WHITEPAPER

LINDENBAUM’s

HIGH-AVAILABLE MEDIA SERVER

BASED ON A

MicroTCA SYSTEM

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Challenges in the voice application and conferencing market

The voice application and conferencing market is changing rapidly. The following challenges have become increasingly important and providers with the best answers to these challenges will benefit the most within the growing market.

Faster development pace

Service providers of Voice Applications such as Interactive Voice Response Systems (IVRs), Conferencing, Call-Center have to provide new applications and features to serve new market requirements driven by the success of the internet and mobile devices. In order to be successful, reduced development time, increased speed-to-market while maximizing application features and user experience are crucial.

IP-based IMS/NGN standards

In order to deal with the increased data flow in landline and mobile networks, telecom service providers are migrating their networks onto IMS (IP Multimedia subsystem) based, New Generation Networks. Such networks will create a base both for networking applications and for various "value added services" and require the usage open based protocols. New products have to be developed according to the IMS/NGN standards.

Smooth PSTN to VoIP migration

While VoIP and SIP is the future standard for voice communication the old PSTN network will be there for at least 5 more years. The co-existence of PSTN and VoIP require a smooth migration from PSTN to VoIP. Thereby the high quality of PSTN in a mixed VoIP / PSTN-system continues to be a must.

High-availability and high-scalability

All service providers require high availability for their systems and applications. With increasing demand, such systems shall be flexible and scalable enough. For voice services and conferencing in the cloud these aspects are essential for their success. Reliability and scalability are some of the key characteristics of cloud computing: Reliability is improved if multiple redundant sites are used making well-designed cloud computing suitable for business continuity and disaster recovery. Scalability and elasticity via dynamic ("on-demand") provisioning of resources on a fine-grained, self-service basis near real-time, without users having to engineer for peak loads (see Wikipedia, Cloud Computing, http://en.wikipedia.org/wiki/Cloud_computing).
Green technology

Sustainability is an imperative in nowadays world. New IT products and processes must drive economical and operational improvements, increase accountability and last but not least lessen environmental impact.

Lindenbaum’s MicroTCA-based Media Server helps to solve these challenges

State-of-the-art communication technology has to tackle all the challenges listed above. Lindenbaum (www.lindenbaum.eu) takes these crucial aspects serious and launches its new Media Server.

MicroTCA as the technological basis

The Lindenbaum Media Server is based on the open standard MicroTCA. Formerly used CompactPCI cannot satisfy any longer today’s end-user’s and provider’s demands. The advantages of MicroTCA dominate:

- **Flexibility** and **independence**: all PICMG compliant Advanced Mezzanine Cards (AMCs) are deployable – no single vendor lock-in -> a vendor-independent system configuration
- **Scalability**: depending on the chassis size, **up to 20,000 audio ports** can be addressed with one system
- **Maintenance**: all AMCs are **changeable in the running system** without special tools
- **Redundancy**: **99,999 % availability** (less than 5 minutes downtime including maintenance per anno)
- **High bandwidth**: Gigabit Ethernet enables **high performance communication**
- **Security**: use of SSL-encrypted data transfer

Redundancy, maintenance and an intelligent server system are the most important elements for Lindenbaum ensuring to be available **24/7**. System breakdowns are often related to defect elements or the need to update software or to upgrade a system to higher performance. Not for a MicroTCA system: updates can be done in the running system because the components are interchangeable in the working mode.

This media server solution can process millions of phone calls every day because it is scalable. It can be configured of several MicroTCA 19 inch chassis depending on the demanded port capacity.
The MicroTCA system is equipped with Advanced Mezzanine Cards (AMCs) from N.A.T. (view http://www.nateurope.com/products/amc/amc.htm):

- **NAT-MCH**: Contains a 16 port GbE switch, distributes the clock signals, manages the remote access, the inventory, is responsible for electronic keying and redundancy on the lower layer and generates system alarms and harmonizes the firmware updates.

- **NAMC-8569-xE1/T1**: A signalling processing engine providing 16 E1/T1/J1 line interfaces including TDM cross connect and I-TDM interworking in full-size form factor.

- **NAMC-STM1**: A STM-1 SDH line interface card providing add/drop functionality at DS0 and subrate levels including TDM cross connect and I-TDM interworking for termination and monitoring in mid-size form factor.

**Leveraging the MicroTCA advantages with Erlang and the Open Telephony Platform**

To leverage the strength of a MicroTCA System an appropriate Software environment is essential. Lindenbaum decided to use Erlang and the Open Telephony Platform (OTP) for this.

Erlang is a programming language used to build massively scalable soft real-time systems with requirements on high availability. Some of its uses are in telecoms, banking, e-commerce, computer telephony and instant messaging, e.g. Erlang is used for the chat engine of Facebook. Erlang's runtime system has built-in support for concurrency, distribution and fault tolerance – all essential for a high-available and scalable Media Server. The Open Telephony Platform (OTP) is a set of Erlang libraries and design principles providing middleware to develop these systems. It includes its own distributed database, applications to interface towards other languages, debugging and release handling tools [see http://www.erlang.org/].

Release handling in Erlang is upgrading and downgrading between different versions of a release, in a (possibly) running system. I.e. new software releases of the Media Server can be deployed without interrupting the running services.

While Lindenbaum Media Server is developed in Erlang, due to open interfaces you can develop applications for the Media Server in any programming language (e.g. Java, Perl, PHP, Ruby, C#), so that learning of Erlang is not required.
Broad spectrum of media processing functions

Lindenbaum Media Server provides a rich set of media processing capabilities to support a wide range of voice and conferencing applications:

- **Audio processing**: Transcoding; Voice Activity Detection (VAD); Adaptive Gain Control (AGC); Adaptive Level Control (ALC); Conferencing (n-way audio mixing across all supported codecs; n-loudest); Recording; Playback
- **Voice Quality Enhancements**: Acoustic Echo Cancelation; Noise Reduction; Noise Gating; Noisy Line Detection
- **Telephony Events**: DTMF generation; detection & clamping (no one can hear the DTMF tones); Caller ID detection and generation
- **Supported audio codecs**:  
  Narrow band: G.711, G.729 AB, GSM (AMR NB), G.726, G.723.1, iLBC
  Wide band for superior audio quality: G.722 (AMR-WB)
- **Video processing (planned)**: Transcoding; Resizing; Frame rate and bit rate adaption; conferencing
- **Supported video codecs (planned)**: H.264, H.263, MPEG-4

All media processing is DSP-based on dedicated AMCs. To simplify capacity enhancements additional media processing AMCs can be added into a running system.

Integrated high-quality TDM gateway based on I-TDM interworking

In order to interconnect IP-based Media Servers with voice and media from TDM networks, the IMS architecture foresees media gateways and signalling gateways. Lindenbaum Media Server comes with optionally integrated media and signalling gateways to ensure high-quality TDM integration. In-chassis gateways allow optimizing the interworking of gateway and media server particularly with regard to latency, a key factor of voice quality.

By using the I-TDM standard the advantages of an integrated TDM gateway can be leveraged. The primary benefits of the iTDM standard are that it exists as a chassis-optimized, fabric-neutral, multi-vendor supported technology. Within the I-TDM standard several TDM channels together are multiplexed into one packet, so that there is no need to wait for several frame times to accumulate enough data for a given TDM channel. Two options are provided within I-TDM:

- Packet emission interval of 125 µs, which provides the lowest possible latency
- Packet emission interval of 1 ms, which provides higher latency, but is easier to handle in software-centric approaches

Both options are supported by the Lindenbaum Media Server.
Within the Lindenbaum Media Server NAT AMCs provide TDM interfaces and I-TDM interworking:

- The NAMC-8569-xE1/T1 is a signalling processing engine providing 16 E1/T1/J1 line interfaces including TDM cross connect and I-TDM interworking in full-size form factor.
- The NAMC-STM1 is a STM-1 SDH line interface card providing add/drop functionality at DS0 and subrate levels including TDM cross connect and I-TDM interworking for termination and monitoring in mid-size form factor.

**APIs for fast and easy development**

The complexity of this powerful media server and PSTN gateway is hidden behind multiple application interfaces to fasten the development of new voice and conferencing services. For web-experienced developers RESTful Interfaces are provided. For application developers experienced with voice applications VoiceXML and Media Server Markup Language (MSML) are supported. Further APIs can be provided on developers demand (e.g. mediacTRL, XMPP). Please contact Lindenbaum in case of specific requirements.

**Standardized monitoring interfaces**

Rich alarms, logs, and statistics are provided for support, maintenance and monitoring purposes of the Lindenbaum Media Server. Beyond the MicroTCA “built-in” monitoring interfaces Intelligent Platform Management Interface (IPMI) as provided by the N.A.T. MCH, a Command Line Interface (CLI), a read-only Simple Network Management Protocol (SNMP) interface and a Web-based tool for graphical media server overview (status of AMCs including used resources and DSP-load) are provided.

**Fitting into today's and tomorrow's NGN/IMS architectures**

Lindenbaum Media Server perfectly fits into IMS / NGN architecture as shown in the figure below. The Media Resource Function Processor (MRFP), which is a component within the IMS / media layer, is connected to the IP network to send and receive RTP packets. If PSTN connectivity is required, the Media Gateway (MGW) is responsible for connectivity and interworking with the MRFP via I-TDM. Corresponding components within the control layer are the Media Resource Function Controller (MRFC) as part of the Media Server and the Signalling Gateway (SGW) as part of the PSTN Gateway. The MRFC’s interfaces to applications such as conferencing or Serving Call Session Control Function (S-CSCF), the main SIP session control node within the overall IMS network, is Mr and Mr’ (SIP) for control, Cr/Sr (SIP) to fetch documents (not shown in figure) and Rf (diameter) to exchange offline charging data (not shown in figure).
Going Green

Nowadays “going green” is an emerging challenge for service providers. It is about saving operating costs (reduced energy consumption for system power and cooling) and sustainability. As an example Deutsche Telekom compensates all energy emissions in the country by so-called RECS certificates.

MicroTCA enables a “green” media server with a small ecological footprint in several ways: The energy efficiency of a MicroTCA system is a strong compared to the various other form factors (e.g., cPCI, AdvancedTCA). Power consumption in a Lindenbaum media server can be as low as 0.03 Watt per voice line (600 Watt/20,000 voice lines). Additionally unused resources (AMCs) can be automatically switched off during off-peak times to further improve the energy efficiency.

Picture 1: Lindenbaum Media Server & Gateway within IMS/NGN Architecture
Carrier-grade Voice, Video and Web Conferencing on top of Lindenbaum Media Server

Lindenbaum itself has developed on the basis of the Lindenbaum Media Server different conferencing applications for conferencing service providers.

The robust and feature-rich Lindenbaum Business Conference service consists of an audio conferencing platform and a seamlessly integrated web conferencing solution. Our web conferencing system provides desktop video. The Cisco WebEx® service can also be integrated for on-premise solutions. We provide mobile applications for several smartphones, including BlackBerry®, iPhone® and, coming soon, Android®. Plus, conference call scheduling is smart and simple thanks to full integration with Microsoft Outlook.

Carriers enjoy the host of features the Operator Call Centre offers permitting efficient and economical live operator support for premium conference services. In addition to this, the web management tool monitors all systems and is the advanced administrator interface which configures all settings.

Lindenbaum Ready Audio Conference (RAC) is an easy-to-use audio conferencing service that does not require registration, user ID or an account. To further enhance user experience, RAC optional includes web-based conference control, a web-based invitation service and simultaneous web conferencing.

Whether in conjunction with a cloud service or using an on-premise solution – renowned European carriers and conference service providers rely on our applications.

Conclusion

Lindenbaum Media Server is a powerful, high-capacity, carrier-grade media platform for cost-effective voice and conferencing solutions. The IP-based open communication architecture allows seamless integration with (growing) packet-based access networks while supporting legacy PSTN networks using an integrated gateway. Thus protecting current investments and offering smooth migration to next-generation IMS-based architectures. Redundant components eliminate single points of failure throughout the system. For geo-distribution media server resources may be utilized at different locations. Finally the complexity of this powerful media server and PSTN gateway is hidden behind multiple application interfaces that allow rapid development of new voice and conferencing services.

N.A.T. is an expert of innovative communication solutions. Together with Lindenbaum the advantages of the state-of-the-art technology MicroTCA are turned into a sophisticated field application. Most decisions to replace former standards with MicroTCA are based on features such as flexibility and independence, scalability, maintenance, redundancy and high bandwidth or security. N.A.T. goes beyond these technical features and highlights the aspect of going green to create sustainable concepts.
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About N.A.T.:
N.A.T. offers a wide product range in data and telecommunication for industrial bus -standards and systems as AMC, MicroTCA, VMEbus, CompactPCI, PMC, PCI Express and many others. This product offering is completed by various software protocol stack solutions in the area of telecommunication and networking which are adapted to the different hardware platforms. For further information, please visit www.nateurope.com.

About Lindenbaum:
Lindenbaum is an independent software and consulting company with headquarters in Karlsruhe, Germany. Lindenbaum has been enabling carriers and conference service providers to provide their end customers with high quality audio, web and mobile conferencing solutions since 1999. Its customers are international telecom service providers, including several renowned carriers, and enterprises in various industries. For further information, please visit www.lindenbaum.eu.

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