



- Pure SIP PBX out of the box
- SIP proxy/registrar/locationserver – no B2BUA like *
- RTP proxy
- Configuration via Web Interface
- Flexible customization – all configuration in plain text
- GPLed Open Source Software

Outline

- Motivation
- Embedded Hardware Playground
- Features
- Main Scenario
- Examples

Motivation

- Increasing number of Internet connections with increasing bandwidth
- VoIP has entered the SOHO market
- Calls via SIP provider cheaper than via POTS provider ... but if everybody has a flatrate calls could also be made peer to peer for free
- Some services @home would be nice, SIP-aware router or even better a router with SIP PBX functionality needed
- Milkfish motivation: Provide that with affordable hardware

Motivation - The SIP World

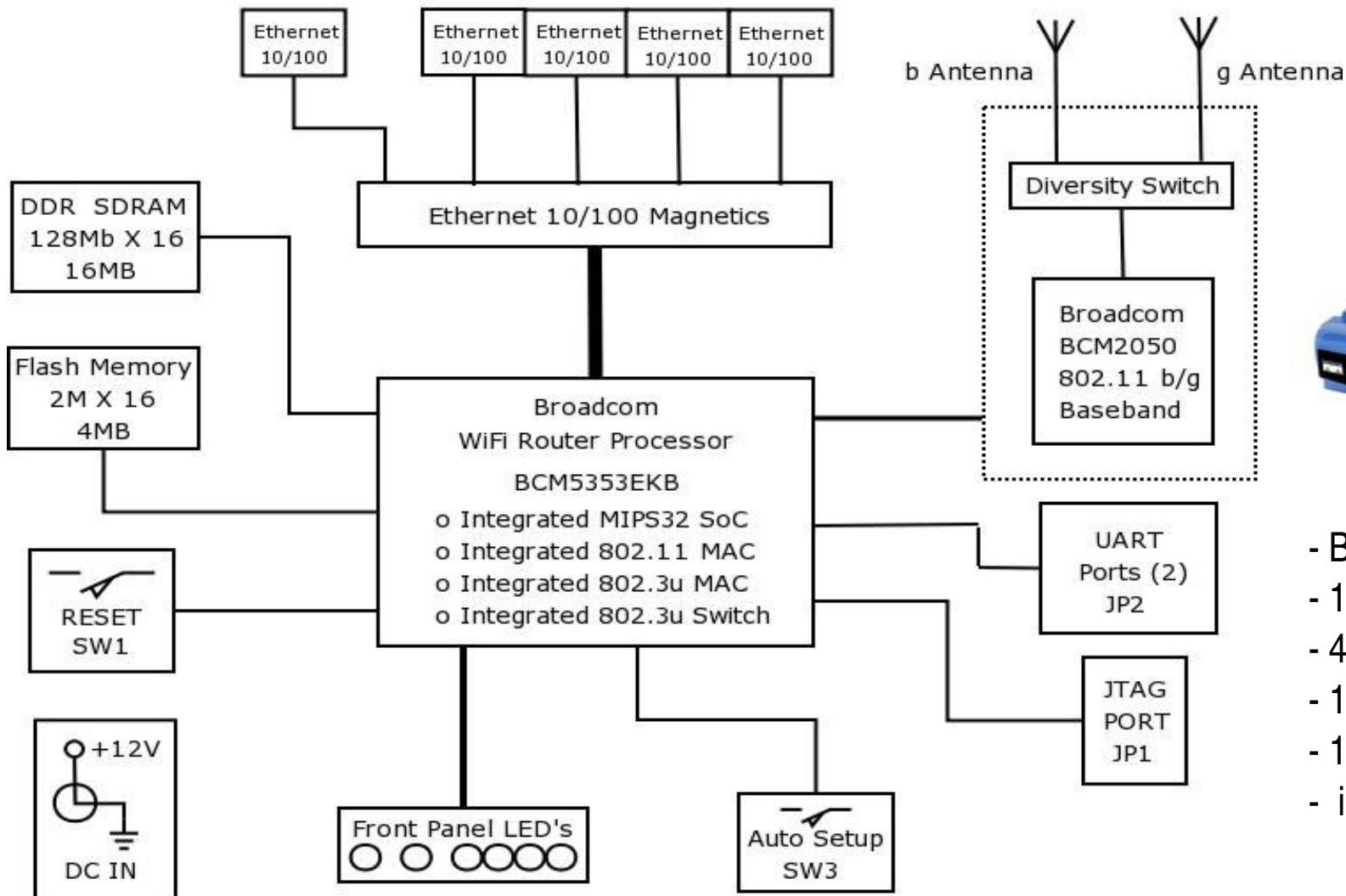
- Email-like-addresses: <sip:name@company.com>
- SIP packets do not carry media like voice
- Used for signaling and negotiating media streams
- There are “User Agents” and “Network Elements”
- “Network Elements” connect “User Agents”
- Address resolution by DNS, ENUM or LocServer
- SIP alone needs a non-ambiguous addressing plan

Motivation – showstoppers NAT and firewall

- User Agent in RFC1918-net lacks unique address
- Per definition a call is answered by a UA
- Where and who is <sip:fronce@192.168.1.23> ?
- Who will answer to <sip:*@externalip:5060> ?
- NAT is a reality. Plus: NAT is necessary! Why?
- RFC1918 address is real source of UA IP package
- The same local address is used inside SIP as inside IP
- Again the address is used in the SDP-offer inside SIP
- “Invalid” RFC1918 IP addresses contaminate „SIP-World“
- SIP message content needs to be address translated

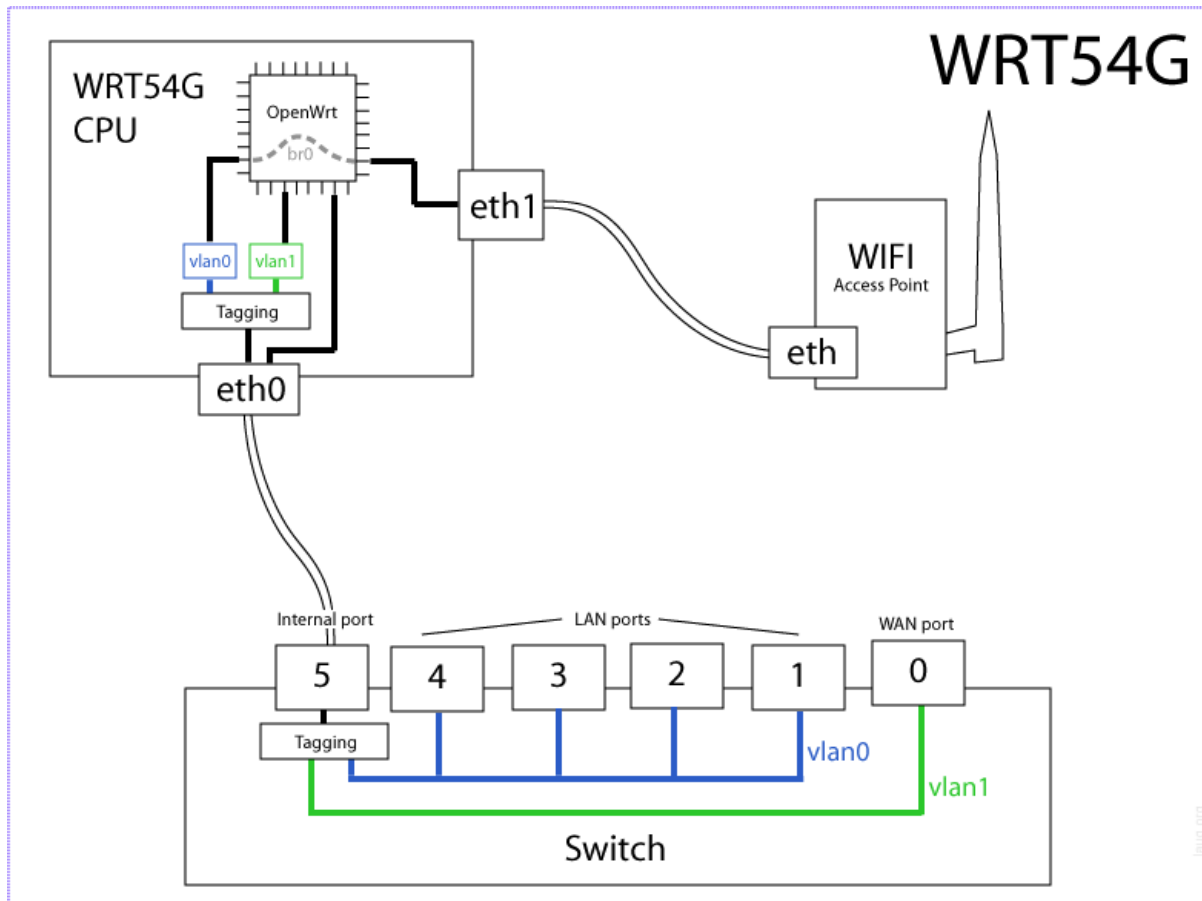
Embedded Hardware Playground - WRT

Linksys WRT54GL Block Diagram

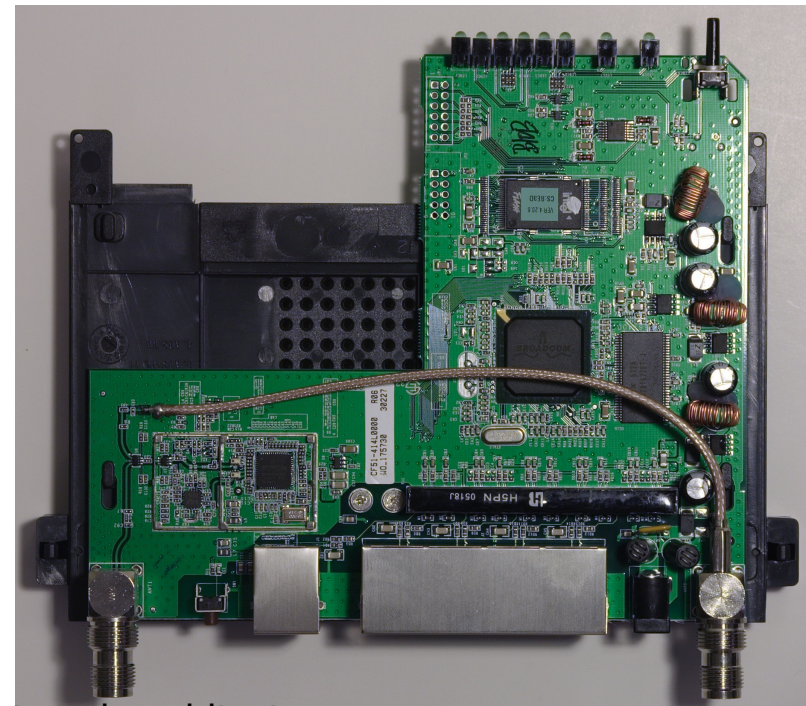


- BCM SoC @ 200 MHz
- 16 MByte SDRAM
- 4 MByte Flash
- 1 x Fast Ethernet
- 1 x WLAN
- internal RS232

Playground - Networking on a WRT



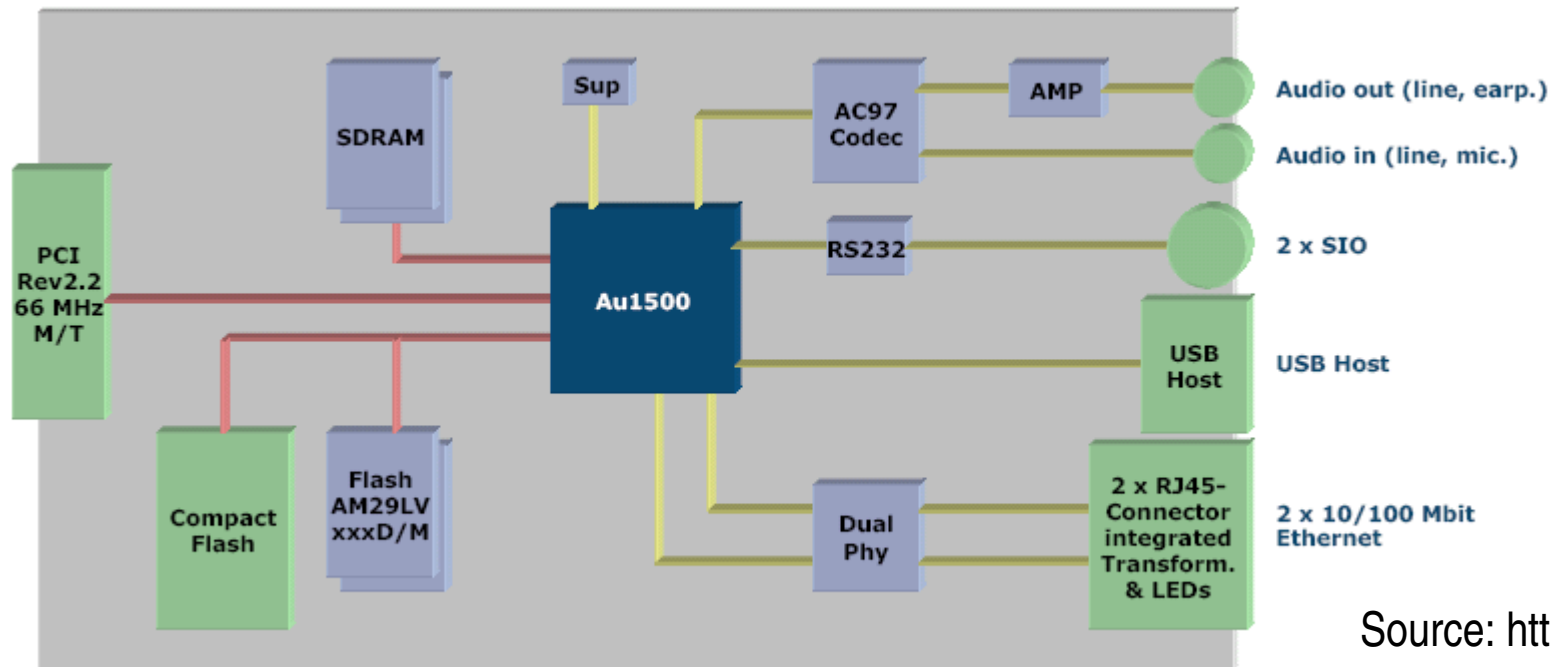
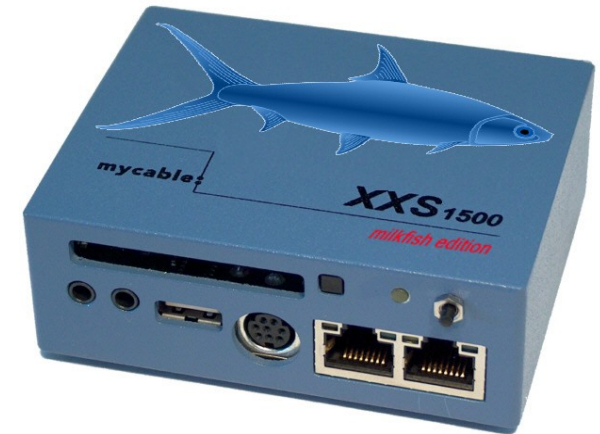
Source: <http://www.linksysinfo.org/>



Source: http://upload.wikimedia.org/wikipedia/commons/0/0f/WRT54G_internal_architecture.png

Embedded Hardware Playground - XXS

- AMD Alchemy Au1500 @ 500 MHz
- 64 MByte SDRAM
- 16 MByte Flash
- CompactFlash slot
- 2 x Fast Ethernet
- 1 x USB Host (1.1)
- 2 x Seriell RS232
- DSUB25 16x GPIO + 300 mA @ 3,3 V / 5V



Source: <http://www.mycable.de>

Features – Milkfish Ingredients - 1/3

- OpenSER
 - Open source SIP router
 - Small in size but big in performance (footprint / scalability)
 - Modular structure (core binary and runtime modules)
 - Used by major SIP providers (e.g. sipgate, 1und1)
 - Special Milkfish configurations – defined by main scenario
 - Usage of tiny text based database (dbtext)
 - Routing with integrated NAT-fixing of SIP and RTP packets
 - Configuration for operation on two network interfaces (LAN/WAN)

Features – Milkfish Ingredients - 2/3

- RTPProxy
 - Proxy for RTP media streams
 - Controlled by OpenSER

- Shell scripts
 - Starting of Milkfish environment at router startup
 - Reconfiguration in case of PPPOE reconnect
 - Firewall adaptation

Features – Milkfish Ingredients - 3/3

- Web interface
 - System Status Information
 - Administration of subscribers and aliases
 - Local phone book with account details
 - SIP/SIMPLE messaging
 - Internet Firewall Test (real external port scan)
 - Fixing NAT on the NAT: No more problems with NAT and easier firewall configuration.
- „There is no spoon.“

Web Interface – User Management

OpenWrt Admin Console

[About](#) [Status](#) [Contacts](#) [Phonebook](#) [»Database«](#) [Messaging](#) [Firewalltest](#)

Milkfish Database

Aliases

Alias	SIP URI
123	123456789@sipprovider.com Remove
bob	1889599@192.168.1.35 Remove
<input type="text"/>	<input type="text" value="sip\:"/> <input type="button" value="Add"/>

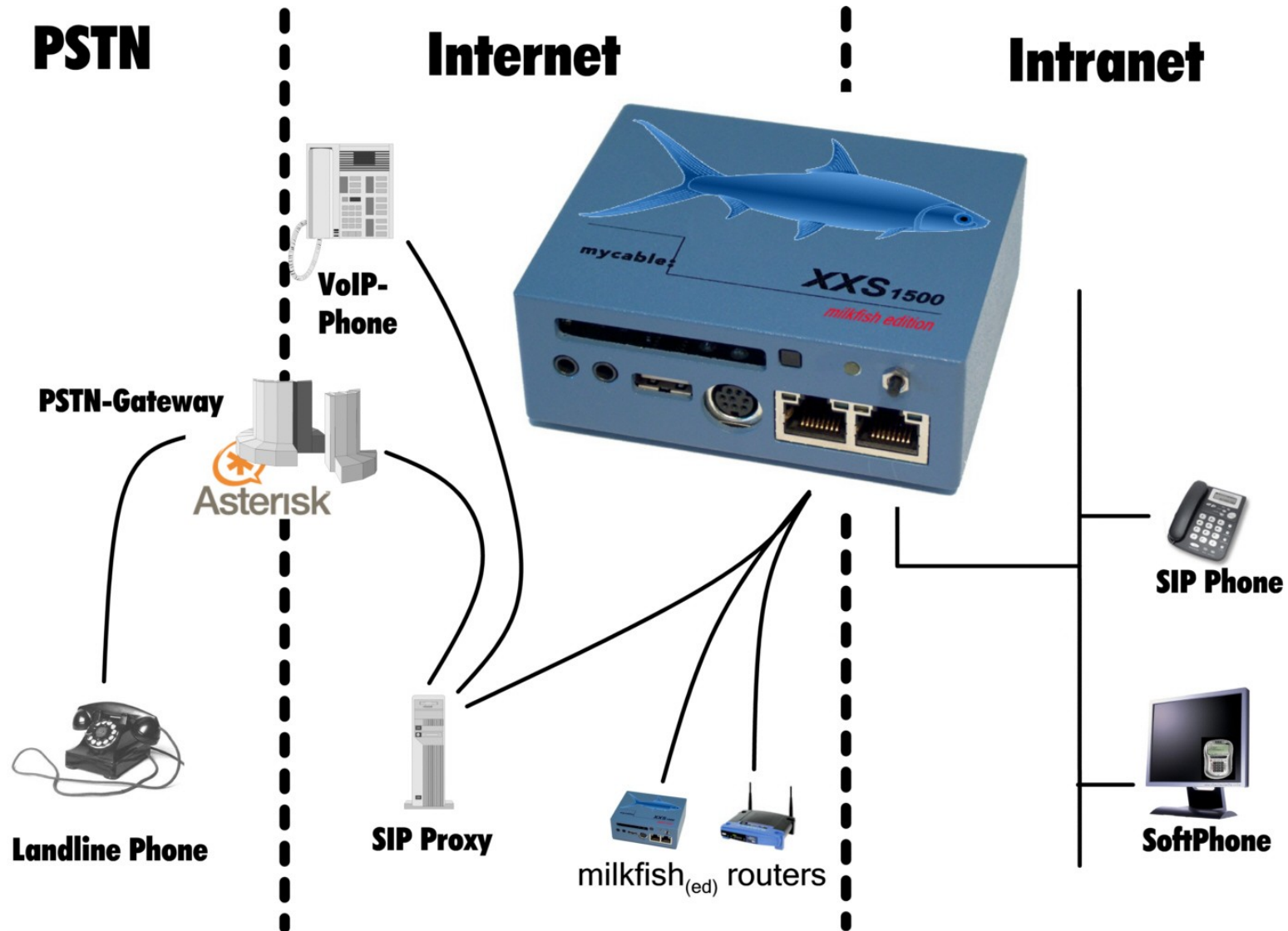
Accounts

Account
1889599 Remove

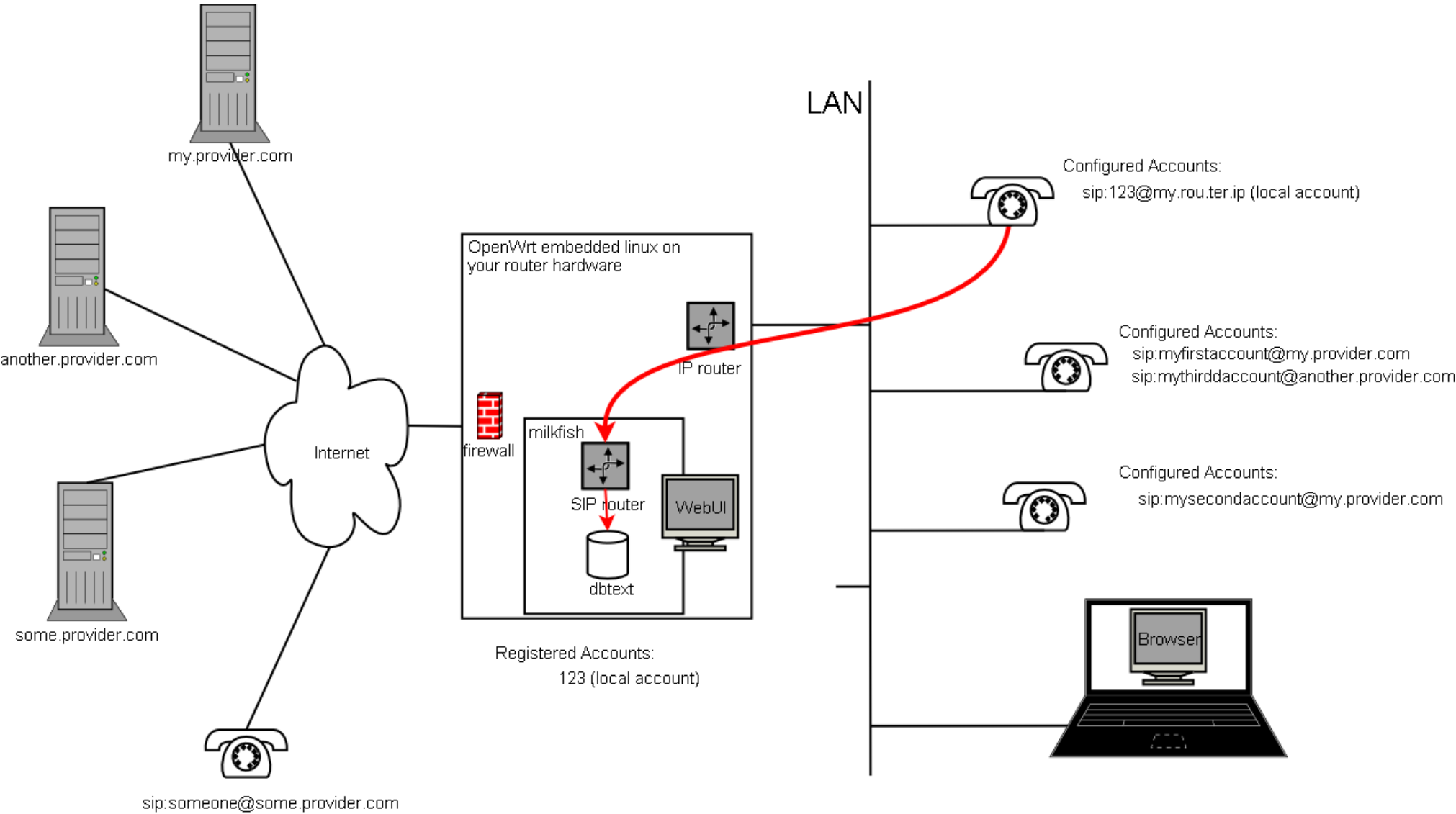
Local Subscribers

SIP Username	Password
alice	alice_pwd Remove
<input type="text" value="username"/>	<input type="text" value="password"/> <input type="button" value="Add"/>

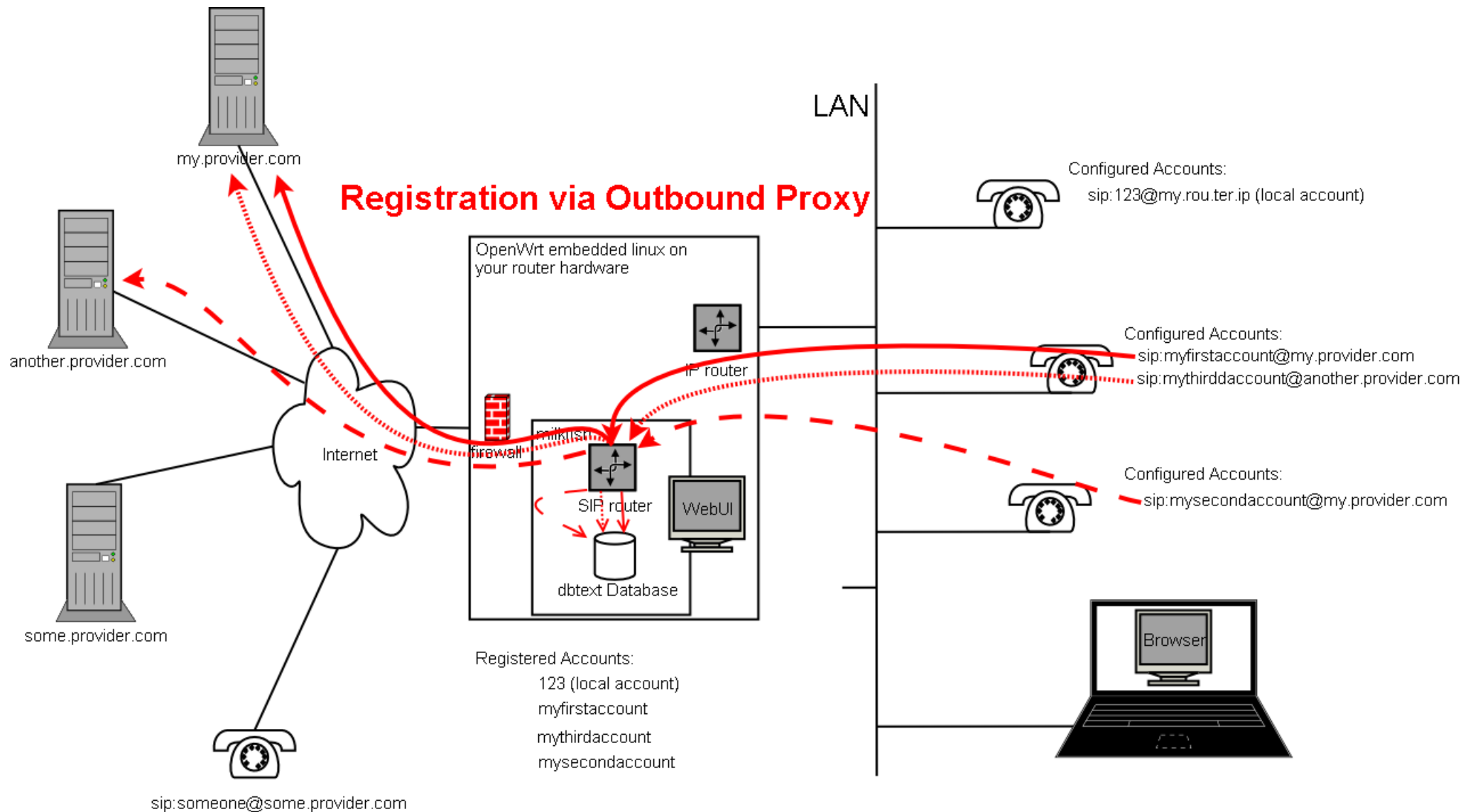
Main Scenario – SOHO Internet Router



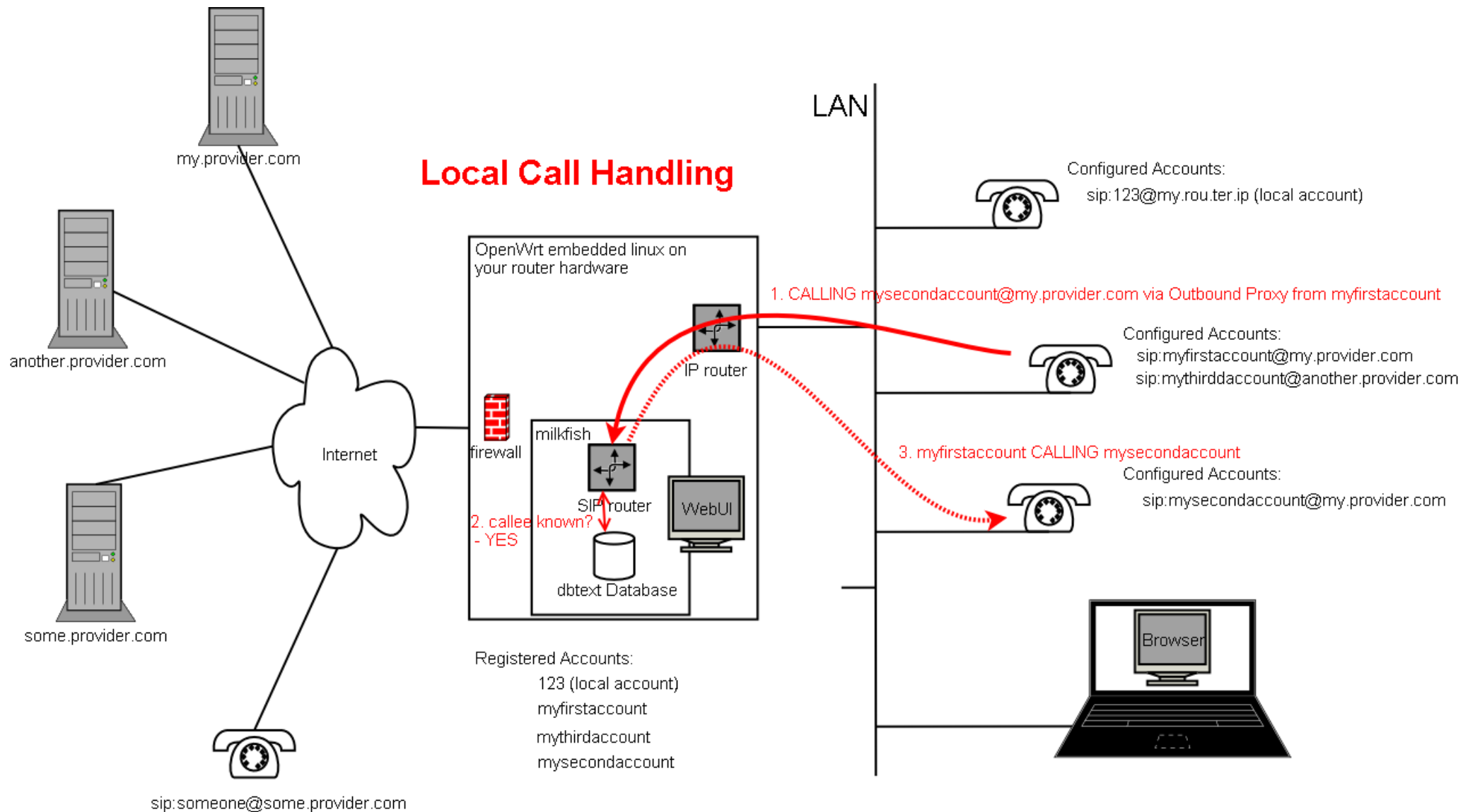
Examples - Local Subscriber Registration



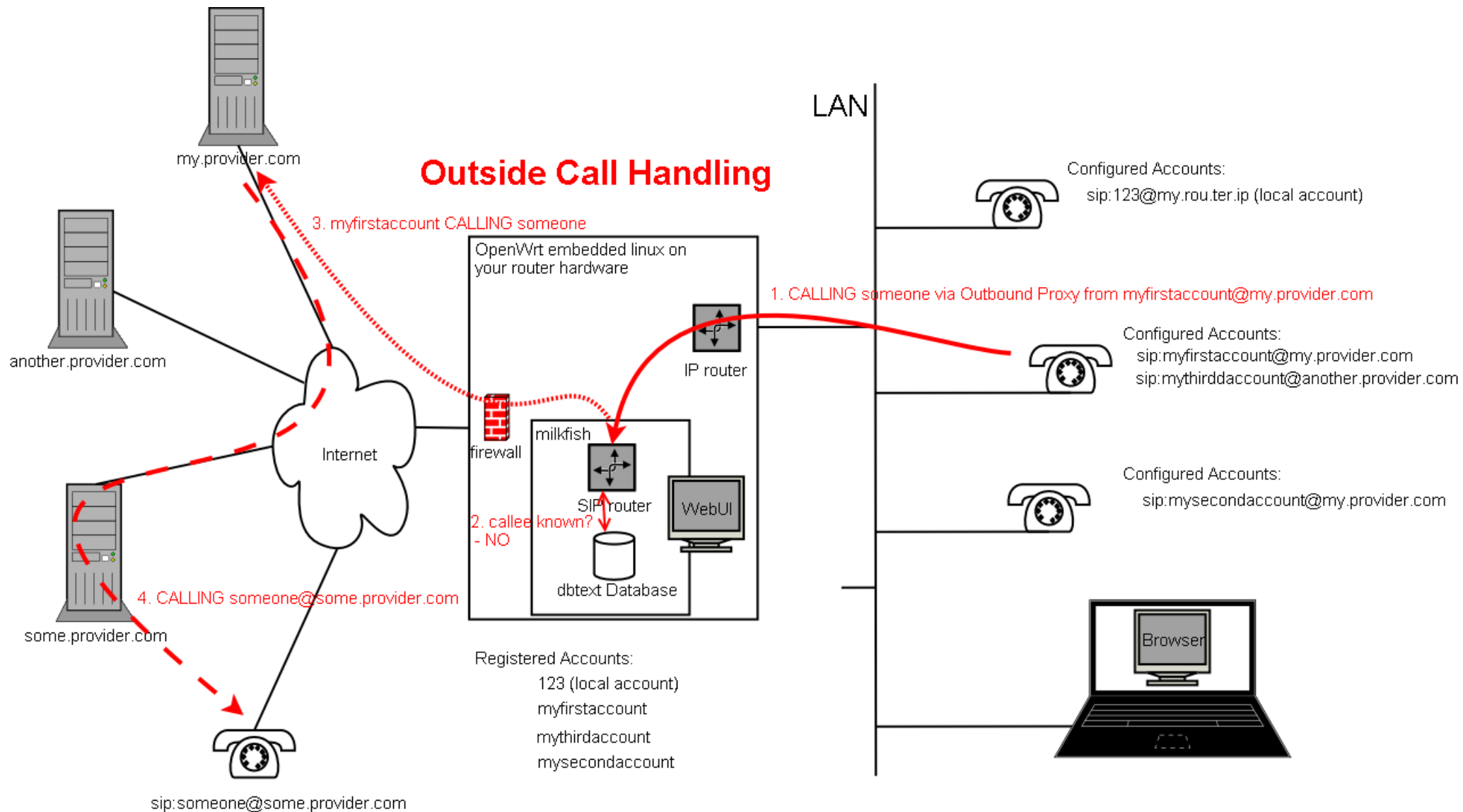
Examples - Provider Account Registration



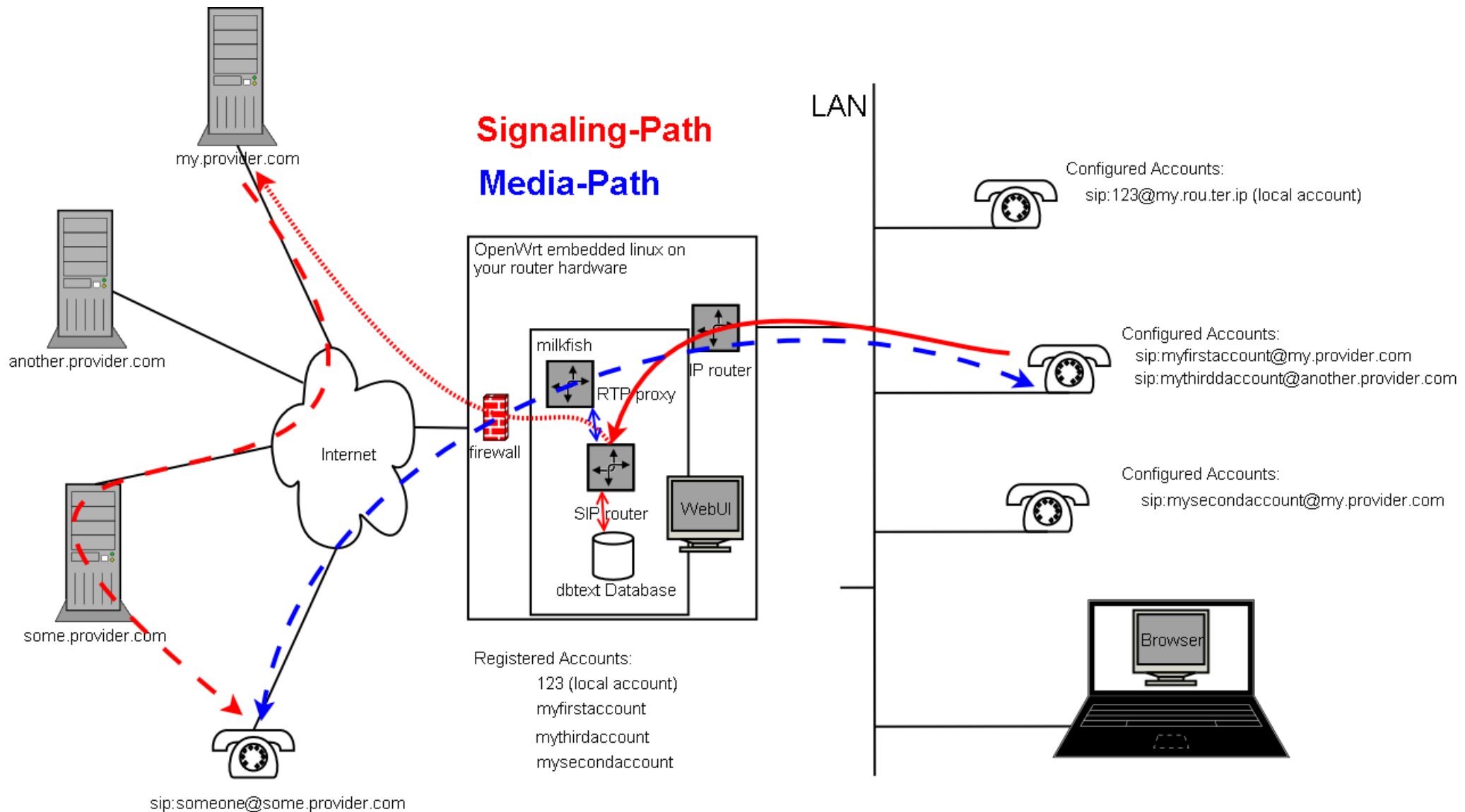
Examples - Local Call Handling



Examples - Outside Call Handling



Examples - Outside Call Packet Paths



INVITE questions
else BYE/200 OK