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Swisscom Approaches Unified Communication

This article shows our vision of Unified Communication and how to approach it. To link the vision with real world challenges we give a view on the exploration work at Swisscom Innovations linked with Unified Communication. By this we lay open and answer parts of the challenges and furthermore hope to give understandable hints how future Unified Communication services could look.

The CTO Office supports the Swisscom CTO (Chief Technology Officer) by tracking technological developments, market trends, and strategic research. The objective is to deliver aggregated technology forecasting and to provide an expert view on technological trends to ensure future-proof technology management within the Swisscom Group. The programme also runs an office in Silicon Valley to closely monitor new developments in the telecommunication industry and to establish business relationships with attractive startups.
With its Innovation Programmes, Swisscom Innovations follows the objective of recognising early on the impact of technological developments, finding new business opportunities, promoting technical synergies, and developing concrete innovation proposals. Further, the expertise built up enables active engineering support of business innovation projects.

Unified Communication is communication across networks, applications/services and providers, independent of devices. Most of today's communication applications, e. g. mobile phone, email, Instant Messenger, etc, are

CYRILL MEIER AND OLIVER KRONE

bound to either a network or a provider. Even within one network or provider different applications with similar purposes do not always work together (e. g. MSN Messenger and Microsoft Outlook).

Unified Communication unifies a lot of different communication elements which all have their specific problems.

The four relevant elements of Unified Communication are addressing, messaging, direct communication and presence (figure 1).

- *Unified Addressing* gives users the feeling of owning one personal address book which can be used in different applications and devices. It also makes it easier to look for people, companies, organisations etc., without having to look for the most suitable directory.
- *Unified Messaging* offers the users a common control and view on voice and text messages from different message boxes. This includes message notification and channel transformation (voice to text, text to voice, etc).
- *Direct Communication* combines synchronous voice (e. g. phone calls) or text communication (e. g. Instant Messages) across any device including notification, timeout options, second call handling etc. In the ideal situation it would include some form of call management making it easier to reach a person (not a device) or to filter/manage incoming calls.
- *Unified Presence* is considered to be a separate entity of Unified Communication, although presence information is usually part of an addressing system (e. g. buddy list). Once you start to unify communication the presence information gets more complex, because you retrieve it from different networks, applications, and providers. Furthermore, you can use presence information to support direct communication (call management) and messaging.

Unified Presence and Unified Addressing

As mentioned above there is a strong link between addressing and presence information. Therefore we look at them as a tightly combined unit but with clear interfaces (figure 2).

- A *public meta directory* will make it possible to look for a person's information by simply entering a name. The data will be gathered from different directories and displayed in a single overview. The biggest problem is to link different entries to one person (manual work from the data owner is likely to be needed).
- Via a *personal addressing system* the users get a unified overview of all personal addressing information stored in different devices and services. This information can then be used from different devices and services to set up/facilitate communication.
- *Unified buddy list* services are already showing up on the market. One such service is provided by Jabber's Instant Messaging solution. The user gets an overview of all buddies independent of the Instant Messaging service provider (AIM, MSN, Yahoo etc.). Other buddy lists (e. g. on the mobile phone) could be integrated as well.
- *Unified presence* would give an integrated overview of the presence status of a person (availability, location, context, mood etc). It combines information gathered from different devices and services.

Publishing address and presence information is only attractive for a user if this information can be protected and customised for personal use. *Privacy filters* help the user to decide what information to publish depending on the person or situation. There are two different levels of privacy. The first one protects and the second one controls publishing of personal information. The personal information itself consists of addressing information, availability information, and presence information. The privacy filter does not only apply to published data, but could also be used to manage direct communication (see below, Unified Presence and Direct Communication).

Unified Presence and Unified Messaging

Unified Messaging interacting with Unified Presence would make it possible for the user to get a unified overview of all message boxes from different devices and services. Nevertheless, the user

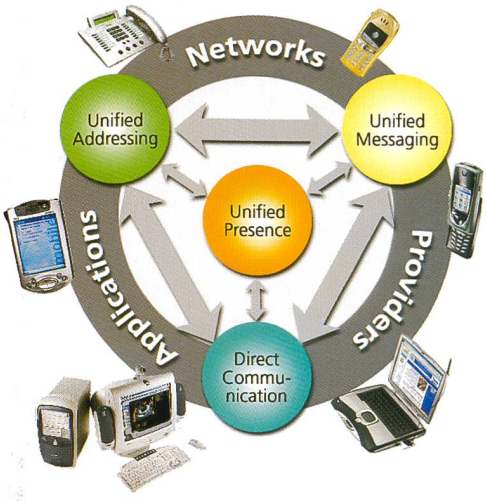

Fig. 1. The 4 relevant parts (addressing, messaging, direct communication and presence) enabling Unified Communication

should be able to distinguish the different sources as they are normally linked to roles and privacy needs (hotmail e. g. offers exactly this for mails from different pop-mail accounts). It should also be possible to get a unified view of the different histories, e. g. messages sent and received about one topic or related to one person (figure 3).

It is not necessary to unify entire message boxes (including all the content). For a lot of people it might be sufficient to get an overview of all message headers, sender, and time (e. g. in the case of voice messages). This could also overcome the limitations of a slow connection or limited storage capacity (e. g. on a mobile phone). When message boxes are unified it should be done in such a way that they stay synchronised (i.e. if a message is deleted in one box this should be reflected in other message boxes).

Furthermore, it should be possible to have a mechanism to notify the user about different types of new messages, resulting in a unified notification functionality. Different notification mechanisms can be used for different types of messages or message senders. The notification mechanism itself defines which notification channel and which kind of alerting is used on which device. This results in so-called notification profiles which can even depend on the different presence states. For example on the mobile phone you may normally be notified of SMS and emails (urgent or from specific persons) with a beep, but if you are in a meeting notification may be by vibrating and restricted to SMS. Customisable content is also very useful for the notifications. This allows the notification of a message to already contain some information about the message itself.

In some cases it is not necessary to notify a person of all incoming messages. It might be sufficient to give a visual reminder that there are messages to be checked (e. g. blinking light indicating that there are new voice messages) or simply a number indicating the total amount of new messages. The requirements for notifications are expected to change very frequently throughout a day; therefore it should be easy to manage the notification profiles.

Other very obvious but nonetheless important functionalities are channel transformations. A Unified Message service needs to have interfaces to phones and PC/Laptops. Therefore options like "vocal email reading" (text to speech) on the phone or "speech to text" translation to send short replies are crucial. This allows the users to utilise text mails even if there is only phone access to the Unified Message box.

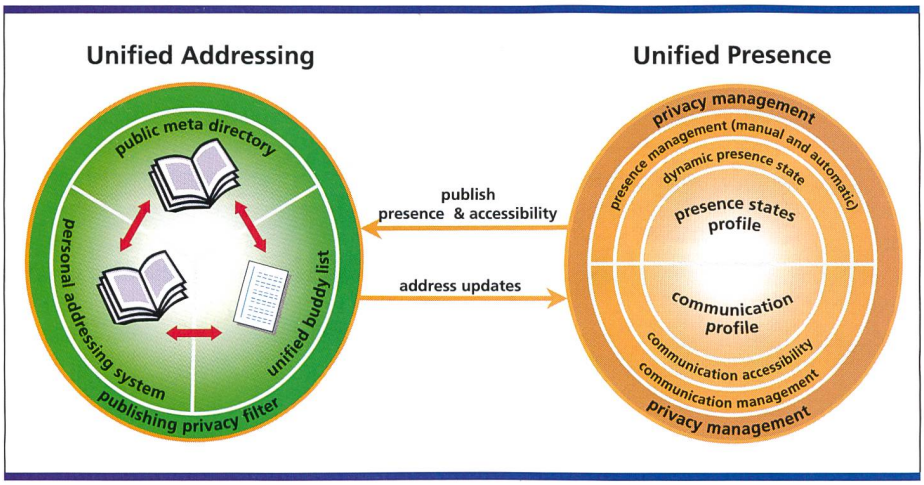

Fig. 2. The dependencies between Unified Presence and Unified Addressing

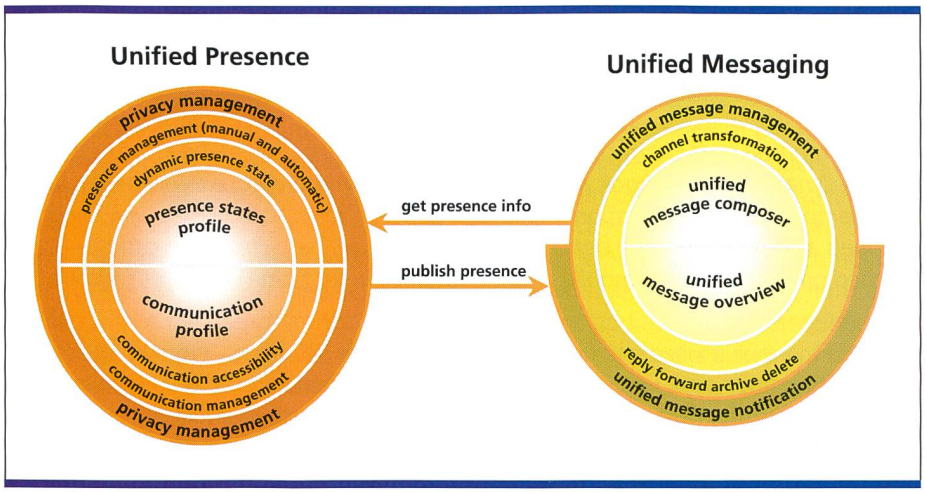

Fig. 3. How Unified Presence and Unified Messaging will interact

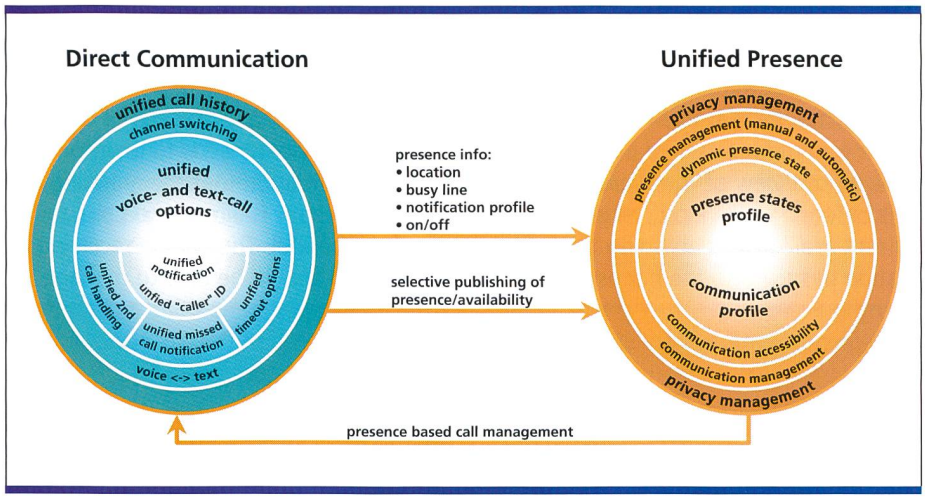

Fig. 4. Unified Presence combined with Direct Communication is an enabler for Unified Communication

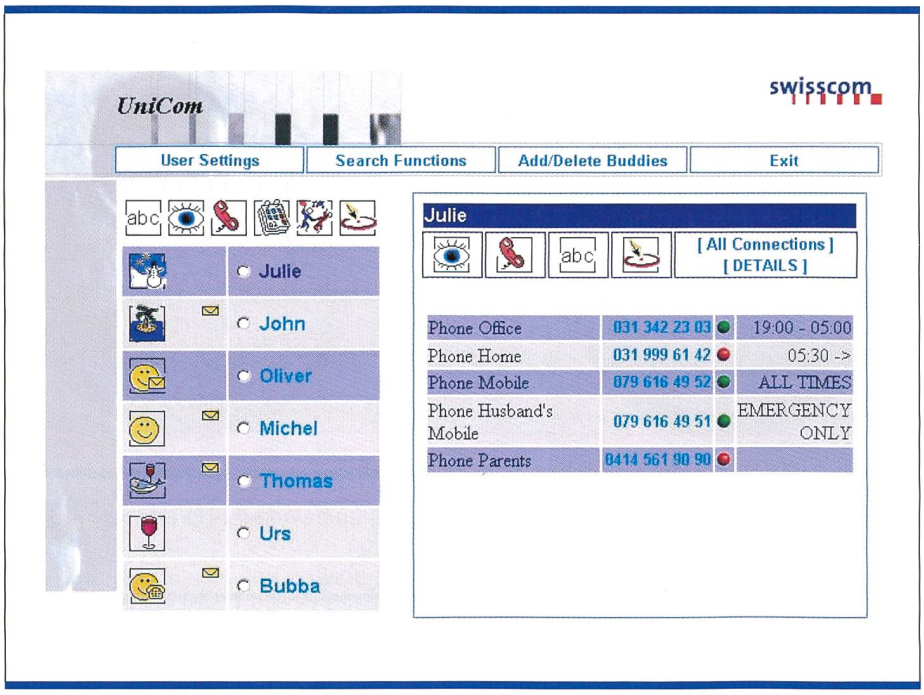

Fig. 5. Graphical user interface of the Communicator (experimental platform) showing the dynamic address book and a buddy list including presence information. In this example John is on vacation and Bubba on the phone. Julie's communication channels are shown in more detail on the right side of the picture: she can be reached on her office and mobile phone, but not on her home or parent's phone.

Unified Presence and Direct Communication

To make direct communication easy it is necessary to lower the barriers hindering communication. Therefore a kind of personal one number would be very useful. The user could define which existing phone numbers or other addresses are linked to this one number. This definition is a flexible set that can change during the day based on availability preferences. This information can then be used to have an overview of the available channels before making a call, reflecting the current availability. Publishing this information has to be in the hands of the user (figure 4).

The communication channels (phone, email, Instant Message etc) should be combined to make it possible to reach a person on any device (fixed phone, mobile phone, PC) from one integrated application or device. Because usually there are several channels available at the same time it is necessary to have a call management linking the corresponding channels (by making use of presence information). While in a call or taking a second call, it should be easy to switch between a voice and a text channel. This again relies on the call management which connects the voice channel with the right text channel.

The person receiving a direct call should be notified on all channels at the same time or in sequence (based on the presence information of this person). This notification has to stop once the call is taken.

Furthermore, it should be possible for the user to manage more than one call independently of the channel or device. The calling person needs to be informed about the situation that the receiving person currently is already on call using another channel. The person receiving a second call should be able to manage this call across channels. If a call is timed out / not answered the caller should have all possible options available depending on the channel or device to either end the communication or switch to another channel.

If a call on any channel is not answered the missed call notification should be available on any device, i.e. a call history service is needed. This call history should offer an overview of all the calls that were missed, received, or made, independently of the channel or device. Such information could as well be included as part of the unified addressing system.

Once it is very easy to reach a person through all channels it will be necessary to protect the user from privacy invasion. Privacy is a very important issue for the acceptance of easier forms of communication.

To be able to reach a person through a single channel the system needs to have an overview of all the devices and communication channels linked to this person. This forms a kind of static communication potential. But the communication availability of a person is very dynamic, i.e. a device/service may be switched on/off or is offline. Therefore a highly dynamic part is needed that automatically alters the static communication potential ending up in the current personal communication availability.

The dynamic presence state can either be set automatically based on location and time (schedule), or manually. This gives the user the chance to control whether or not and how he/she is reached at any place and point in time, without any form of active management. Being able to additionally manage the presence state based on moods would give the user even more control. This would have to be done manually unless the psychological state was monitored by sensors ...

The first step concerning privacy protection towards communication is whether or not you will publish all the channels through which you can be reached. This topic has already been discussed above (see Unified Presence and Unified Addressing).

The second step to manage one's privacy is to define the communication availability for different user contexts. The user has to define a number of possible presence states (e. g. meeting, working, holidays) with the corresponding channels and notification profiles. This we call the *static presence states*.

Furthermore, there are a lot of people who filter their calls based on who is calling (caller ID). In the Unified Communication situation the caller ID should be available across different channels and devices. Therefore the users should be offered privacy filters to refine their availability profile, i.e. the user defines how he/she would like to be reached by specific groups or individuals. The communication management system would have to check communication availability, presence state, but also the caller ID to decide through which channel to reach a person and with what notification mechanism.

Another point where privacy comes into play is the publishing of presence information. Without control possibilities people will be reluctant to enter their personal data. It should be possible to define what personal information, i.e. addressing information, communication availability, presence states, or moods, is shown to whom.
On the one hand direct communication will help people to reach everybody more easily; on the other hand it helps people to be reached selectively. These are very contradictory characteristics which have to be balanced by some form of negotiation. It will be possible for a person to set his/her availability and notification preferences and to publish it for others. Still, a caller should be able to decide on the level of intrusiveness of the notification or the channel (e. g. text is less intrusive than voice). It should therefore be possible to overrule some settings, which demands a negotiation mechanism between two persons.

Current Exploration Work@Swisscom Innovations

Presence based systems have a great value for the customer; however, the overall success of such a system depends heavily on its usability. The actual management of the presence information needs to be automated as much as possible and needs to be done without any user interference. The system should be able to detect automatically, depending on the current situation of a user, how the user can best be reached.
To facilitate this management of presence information, we have developed a communication tool (figure 5) that is based on the notion of a dynamic address book and includes the well-known functionality of today's state of the art communication environments, e. g. access to directory information (ETV) and different instant messaging systems such as ICQ, AOL, and MSN via Jabber, as well as voicemail, and email. In order to handle these different types of communication, the platform takes advantage of different communication channels and end devices. A web interface is used to fully configure and deploy the system, a J2ME interface for Java enabled mobile devices, a voice interface to access the address book or voice mail box for example, and a WAP interface to quickly modify communication properties while on the move. The overall goal of this development is to access any information from any location and any device.
The dynamic address book uses a dynamic buddy list in which different communication channels are dynamically represented, i.e. only channels that are actually available can be used. The information which channel is available can be entered manually by the user over one of the various input devices supported by the platform, or it can be deduced from different sources, such as entries in the user's calendar. For example, someone attending a meeting should only be contacted via SMS or voice mail, therefore all other channels are inaccessible. Also, information such as the phone status (turned on or off), or additional information from the network (logged in/out) can be used to dynamically update presence information. Whenever a new buddy is added to the dynamic address book all its attached communication channels are included, and, whenever a channel is added or it's properties change, this change is propagated to all address books of which this buddy is a member (dynamic address book). The advantage of these active buddies is that the user does not have to care about changes such as new telephone numbers, changed email addresses, etc., as all this information will be updated automatically in a dynamic address book. Passive buddies, however, remain local and are not managed by the system, similarly to the "classical" address book entry known today.

The Unified Communication Revisited

The total Unified Communication vision (figure 1) would unite the elements of addressing, messaging, direct communication and presence. The requirements for the separate entities have been described in this article. These requirements already offer quite big technical, political, and strategic challenges.
The key to unite all these elements could be a unified presence system. Such a system contains an overview of people with corresponding devices (addressing information), services, and personal preferences across channels. This information can be supplied by separate messaging, direct communication and addressing services, but none of these services offers the complete overview.
In the addressing and direct communication chapters we outlined a strong connection with the presence information. The addressing information, which is needed by the call management to make calls, can be entered by the device (network provider or user), service (provider), or addressing system (provider). The presence information can be used by several communication providers to give the users an overview of the available communication channels. The presence can also be published even if it is not primarily intended for direct communication in the addressing or messaging service, to give the users a sense of closeness (e. g. Instant Messaging buddy lists). For direct communication the presence service offers a way to do call management by linking persons to available devices and services, and by managing their availability according to their personal preferences.
Unified messaging and direct communication are also related to each other. First of all it should be possible to start direct communication from the unified messaging service. The direct communication channel can be used for new message notifications. In case of a call timeout it

Zusammenfassung

Heute stehen dem Kunden mannigfaltige Kommunikationsdienste zur Verfügung (E-Mail, SMS, Fax, Audio, Video, Instant Messaging), die unterschiedliche Netze (GSM/GPRS, UMTS, IP) und verschiedenartige Applikationen verwenden. Das effiziente Nutzen dieser Kommunikationsdienste ist das Ziel einer «Unified-Communication»-Architektur, in der die verschiedenartigen Kommunikationsdienste dem Kunden über ein einheitliches, geräteunabhängiges Konzept zugänglich gemacht werden, um damit den Nutzen der einzelnen Dienste zu erhöhen.

should also be possible to switch from direct communication to the unified messaging service.

Outlook

In the future we plan to use wearable computing technology, such as sensors, and wearable computers to enrich the presence information with things like user location, mood, or what kind of game the user is playing, and much more. Additionally, we plan to develop a comprehensive security concept, so that only authorised people with the right permission can get access to the presence information. 1

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Light Emitting Diode (LED)

« LEDs für Kunststofffaser-LANs »

Firmen-, behörden- und institutsinterne Local Area Networks (LANs) erstrecken sich in der Regel auf verhältnismässig kleine Flächen. Werden die an ein LAN angeschlossenen Stationen untereinander über Lichtwellenleiter (LWL) verbunden, dann genügen wegen deren geringer Länge preisgünstigere Kunststofffasern vollauf den Anforderungen.

Sollen grössere Strecken verbunden werden, bedarf es der hochwertigen und kostspieligen Glasfasern mit niedriger Dämpfung und geringer Dispersion.

Kunststoffmantel für Glasfasern

Für Entfernungen von mehreren hundert Metern, wie sie zuweilen bei weitläufigem Werksgelände zu überbrücken sind, können weniger hochwertige, mit Kunststoff ummantelte Glasfasern (polymer cladded fibers, PCF) eine günstige Alternative zu den extrem dünnen, aus reinem Quarzglas bestehenden Fasern sein. PCF-Fasern, die immerhin Übertragungsraten von einigen hundert Mbit/s erlauben, haben einen Kern mit 200 µm Durchmesser und einen etwa 30 µm dicken Mantel. Sie sind nicht nur wesentlich billiger als die dünnen Glasfasern, sondern auch leichter zu handhaben. Sie erfordern nämlich weder äusserst exakt beschliffene Stirnflächen, die das möglichst verlustfreie Ein- und Auskoppeln des Lichts gewährleisten, noch eine präzise, fast nur in der Fabrik sicherzustellende Montage von Steckern. Allerdings müssen über PCF-Fasern angeschlossene LAN-Sendeeinheiten eine Lichtintensität aufbringen, die allgemein nur Laser-, nicht aber handelsübliche Leuchtdioden (light emitting diodes, LEDs) abstrahlen können. Das veranlasste Wissenschaftler des Optoelektronik-Forschungszentrums an der finnischen Tampere University of Technology, nach Möglichkeiten zur Steigerung der Leuchtstärke von LEDs zu suchen. Diese Entwicklungsarbeiten wurden von der nationalen Technologieagentur Tekes, der Akademie von Finnland und von der Europäischen Union im Rahmen des SMILED-Projekts unterstützt.

Stärkere Leuchtkraft von LEDs

Als besonders gut geeignet erwiesen sich Dioden mit einem Resonanzraum, die man zwar auf ähnliche Art herstellen kann wie konventionelle Dioden. Doch kommt es dabei auf eine hoch präzise Ablagerung der nacheinander aufgebrachten Schichten an, was den Prozess merklich verteuert. Die Produktion von Dioden, die Licht nicht aus der Seitenkante, also horizontal, sondern vertikal aus der Oberfläche abstrahlen, ist kostengünstiger. Deshalb wählten die Forscher einen Aufbau, bei dem sie die Schichtstruktur im Verfahren der Molekularstahl-Epitaxy gewinnen konnten. Aus 6 bis 8 nm dicken Quantenwällen, die zusammen einen Mikro-Resonanzraum bilden, der zwischen zwei parallelen Spiegeln im Abstand der Wellenlänge liegt, emittieren die Dioden senkrecht zu den Spiegeln einen Lichtstrahl der Wellenlänge 650 nm. Sie sind nicht nur heller als ihre konventionellen Gegenstücke, sondern gewährleisten auch höhere Modulationsgeschwindigkeiten und bessere spektrale Reinheit und Strahlausrichtung. In ersten Tests lieferten die Resonanzraum-LEDs eine Kleinsignal-Modulationsfrequenz von 200 MHz bei 40 mA Treiberstrom mit 1,4 mW Freiraum-Lichtabstrahlung. Eine derart hohe Modulationsgeschwindigkeit ist das Ergebnis eines verbesserten Resonanzraumeffekts, der die strahlungsbedingten Rekombinationsraten von Ladungsträgern in den Quantenwällen steigert und zu Übertragungsraten von über 250 Mbit/s führen kann.

Von den neuen LEDs versprechen sich die Entwickler auch Anwendungsmöglichkeiten in der Autoindustrie, indem sie, integriert mit Kunststoff-Lichtleitfasern, für die Verkabelung der Funktionseinheiten im Fahrzeug eine Alternative zu Kupferleitungen bieten. 10

Ernst-Karl Aschmoneit,
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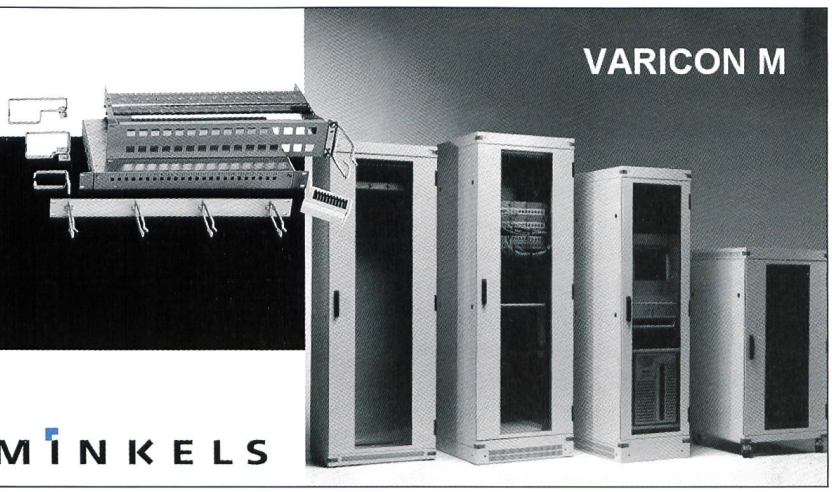

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