

# Multimedia Conferencing

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## Corso di **Applicazioni Telematiche**

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## Roadmap



- Part I:
  - History, background and state of the art
    - Conferencing as a service
    - Standardization approaches
    - Related topics
      - Media control
- Coffee break
- Part II:
  - Hands-on conferencing
    - Ongoing activities at the University of Naples
      - *CONFIANCE* & *DCON* projects
    - Contribution to standards
    - Implementation efforts
    - Open issues

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# Conference



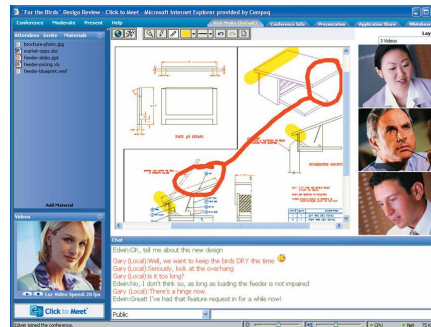
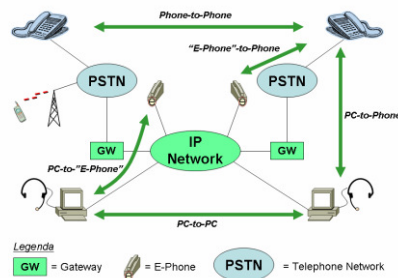
- The term “Conference” can be used to describe any meeting of people that “confer” about a certain topic.
- Web Conferencing is used to conduct live meetings or presentations over the Internet.



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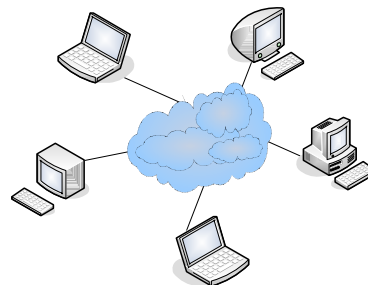
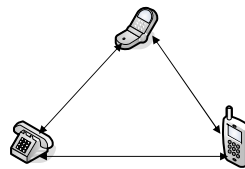
## Features

- Voice over IP
- Live video
- Text chat
- Slide presentations
- Whiteboard with annotation
- Screen/desktop sharing
- Application sharing
- Recording
- Polls and surveys



## History

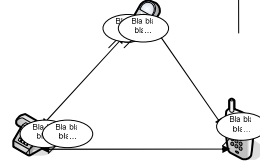
- Tele-Conferencing
  - Conference calls (Audio Tele-Conferencing)
  - Video conferences (Video Tele-Conferencing)
- Web Conferencing
  - Text Conferencing
  - Audio/Video Conferencing
  - Data Conferencing



## Audio Tele-Conferencing (ATC)



- Analog Phone Lines (PSTN)
  - Conference calls
    - Three-way calling
    - Conference bridges
- Digital Telephony (ISDN)
  - ITU-T H.320 umbrella recommendation
- IP-based Tele-Conferencing
  - Real-time Transfer Protocol (RTP)
  - Voice over IP (VoIP)



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## Video Tele-Conferencing (VTC)



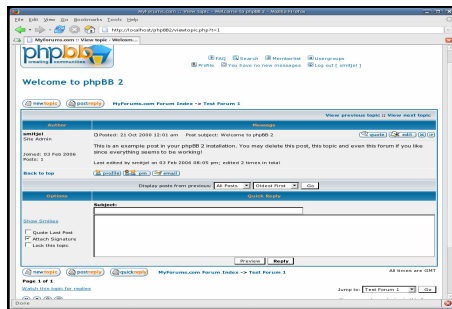
- Closed-circuit television systems
- Radiofrequency (UHF or VHF) links
- Mobile links to satellites
- Analog phone lines (PSTN)
  - Videotelephony (AT&T PicturePhone)
- Digital Telephony (ISDN)
  - ITU-T H.320 Umbrella Recommendation
  - Multipoint Videoconferencing (MCU)
- IP-based Videoconferencing
  - Better video-compressing technologies

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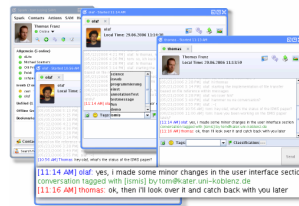
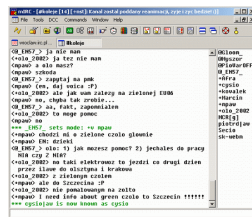
# Text Conferencing



- Asynchronous Meetings
  - Posted text messages (not live)
    - Message/Bulletin Boards
    - Fora/Forums
    - Network news groups/Mailing lists



# Text Conferencing

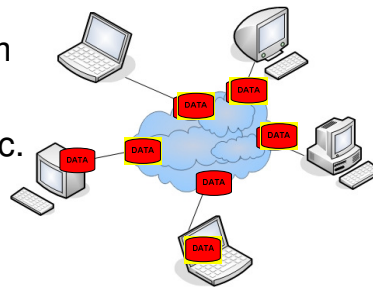


- Synchronous (Live) Meetings
  - Live text communication
    - talk/ntalk/ytalk (Unix)
    - Internet Relay Chat (IRC)
    - Web-based Chat (CGI/Java)
    - Instant Messaging (Skype/MSN/ICQ/XMPP/SIMPLE/etc.)

# Data Conferencing



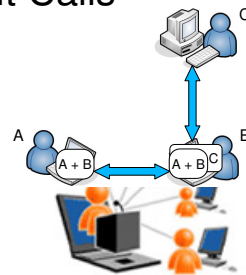
- Participants sharing computer data in real time
  - Text (Instant Messaging)
  - Audio/Video
  - Screen/Documents/Graphics/Applications
- Desktop Systems
  - Placeware/ProShare/Databeam
  - Netmeeting/Gnomemeeting
  - Skype/AIM/ICQ/MSN/Yahoo/etc.



# Typical Scenarios



- Point-to-Point Calls to Multipoint Calls
  - Three-way calling
  - Coaching scenario
- Lecture-mode Conferences
  - Presentation
  - Question & Answers session
- Ad-hoc and Reserved Conferences
  - Conference-aware/-unaware participants
    - Manage conference/users/media/policies
    - Sidebars/Whispers

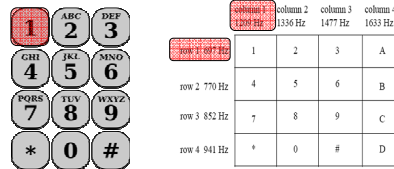


## Issues

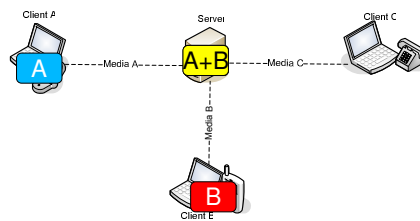
- Call Signaling
  - Gateway functionality



- Control and Management
  - Tone detection (DTMF)
  - Dedicated protocols



- Mixing and Transcoding
  - Terminal capabilities
  - User media profiling
    - Coaching scenario
    - Videoswitching



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## Standardization Efforts

- No standardization for many years
  - Lack of interoperability
  - Platform dependency
  - Security issues
  - Cost
  - Market segmentation
- Standardization Bodies
  - ITU (International Telecommunication Union)
  - IETF (Internet Engineering Task Force)
  - 3GPP (3rd Generation Partnership Project)

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## Standardization Efforts: ITU



- Established to standardize and regulate international radio and telecommunications
- International Standards referred to as “Recommendations”
- ITU-T: Telecommunication Sector
  - G: Transmission Systems and Media
    - G.71x (Audio compression, mu-law and a-law)
    - G.72x (Audio compression, ADPCM)
  - H: Audiovisual and Multimedia Systems
    - H.320 (PSTN/ISDN, Telephone Systems)
    - H.323 (IP, Packet-based Communication Systems)
  - T: Terminals for Telematic Services
    - T.120 (Data Sharing Protocols)
    - T.140 (RTP Interactive Text)

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## Standardization Efforts: IETF



- Under the umbrella of the Internet Society
- Develops and promotes Internet Standards
- Deals in particular with standards of the TCP/IP suite
- Organization
  - Working Groups (WG)
  - Internet Drafts
  - Requests for Comments (RFC)
  - “Rough consensus, running code”

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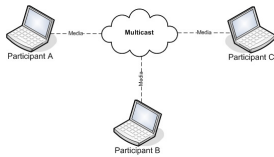


## SIPPING Working Group

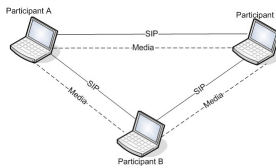


- Session Initiation Proposal Investigation
- Documents the use of SIP for several applications related to telephony and multimedia
- SIP Conferencing

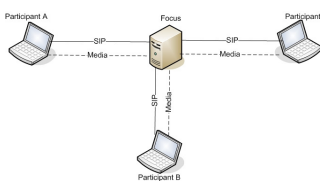
Loosely-Coupled Conference



Fully Distributed Multiparty Conference



Tightly-Coupled Conference



### SIP Conferencing Framework (RFC 4353): fundamental elements

- Focus
- Policy Server
- Mixer
- Notification Service (Event Package, RFC 4575)
- Participants

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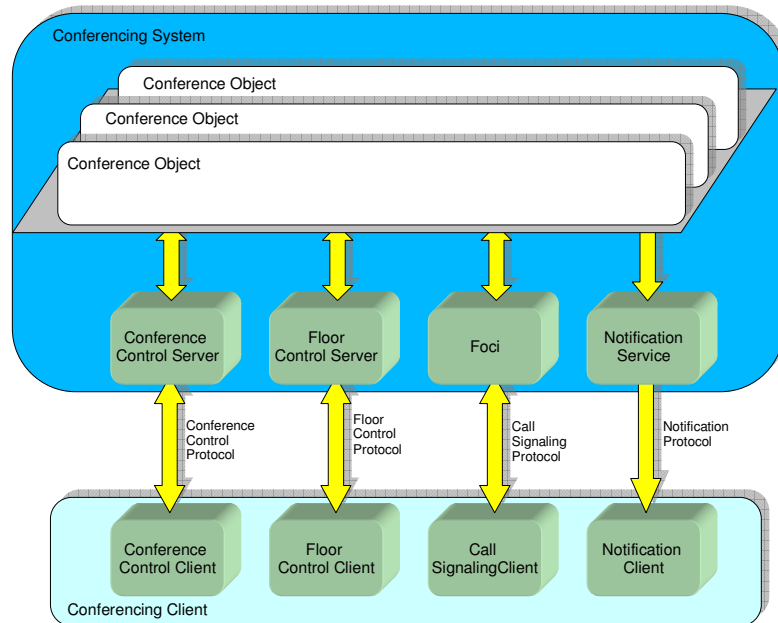
## XCON Working Group



- Centralized Conferencing (XCON)
- Extends RFC 4353
  - Protocol-agnostic (not only SIP)
  - Data Sharing (not only audio/video)
- Suite of Protocols
  - Conference Control (CCMP?)
  - Floor Control (BFCP)
  - Call Signaling (SIP/H.323/IAX/etc.)
  - Notification (Event Package?)

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# XCON Framework



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## Conference Control Protocol

- Create/Manage/Schedule/etc. Conferences
- Several candidates in the past, all rejected
- New proposal
  - Centralized Conferencing Manipulation Protocol (CCMP)
    - Based on Web-Services (SOAP)
    - Still in early stages
- University of Naples (COMICS research group):
  - Highly active in this field
    - A proposal for a WS-based approach to conference control
    - Running code ☺...but no rough consensus ☹
    - Need for lobbying with enterprises...

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# Floor Control Protocol



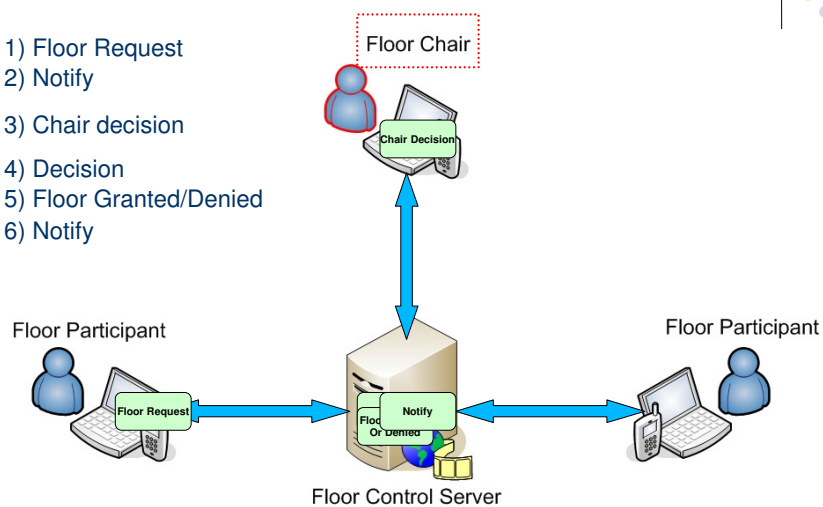
- Coordinates access to set of shared resources
  - A “Floor” is a token, a temporary permission to access or manipulate a specific shared resource or set of resources
- Binary Floor Control Protocol (BFCP)
  - Standardized in RFC 4582
    - Identifiers (Conferences/Floors/Users)
    - Floor Control Server
    - Floor Control Participant
      - Floor Chair
    - Only existing implementation to date: COMICS/Ericsson
  - Negotiation of BFCP connections within SIP/SDP standardized in RFC 4583

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# BFCP



- 1) Floor Request
- 2) Notify
- 3) Chair decision
- 4) Decision
- 5) Floor Granted/Denied
- 6) Notify

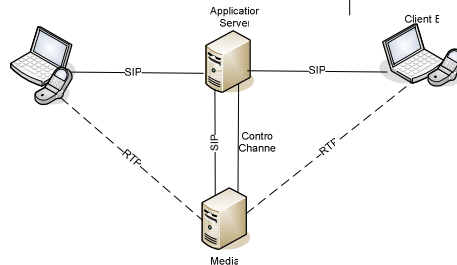


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# MEDIACTRL Working Group



- Media Server Control
  - Media Processing
    - Mixing/Transcoding
    - Playing/Recording
    - Storing/Retrieving
    - Detecting Tones (DTMF)
    - Interactive Voice Response (IVR)/VoiceXML
    - Text-to-Speech/Speech Recognition
  - RTP Streams Manipulation
- Of great interest to the XCON working group
- MRFC/MRFP (interface/container) in IMS



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# CONFIANCE

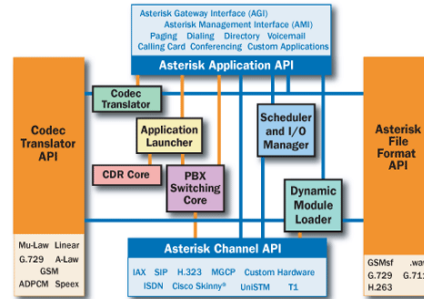


- CONFERencing IMS-enabled Architecture for Next-generation Communication Experience
- Open source prototype implementation of the XCON Framework, compliant with the IMS specification
- Extends the Asterisk PBX functionality
  - Enhanced “MeetMe” application
    - Support for Conference Management (Scheduler)
    - Support for Floor Control (BFCP)
    - Support for BFCP-guided videoswitching
    - Support for MSRP (Message Session Relay Protocol) text chatrooms

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# Asterisk PBX

- Open source Private Branch eXchange (PBX)
- Advanced features
  - Highly configurable dialplan
  - Modular architecture
    - Channel API
      - SIP channel driver
    - Application API
      - MeetMe conference bridge
    - Codec and File Format API
      - Audio transcoding
      - Video passthrough
  - Remote Manager Interface



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# Asterisk dialplan: extensions.conf

## Definiton of a single extension with name "123".

```

exten => 123,1,Answer
exten => 123,2,Playback(tt-weasels)
exten => 123,3,Voicemail(44)
exten => 123,4,Hangup
    
```

When a call is made to extension 123, Asterisk will answer the call itself, play a sound file called "tt-weasels", give the user an opportunity to leave a voicemail message for mailbox 44, and then hangup.

## Extension Patterns

A single extension can also match *patterns*. In the `extensions.conf` file, an extension name is a pattern if it starts with the underscore symbol (`_`).

```

exten => _123.,1,Answer
exten => _123.,2,Playback(tt-weasels)
exten => _123.,3,Voicemail(${EXTEN})
exten => _123.,4,Hangup
    
```

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# XCON through MeetMe

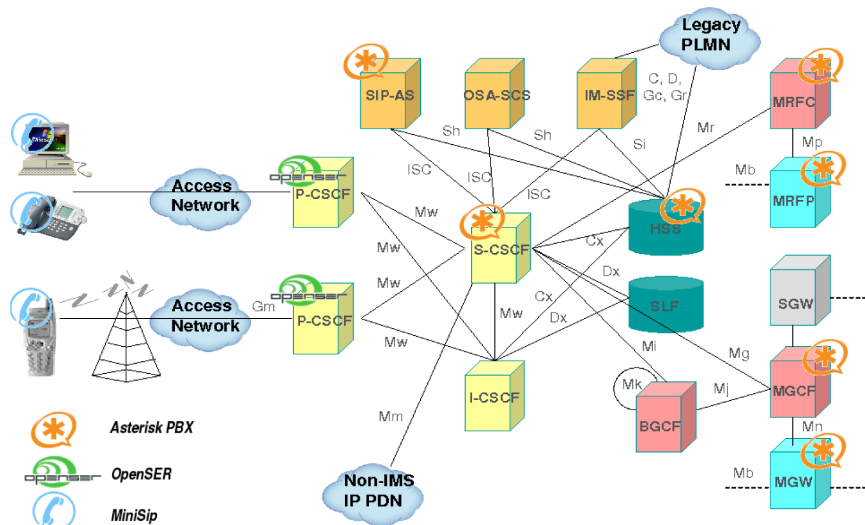


extensions.conf

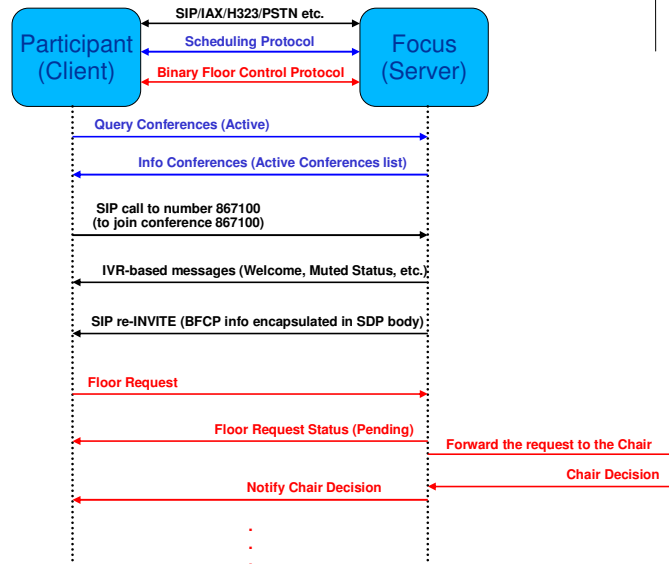
```
[...]  
  
; XCON through MeetMe: example of wildcards to add flexibility  
;   - First 7 numbers = conference  
;   - Next (1-4) numbers = PIN (Phone PIN, not Admin's password)  
;  
; the 'B' flag tells MeetMe this is an XCON conference (B => BFCP)  
;  
exten => _857.,1,Meetme(${EXTEN:0:7}|B|${EXTEN:7})  
exten => _857.,2,Hangup  
  
[...]
```

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# CONFIANCE in IMS



# CONFIANCE Use Case

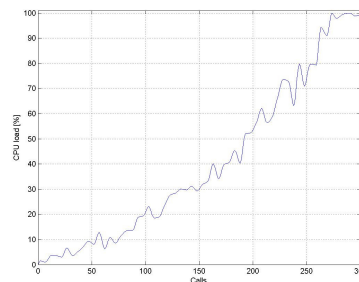


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# Distributed Conferencing



- Centralized Conferencing being standardized
  - Poorly scalable
  - Limited capabilities
  - Single point of failure
- Distributed Conferencing
  - Cascaded Conferencing
    - Each focus is seen as a participant by the others
    - Only affects mixers' distribution
    - Centralized protocols like BFCP don't work
  - P2PSIP Working Group
    - Has not dealt with conferencing yet

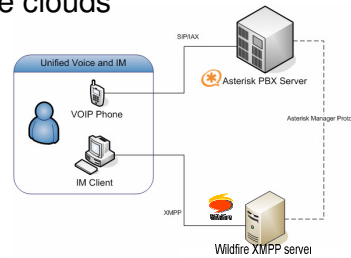


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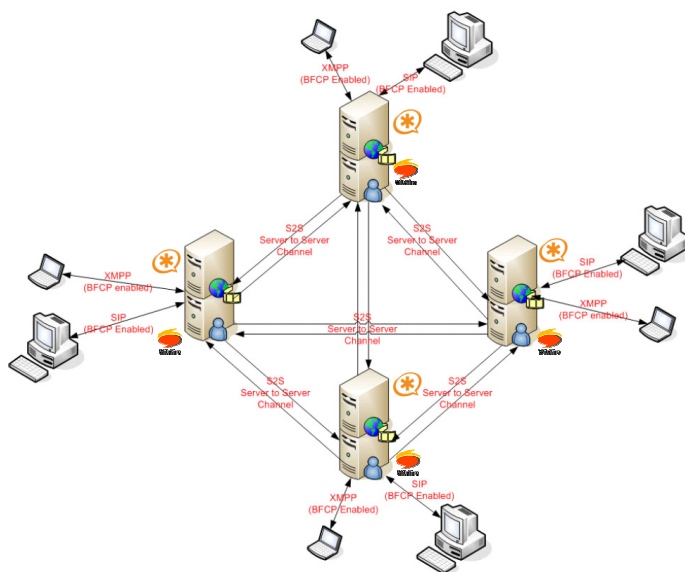
# DCON Proposal

- Distributed Conferencing (DCON)
  - Explicitly recalls XCON
    - Orchestrates the operation of a set of XCON focus elements, called “clouds”
    - Overlay network interconnecting the clouds
    - Intra-focus communication
      - Still based on XCON protocols
    - Inter-focus communication
      - Exploits Server-to-Server (XMPP)
  - Requirements
    - Focus discovery
    - Initialization information & spreading of conference events
    - Setup and managing of distributed conferences
    - Transparent dispatching of natively centralized protocols among the involved conferencing clouds



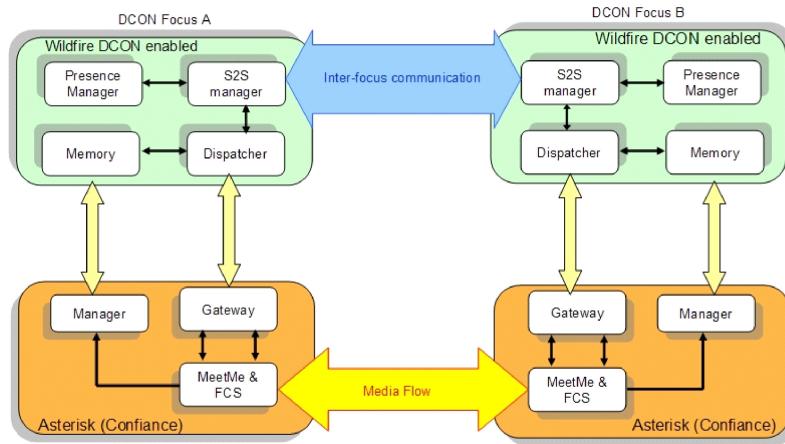
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# DCON architecture



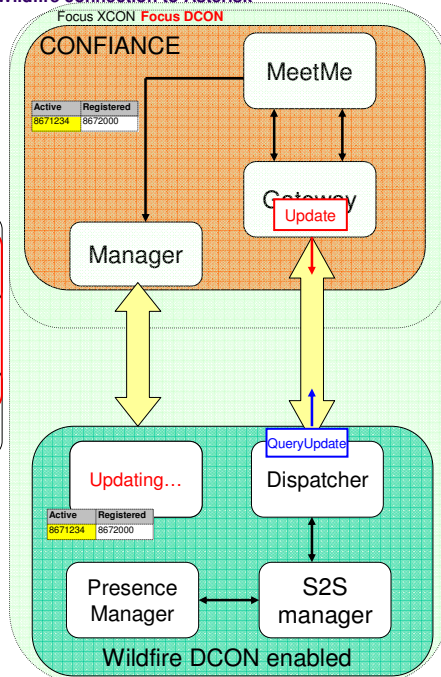
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# DCON Implementation



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## Wildfire connection to Asterisk



We suppose CONFIANCE is working

When the DCON component starts, 3 main events happen:

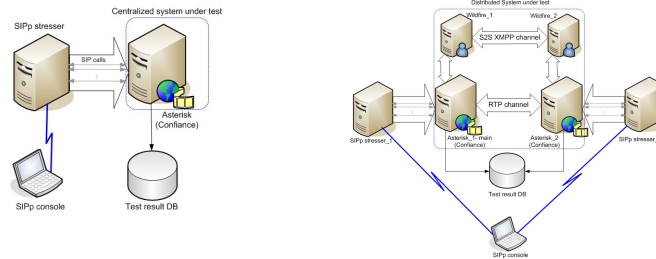
- 1) Connection to the Asterisk Manager interface
- 2) Connection to the Gateway interface
- 3) Request for initialization information

Now the focus cloud involves also the Wildfire server and SPACE component which has in charge:

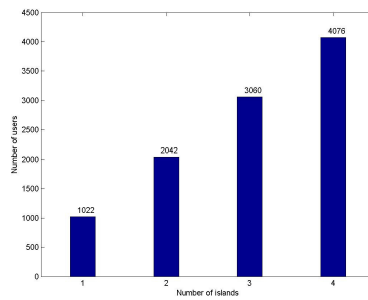
- 1) Discovery of other foci
- 2) Managing of DCON information and BFCP packets.

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# Testing DCON: Scalability

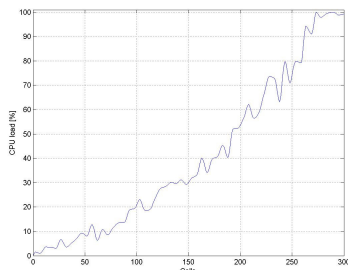


- The maximum number of participants linearly grows with the number of DCON islands



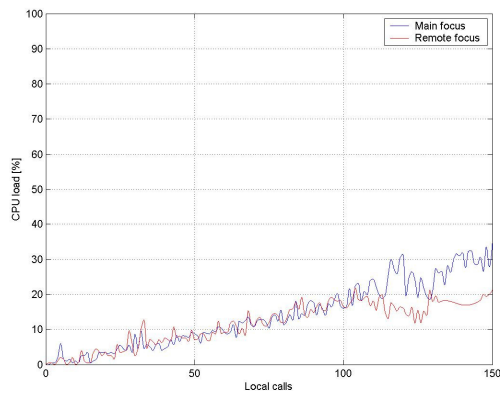
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# Testing DCON: Performance



Focus	calls	CPU load (%)
Main	300	99,4

- 2 islands



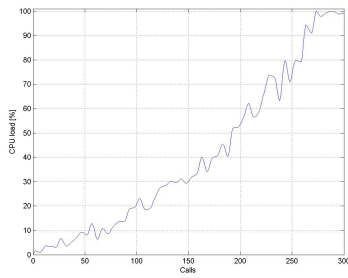
Focus	Number of calls	CPU load (%)
Main	150	30,04
Remote	150	20,19

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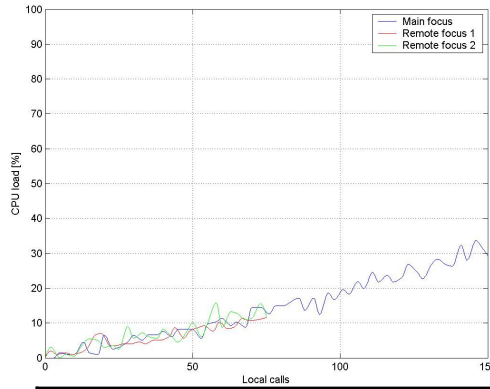
# Testing DCON: Performances



• 3 islands



Focus	calls	CPU load (%)
Main	300	99,4



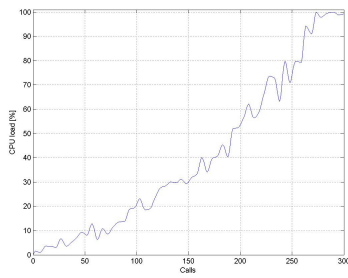
Focus	Number of calls	CPU load (%)
Main	150	31,05
Remote_1	75	12
Remote_2	75	12

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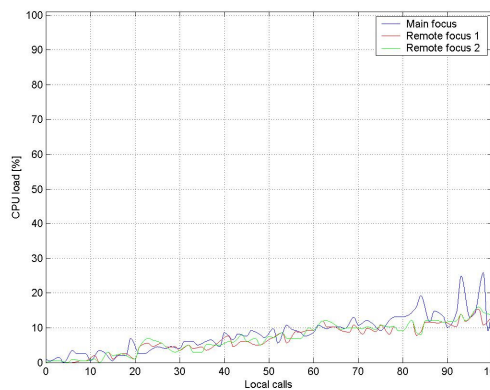
# Testing DCON: Performance



• 3 islands



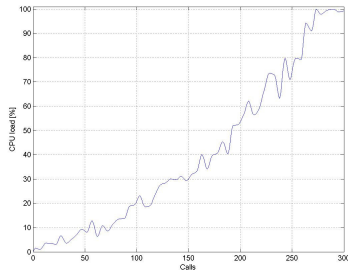
Focus	calls	CPU load (%)
Main	300	99,4



Focus	calls	CPU load (%)
Main	100	20
Remote_1	100	18
Remote_2	100	18

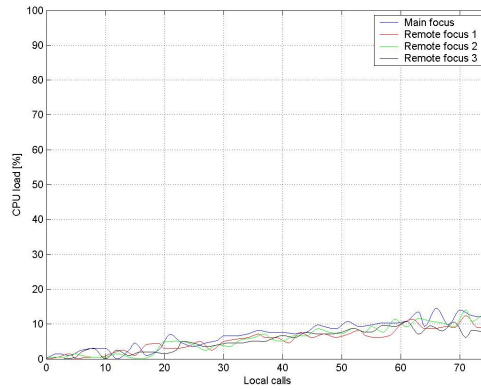
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# Testing DCON: Performance



Focus	calls	CPU load (%)
Main	300	99,4

● 4 islands



Focus	Number of calls	CPU load (%)
Main	75	12,66
Remote_1	75	12
Remote_2	75	12
Remote_3	75	12

# Testing DCON: Performance



Number of islands	Number of local users	Number of remote users	Main focus CPU load	Remote focus 1 CPU load	Remote focus 2 CPU load	Remote focus 3 CPU load
1	300	-	99.4%	-	-	-
2	150	150	30.04%	20.19%	-	-
3	100	200 (100/100)	20%	18%	18%	-
3	150	150 (75/75)	31.05%	12%	12%	-
4	75	225 (75/75/75)	12.66%	12%	12%	12%
4	150	150 (50/50/50)	32.4%	7.8%	7.8%	7.8%

## References



- CONFIANCE web site
  - <http://confiance.sourceforge.net/>
- DCON web site
  - <http://dcon.sourceforge.net/>