the Availability Digest

HP's OpenCall INS Goes Active/Active

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A major telecommunications company is now providing an extended version of HP's OpenCall INS cell phone application to cell-phone service providers. Running on NonStop servers in an active/active configuration, this product is highly scalable. Furthermore, this configuration can survive multiple node failures and will virtually never be out of service.

OpenCall INS

HP's OpenCall is a broad portfolio of software products that supports all levels of telephony network infrastructure. Within this portfolio, the OpenCall Intelligent Network Server (INS) supports wireline, wireless, and the new IP Multimedia Subsystem-based networks (IMS). Running on HP's NonStop servers, OpenCall INS is highly reliable and highly scalable.

OpenCall INS provides key telecom functionality required by cell-phone service providers via packages developed by HP and its partners. These functions include:

- generic number translation of abbreviated numbers into complete final addresses.
- setting up global virtual private networks and wireless private branch exchanges (PBX).
- Home Location Registers (HLR) for managing wireless networks and subscriber privileges.[1]
- providing integrated subscriber data storage and management for instant group communication services in IMS networks.
- Controlling and managing the resources required to calculate a mobile terminal's position.
- real-time rating and management for service providers offering advanced voice/data product catalogs.
- real-time billing for prepaid or post-paid subscriptions.
- delivering missed call information to subscribers via SMS (Short Message Service).
- wireless caller identification for providing the called party with the calling party's name before the call is answered.

OpenCall INS in an Active/Active Environment

The active/active version of OpenCall INS runs on a multinode NonStop system. Each node runs the entire gamut of applications, and a request or update can be directed to any node in the application network.

Transaction routing is done such that the load across all of the nodes remains balanced.

[1] See "HP's Active/Active Home Location Register" in the November, 2006, issue of the *Availability Digest.*

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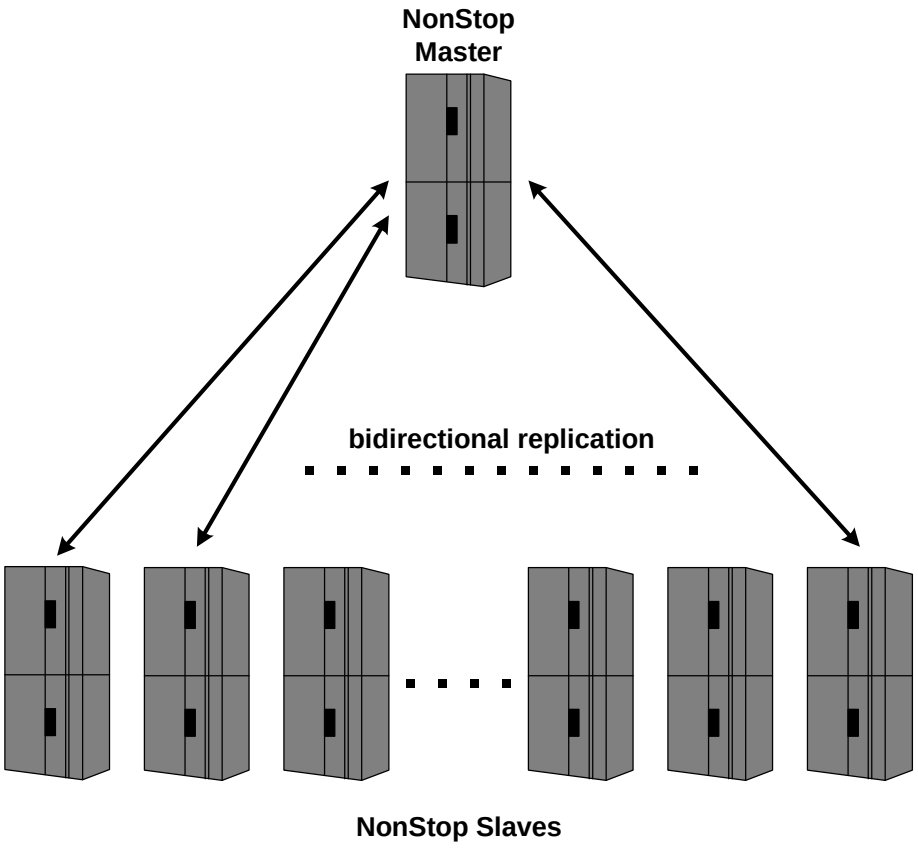
Should any node fail, it is simply removed from the network. The transaction load is then handled by the surviving nodes in the network.

The system is configured so that there is the number of nodes required to handle the transaction load plus at least one additional node to allow for a node failure. By distributing the nodes geographically, disaster tolerance is achieved. Should a node be taken down by a disaster of some sort, all further transactions are simply routed to the surviving nodes. The product vendor calls this configuration its "N+1 Geographic Redundancy Configuration."



N+1 Geographic Redundancy Configuration

The databases of all of the nodes are kept in synchronization via Shadowbase bidirectional replication from Gravic, Inc. (www.gravic.com).

The original OpenCall INS applications were not able to run in an active/active environment, except in partitioned manner in which each node "owned" a portion of the database. All updates to a partition had to be directed to the "owning" node. Shadowbase extends this capability by allowing any node to process any transaction against any partition of the database in a true active/active manner.

Data Collision Detection and Resolution

In the applications running on each node, data collisions can occur. To resolve them, one of the nodes in the application network is designated the Master node. The others are designated Slave

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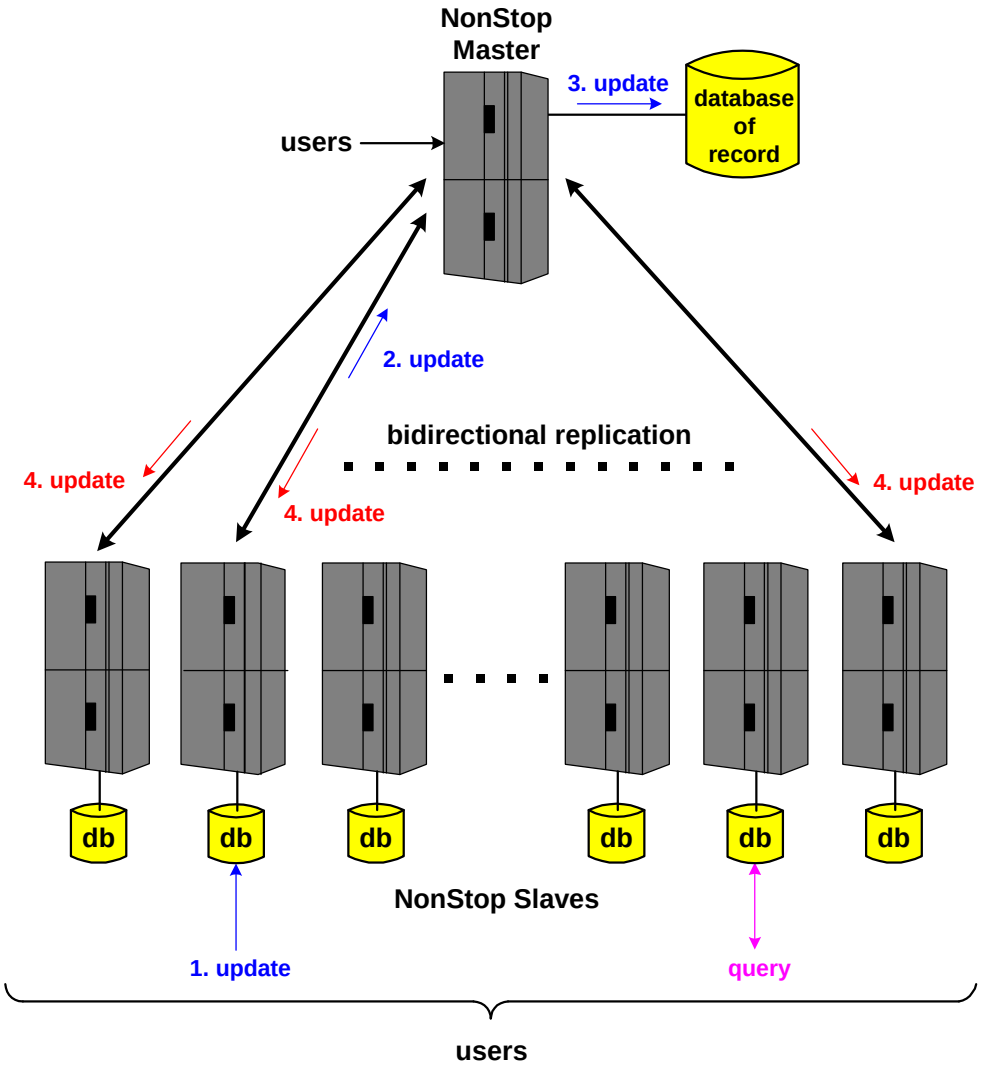
nodes. This is an example of an active/active hierarchical configuration (as opposed to those configurations in which all nodes are equal peers).

When a change is made to the database by a Slave node, rather than replicating it to all nodes in the network, the Slave simply replicates the change to the Master node. The Master node will update its database and will then replicate that change to all of the Slave nodes.

Should two nodes (either two Slaves or a Slave and the Master) attempt to change the same data item at the same time within the replication latency time so that neither is aware of the other's change, a data collision has occurred. The Master will receive these conflicting updates and will resolve the collision based upon its business rules.[2] In this case, the first change to update the Master wins.



After updating its database with the chosen update, the Master will replicate that change to the Slave nodes. In this way, all databases are kept in an identical state (within the replication latency). Rejected changes are logged for later review.

[2] See "Collision Detection and Resolution" in the April, 2007, issue of the *Availability Digest*.

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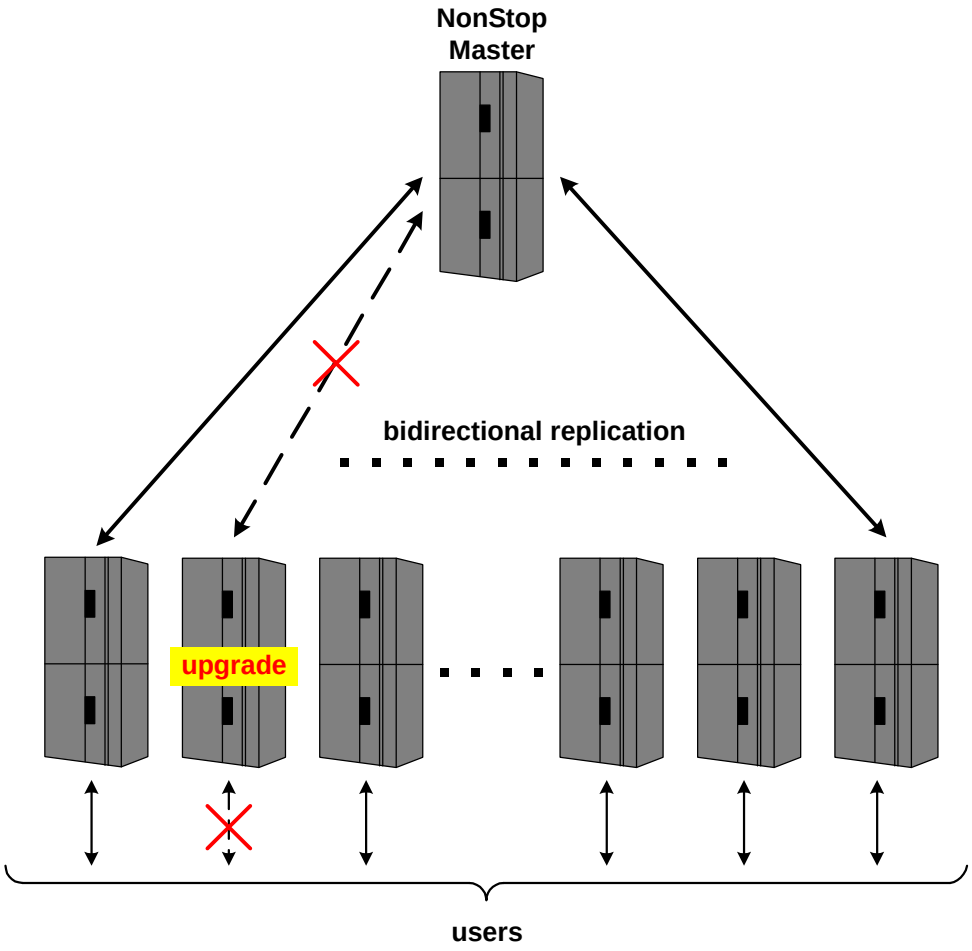
Thus, data collisions are resolved by the Master node, which is the final adjudicator. The databases of all of the Slave nodes will converge to the contents of the Master database. Therefore, the database at the Master node may be considered to be the "database of record."

Zero Downtime Migrations

Equally important to extreme availability is the need to eliminate planned downtime. Among other reasons, planned downtime is needed to move to new application versions, to upgrade the operating system, to restructure the database, or to modify the nodal hardware configurations.

In an active/active configuration such as this, any node in the system can be upgraded without taking down the system. This is done simply by taking that node out of service. While the node is out of service, all processing activity is handled by the other nodes. The downed node is then upgraded, tested, and returned to service by letting the Master node know that it is now available.



Rolling Upgrades

The Master will resynchronize the downed database by letting the replication queue that had been building in the Master drain to the restored node's database. This procedure updates that database with all of the changes that had occurred while it was down.

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If the outage was long, or the database was upgraded so significantly that it needs to be reloaded to match the master's database, then the replication facility provides the tools to re-load the upgraded node's database with the full image of the master's database.

The upgrade can then be rolled through the system by taking down each node one at a time, upgrading it, returning it to service, and moving on to the next node. When the Master node is to upgraded, one of the Slave nodes is promoted to be the Master before taking the Master out of service.

Once the Master is upgraded and returned to service, it can either be restored to its Master status, or it can continue in service as a Slave node.

Capacity Expansion

System capacity can be easily modified by adding or removing Slave nodes. When a node is added or removed, the Master node is notified of the new configuration.

System Availability

From an availability viewpoint, any number of Slave nodes may fail; and the system will continue to be operational within the capacity capabilities of the remaining nodes. Should a Master system fail, one of the Slave nodes is promoted to be the new Master; and the system continues in operation.

If the system is configured with two or more spare Slave nodes, the system availability becomes so high as to render meaningless any sort of availability calculation. For instance, a ten-node NonStop system with two spares will have a calculated availability of over ten 9s, which is an average of 3 milliseconds of downtime per year. However, this availability can never be verified and is bound to be swamped by other factors.

Summary

Operating the HP OpenCall INS applications in an active/active system configuration such as that described above provides unparalleled scalability and availability for cell-phone service providers. Service availability is commensurate with what one expects from the telephone network. Downtime is virtually a thing of the past.

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