

TECHNOLOGY
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TRAINING

SERVICE EXCELLENCE. DELIVERED

Number Portability Framework System Architecture



May 2011



Architecture highlights

- Proven, working, mature technologies
- Built on:
 - Microsoft Windows Server Platform
 - Microsoft BizTalk Server
 - Microsoft SQL Server
 - IIS
 - .NET Framework
- Solution is functional in 4 countries
 - Belgium
 - Oman
 - Romania
 - Albania

Technology

NP Framework

BizTalk

.NET

Windows
Server

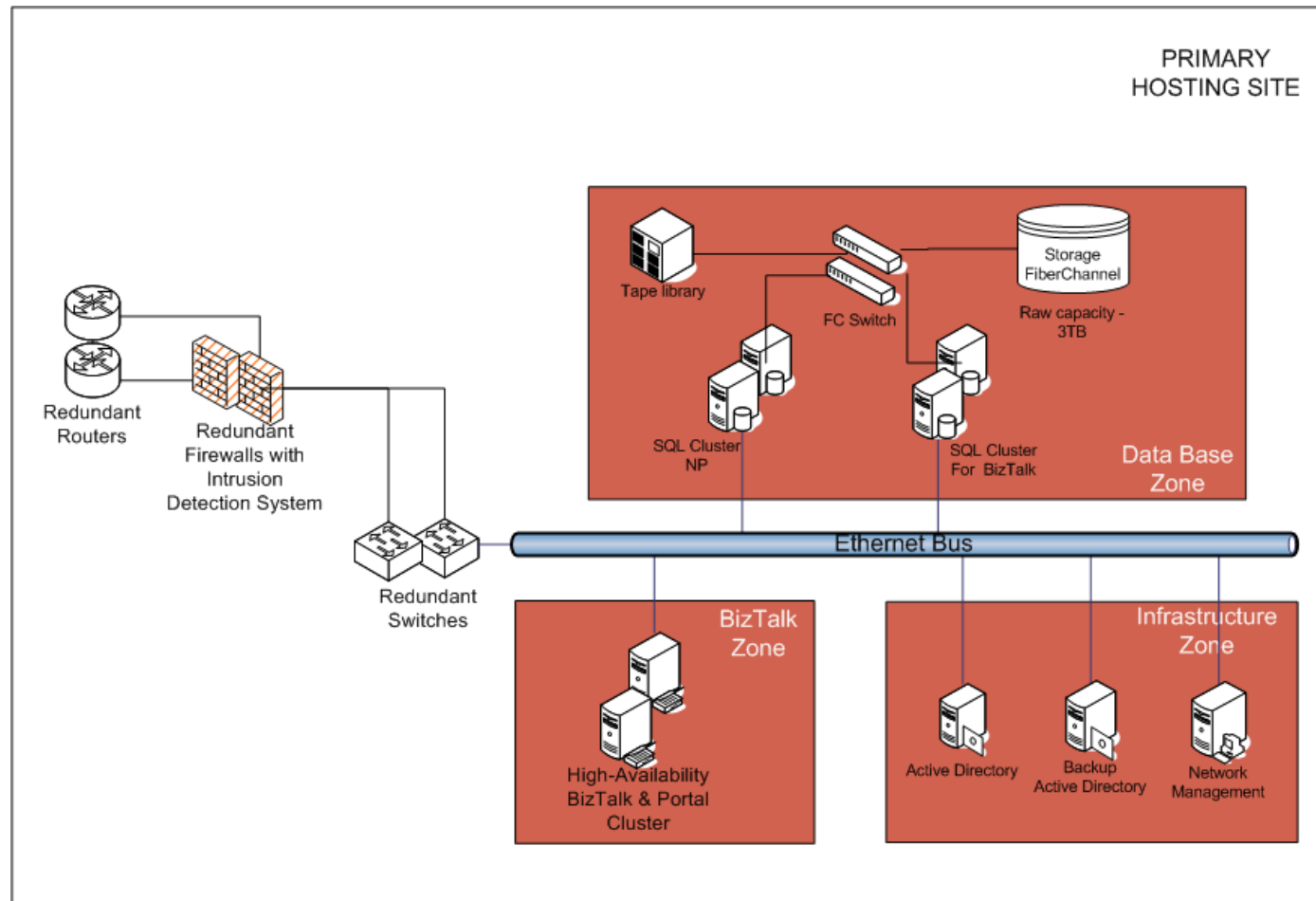
SQL
Server

Clustering

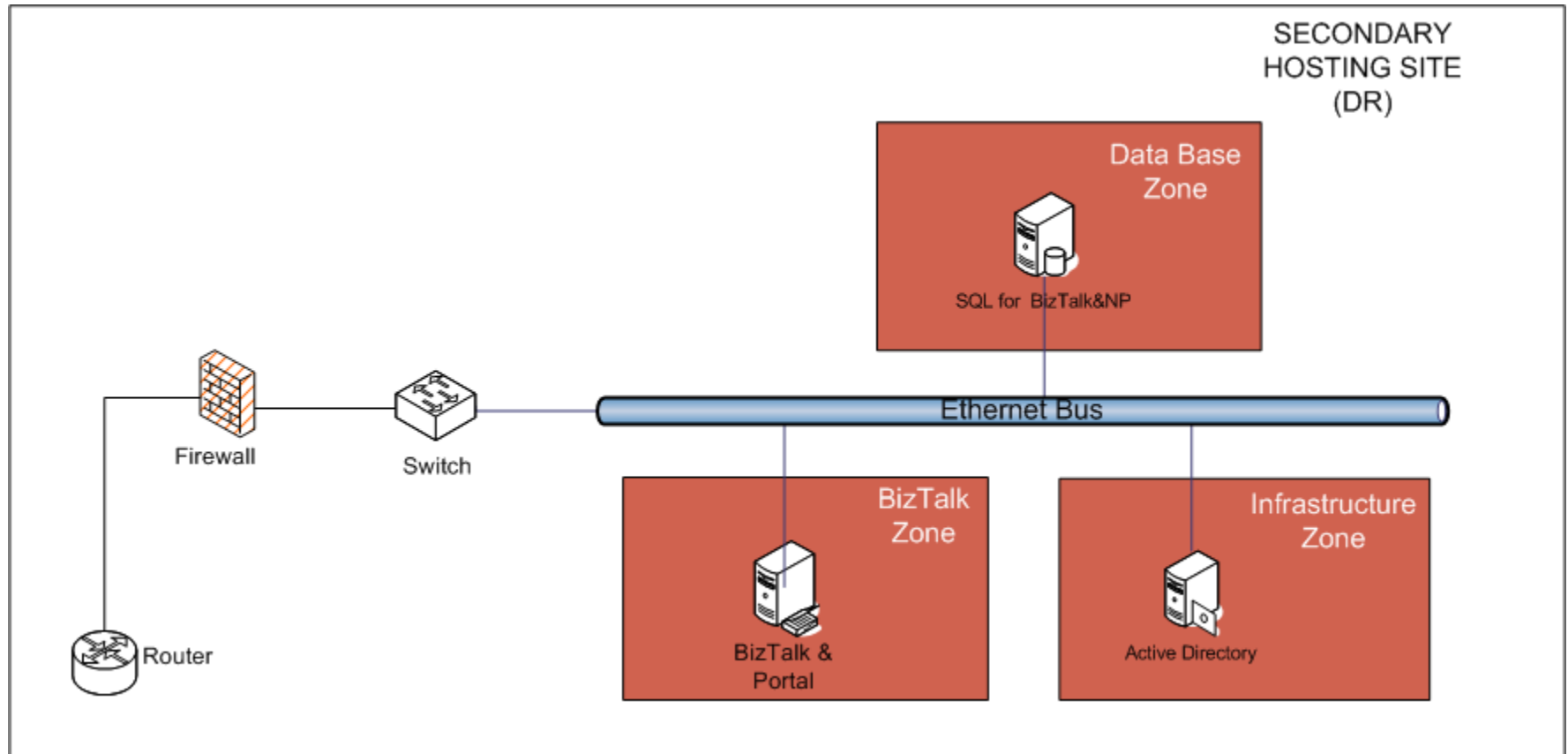
IIS

Load
Balancing

Primary location



Disaster recovery location



Security concerns

- All communication is made over IPSec channels
- Dedicated VPN tunnels
- All system components run under the least possible privileged account
- Trust inside the system is addressed using an Active Directory implementation
- Hosting location is secured

Performance characteristics

- All inbound traffic is balanced between servers with same role
- Highly tuned during previous implementations
- Compliancy with requested capacity
 - The system is designed to handle the requested porting volume
 - All performance indicators are above requirements
 - Data is based on measurements in similar environments
- Can handle very high loads
 - Performance will gracefully be reduced, but the system will continue to function

High availability

- All server nodes are redundant
 - Windows NLB
 - Windows Cluster Services
 - BizTalk High availability setup
- All equipments are redundant
 - Switches, Routers, HBA switches
- SAN is redundant by design
- Redundant physical connections to datacenter
- Maintenance procedures ensure low MTBR
 - Equipment specifications ensure high MTBF

High availability

- Fail over to secondary location
 - In case of permanent failure on primary location
- Synchronization between locations
 - Using SQL Server Mirroring Technology
- Switching from primary to secondary location is manual
- Why?
 - Due to secondary location being test environment
 - Allows technical team to ensure risk free switch over

Backup

- Done using
 - IBM Tivoli Storage Manager – compatible with all hardware
 - IBM TS3100 Tape Library
 - SQL Server specific backup mechanisms
- Frequent backups
 - Most probably, every 30 minutes
 - Full of diff are made regularly

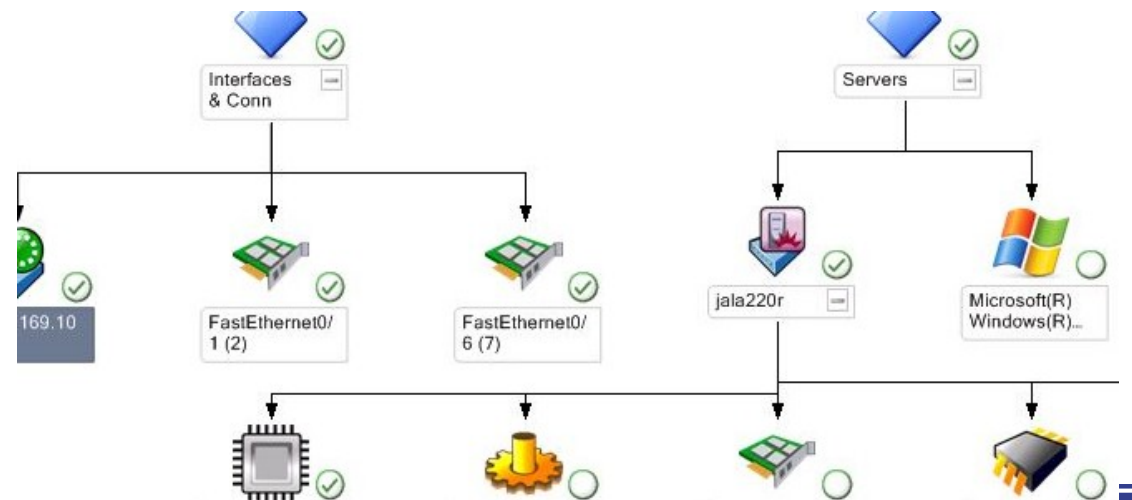
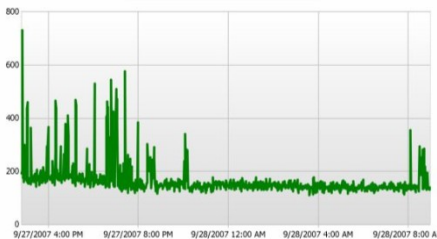
Disaster recovery strategy

- Fail over (to DR location)
 - Switch over to secondary location
 - Standard procedures for switch over and testing
- Fail back (back to primary)
 - Can restore using system images made using Tivoli Storage Manger
 - Can restore database from backups
 - Standard procedures for starting up the system

System management

- Using Microsoft System Center Operations Manager (SCOM)
- Provides monitoring
 - Applications, BizTalk server, SQL Server, Windows Server, AD, DNS, etc...
 - Real time monitoring and bottleneck detection
 - Specific evaluations modes for each monitored device

Real time visual status of components



Functional Description

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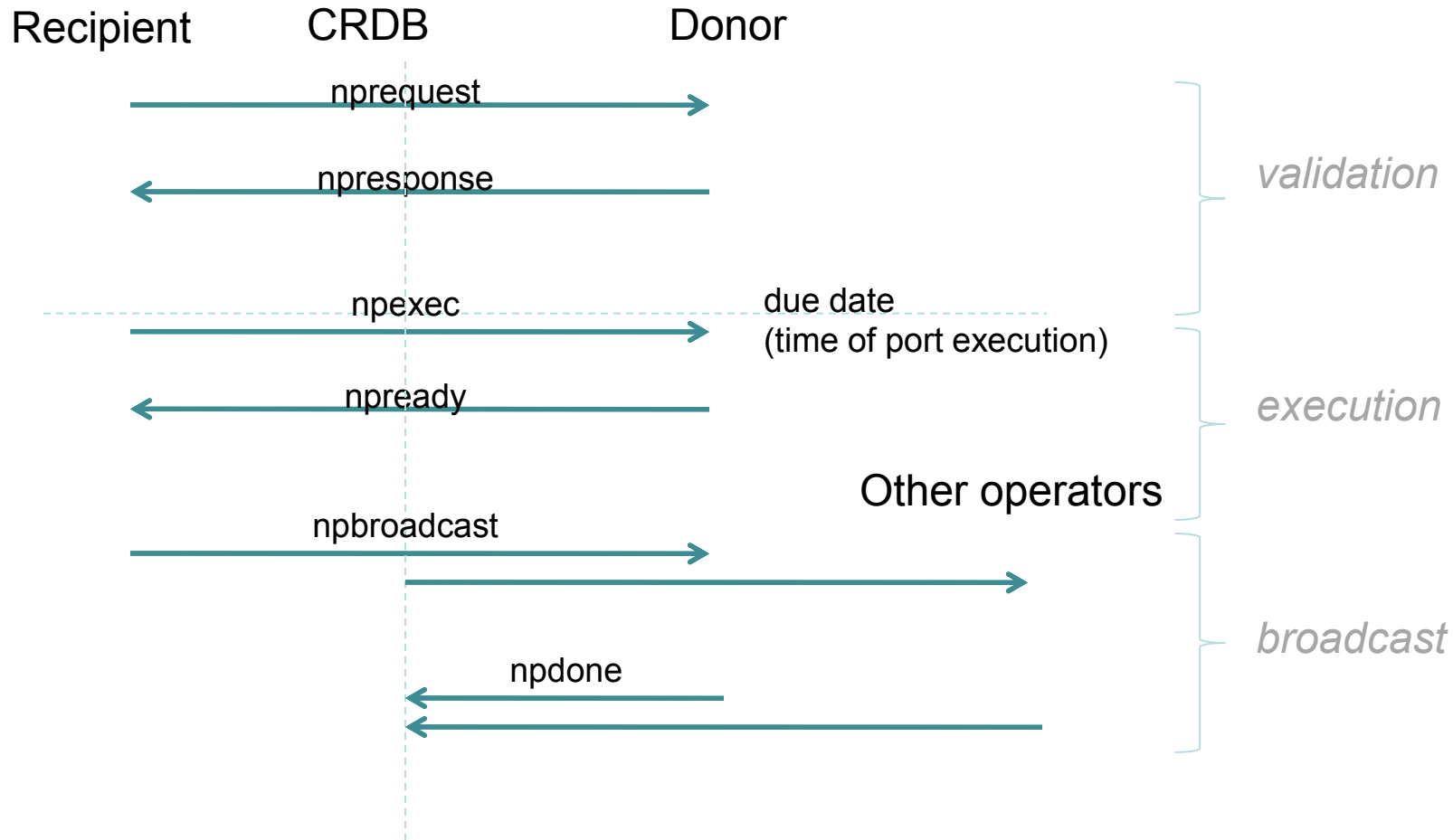
Characteristics

- Centralized number portability solution
- Trusted authority
 - Consistency and transactionality – validation rules
 - Process monitoring - timers
- Standard number portability processes
 - Port
 - Update routing information
 - Number disconnect
 - System availability notification

Characteristics

- Interfaces
 - M2M – SOAP based, XML exchange
 - Web portal – supports all NP processes
 - Public portal
 - synchronization mechanisms
- Secure
 - Secured access
 - Encrypted communication
 - Audit trail

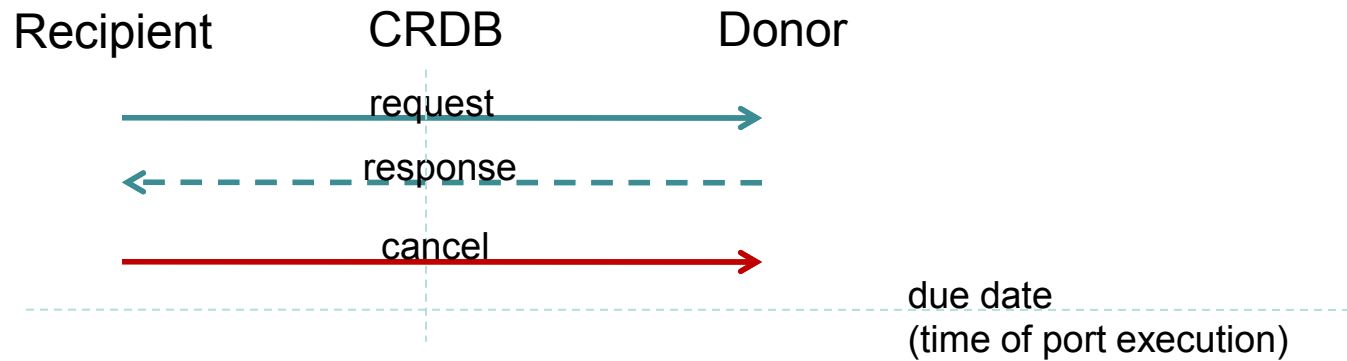
Porting Process – normal flow



... next: content & purpose of messages

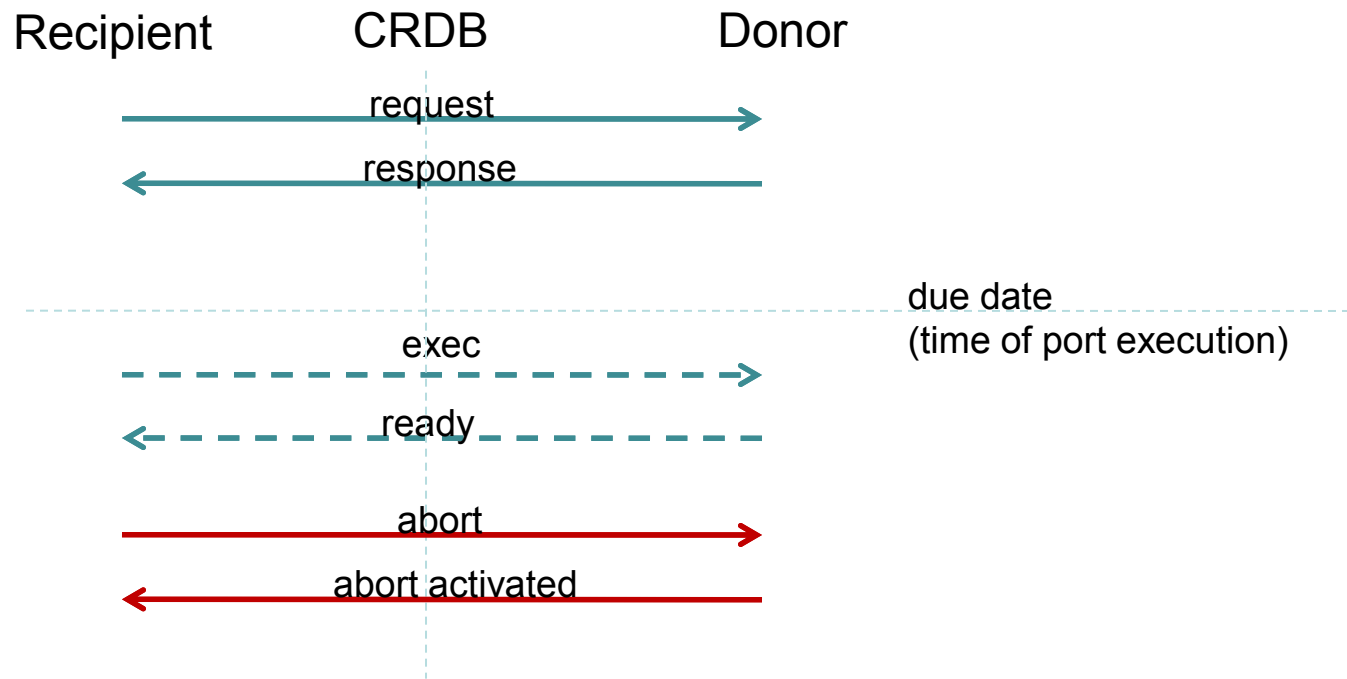
Alternative flows

- Customer may no longer want to port
 - Recipient sends cancellation (**npcancel**)



Alternative flows

- Recipient may not be able to activate number and route calls
 - Recipient sends process abort message (**npabort**)
 - Donor confirms reactivation of number (**npabortactivated**)



Timers

- Monitor duration of certain sub-phases
- Used to:
 - terminate processes that take too long
 - measure response time of operators (KPI)
- Are:
 - Configurable as duration
 - Different target values in predefined circumstances

Timer for KPI measurement

Timer	Started at	Stopped at	Refers to
T1	Porting request	Porting response	Donor
T3	Execution start	Number deactivation	Donor
T4	Number deactivation	Activation at recipient	Recipient
T5	Delivery of broadcast message	Receive confirmation of database update	Any participant

Process monitoring timers

Timer	Started at	Stopped at	On expiry	Responsible
T6	Porting request	Porting response	Cancels the process (npcancelledbycrdc)	Donor
Ensure validation phase does not exceed proposed window				
T11	Due date	Broadcast of porting	Cancels the process (npcancelledbycrdc)	Donor or Recipient
Ensure execution is not taking too long				
T9	On port abort	On abort activation	Abort of process (npabortbycrdc)	Donor
Ensure number is not left without service too long				

Synchronization Operators <-> CRDB

- Exchange of broadcast messages
- Synchronization files
 - XML & CSV format
 - Generated regularly (daily, weekly, monthly)
- Number status query
 - Using dedicated XML messages
- Operators can request a copy of the databases
 - XML/CSV containing all ported numbers
- Dedicated report in web portal

Other functional features

- Complete number disconnect process
 - Uses dedicated messages
 - Specific validation rules
 - Employs specific timers
- Complete routing information update process
- System availability notification
 - When a donor is down the recipient is notified that porting cannot start
- CRDB availability notification
 - Custom messages that announce planned downtime

Conclusions

In order to ensure system success, there are several factors to keep in mind:

1. Don't cut corners, methodologically. In the long run, this results in system failure or an inadequate system that doesn't meet the users' needs.
2. Audit each major deliverable and step along the way for accuracy and correctness.
3. Carefully monitor top management support for the project. Make sure that managers are aware of the progress of the team.
4. Secure the correct technical lead for the project.

There is no free lunch in software engineering. If you insist on keeping costs low and hurrying the project along, then quality will be low or the risk of failure will be high no matter how well the project is managed.

Dr. Paul Dorsey, President of Dulcian Inc. Oracle Consultant





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