NewNet Communication Technologies
Mobile Messaging
Krypton High Level Function Description
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**HIGH LEVEL FUNCTION DESCRIPTION**

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*DISCLAIMER:* The information presented in this document describes features and functions of the Krypton product that are generally available. Specific features are dependent on the purchase of combinations of software components and usage licenses.

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Krypton Overview

NewNet is pleased to introduce its Krypton product as a solution for mobile operators to supply RCS-compliant application services. Rich Communication Suite (RCS) is a mobile industry effort led by the GSM Association (GSMA) to unify communication such as voice, presence, status, instant messaging/texting, buddy lists, media sharing, conferencing and video chat into one service on a mobile handset without the need for third-party software and downloads. This effort is in response to the increasing popularity of third-party messaging applications eroding the SMS and MMS volumes of operators in mature markets.

Krypton provides a way for mobile operators to rapidly deploy the GSMA’s RCS services with low upfront risk, little capital expenditure, and rapid time to market. RCS-based services provide a strong alternative to the many community-based “over-the-top” solutions.

Krypton can be deployed in two ways:
• The software provides a full messaging Application Server that is designed to be deployed inside a mobile network operator’s network as either an IMS Application Server or as a stand-alone application server (pre-IMS). The product includes all the required features to be compatible with the RCS-e and RCS 5 specifications.
• The software is provided as a service (SAAS) operated by NewNet from the “Cloud”. This allows operators to rapidly launch an RCS-e or RCS 5 compliant service without the expensive capital needed to deploy an IMS and to perform complex integration.

For both types of deployment, Krypton is integrated with the operator’s existing billing and provisioning systems and uses the operator’s existing application programming interfaces.

Product Features
NewNet offers Krypton for Mobile Operators so that they can rapidly deliver either an RCS-e or RCS 5 solution to their consumers with or without an IP Multimedia Subsystem (IMS). Krypton provides the following RCS functionality:
• RCS-e Capabilities Discovery
• OMA Presence Server (Optional)
• Standalone Messaging (with SLI/TLI interworking)
• Instant Messaging (1 to 1 Chat, Group Chat, Pager Mode, Large Message Mode, SLI/TLI Interworking)
• Store & Forward Instant Messaging
• Message Store (IMAP4 interface)
• File & Image Transfer
• File & Image Store and Forward
• Group chat store & forward
• Video Share
• Best Effort IP Voice & Video Call (including IR.74/IR.84 for video share support)
• Geo location Push & Pull (via File Transfer)
• Client Configuration Server
• End User Confirmation Server
• Optionally includes the Registrar components for operators without an IMS core
• IR.90 Internetworking Support
• RCS Network API

Krypton also implements requirements beyond those found in the RCS standard including:
• Standardized API for Billing Integration (Pre & Post Paid)
• Standardized API for operator provisioning
• Generation of Charging/Call Detail Records (CDR)
• Comprehensive Reporting Subsystem and Interfaces
• Compatibility with well known joyn™/RCS client developers
Product Features Continued

NewNet’s Krypton allows an operator to deploy an RCS service:
• Without initially requiring an IMS core network. The service runs “over the top” of the operator’s existing mobile network, provided it will allow SIP connectivity from the User Equipment (UE) through the Radio Access Network (RAN) to Krypton’s CSCF/UNI interface
• Without purchasing, installing and maintaining additional expensive capital equipment on the operator’s premises (Cloud based solution)
• With the ability to keep current with the evolving RCS standards without additional license fees as part of a regular maintenance contract
• With the ability to transition from Hosted to On-Premise to IMS Architectural models
• With compatibility with Third-Party RCS API Vendors. This allows operators to have access to RESTful API for integration with other applications.

Service Delivery Options
The Krypton product is designed to be deployed in three different models:
• As a Hosted Solution
• As an Application Server without an IMS on an Operator’s premises
• As an Application Server in an existing IMS

The product is also designed to allow operators to transition easily from each deployment model using the same software base. Operators can start small and move to larger more complex deployments keeping the exact same software in production.

Hosted Solution Deployment
Krypton Cloud is NewNet’s hosted version of Krypton. This unique business model allows a mobile operator to deploy the features of RCS without new hardware or software infrastructure within the operator’s network.

Krypton Cloud is a turnkey managed service in an Application Service Provider (ASP) model. Operators pay a monthly fee for the active users of the service. NewNet provides all operational aspects of delivering the service; including hardware, network infrastructure and technical expertise. Operators gain the benefit of continuous service improvements as new features and functionality in regular releases of Krypton are included in the price of the service.

Operators using Krypton Cloud are also able to achieve interoperability faster. All carriers on our hosted platform are fully interoperable among each other, and NewNet will negotiate technical interoperability between its platform and other operators which operate their own IMS based infrastructure. Krypton’s design, however, ensures that each operator’s data can stay separate and independent of other operators. Agreeing to interoperability is a key requirement to using the Krypton Cloud service.

A hosted solution is ideal for the following types of situations:

Pilot & Market Trials: The solution can be rapidly deployed to support technical pilot trials and consumer focused market trials without requiring significant investment in software or infrastructure

Rapid Response to Market Conditions: Since the Krypton Cloud infrastructure is already deployed and in operation, operators can deploy services rapidly to offer enhanced services to counter threats in their market

Operator Groups: Operators with multiple operating companies in differing geographic regions or with different technical infrastructure technical can launch a unified service across all operators simultaneously

Small Country Launches: Multiple operators within a single country can select the same hosted solution (operated by a neutral third-party,) to simplify interoperability and ensure a simultaneous launch

Capital Restricted: Operators who face restrictions on capital expenditures can selected a hosted solution to minimize up-front costs of purchasing hardware and licenses
Figure 1 illustrates the conceptual architecture of Krypton Cloud

**Mobile Data Network:** The highest quality of service is delivered with access to the operator’s mobile IP network; However traffic can be carried “over-the-top”.

**Public Internet:** RCS access to the service over WiFi and public internet connected devices, connectivity to the public Internet can be provided.

**OSS/BSS/HSS Provisioning:** Well-defined interfaces exist for provisioning transactions to Krypton or the system can use Diameter, LDAP or other operator specific protocols.

**Billing (Pre & Post-Paid):** Diameter or other operator specific protocols can be used to reserve credit and transmit notification of billing events for chargeable activities in the service.

**eNum:** An eNum and other routing services are used by Krypton to determine the carrier and associated SIP gateway addresses for IR.90 Interconnect.

**SMPP/SMSC:** For WiFi device authorization, integration with an SMS gateway is required.
Application Server without IMS Deployment

NewNet’s Application Server version of Krypton is designed so that Mobile Operators can deploy with or without an IMS and with the ability to migrate into an IMS environment when it is deployed.

This architecture is ideal for mobile network operators:
- Unwilling to deploy IMS, or who will implement IMS at a later date but need an RCS solution now to counter in market threats
- With legal needs for data or functionality to remain inside their own network infrastructure
- Interested in using Krypton to deploy private messaging solutions for Enterprise clients.

Krypton is designed to be deployed using an operator’s existing infrastructure as shown below.

**Figure 2 - Krypton deployment in 3G/LTE Network (No IMS)**

**CSCF/MRFC/MRFP:** NewNet supplies a SIP compliant Proxy Call Session Control Function along with a Media Resource Function Controller (MRFC) and a Media Resource Function Processor (MRFP) if required.

**Mobile Data Network:** The solution is implemented within the operator’s existing Mobile Data Network as shown in Figure 2, above.

**Public Internet:** Access to the RCS service can be supplied over WiFi and public internet connected devices; connectivity to the public Internet can be provided.

**OSS/BSS Provisioning:** Well defined interfaces exist for provisioning transactions to Krypton or the system can use Diameter, LDAP or other operator specific protocols.

**Billing (Pre & Post-Paid):** Diameter or other operator specific protocols can be used to reserve credit and transmit notification of billing events for chargeable activities in the service.

**eNum:** An eNum or other routing service is used to determine the carrier and associated SIP gateway addresses for IR.90 Interconnect.

**SMPP/SMSC or IP-SM-GW:** For seamless integration an IP-SM-GW is required. For partial integration a legacy SMS gateway or SMSC using the SMPP protocol is required.

**CDR:** CDR’s can be generated by the Krypton platform if required by the operator. In this case, a standardized CDR format delivery mechanism will be agreed upon between NewNet and the operator.
Deployment in an IMS Environment

NewNet’s Application Server version of Krypton is designed so that Mobile Operators can deploy with or without an IMS and with the ability to migrate into an IMS environment when it is deployed. This architecture is ideal for mobile network operators:

• With an existing IMS deployment
• With legal requirements for data /functionality to remain inside their own network
• Pursuing a pure VoLTE network who wish to add an all IP messaging functionality

Krypton is designed to be deployed using an operator’s existing IMS infrastructure as illustrated In Figure 3. Interaction with the HSS and Charging Function uses DIAMETER protocols. NewNet provides a P-CSCF and requires a third party registration be sent from the IMS S-CSCF.

Figure 3 - Krypton deployment in an IMS enabled network

Provisioning: Krypton interfaces with the HSS over using DIAMETER Sh calls to determine the availability or provisioning or RCS features for users the service.

Billing (Pre-Paid): DIAMETER Ro protocols can be used to reserve credit and transmit notification of billing events for chargeable activities in the service.

Billing (Post-Paid): DIAMETER Rf protocols can be used to transmit billing events to the Charging Function. Alternative the platform can send Call/Charging Detail Records (in the format specified by the operator) for chargeable activities in the service.

SMPP/SMSC or IP-SM-GW: For seamless integration with legacy SMS networks an IP-SM-GW is required. For partial integration, a legacy SMS gateway or SMSC using the SMPP protocol is required.

Migration between Deployment Models

Inherent in Krypton’s system design is the ability to migrate between the three deployment models described above. The design of the RCS standard anticipates this and provides a mechanism to transfer customers between RCS solutions. Mobile network operators who select any deployment model of the Krypton solution can transition their customers to a different model.

Data between each model can easily be transferred in bulk and database replication techniques are implemented to ensure continuity of customer data between platforms while the migration is on-going.
**Technical Overview**

The **Krypton** product encapsulates software functionality in small, reusable, and individual software process applications. Each autonomous software “server” process performs one or more tightly related functions to deliver the overall RCS solution. Each process communicates using a TCP based, asynchronous, inter-process communications mechanism to achieve the delivery of the overall functionality.

**High Level Architectural Model**

When **Krypton** is deployed in an operator’s facilities or using **Krypton Cloud** service, well-defined interface points are established between the operator’s infrastructure and NewNet’s infrastructure. The design philosophy of encapsulation allows integration with operators using their existing well-defined API’s without requiring significant software changes to NewNet’s overall solution.

Figure 4 illustrates the High Level Software Architectural Model of the solution.

**Standardized Application Framework**

**Krypton** employs a reusable application framework that provides its software developers with common functionality and libraries. This framework provides standardized core functionality for:

- Application configuration
- Operational administration, monitoring, and performance functionality (SNMP Traps, KPI/Statistics Gathering)
- Logging
- Inter-process communications protocols
- Database abstraction layers
- Implementations of standard Internet protocols (such as HTTP, SIP)
- Implementations of common processes for parsing (XML processing etc.)
- File storage and processing

This high performance framework yields huge productivity gains. The software development team is able to rapidly develop new software processes using familiar tools. Reliability is improved by encapsulating functionality in one location; therefore when bug fixes or other improvements are implemented they are shared across all applications.
Scaling and Redundancy

The highly modularized software and hardware infrastructure allows the addition of incremental hardware servers in order to accommodate additional load. It also allows for accurate prediction of hardware requirements for various load requirements.

Each standard Krypton Application server instance meets the following performance objectives:

- 250,000 simultaneously registered clients and 23,000 concurrent chats
- 1,000 concurrent file transfers and 1,000 concurrent video sessions
- Session establishment latency of less than 1 second, excluding network or client latency
- Chat message latency of less than 1 second, not including network or client latency
- File Transfer rate of 100KB per second for each of the 1000 sessions
- Real-time media latency establishment of less than 1 second, excluding network latency
- Message store synchronization of 10 seconds for 100 messages, excluding network latency

In general, an additional server is required for every additional 250,000 active users of the system.

NewNet uses an active redundancy model to achieve high availability with no performance decline. The Krypton design philosophy incorporates an N+1 redundancy and scaling model. Multiple instances of the same software are incorporated into a design that includes methods to detect failure and automatically reconfigure the system to reroute requests to a working software instance.

Krypton uses virtualization techniques that permit abstraction of server instances from physical servers, allowing hardware installations to scale independently of application instances. Transient data is stored in a clustered, high availability database which is further backed by geographic redundancy and usage of SAN infrastructure.

Through careful capacity monitoring and introduction of additional processes/servers as required, the N+1 model ensures the complete service is always capable of taking the full load of a failed/inactive server for service upgrades.

An N+1 philosophy can also be applied to ensure that there is N+1 geographic redundancy, enabling operation of the system from multiple locations.

Operation and Maintenance

Reporting Subsystem

The Krypton product includes a comprehensive reporting subsystem, allowing operators a unique insight into how their customers use the RCS features.

Available reports include:

<table>
<thead>
<tr>
<th>Monthly Summary Reporting</th>
<th>Monthly Usage Reporting</th>
<th>Performance Monitoring Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Number of active users by user agent</td>
<td>By User, with the following fields:</td>
<td>• DB latencies</td>
</tr>
<tr>
<td>• Number of new accounts provisioned</td>
<td>• # of chat sessions</td>
<td>• External interface request latencies</td>
</tr>
<tr>
<td>• Total number of active users at month end</td>
<td>• # of file transfer sessions</td>
<td>• MSRP connection statistics</td>
</tr>
<tr>
<td>• Number of deletions</td>
<td>• # of video shares</td>
<td>• Network traffic</td>
</tr>
<tr>
<td></td>
<td>• Messages sent</td>
<td>• Server CPU usage</td>
</tr>
<tr>
<td></td>
<td>• Messages received</td>
<td>• Memory usage</td>
</tr>
<tr>
<td></td>
<td>• # registration changes</td>
<td>• SIP &amp; HTTP requests</td>
</tr>
<tr>
<td></td>
<td>• Average session length</td>
<td></td>
</tr>
</tbody>
</table>
Reporting Subsystem Continued

Other reporting features include:
• Reporting data may be accessed via the data warehouse interface or through a RESTful API
• All reporting is available in multiple time increments and flexible timeframes
• Ability to filter reports by feature, i.e. IM, File Transfer, Video Share, Image Share
• Ability to differentiate between on net/off net communications and by transport type
• IM reports include number of IMs sent, number of unique subscriber using the service, number of IMs per user agent, number of group chats, number of IMs sent in group chats
• File transfer, Video share and Image share reports include number of sessions, number of successful/unsuccessful transactions, number of unique subscribers using each service, counts of the types of service transaction, number of service transactions accepted/rejected by the B-party

System Monitoring, Logging and Traps
Krypton has a statistical monitoring system and an event recording system to track all of the transactions in the system for reporting purposes. Every transaction in the system generates an event record which is stored for statistical and reporting purposes, and every software process tracks internal real-time key performance metrics. Dedicated gateway processes send SNMP traps, system logs, and Key Performance Indicators to the operator’s centralized monitoring system from the event recording and KPI infrastructure. The internal monitoring system can also be configured to generate SNMP traps when various conditions arise (e.g. KPI value high or low, KPI rate of change exceeds a threshold, KPI is off trend, etc).

Hardware
NewNet’s Krypton solution is designed to scale with customer growth using commercially-available, low cost server hardware and Linux operating systems. This allows operators to deploy only the number of low-cost hardware servers required to support traffic loads, thus minimizing upfront capital expenditures and lowering costs to the operators. It also provides a way to rapidly add hardware and computing power when additional growth is expected. Furthermore, with a virtualized infrastructure, an operator can leverage commercially-available cloud solutions for periods when high utilization is anticipated, thus only incurring expense when it is truly required.

A minimum of six servers are used for the smallest data center instance. This instance will support 250,000 subscribers. In general, an additional server is required for every additional 250,000 active users of the system.
About NewNet Communication Technologies, LLC

Headquartered in Arlington Heights, IL, NewNet is a recognized leader in mobility technologies with a primary focus in messaging, signaling, wireless broadband, consumer internet, multimedia content delivery, mobile advertising, real-time rating and charging, Interactive Voice Response (IVR), and secure transaction processing. NewNet Communication Technologies is a part of the Skyview Capital LLC, portfolio of companies. Skyview Capital, LLC, is a private investment firm that specializes in the acquisition and management of companies across multiple sectors of technology, telecommunications, services, and niche manufacturing. For further information, please visit www.newnet.com

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NewNet Communication Technologies, LLC
1455 W. Shure Drive
Arlington Heights IL, 60004
Tel. +1 224.795.5200