

Carrier Managed Network Solutions (CMNS).
Carrier Intranet Service (IP VPN Layer 3).

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ICSS – Carrier Intranet Service. Content.

- Deutsche Telekom – International Carrier Sales & Solutions
- Carrier Intranet Service – CIS L3 MPLS
- Coverage
- Benefits

Deutsche Telekom - The entire spectrum of modern information technology and telecommunications services from a single source.



Broadband/ Fixed Network

- T-Com serves private customers along with small and smallest enterprises.
- T-Com includes the wholesale sector (domestic and international).
- T-Com is also responsible for the entire basic infrastructure in the fixed network field.

Mobile Communications

- T-Mobile
- Deutsche Telekom bundles all its wireless activities worldwide in the strategic business area of Mobile Communications.

Business Customers

- T-Systems Enterprise Services deals with multinational corporations.
- T-Systems Business Services handles business with about 160,000 large and medium-sized companies in Germany.

ICSS - Proven Experience in International Wholesale.

Bridging Europe and the world to secure your next generation success.



Solid customer and partner base

- Serving the wholesale requirements of the group entities (e.g. T-Mobile)
- Contracts with top carriers and service providers worldwide
- Strategic partner agreement with Telecom Italia Sparkle, cooperation with China Telecom and SingTel

Strong positioning and enhanced offering in Voice and IP

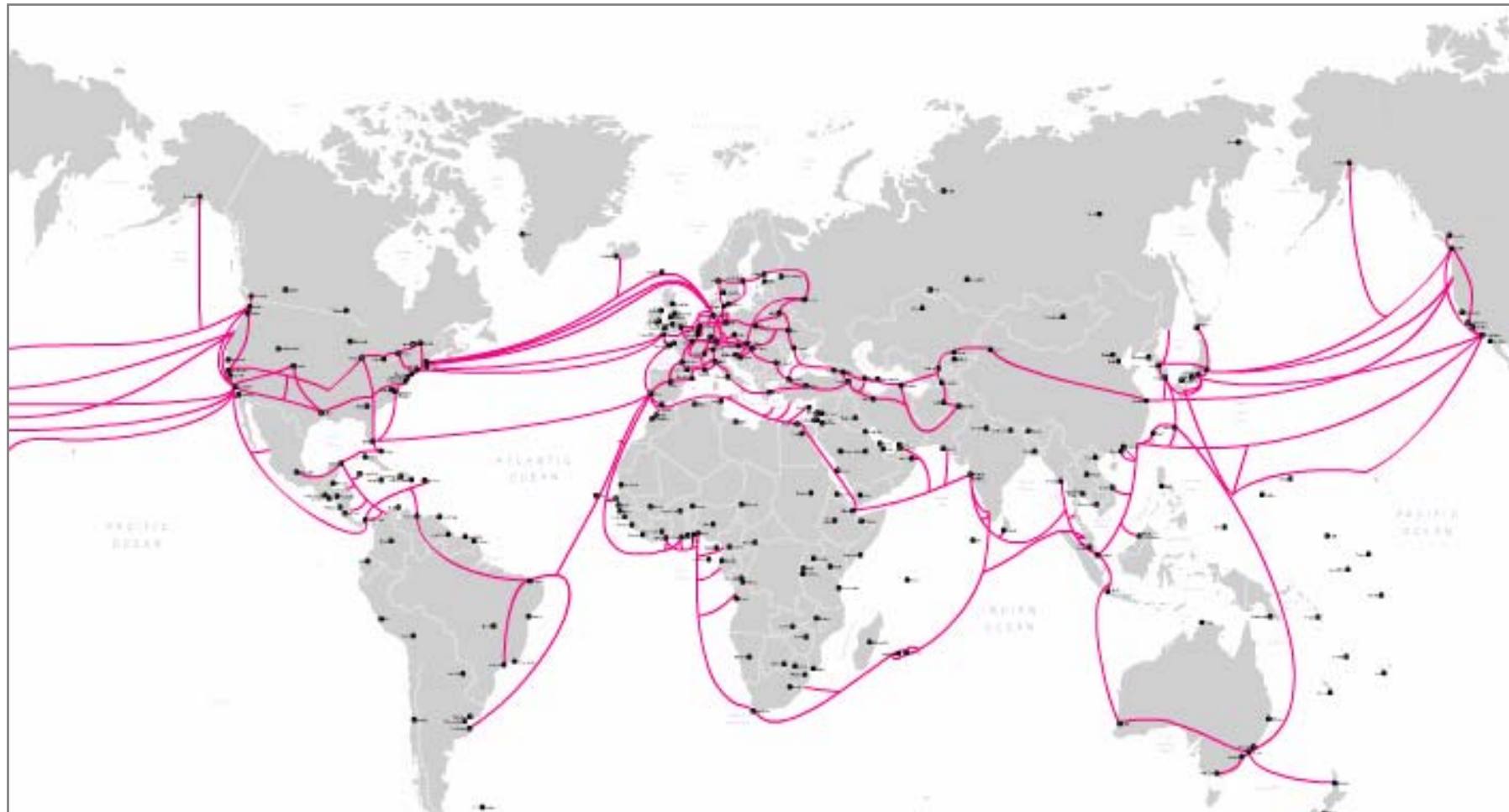
- Excellent position in Voice and IP in Europe
- 13 billion PSTN Voice minutes per year (2005/2006)
- Almost 11 million DSL customers on our IP Network (2006)
- 104 petabyte IP throughput a month
- More than 200 Gbps total peering capacity
- Sophisticated international network operations
- Flexible access to an enhanced/comprehensive portfolio
- Proven experience in international wholesale

Financial stability and international presence

- About 230 employees of about 20 nationalities
- 4 regional and 16 international branch offices
- Customer proximity: experienced international Sales team.
- Local expertise thanks to in-country staff
- Technical presence in all major business centers
- Financial stability via Deutsche Telekom Group

Local Access to Global Services & Solutions. Deutsche Telekom's International Network.

Offering the full range of Wholesale Services via Deutsche Telekom's International Network



ICSS – Carrier Intranet Service.

Introduction to Carrier Intranet Service.

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ICSS – Carrier Intranet Service.

The product

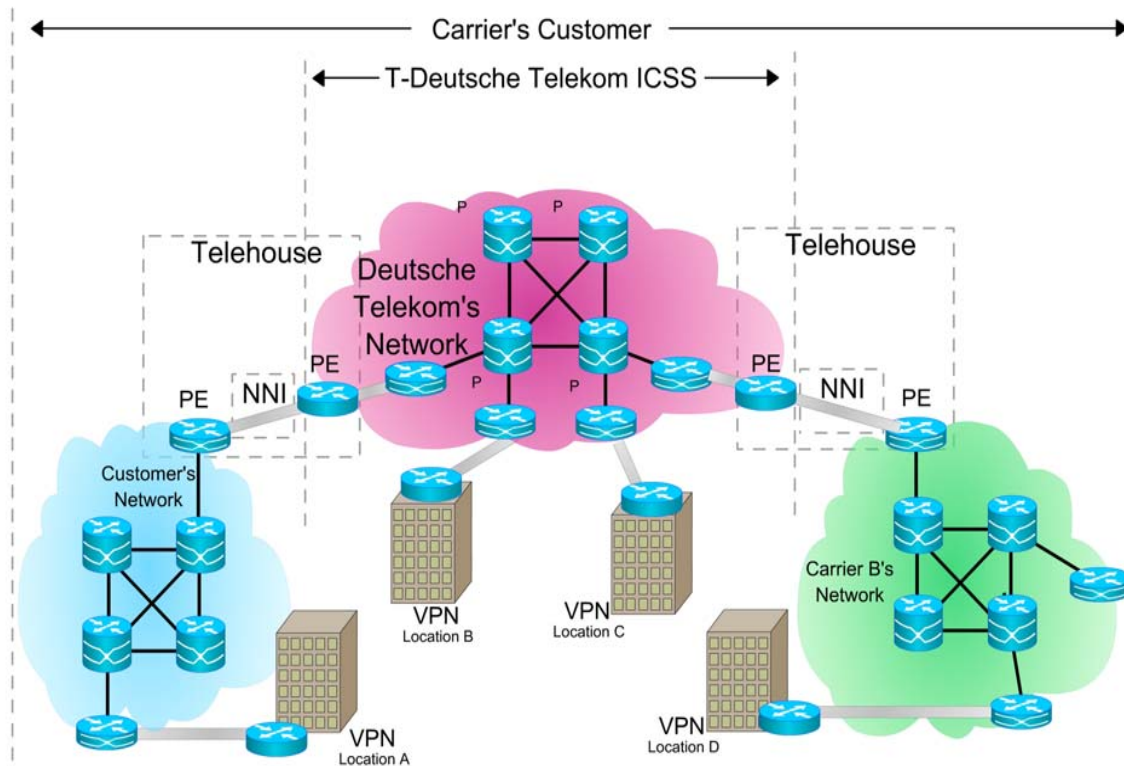
- Carrier Intranet Service is an MPLS based data transport solution that provides access into Deutsche Telekom's managed MPLS network. The solution offers connectivity between several customer locations anywhere in the world
- The Solution provides the end customer with a private and secure WAN and quality of service based on reliable and scalable dedicated IP VPNs; offering connectivity to service providers (ISP's, Carriers, national regional network operator, cable TV companies, VoIP carriers, ASPs, content delivery networks, etc.) that are not able to fulfill the network coverage requirements of their customers to offer international IP VPN services but would like to provide their own network infrastructure within the required country
- One of the most robust and far-reaching networks available
- More than 150 PoPs available worldwide for CIS product offering
- High redundancy
- Full support of carriers routing protocols

Carrier Intranet Service. VPN Scenarios.

Different Layer 3 IP VPN options are available:

- Build out of customer's VPNs for a carrier on Deutsche Telekom's managed MPLS network (all customer's locations connected to Deutsche Telekom's platform, Carriers network will be not used, Reselling function)
- Partial build out of customer's VPNs on Deutsche Telekom's managed MPLS network with other locations connected to the carrier's own network
(Extension of the Carriers network – extended coverage through our service – requires NNI)
- Partial build out of customer's VPNs on Deutsche Telekom's managed MPLS network with usage of other carriers' networks via NNI for in-country coverage extension
(Extension of the Carriers network through our NNI Partners)

ICSS – Carrier Intranet Service. How it looks 1



- MPLS networks of different providers can be connected via a NNI solution to provide a higher network coverage to the customer
- Usually, the NNI can be build with a simple in-house cable, because Deutsche Telekom's network equipment is located in main Telehouses of major cities worldwide.
- NNI's are ICSS responsibility
- Carrier is responsible for the access of the endpoint connected to its network and owner of business relationship with VPN customers
- Carrier B is used only for regional access for location D, but has no direct business relationship with the customer. Act as a supplier for Deutsche Telekom.

ICSS – Carrier Intranet Service.

Access Methods for the remote sides (UNI)

- Access possibilities

- Fixed connection with 64 kbit/s to 2,5 Gbit/s
- ADSL fixed connection from 1.5 to 6 Mbit/s
- Fast Ethernet or Gigabit Ethernet

- CE router possibilities

- Port + Local Loop + CPE
 - Deutsche Telekom delivers and installs CE router on customer site. The hardware maintenance of the router is Deutsche Telekom's responsibility, but the management of the router is in the hands of the carrier.
- Port + Local Loop
 - Carrier delivers and installs CE router on customer site, hardware maintenance and router management is in the hands of the carrier

Carrier Intranet Service. SLA's

- Network Performance
 - Availability: Network Availability 99,95%
 - Latency: between 39ms and 182ms (depending of class and region), no latency for best effort (guaranteed)
 - Jitter: between 25ms and 50ms (guaranteed) – depending on region
 - Packet Loss: between 0,2% and 0,5% (guaranteed)
- Time to restore
 - Compact Service Level: 24 hours
 - Comfort Service Level: 8 hours
- Delivery Times
 - 2MB/s to 155MB/s: 60 Working Days
 - ADSL in Germany: 20 Working Days
- SLA defines service credit if values exceeds

Carrier Intranet Service.

NNI Specification 1

- Access method:
 - Direct.
 - The NNI is directly connected to provider edge (PE) router via dark fiber
 - Interconnection Access possibilities
 - Port only
 - Port + In-house Cabling (direct or in Meet-Me-Room)
 - Port + Local Loop
 - NNI port possibilities
 - POS from E1 up to STM64
 - Fast Ethernet, Gigabit Ethernet

Carrier Intranet Service.

NNI Specification 2

- RFC 4364 Section 10a specifications (BGP/MPLS IP Virtual Private Networks)
- Layer 2 encapsulation method:
 - In case of Ethernet this is ensured by IEEE802.1Q CSMA/CD with VLAN's
 - In case of serial point-to-point connection Layer2 is based on Frame Relay, where the encapsulation of each customer is carried out over DLCI's
- The routed protocol is IPv4
- The routing protocols are static or dynamic (eBGP) with maximum routes and BGP password option

ICSS – Carrier Intranet Service.

Classes of Service

Through separation into traffic categories, all data packages are transferred according to their particular requirement profile



■ Voice

Optimized for the typical profile of VoIP, i.e. a relatively regular stream of small data packages



■ Multimedia

Optimized for applications that tolerate a certain degree of package loss, but are sensitive with regard to delay (e.g. Video Conference)



■ Premium / Critical Data

Optimized for applications that only tolerate a low degree of package loss (e.g. ERP systems such as SAP)



■ Best effort

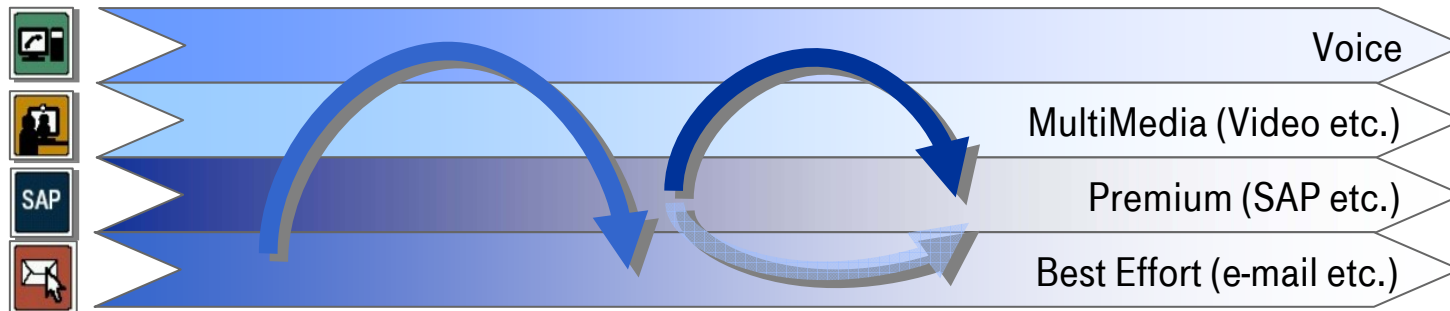
For non-time critical applications (e.g. e-mail)

Carrier Intranet Service.

Classes of Service - Rules

Shared utilization of available bandwidth:

- The Customer defines the needed bandwidth per Class of Service (within the given limits of max % per class) that will be reserved
- If in one class the reserved bandwidth isn't fully utilized, the remaining bandwidth will be made available for the other classes (with priority for the higher classes)
- As soon as the full reserved bandwidth is needed again, the bandwidth is immediately reallocated again
- Packets exceeding the set Voice CoS bandwidth will be dropped



- Result: Capacities are optimally utilized ,even at peak times, but always guaranteeing best QoS for critical applications

Carrier Intranet Service.

Classes of Service – Policy

- QoS rating has to be defined by the customer for
 - NNI trunk itself in general
 - Each Sub-NNI Interface (=VPN) of the NNI trunk
 - The UNI interface (on the remote end), PE-CE connection
- Maximum values
 - NNI trunk, single UNI
 - Voice: 50%
 - Multimedia: 85%
 - Premium: 85%
 - Best Effort: rest
 - Voice + Multimedia + Premium: 85%
 - Sub-NNI Interface
 - Voice: 25%
 - Multimedia: 45%
 - Premium: 45%
 - Best effort: rest
 - Voice + Multimedia + Premium: 45%

Carrier Intranet Service.

Class of Service - Classification.

- CoS transparency (standard solution)
 - DT IP VPN enables full CoS transparency
 - IP precedence values will be not replaced (incoming and outgoing IP precedence values of the customer remain unchanged)
 - DT only classifies the IP precedence values to the appropriate DT EXP bits
 - DT EXP bits are assigned to 4 classes
 - CoS handling within the DT IP VPN will be done on this 4 classes
 - Carrier will see his original IP Precedence values on UNI

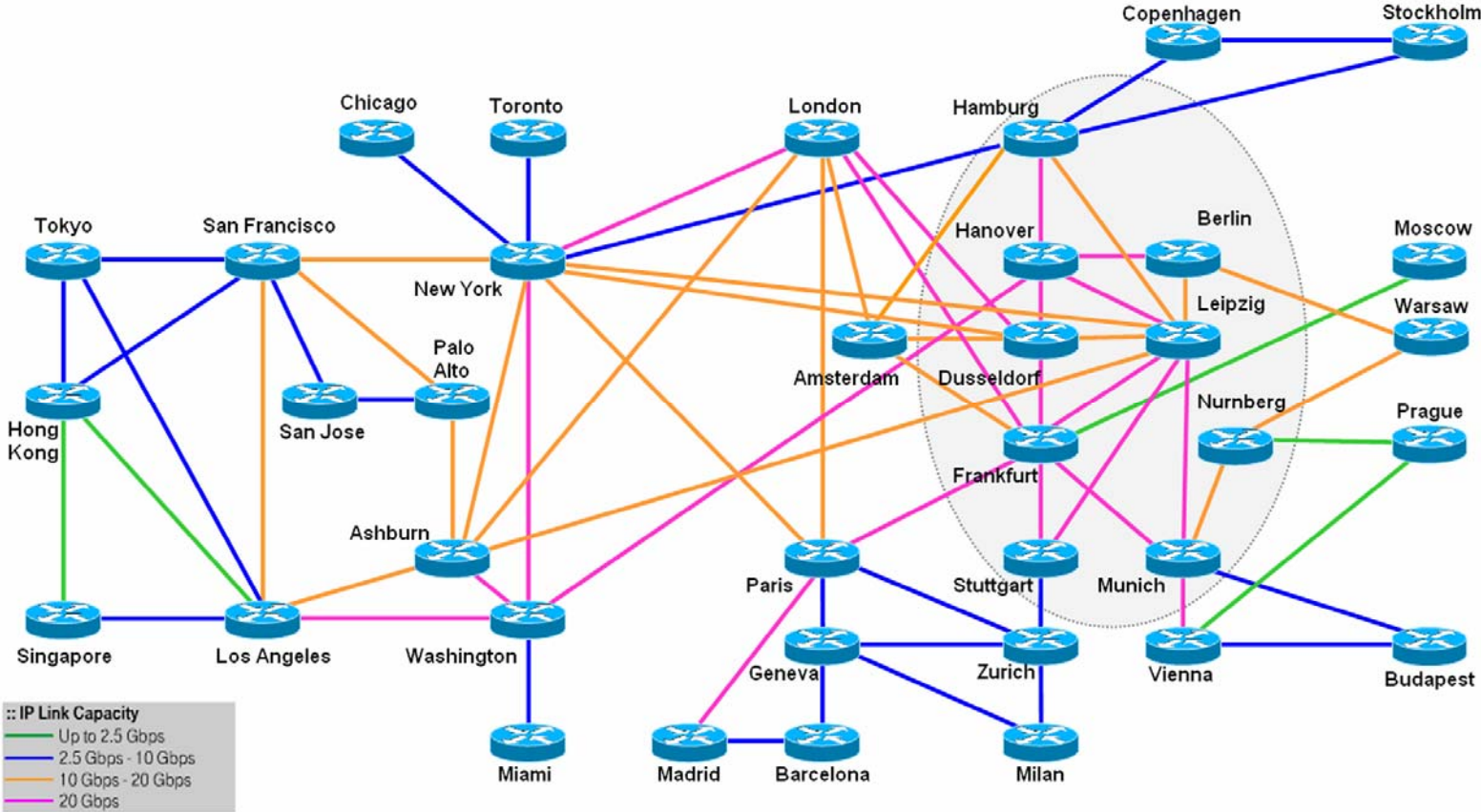
- CoS classification is done on the CPE device configured by customer:
 - IP traffic will be separated in different queues
 - Queues are served according to assigned bandwidth per class
 - The QoS critical incoming local loop is covered

- CoS classification can be done based on (on request)
 - IP precedence bits (e.g. used on a NNI connected carrier network)
 - IP-addresses or prefix
 - Port number (applications)

ICSS – Carrier Intranet Service. Benefits.

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The International IP Network of Deutsche Telekom AG



Partnerships with Global Players worldwide enables DT to extend the reach of it's CIS product to more than 150 PoP's !

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ICSS – Carrier Intranet Service.

Our Offering – Your Advantage.

Product

- Carriers and ISPs will be empowered to offer their customers an international service offering
- Enables carriers and ISPs to expand their product portfolio and enhance their added value against their end customers
- Benefit from one stop shopping for international connectivity
- Focus on market segments which cannot be provided today with a satisfactory solution (new business opportunities)
- Cost effectiveness
 - Decreases WAN and remote access costs (for large enterprises)
- Reduced total cost of ownership
- Simplify new site addition to the network
- Ease the access to remote locations by expanding private networks
- Implement latest/future technologies
- Rapid and flexible deployment (most of the infrastructure of a VPN is already in place in contrast to the establishment a customer's WAN)