

Kamailio® as SBC for MS Teams

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Kamailio World

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Agenda

- ▶ About me
- ▶ The basics
- ▶ Advanced topics
- ▶ Debugging
- ▶ Contact

About me

- ▶ Henning Westerholt
- ▶ With Kamailio project since 2007
- ▶ Core developer of the Kamailio® project, member of management board
 - ▶ Core, database work and different other modules
 - ▶ Administration, code quality, security testing, quality assurance
 - ▶ Kamailio fuzzing project
- ▶ Company started in 2018
 - ▶ GILAWA
 - ▶ Consulting for Kamailio and Voice over IP services
 - ▶ Services, support, development, workshops and trainings

Introduction

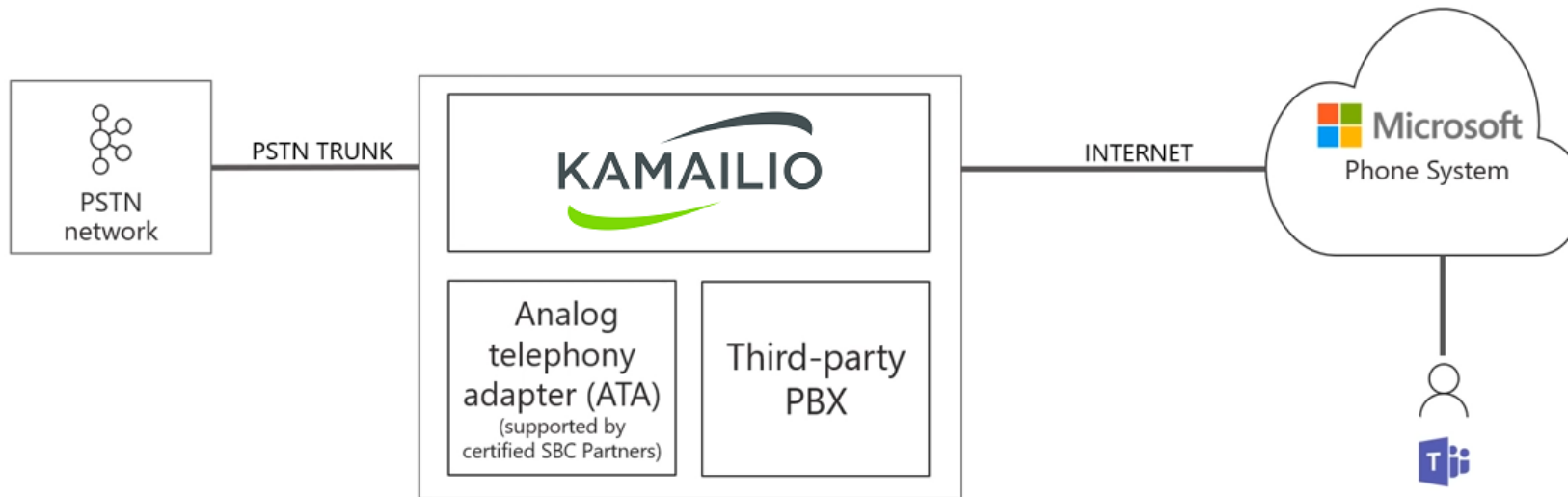
- ▶ I would prefer if everybody used open and federated systems for private and business communication
- ▶ Using Kamailio as SBC for teams is not particular hard, but you need to have solid knowledge in SIP, Kamailio and also preferable your PBX
- ▶ If you don't fulfil this requirement, get a commercial SBC or pay somebody to setup it for you
- ▶ There is no “secret sauce”, one need to follow the available documentation and also spend a fair amount in interoperability debugging

Motivation

- ▶ By default MS Teams only support calls in the own organisation and to guests
- ▶ One option is to use the Cloud offering from Microsoft, called „Calling Plan“
- ▶ But you might have already a PSTN provider or some PBX functionality, so you still want to use this
- ▶ The Microsoft way how to call to the outside world is „Direct Routing“
- ▶ This way you can connect your MS Teams clients to the PSTN network to place and receive calls
- ▶ It works by directly connecting the SBC to the Microsoft Cloud infrastructure

Basic setup

Direct Routing for Teams



Kamailio as SBC for MS Teams

Advantages

- ▶ It is probably more flexible and secure as other offerings
- ▶ In most of the scenarios it will be cheaper as using commercial SBCs
- ▶ You might already use it internally
- ▶ Better compability to other parts of VoIP infrastructure

Disadvantages

- ▶ It is not certified from Microsoft
- ▶ It does not support all Microsoft MS Teams modes yet (according to my experience)
- ▶ It is not an integrated appliance as other solutions

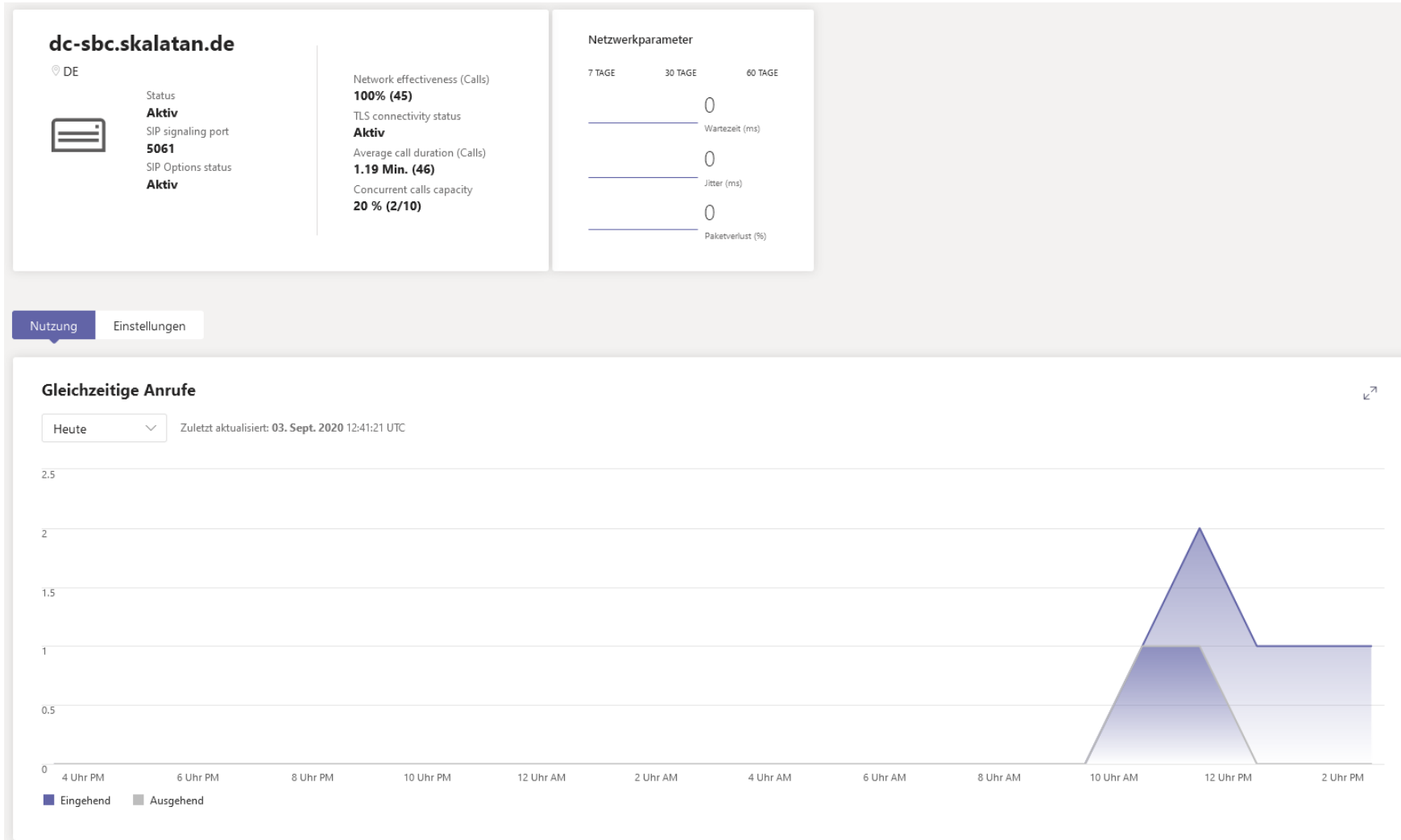
The basics - Kamailio

- ▶ You need a Kamailio server 😊
- ▶ You will need a PBX (or access to another B2BUA)
- ▶ For TLS use letsencrypt, wildcard certificate is only needed for multi-tenant
- ▶ OPTIONS handling
 - ▶ You need to send OPTIONS ping to MS Teams and answer them from MS Teams
- ▶ setup the FQDN of the server in the Contact
- ▶ Kamailio needs to route calls to Teams with proper Record-Route headers
- ▶ Use RTPEngine to encrypt media from Teams and decrypt media to teams
- ▶ Use the full qualified domain name, not the IP is important
- ▶ Use dispatcher to route calls to Teams

The basics - Microsoft

- ▶ You need a Windows machine 😊
 - ▶ With Powershell and Skype for Business plugin
 - ▶ Native Teams client makes things also much easier
- ▶ You need some Microsoft licenses
 - ▶ Office365 E3 with phone system add-on, or Office365 E5
- ▶ Its necessary to register the Domain in your tenant, if it different from tenant
- ▶ Register your SBC with powershell or in Teams Admin console
- ▶ Assign a phonenumber to the test user
- ▶ Check if your SBC is active in Teams Admin console

Teams admin overview



The basics - PBX

- ▶ Setup a PSTN trunk in your PBX, if not already configured
- ▶ Create a association between Kamailio and PBX
 - ▶ To allow calls between both
 - ▶ Depends on your particular PBX
- ▶ Route outgoing calls to your PBX, e.g. by using PSTN route
- ▶ Route incoming calls to the Kamailio
- ▶ More integration can be done at a later step, e.g. REFER handling etc..

The basics - call scenarios

- ▶ Incoming calls
 - ▶ Route calls from Teams to registered user (lookup location)
 - ▶ Route calls from Teams to your PBX (for calls to PSTN)
- ▶ Outgoing calls
 - ▶ Route calls from registered user to Teams
 - ▶ Route calls from PBX to Teams
- ▶ Observe and verify call flows with debug logging, sngrep, sipdump etc..

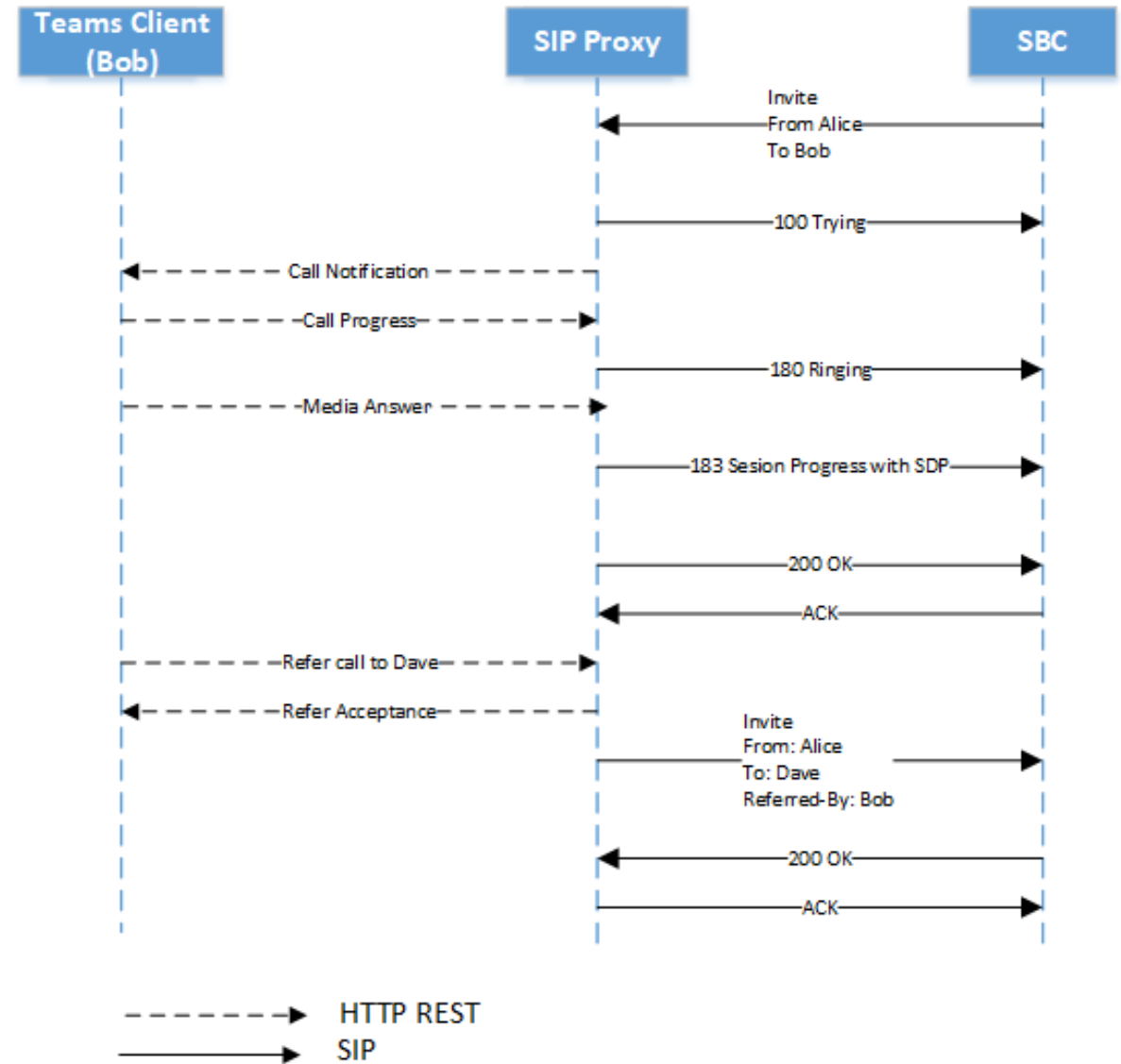
- ▶ Note: configuration examples can be found in my blog, link at the last slide

Advanced topics

- ▶ SBCs can support two different modes for call-transfer
- ▶ SBCs can support two different modes for media
- ▶ Different call-transfer scenarios

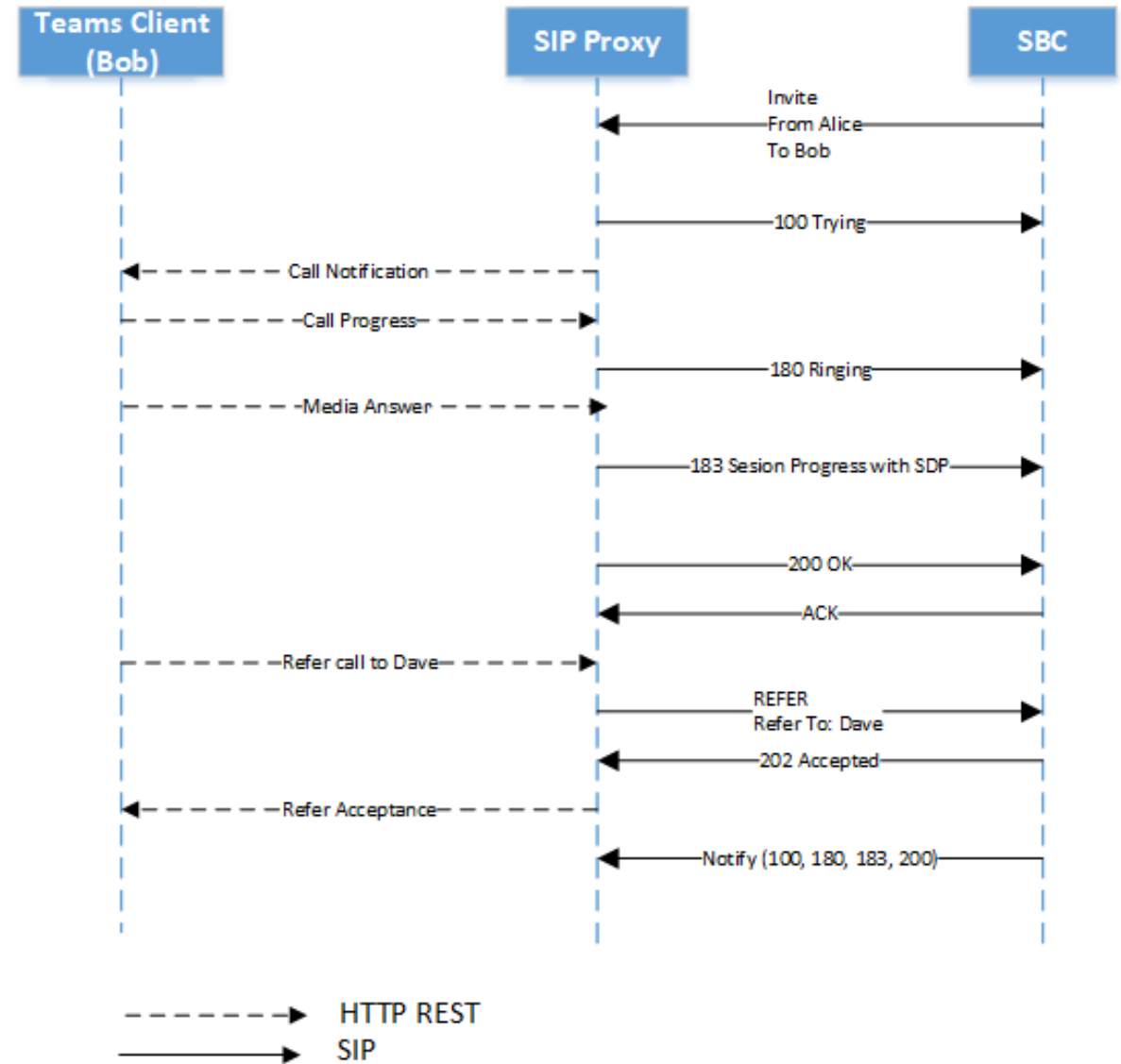
Call-transfer without REFER

- ▶ MS will use INVITE with Replace, therefore terminate the transfer and adds a new INVITE
- ▶ Microsoft will transfer the call internally
- ▶ From: <https://docs.microsoft.com/en-us/microsoftteams/direct-routing-protocols-sip>



Call-transfer with REFER

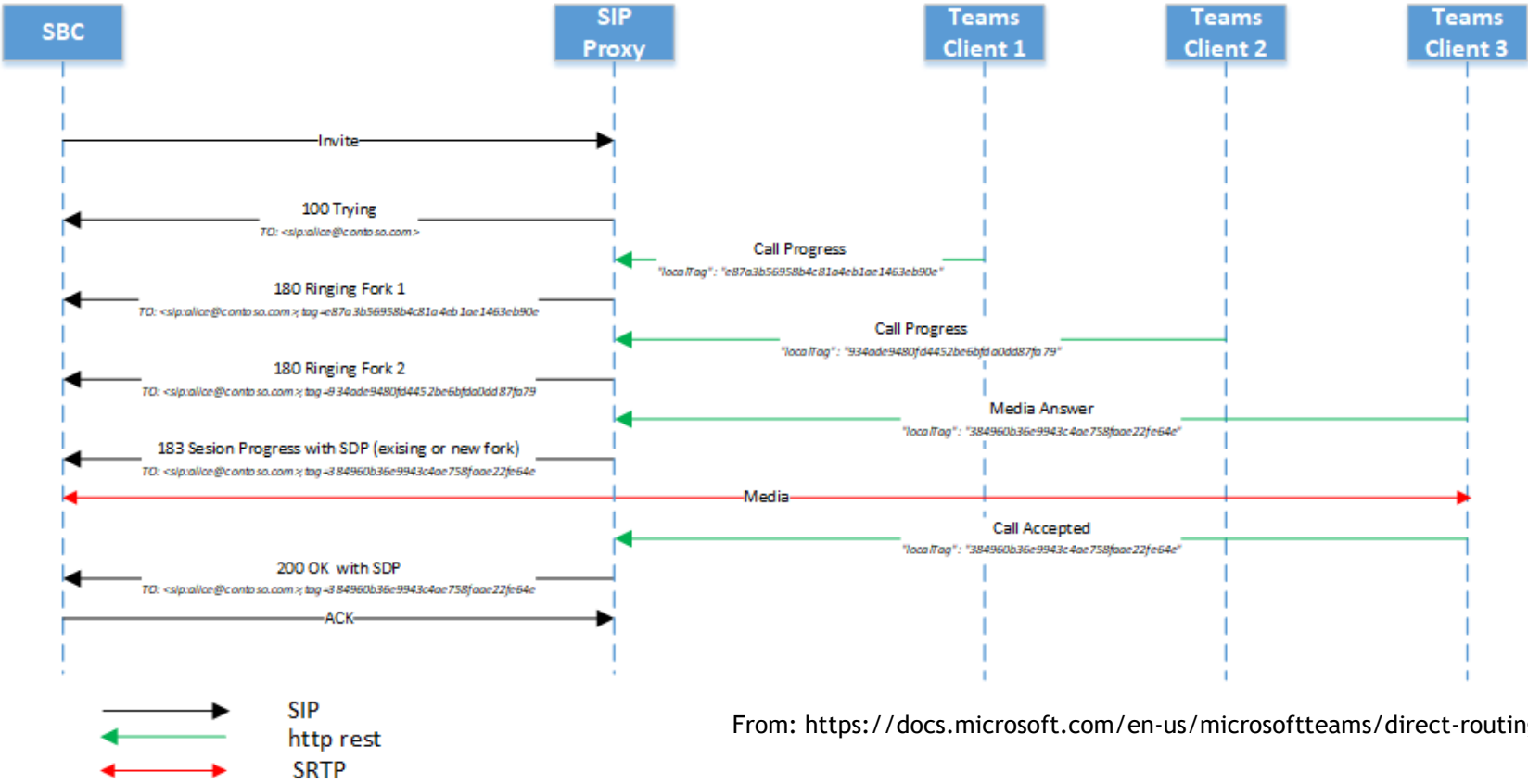
- ▶ Recommended method
- ▶ MS will send REFER to the SBC and expect it to handle the transfer fully
- ▶ From: <https://docs.microsoft.com/en-us/microsoftteams/direct-routing-protocols-sip>



Advanced topics - media processing

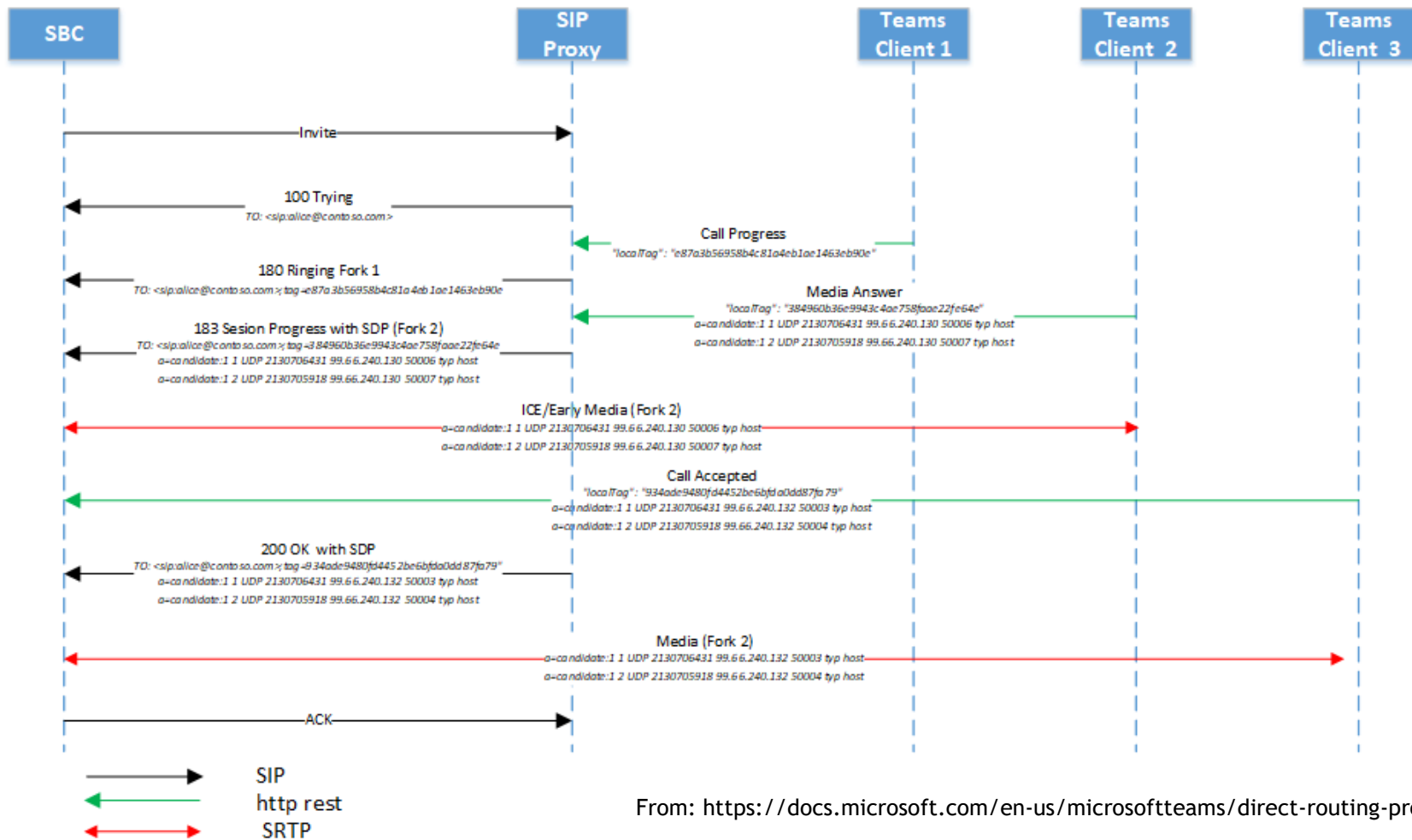
- ▶ SBCs can support two different modes for media
 - ▶ One is called media-bypass, the other one non-media bypass
 - ▶ Media bypass: in which all RTP media flows between the Teams endpoints and the SBC
 - ▶ Non-media bypass: in which all RTP traffic flows between the Teams client, the media processors, and the SBC
 - ▶ With Kamailio/RTPEngine you can use the non-media-bypass mode

Non-media bypass



From: <https://docs.microsoft.com/en-us/microsoftteams/direct-routing-protocols-sip>

Media bypass



Advanced topics - call transfer

- ▶ Make sure that you test attended and unattended call transfer, they might behave differently
- ▶ You can use your own waiting music by deactivating the default one from MS
- ▶ You can also configure Call-Forwarding and Caller-Identity related headers

SIP example

- ▶ INVITE sip:+491579XXX@dc-sbc.skalatan.de:5061;user=phone;transport=tls SIP/2.0
- ▶ FROM: VoIP
<sip:+497156XXX@sip.pstnhub.microsoft.com:5061;user=phone>;tag=8abb05cb37874293b6777dccabde0e19
- ▶ TO: sip:+491579XXX@dc-sbc.skalatan.de:5061;user=phone
- ▶ CSEQ: 1 INVITE
- ▶ CALL-ID: b96f2e1b48f35b3695faa74573e49326
- ▶ MAX-FORWARDS: 70
- ▶ VIA: SIP/2.0/TLS 5 2.114.75.24:5061;branch=z9hG4bK9c43fad
- ▶ RECORD-ROUTE: <sip:sip-du-a-eu.pstnhub.microsoft.com:5061;transport=tls ;lr>
- ▶ CONTACT: <sip:api-du-b-euwe.pstnhub.microsoft.com:443;x-i=ca73510a-42a0-47d5-a927-dcbdfc234279;x-c=b96f2e1b48f35b3695faa74573e49326/d/8/dd0bff1612fe45f89f1d84abb5896164>
- ▶ CONTENT-LENGTH: 1103
- ▶ MIN-SE: 300
- ▶ SUPPORTED: timer
- ▶ USER-AGENT: Microsoft.PSTNHub.SIPProxy v.2020.7.31.1 i.EUWE.1
- ▶ CONTENT-TYPE: application/sdp
- ▶ ALLOW: INVITE,ACK,OPTIONS,CANCEL,BYE,NOTIFY
- ▶ SESSION-EXPIRES: 3600

Debugging

- ▶ The difficult part is obviously the TLS encrypted communication to and from Teams
- ▶ Use the usual tools for the other communication, sngrep, tcpdump etc..
- ▶ For the TLS you can use sipdump, Homer, or corex module (network event routes)
- ▶ Microsoft will give you somethings hints in their messages, e.g. missing ACK:
 - ▶ REASON: Q.850;cause=18;text="d2d007be-3337-4b10-8656-fa0c0b5dd5ce;Call Controller timed out while waiting for acknowledgement."
 - ▶ Also if some necessary headers are missing
- ▶ In some cases MS will just not reply to your messages, e.g. for TLS errors

Debugging

- ▶ The MS documentation is really extensive and helpful on this whole topic
- ▶ Even commercial SBCs had issues to support special cases in the past
- ▶ Documentation and test protocols are important

Thank you for your attention

- ▶ **Details:**
 - ▶ <https://skalatan.de/en/blog/kamailio-sbc-teams>
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