP (product)

Resource Management

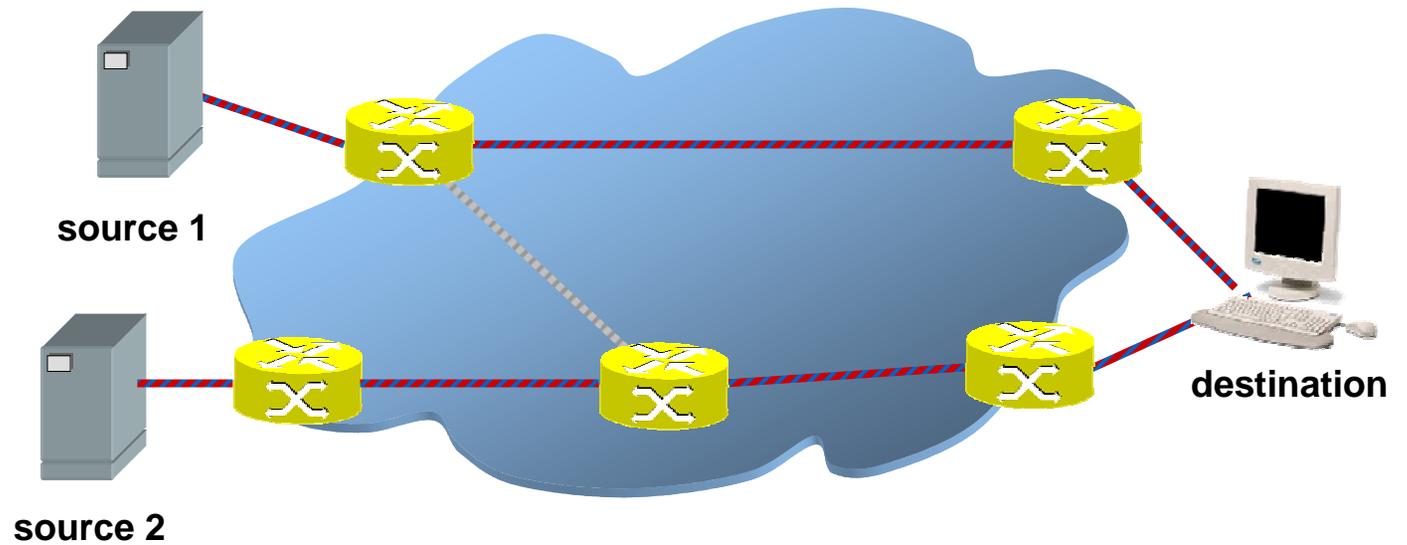
- ▶ KING NAC (Admission Control)

Additional configuration parameters

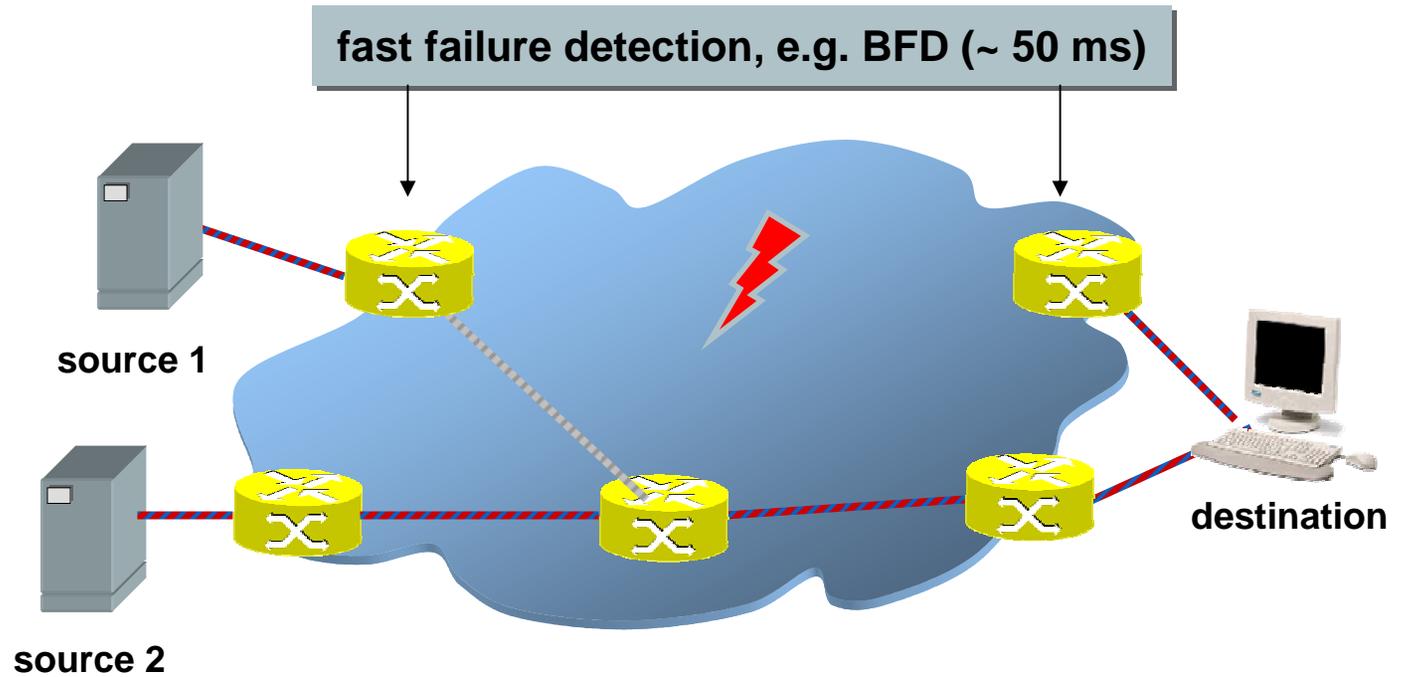
Automated network control

- ▶ KING NCS

Fast fail-over in OSPF/IS-IS networks

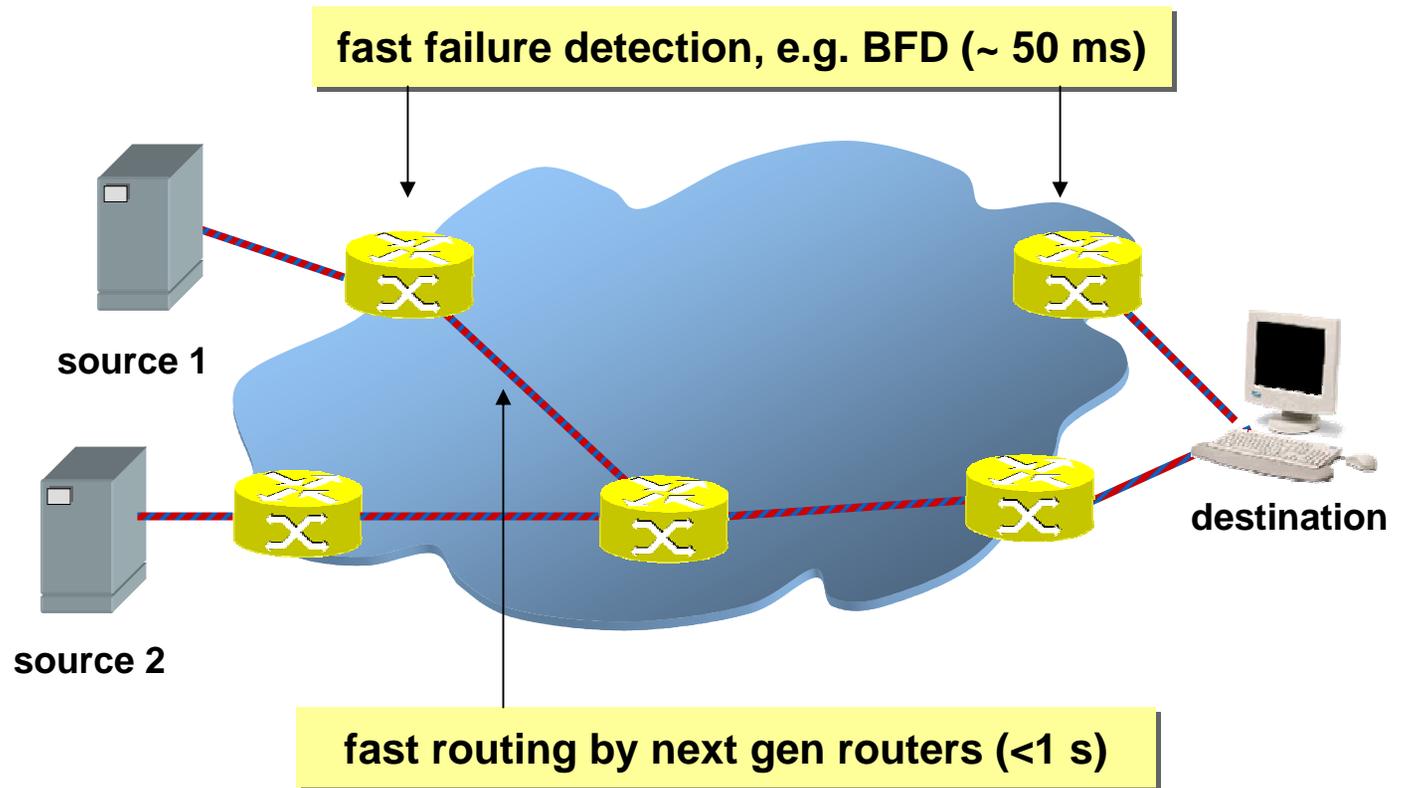


Fast fail-over in OSPF/IS-IS networks



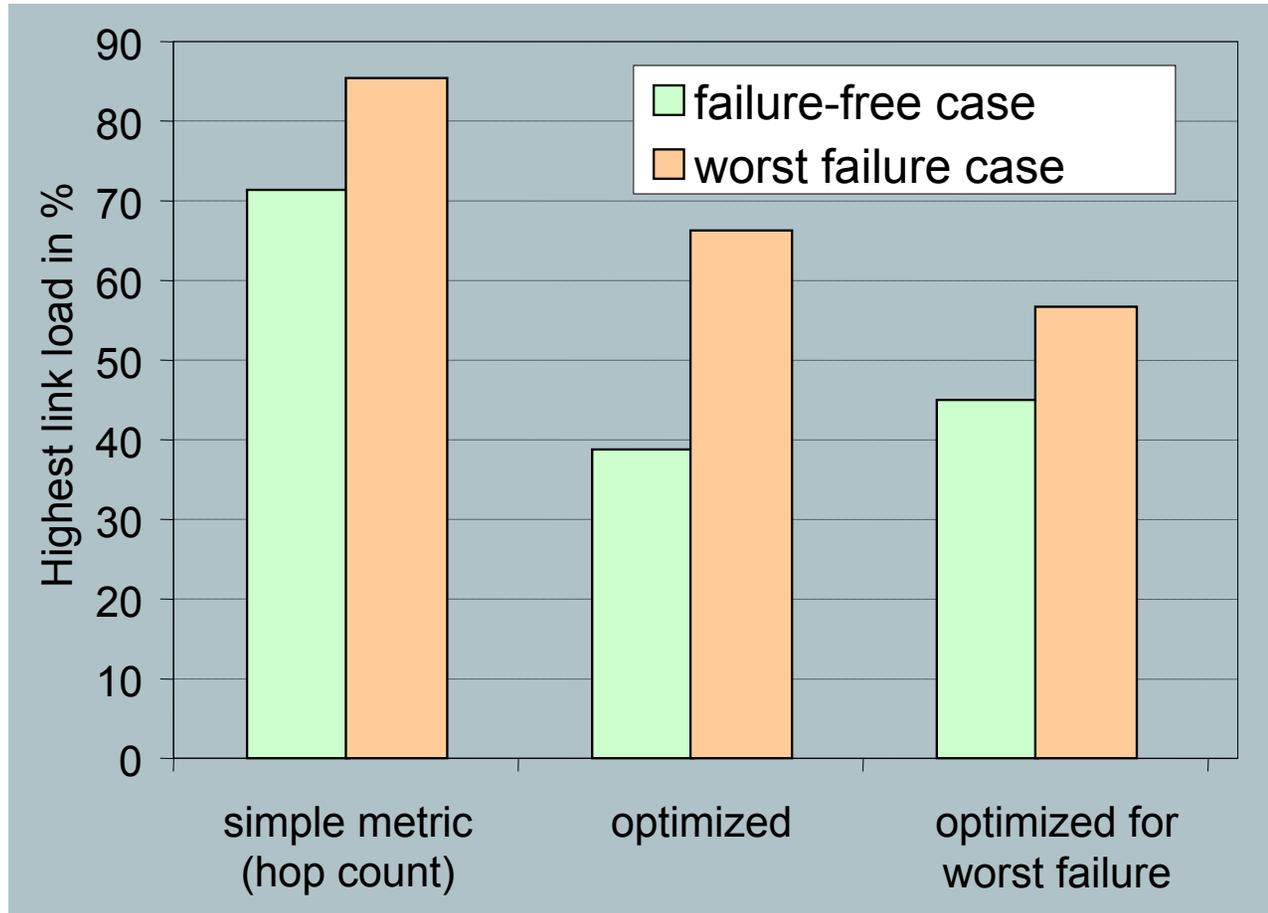
BFD Bidirectional Forwarding Detection

Fast fail-over in OSPF/IS-IS networks



BFD Bidirectional Forwarding Detection

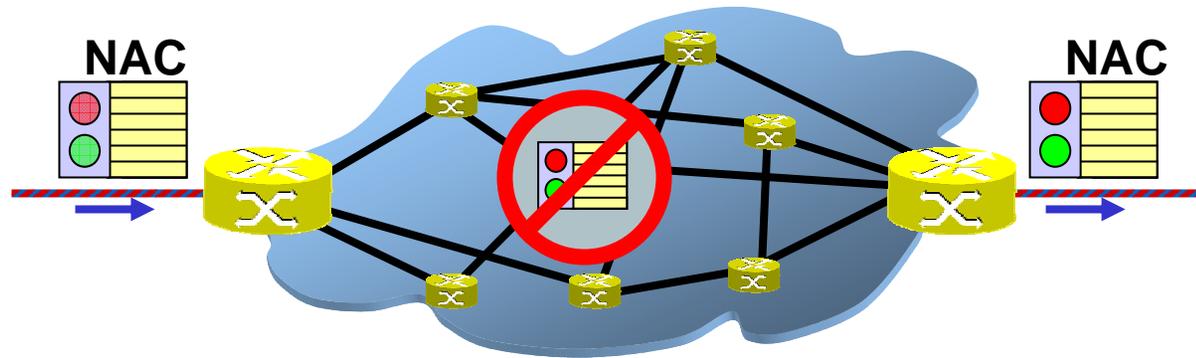
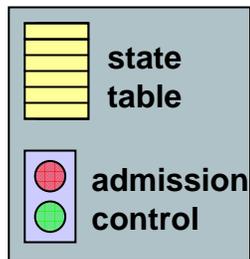
Optimized Resource usage through link metric optimization



Basis: COST239
Reference network

Optimized metrics reduce the maximum link load significantly

stateless core with Diffserv, fast routing and ECMP



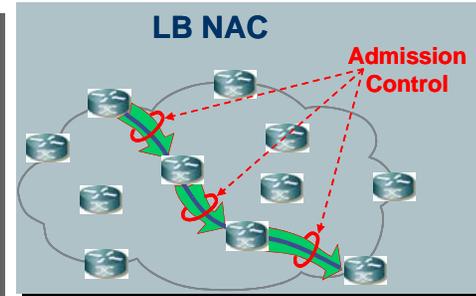
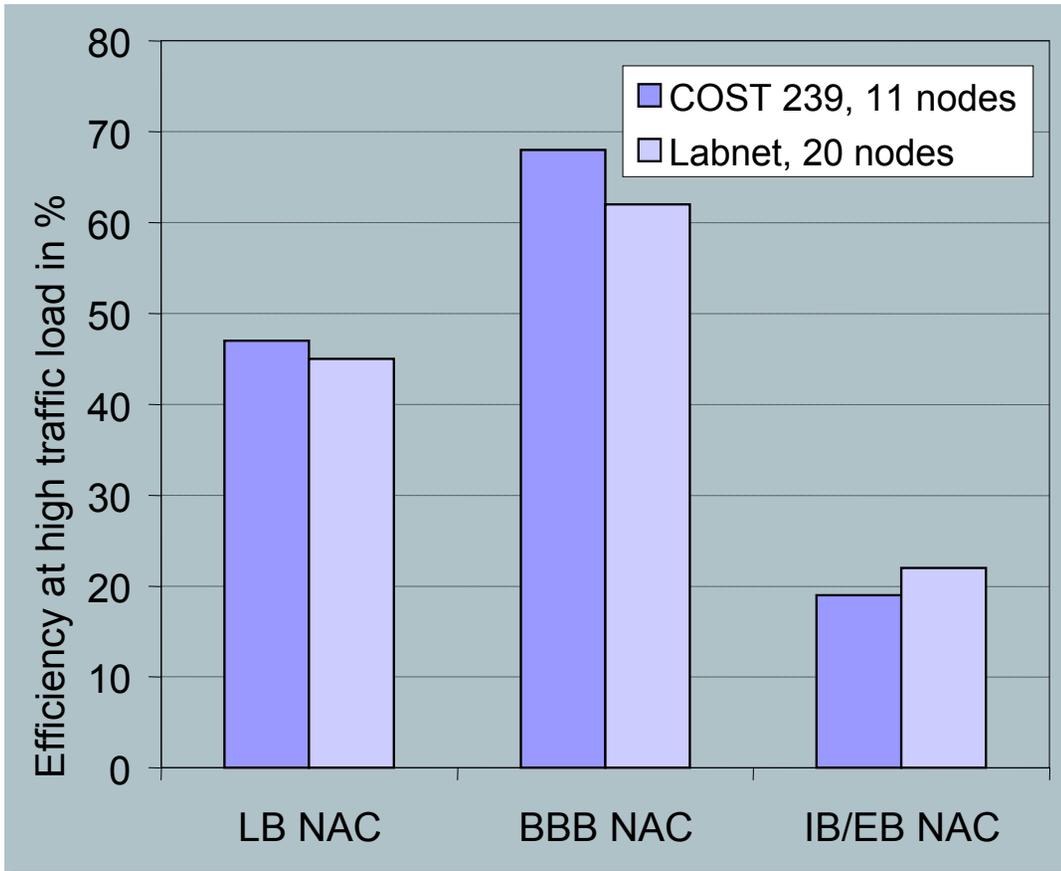
Characteristics:

- Network admission control at the edges assures QoS
- NAC budgets also include reserves for resilience
- Fast fail-over enabled:
 - ✓ QoS reservation states at borders only
 - > flows' paths through the network can change
 - ✓ Diffserv-like forwarding locally preserves QoS traffic in all routers

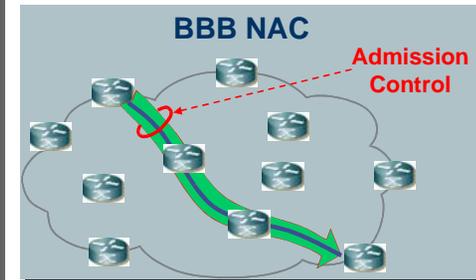
NAC Network Admission Control

Resilience can be included in Network Admission Control

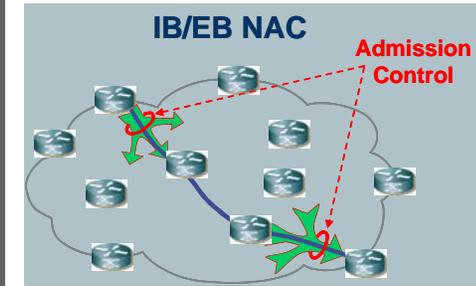
NAC Budgets with reserves for failures



LB:
Link Budgets



BBB:
Border-to-Border
Budgets

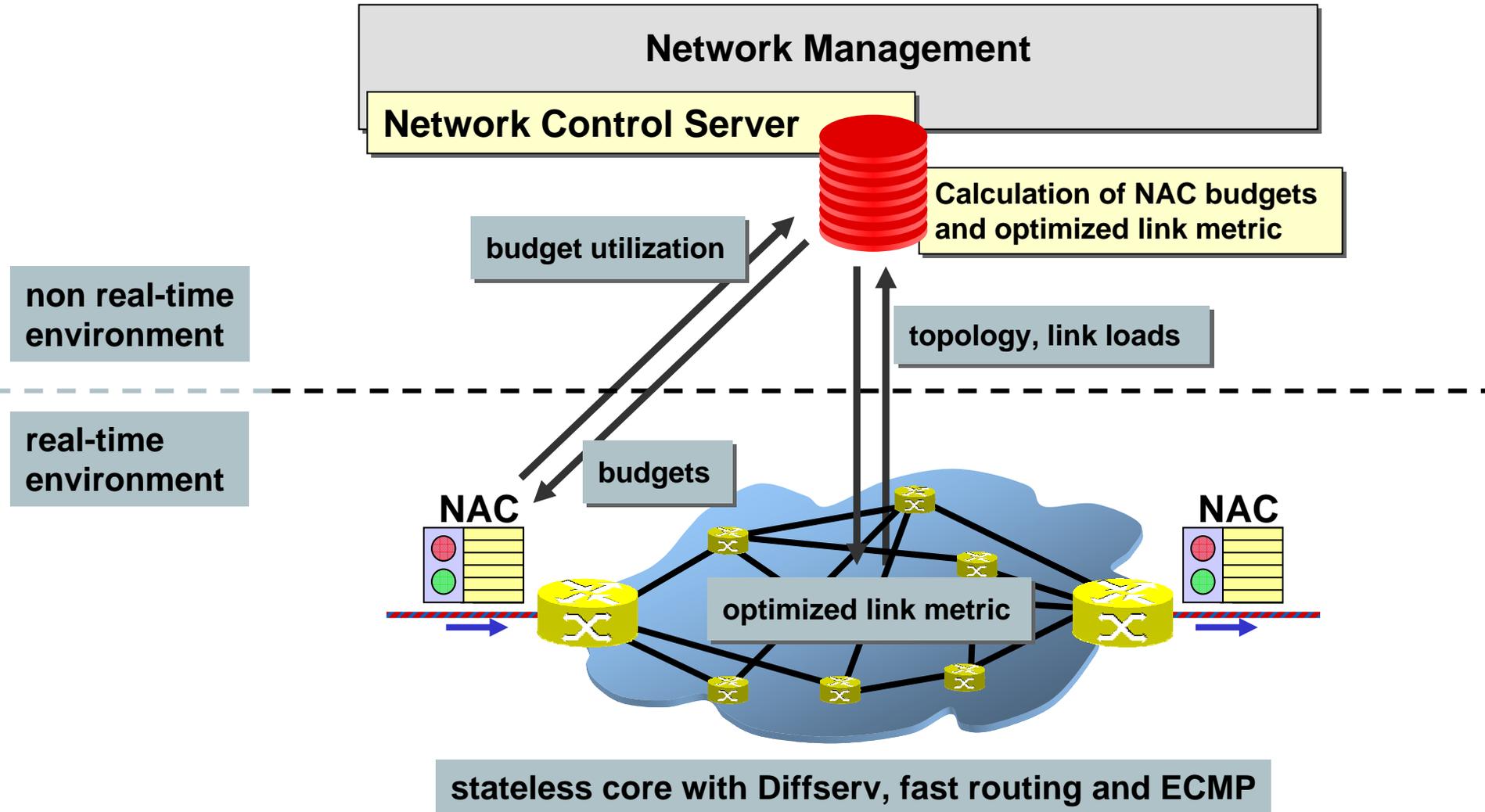


IB/EB:
Ingress/Egress
Budgets

BBB NAC considers failures effectively

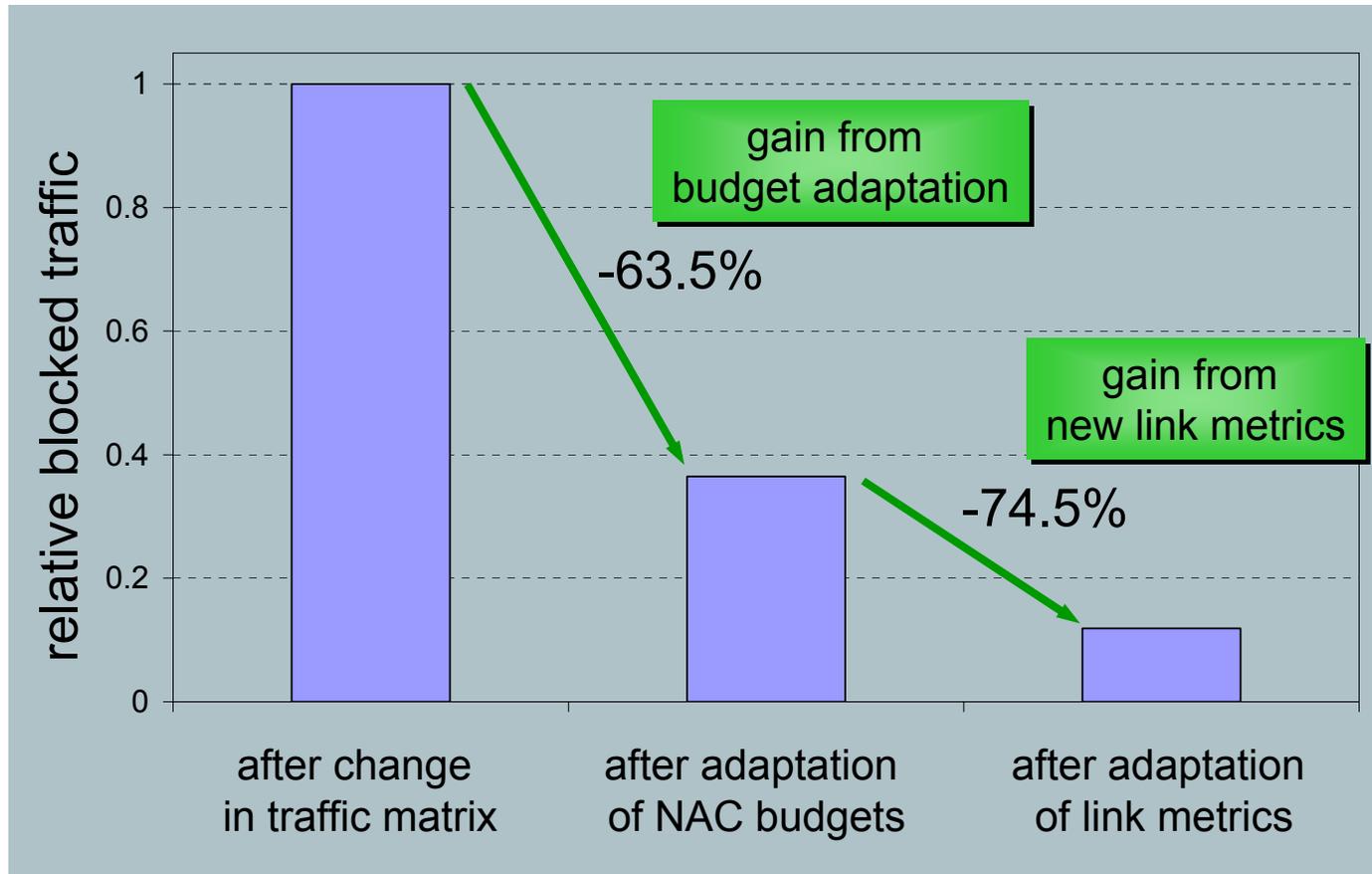
Efficient Network Operation by Network Control Server

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The NCS reduces blocked traffic effectively

blocking is minimized through traffic monitoring
and re-adjustment of budgets and routing



Additional KING highlights

QoS, Reliability and Security across networks

Ethernet-based aggregation networks

- ✓ QoS and resilience (failover) investigations

Inter-domain topics

- ✓ Prototype for an inter-domain resource reservation protocol
- ✓ Concepts for resilient interconnection of NGN domains
- ✓ Approaches for improving the performance of inter-domain routing based on BGP

Reliable Server Pooling for highly available network elements (e.g. NAC)

Security investigations

- ✓ Threat modelling
- ✓ Security concepts for KING network elements
- ✓ Management of access rights

The benefits derived from KING

Extensive theoretical and practical know-how was acquired in the areas of Routing, QoS, Resilience, Traffic Engineering, Resource Management, Security and Automated Network Control.

This know-how is used in several product areas. Specifically, it has contributed to place Siemens in a favourable situation in the now emerging market for admission control and bandwidth management products.

The KING lab demonstrations have been seen by many established and prospective customers and has underlined the positioning of Siemens in the NGN market.

The project goals have been achieved



Thank you!

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