WEBINAR
IP-TRANSFORMATION
CLAUDIA NEMAT (BOARD MEMBER EUROPE & TECHNOLOGY)
KERSTIN GÜNTHER (SVP TECHNOLOGY EUROPE)
AGENDA

- Europe strategy
- Transformation program for next decade
- All IP-Migration
  - What is IP-Transformation
  - Why now
  - Advantages and challenges of migration
  - Commercial opportunities
  - When is the completion date
- Target network infrastructure TeraStream
  - Development from today to TeraStream
  - TeraStream in detail
  - Highlights and benefits
- Final remarks
IP-TRANSFORMATION IMPORTANT CORNERSTONE OF EU STRATEGY

Seamless connectivity for the Gigabit Society
More innovation by cooperation
Secure cloud solutions
Best-in-class customer experience

- Cooperation creates economies of scale
- Ownership in country with best competences and infrastructure
- International rotation

INNOVATE
TRANSFORM
COMPETE

1. IP-Transformation
2. B2B Big Bang
3. Mobile Internet Push / TV
4. Cost Revolution/Operational Excellence
OUR TRANSFORMATION PROGRAM FOR THE NEXT DECADE

PSTN migration is the first step

- Execute **switch-off PSTN/ISDN** products efficiently in each country
- The **PSTN migration has been accelerated in 2013** with specific migration plans for each country
- Focus on **additional customer services** (e.g. self-provisioning) for superior customer experience and **efficient cost savings**

Optimization of IP production

- Step 1 **Broadband Network Gateway (BNG)**: consolidation of aggregation and relevant IT systems
- Step 2 **TeraStream**: applying cloud model to network infrastructure, network function virtualization, new real-time OSS
- BNG and TeraStream pilots started in Greece and Croatia respectively
- Focus on **capacity increase for traffic explosion and additional customer services** (e.g. plug-and-play, reduced latencies, 1 Gigabyte capacity) and **lower network production cost**
WHAT IS IP-TRANSFORMATION? – THE CREATION OF A SIMPLIFIED AND STANDARDIZED NETWORK

From the “old PSTN world”...

<table>
<thead>
<tr>
<th>Mobile Consumer</th>
<th>Service provision</th>
<th>Fixed Consumer</th>
<th>Carrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSTN</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

...To the “new IP era”

<table>
<thead>
<tr>
<th>Mobile Consumer</th>
<th>Service provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile Access</td>
<td>Hybrid Fixed Access</td>
</tr>
<tr>
<td>CPE</td>
<td></td>
</tr>
</tbody>
</table>

Virtualized Service Platforms
Infrastructure Cloud
NG IP Network (BNG/TeraStream)
WHY IS NOW THE RIGHT TIMING FOR A STRONG FOCUS ON IP-TRANSFORMATION?

Customers need
- Demand for IP products and services
- Demand for fast & easy new solutions (instant activation)
- Demand for integrated personalized products & services
- Customer demand for bandwidth (+68% in mobile, +21% in fixed CAGR 2012 to 2017)

Technology
- New technologies enable creation of new production model
  - Software-Defined Networking (SDN)
  - Content Delivery Network (CDN)
  - Virtualization
  - Optical IP

Source: Cisco Visual Networking Index: Forecast and Methodology, 2012–2017
ADVANTAGES AND CHALLENGES OF PSTN- MIGRATION

1 Depending on migration strategy; 2 After complete PSTN switch-off

Risks from do nothing
- Does not fulfill future customer demand
- Does not support future cost model

Savings of about 10 € per customer/year²

About 30-60 Euros per migration¹

Influencing

New IP serv./ products

Value for Customer

Improved processes

Cash in

Cash out

Mid term perspective

Long-term perspective

Migration

Do nothing case

09.10.2013
COMMERCIAL OPPORTUNITIES IN B2B & B2C

**Value for Customer**
- Instant provisioning & faster customer service
- Network stability
- Clear voice quality
  - Product examples:
    - Hybrid Access
    - HD Voice
    - Broadband on demand (e.g. Macedonia)
    - On-demand scalability (e.g. number of lines)

**New IP services/products**
- Accelerated time-to-market
- Future proof product concept
- Enables convergent solutions
  - Product examples:
    - IP Centrex/Hosted PBX
    - Unified Communication
    - IP Phone Portfolio

**Improved processes**
- Enables Zero Touch for provisioning and repair (plug & play without assignment of technicians)
- Increase self provisioning capabilities
## TARGET SCHEDULE FOR PSTN MIGRATION BY COUNTRY

### Subscriber base, actuals and target completion dates

<table>
<thead>
<tr>
<th>Country</th>
<th>Total Voice customers</th>
<th>IP Voice July 2013</th>
<th>Expected completion dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macedonia</td>
<td>258 k</td>
<td>200 k (78%)</td>
<td>EoY 2013</td>
</tr>
<tr>
<td>Slovakia</td>
<td>702 k</td>
<td>240 k (34%)</td>
<td>EoY 2014</td>
</tr>
<tr>
<td>Croatia</td>
<td>1,278 k</td>
<td>431 k (34%)</td>
<td>EoY 2015</td>
</tr>
<tr>
<td>Montenegro</td>
<td>155 k</td>
<td>36 k (23%)</td>
<td>EoY 2015</td>
</tr>
<tr>
<td>Hungary</td>
<td>1,436 k</td>
<td>452 k (33%)</td>
<td>EoY 2016</td>
</tr>
<tr>
<td>Romania</td>
<td>2,249 k</td>
<td>87 k (4%)</td>
<td>2018</td>
</tr>
<tr>
<td>Greece</td>
<td>2,880 k</td>
<td>6 k (0%)</td>
<td>2018</td>
</tr>
<tr>
<td>Europe</td>
<td>8,958 k</td>
<td>1,451 k (16%)</td>
<td>2018</td>
</tr>
<tr>
<td>Germany</td>
<td>19,700 k</td>
<td>1,500 k (8%)</td>
<td>2018</td>
</tr>
</tbody>
</table>
TECHNOLOGY DEVELOPMENT:
PSTN (TODAY) – ALL IP /BNG – ALL IP/ TERASTREAM

1. **Today**
   - Historically grown, highly complex network architecture

2. **PSTN - Transformation**
   - One integrated IP factory.
   - Voice application moved into the cloud

3. **BNG**
   - Multi-tiered aggregation integrated in BNG
   - Only two types of routers.
   - All applications moved into the cloud

4. **TeraStream**
   - Cloud Data Center including

---

*AGS1 - Aggregation Switch 1; AGS2 - Aggregation Switch 2; AVst – Automatical Switching Center; BRAS - Broadband Remote Access Server; DIV – Digital Switching Center (PSTN/ISDN); DSR - D-Server Router (Distribution of IP Multicast for IP/TV); IMS - IP Multimedia Subsystem; LER - Label Edge Router; LSR - Label Switch Router; R* - Router; VSt – Switch Center
THE STEP FROM BNG TO TERASTREAM LEADS TO A REDUCTION OF PROTOCOLS

**BNG – Protocols**
- IPv6
- IPv4
- OTN
- ATM
- SDH
- MPLS
- PPPoE
- FRR
- DHCP
- Tunnel
- 100 GE
- OTN
- 100 GE

**TeraStream – Protocols**
- IPv6
- Tunnel
- 100 GE
- DHCP
- Infrastructure Cloud model
- Drastic simplification of IP networks
- Reduction of layers to the minimum
- IP & Optical integration
TERASTREAM FEASIBILITY ALREADY REALIZED AS A PILOT IN CROATIA

TeraStream

- European first native IPv6 network
- Worldwide first integration of network and cloud technology for service production = Network function virtualization
- Worldwide first 100 Gb/s network using IP and optical integration
- New real-time operations support system (OSS)
- Works with all access technologies (e.g. fiber, vectoring, DSL, LTE)

Benefits

Time to market:
- Software-based service production - Innovation cycle will be reduced dramatically from years to month

Customer Experience:
- Self service and plug & play will be common for all customers
- Realtime – minimal latency (from 10s of ms to ms)
- Highest upstream and downstream bandwidth
- It is the basis for simplicity and future customer experience

Cost Aspect:
- It will be operated at a fraction of today’s cost capital, labor and energy cost

1 As a result, 40% of total traffic going forward will be delivered by data centers, tightly linked to the network; all more complex parts of production machine will be centralized
SUMMARY AND CLOSING REMARKS

IP-Transformation is a must do for the industry

- Enhanced customer experience → Superior products, better customer service and faster technology (e.g. higher speed and less latency)
- Efficient cost structure → Savings of about 10 € per customer/year\(^1\) in Europe
- Lean production & virtualization → Easier maintenance and technology roll outs

DT aspirations

- First operator to finalize a PSTN-migration in a European country (Macedonia) by end of 2013
- Migration of all countries by end of 2018
- TeraStream pilot in Zagreb shows DTs superior future production model
- TeraStream principles as key element of the target production model identified and vital part of our vision for a pan-european integrated IP network for Europe

\(^1\) After complete PSTN switch-off
Q & A
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGS1</td>
<td>Aggregation Switch 1</td>
</tr>
<tr>
<td>AGS2</td>
<td>Aggregation Switch 2</td>
</tr>
<tr>
<td>ATM</td>
<td>Asynchronous Transfer Mode</td>
</tr>
<tr>
<td>AVst</td>
<td>Automatical Switch Center</td>
</tr>
<tr>
<td>BRAS</td>
<td>Broadband Remote Access Server</td>
</tr>
<tr>
<td>CDN</td>
<td>Content Delivery Network</td>
</tr>
<tr>
<td>DIV</td>
<td>Digital Switch Center (PSTN/ISDN)</td>
</tr>
<tr>
<td>DHCP</td>
<td>Dynamic Host Configuration Protocol</td>
</tr>
<tr>
<td>DSR</td>
<td>D-Server Router (Distribution of IP Multicast for IP/TV)</td>
</tr>
<tr>
<td>FRR</td>
<td>Fast Re-Route</td>
</tr>
<tr>
<td>GE</td>
<td>Gigabit Ethernet</td>
</tr>
<tr>
<td>IMS</td>
<td>IP Multimedia Subsystem</td>
</tr>
<tr>
<td>IPv4</td>
<td>Internet Protocol Version 4</td>
</tr>
<tr>
<td>IPv6</td>
<td>Internet Protocol Version 6</td>
</tr>
<tr>
<td>LER</td>
<td>Label Edge Router</td>
</tr>
<tr>
<td>LSR</td>
<td>Label Switch Router</td>
</tr>
<tr>
<td>MPLS</td>
<td>Multi Protocol Label Switching</td>
</tr>
<tr>
<td>NFV</td>
<td>Network Functions Virtualization</td>
</tr>
<tr>
<td>OTN</td>
<td>Optical transport network</td>
</tr>
<tr>
<td>R*</td>
<td>Router</td>
</tr>
<tr>
<td>PPPoE</td>
<td>PPP over Ethernet</td>
</tr>
<tr>
<td>PSTN</td>
<td>Public Switched Telephone Network</td>
</tr>
<tr>
<td>SDH</td>
<td>Synchronous Digital Hierarchy</td>
</tr>
<tr>
<td>SDN</td>
<td>Software-Defined Networking</td>
</tr>
<tr>
<td>VSt</td>
<td>Switch Center</td>
</tr>
</tbody>
</table>