3GPP TSG-RAN WG2 Meeting #118 Electronic R2-22XXXXX

Elbonia, 09 – 20 May 2022

**Agenda item: 5.1.4.1.1 Connection control**

**Source: Huawei (Rapporteur)**

**Title: Report of [AT118-e][017][NR1516] Connection Control II (Huawei)**

**WID/SID: NR Rel-15 and Rel-16**

**Document for: Discussion and Decision**

# 1 Introduction

This document is the report of the following email discussion:

* [AT118-e][017][NR1516] Connection Control II (Huawei)

Scope: Treat R2-2204920, R2-2204921, R2-2206145, R2-2206146, R2-2204917, R2-2204918, R2-2204919, R2-2205251, R2-2205252, R2-2205617, R2-2205624

Ph1 Determine agreeable parts, Ph2 for agreeable parts agree CRs (offline agreement, CB online only if necessary).

Intended outcome: Report, Agreed CRs

Deadline: Schedule 1

A **first round** with **Deadline for comments W1 Thursday May 12th 1200 UTC** to settle scope what is agreeable etc

A Final round with **Final deadline W2 Wednesday May 18th 1200 UTC** to settle details / agree CRs etc.

# 2 Contact Points

Respondents to the email discussion are kindly asked to fill in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Name | Email Address |
| Samsung | June Hwang | June77.hwang@samsung.com |
| ZTE | Mengjie Zhang | zhang.mengjie@zte.com.cn |
| Huawei, HiSilicon | Jun Chen | jun.chen@huawei.com |
| Nokia |  | amaanat.ali@nokia.com |
| Qualcomm inc. | Mouaffac | [mambriss@qti.qualcomm.com](mailto:mambriss@qti.qualcomm.com) |
| Apple | Naveen Palle | naveen.palle@apple.com |
| CATT | Rui Zhou | zhourui@catt.cn |
| LGE | SungHoon Jung | sunghoon.jung@lge.com |
| OPPO | Xin You | youxin@oppo.com |
| Lenovo | Lianhai | Wulh5@Lenovo.com |
| MediaTek | Felix Tsai | chun-fan.tsai@mediatek.com |
| Ericsson | Cecilia Eklöf / Marco Belleschi | [cecilia.eklof@ericsson.com](mailto:cecilia.eklof@ericsson.com), [marco.belleschi@ericsson.com](mailto:marco.belleschi@ericsson.com) |
| Google | Frank Wu | frankwu@google.com |
| NEC | Hisashi Futaki | hisashi.futaki @ nec.com |
| ITRI | Nai-Lun Huang | NellenHuang@itri.org.tw |
| Vivo | Jing Liang | liangjing@vivo.com |

# 3 Discussion

## 3.1 CHO related discussions

**CHO related papers**

[1] R2-2204920 Correction on the RRC reestablishment in CHO Huawei, HiSilicon CR Rel-16 38.331 16.8.0 3018 - F NR\_Mob\_enh-Core

[2] R2-2204921 Correction on the RRC reestablishment in CHO Huawei, HiSilicon CR Rel-17 38.331 17.0.0 3019 - A NR\_Mob\_enh-Core

R2-2205850 CHO configuration with SCG release Qualcomm Incorporated CR Rel-16 38.331 16.8.0 3120 - F NR\_Mob\_enh-Core

=> Revised in R2-2206145

[3] R2-2206145 CHO configuration with SCG release Qualcomm Incorporated CR Rel-16 38.331 16.8.0 3120 1 F NR\_Mob\_enh-Core

R2-2205858 CHO configuration with SCG release Qualcomm Incorporated CR Rel-16 36.331 16.8.0 4809 - F LTE\_feMob-Core

=> Revised in R2-2206146

[4] R2-2206146 CHO configuration with SCG release Qualcomm Incorporated CR Rel-16 36.331 16.8.0 4809 1 F LTE\_feMob-Core

[1] and [2] are about corrections to CHO, and the reasons are as below:

* For CHO recovery, the UE can try CHO candidate cell and do the CHO handover if possible. The feature CHO recovery is only valid for CHO, but not CPC. However, the current spec only checks *conditionalReconfiguration* for CHO recovery, which covers both CHO and CPC cases.

In the CRs [1][2], for CHO recovery, it is clarified the UE only checks conditionalReconfiguration for CHO.

**Question 1: Do companies agree with [1] and [2]?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Samsung | No for [1], yes for [2] | For [1] R16, this type of recovery using CHO is only possible with attemptCondReconfig field, and network will configure only UE has CHO conditional Reconfiguration not for CPC conditional Reconfiguration because only one between CHO/CPC can be configured in R16. So, always this procedure is executed for UE with condReconfig for CHO.  For [2], this issue is correct. If coexistence between CHO and CPC in R17 is agreed (currently this is working assumption), the motivation seems correct. |
| ZTE | No | We think there is no big issue even if the UE has CPC configuration during RRC re-establishment. Anyway the UE will not select CPC candidate cell for CHO based recovery. And the UE will perform MR-DC release (including CPC release) after the cell selection specified in section 5.3.7.3.  But if majority thinks some change is needed, we prefer to change “1> if UE is not configured with conditionalReconfiguration” to “1> if UE is not configured with attemptCondReconfig”. Anyway the CHO based recovery is only available when the attemptCondReconfig is configured. |
| Huawei, HiSilicon | Yes | Proponent |
| Nokia | Neutral | We agree there is some room for misinterpretation and are fine to support the changes starting Rel-17 i.e. okay for [2] with updates but maybe we can leave Rel-16 as it is. |
| Qualcomm Inc | No strong view | It’s good to have this clarification |
| Apple | Not needed, but if RAN2 thinks changes are needed, the proposal from ZTE is better. |  |
| CATT | No | In general, we think there is not any technology issue. Even UE will not release corresponding CPC configurations during initiation procedure, but in 5.3.7.3 cell reselection procedure, UE configured with CPC will never do the CHO recovery according to the following conditions as highlight in yellow.  5.3.7.3 Actions following cell selection while T311 is running  --------------------------------- skip unrelated part------------------------------------  1> if the cell selection is triggered by detecting radio link failure of the MCG or re-configuration with sync failure of the MCG, and  1> if *attemptCondReconfig* is configured; and  1> if the selected cell is one of the candidate cells for which the *reconfigurationWithSync* is included in the *masterCellGroup* in *VarConditionalReconfig*:  2> apply the stored *condRRCReconfig* associated to the selected cell and perform actions as specified in 5.3.5.3;  NOTE 1: It is left to network implementation to how to avoid keystream reuse in case of CHO based recovery after a failed handover without key change.  1> else:  2> if UE is configured with *conditionalReconfiguration*:  --------------------------------- skip unrelated part------------------------------------  Further, we share the same view as ZTE, the MR-DC configuration along with the CPC configuration will always be released. The only distinguishment introduced by the CR is to release the CPC configuration earlier in the initiation procedure, instead of in the cell selection procedure. |
| LGE | Yes for R17. | UE attempts CHO-based recovery only if attemptCondReconfig is configured.  For R16, if R16 UE is configured with attemptCondReconfig, it means that the UE is not configured with CPC. So no CR is needed.  For R17, clarification is useful, and the CR is fine (ZTE suggestions works, but we slightly prefer to not change the field to be checked). |
| OPPO | No | We see no essential issue since UE will only perform CHO recovery when attemptCondReconfig is configured. And UE will release CPC configuration after cell reselection. |
| Lenovo | Yes with comment | We agree with intention. comparing to CR 4920, we prefer suggestion from ZTE (if UE is not configured with attemptCondReconfig”). |
| MediaTek | Neutral | We agree there is some room for improvement although it seems not an essential issue. If pursue, we prefer ZTE’s version. |
| Ericsson | Yes | This is a correction for our RIL E139. The CR is not fully correct as the UE should only perform the actions if attemptCondReconfig is configured, not only if CHO is configured. We think the problem can occur also in rel-16 as CPC exists in rel-16. The change is not related to CHO+CPC only, but also to CPC or CHO stand-alone. We support the change with the change proposed in our RIL, to used attemptCondReconfig instead:  **[RIL]**: E139 **[Delegate]**: Ericsson (Cecilia) **[WI]**: DCenh **[Class]**: 1 **[Status]**: ToDo **[TDoc]**: None **[Proposed Conclusion]**:  **[Description]**: This text currently applies to all cases of conditional reconfiguraitons. However, if the UE is configured with CPC, or if it is configured with CHO but *attemptCondReconfig* is not configured, the UE will never be able to apply any of the conditional reconfigurations after the cell selection at RRC connection re-establishment. The UE should then perform the actions in 5.3.7.2, e.g. to perform the MAC reset, release *spCellConfig*, suspend RBs, release MCG SCell(s) and MR-DC, just as in legacy. Otherwise a UE that has CPC configured will still have e.g. MR-DC configured during the RRC connection re-establishment procedure and may thus trigger a CPC execution during the RRC connection re-establishment procedure.  **[Proposed Change]**: Change “*conditionalReconfiguration*” to “*attemptCondReconfig.*  **[Comments]**: |
| Google | Yes for R17 | For R16, the UE cannot be configured with CHO and CPC simultaneously. Therefore, we don’t see a need for the R16 CR. |
| NEC | Yes for Rel-17 | Clarification by LG makes sense that the potential issue may happen in Rel-17, but not in Rel-16. No strong view on how to change, while suggestion from ZTE seems good. |
| ITRI | No for [1], yes for [2] | CHO/CPC co-existence is not supported in R16. That is, R16 UE can only be configured with either CHO or CPC and hence no change is needed.  For R17, the change may be needed in case CHO/CPC co-existence is agreed. |
| vivo | Yes | No strong view but we are OK to have this clarification. ZTE’s suggestion is fine to us. |

[3] and [4] are about CHO configuration with SCG release. In R16, RAN3 agreed on the scenario where the SCG is released upon CHO execution, however the scenario does not seem to be supported. The CRs [3][4] are to introduce support for the scenario where a UE operating in MR-DC releases the SCG configuration upon CHO execution.

**Question 2: Do companies agree with [3] and [4]?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Samsung | Yes for both | seems ok to have this for the clarification |
| ZTE | No | If MR-DC is configured for the UE, the candidate node should include MR-DC release (e.g. set mrdc-SecondaryCellGroupConfig to release) in the generated RRC reconfiguration message for CHO. The UE just needs to apply the RRC reconfiguration message upon CHO execution and perform everything included in the RRC reconfiguration accordingly. So no need to additionally specify MR-DC release upon CHO execution.  [Qualcomm Inc Note]: Since it seems to be a common understanding among many companies that network would signal the release of the SCG upon CHO execution, we can be fine with this. We would like companies to consider if we could have the following text in the specifications in the field description of *condRRCReconfig*, providing this clarification.  ***condRRCReconfig***  The *RRCReconfiguration* message to be applied when the condition(s) are fulfilled. The *RRCReconfiguration* message contained in *condRRCReconfig* cannot contain the field *conditionalReconfiguration,* the field *daps-Config* or the configuration for target SCG for CHO. For CHO, if UE is configured with MR-DC, the *RRCReconfiguration* message contained in *condRRCReconfig* includes *mrdc-SecondaryCellGroupConfig* set to release. |
| Huawei, HiSilicon | No | The current specifications define that conditionalReconfiguration-r16 cannot contain the configuration for target SCG for CHO, but it does not require the UE to remove SCG autonomously when doing CHO. The MN can include mrdc-SecondaryCellGroupConfig set to release to instruct the UE to release the SCG, so we fail to see the need for the proposed change.  In addition, the proposed changed could reduce flexibility for Rel-17. |
| Nokia | Yes | Okay to have the clarification as this may cause misunderstanding otherwise |
| Qualcomm Inc | Yes |  |
| Apple | No | Agree with ZTE and Hauwei. Autonomously removal by the UE is not preferred. |
| CATT | No | Agree with ZTE, NW can control the release of SCG by setting the IE mrdc-SecondaryCellGroupConfig within the RRC Reconfiguration message within the condRRCReconfig to “release”. |
| LGE | No | In our recollection, it is responsibility of network to release the configured SCG as decided in RAN2#110. |
| OPPO | No | Agree with ZTE. SCG release is up to network to do. |
| Lenovo | No | Agree with ZTE. |
| MediaTek | No | We also expect that the NW will use explicit indicator to release SCG in this scenario |
| Ericsson |  | We agree with ZTE that it would be bad network behaviour to not release the SCG. Probably bearers would need to be reconfigured too and the UE cannot do that on its own. But if UE vendors really want the possibility to release, we could perhaps be open for a change. Adding a UE autonomous release will cause issues in rel-17 though, when the UE should not release, but we assume we will introduce a UE capability for CHO with SCG in rel-17 and then we could add a condition that the UE does not release if it has that capability. If we make a change we prefer to have it in chapter 5.3.5.3 instead:  5.3.5.3 Reception of an *RRCReconfiguration* by the UE  The UE shall perform the following actions upon reception of the *RRCReconfiguration,* or upon execution of the conditional reconfiguration (CHO, CPA or CPC):   1. if the *RRCReconfiguration* was received neither within *mrdc-SecondaryCellGroup* nor within E-UTRA *RRCConnectionReconfiguration* nor within E-UTRA *RRCConnectionResume*:   [..]  1> if the *RRCReconfiguration* includes the *secondaryCellGroup*:  2> perform the cell group configuration for the SCG according to 5.3.5.5;  1>if the UE is configured with SCG and if the *RRCReconfiguration* within the stored *condRRCReconfig* of the selected cell includes the *masterCellGroup* including the *reconfigurationWithSync*:  2>perform MR-DC release as specified in clause 5.3.5.10; |
| Google | No | The SCG release should be configured by the network. |
| NEC | No | We also assume this aspect is up to network. |
| ITRI | No | Agree with ZTE. The release should be based on network configuration. |
| vivo | No |  |

## 3.2 DAPS related discussions

**DAPS related papers**

[5] R2-2204917 Discussion on RLC re-establishment issue upon DAPS fallback Huawei, HiSilicon discussion Rel-16 NR\_Mob\_enh-Core

[6] R2-2204918 Correction on UE behaviours for DAPS fallback\_Alt1 Huawei, HiSilicon CR Rel-16 38.331 16.8.0 3016 - F NR\_Mob\_enh-Core

[7] R2-2204919 Correction on UE behaviours for DAPS fallback\_Alt2 Huawei, HiSilicon CR Rel-16 38.331 16.8.0 3017 - F NR\_Mob\_enh-Core

[5] is about an issue during DAPS fallback procedure, and the contribution includes background, issues and some possible solutions. [6] and [7] are CRs for some solutions.

**Question 3: Do companies agree with the following observation in [5]?**

**Observation: It is hard for the source gNB to handle the SRBs (including RLC state) from when the DAPS HO command is sent to when failure information message is sent.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Samsung | No | In our view, the current spec is Alt 2 with modification as follows:  Alt 2: after successfully receiving DAPS HO command, the UE stops any SRB data transmission to the source cell group (including ~~PHY/MAC~~/RLC/PDCP transmission or re-transmission). Suspending SRB means that all RLC/PDCP transmission for the SRB is not performed. Thus, SRB data transmission is stopped. PHY/MAC transmission is not directly coupled with radio bearer, since MAC multiplexes all data from configured logical channels. Thus we do not have a particular PHY/MAC data for an SRB.  [Huawei2] Thanks for the above explanations. The above UE behaivours have not been captured in the current specs, and we are not sure whether it is aligned with other companies’ opinions or not. |
| ZTE | Yes | We have some sympathy with Huawei that HAQR/RLC data re-transmission may include SRB data re-transmission, which may cause the RLC status misalignment between the UE and the NW upon DAPS fallback. |
| Huawei, HiSilicon | Yes | Proponent. Firstly, we share the similar view with Samsung that “Suspending SRB means that all RLC/PDCP transmission for the SRB is not performed. Thus, SRB data transmission is stopped.”. Secondly, the UE RLC may perform the following (1) and (2) at the same time, OR, (2) happens shortly after (1):   * (1) UE RLC receives “Suspend SRB for the source” * (2) UE RLC (re-)transmits some SRB data (like measurement reports)   In this case, the above observation is valid because the source gNB has to consider the DAPS fallback. |
| Nokia | No | In 38.331, it states that the UE suspends the SRB for the source cell upon the reception of daps handover command, e.g.,  1> If any DAPS bearer is configured:  ....  2> suspend SRBs for the source cell group;  This means also that the UE should stop the re-transmission of the SRB data to the source cell as the SRB was suspended. So Alt2 is already supported in the specs.  [Huawei2] Yes, we also list the text in our discussion paper R2-2204917. As commented by other companies, TS 38.300 has similar text.  Our main concern is about UE RLC behaviours, and all listed text does not mention anything about it. |
| Apple | No | Alt2 is already supported. |
| CATT | No | Alt2 is already supported in the current spec. |
| LGE | No | We do not think there is a serious problem to be fixed. TS 38.300 specifies that upon DAPS HO, UE stops sending and receiving any RRC control plane signalling to the source. Even if ARQ retx or HARQ retx of PDU related to RRC message generated before DAPS HO initiation occurs during DAPS HO, the source cell can re-establish the RLC at the timing of T304 expiry; then potential RLC state mismatch can be avoided in case DAPS HO fallback happens.  [Huawei2] Thanks for the comments. For T304 related description, we think T304 is a timer for UE side, and it is optional for network. For “Even if ARQ retx or HARQ retx of PDU related to RRC message generated before DAPS HO initiation occurs during DAPS HO”, it seems that different companies have differen views, and we may need to figure out such UE behaviours first. |
| OPPO | No | Upon receiving a handover command requesting DAPS handover, UE suspends source cell SRBs, stops sending and receiving any RRC control plane signalling toward the source cell. The CR of Alt2 is already captured in TS 38.300, we see no need to introduce such redundant description. |
| Lenovo | No | UE suspends SRB during DAPS. |
| MediaTek | No | We think Alt-2 is already supported in current SPEC. |
| Ericsson |  | The contributions address that during the period from receiving the DAPS HO command followed by suspending the source SRBs until fallback is triggered there may have been some HARQ and RLC retransmission on the suspended source SRBs. This could perhaps be considered a corner case and perhaps does not need to be addressed.  [Huawei2] Thanks for the comments, and yes we think the 1st sentence is the same as the problem we found so far. We are not sure whether it is a corner case or not, because DAPS HO procedure and UE RLC data transmissions are independent. |
| Google | No | It is covered by “suspend SRBs for the source cell group” in the current specification. |
| NEC | No | We share the view from Samsung. |
| ITRI | No | Alt2 is already supported in the current spec. |
| vivo | No | Share the view that Alt2 is already supported. |

**Question 4: for Q3, if the issue is confirmed, which of solutions do you prefer? E.g. Alt 1, Alt 2, Alt 3 (in [5]), and others if any.**

|  |  |  |
| --- | --- | --- |
| Company | Preferred solution | Comments |
| Samsung | N/A | We don’t think CR is needed. |
| ZTE | Alt.1 | We think Alt.1 is simpler. And the NW implementation can handle the old re-transmitted RRC message to the source. |
| Huawei, HiSilicon | Alt 1 | We prefer Alt 1. Alt 3 is more complex than Alt 1, but we are open for Alt 3.  For Alt 2, our concern is that UE RLC behaviours have not been clearly defined in specs, and then it is hard for the UE RLC to precisely follow “the Suspending SRB order” from RRC. |
| Nokia | Alt 2 | Already this is supported by specifications and no need to change. |
| Apple | No CR is needed. |  |
| CATT | No CR is needed. |  |
| LGE | No CR |  |
| OPPO |  | The CR is not needed. |
| MediaTek | No CR is needed |  |
| Ericsson | Alt. 2 | Previously this was agreed:  **Agreements**  1 At DAPS handover failure, upon fallback to source cell, for each SRB, the UE discards any PDCP SDUs along with the PDCP data PDUs.  2 At DAPS handover failure, upon fallback to source cell the UE performs RLC re-establishment for each SRB.  We think option 2 is more inline with these agreements. |
| Google |  | Nothing is needed. |
| ITRI | No CR is needed. |  |
| vivo | No CR needed |  |

## 3.3 IAB related discussions

**IAB related papers**

[8] R2-2205251 Corrections on BAP entity release in MR DC release procedure in TS 38.331 Huawei, HiSilicon CR Rel-16 38.331 16.8.0 3060 - F NR\_IAB-Core

[9] R2-2205252 Corrections on BAP entity release in MR DC release procedure in TS 38.331 Huawei, HiSilicon CR Rel-17 38.331 17.0.0 3061 - A NR\_IAB\_enh-Core

[10] R2-2205617 Correction to RRC reestablishment for IAB Google Inc. CR Rel-16 38.331 16.8.0 3104 - F NR\_IAB-Core

[11] R2-2205624 Correction to RRC reestablishment for IAB Google Inc. CR Rel-17 38.331 17.0.0 3105 - A NR\_IAB-Core

[8] and [9] are about an issue for IAB, and it is observed that the spec 38.331 does not clarify whether the IAB-MT releases the BAP entity even if the last and only configured bap-Config is released. The CRs [8][9] add the operation and the condition to release the BAP entity in IAB-MT’s MR DC release procedures

**Question 5: Do companies agree with [8] and [9]?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Samsung | Yes | Seems correct. |
| Huawei, HiSilicon | Yes | Proponent. The intention is to add the missed “release the BAP entity” operation. |
| Nokia | Yes | We are okay with this |
| Qualcomm Inc | Yes |  |
| Apple | Yes |  |
| LGE | Yes | While 5.3.5.12 BAP configuration section indicates BAP entity release upon bap-Config set to release, the proposed text seems still needed. |
| Lenovo | Yes |  |
| Ericsson | Yes | That is correct. |
| Google | Yes |  |
| ZTE | Yes |  |
| vivo | Yes |  |
|  |  |  |
|  |  |  |

[10] and [11] are about an issue for IAB, and the reasons are as below:

* If the IAB-MT is configured with the conditionalReconfiguration, the IAB-MT does not suspend BH RLC channels upon initiating the RRC reestablishment procedure. Upon initiating the RRC reestablishment procedure, the IAB-MT should suspend the BH RLC channels irrespective of whether the IAB-MT is configured with the conditionalReconfiguration.

In the CRs [10][11], it is clarified that if the IAB-MT is configured with the conditionalReconfiguration, the IAB-MT suspends BH RLC channels upon initiating the RRC reestablishment procedure.

**Question 6: Do companies agree with [10] and [11]?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Samsung | No for [1], Yes for [2] | This problem is only applicable to R17 since CHO as a RRE (failure recovery solution) is introduced only in R17, not R17. |
| Huawei, HiSilicon | No | CHO is not supported by R16 IAB officially. For R17 CR, it should be discussed in IAB session under RRC RIL issues. There seems some related/similar issue treated there. |
| Nokia | No for [1], Yes for [2] | Not sure this is essential. Double checking is needed on understanding whether IAB in Rel-16 supports CHO config? No explicit exclude is there, but we think in practice it won’t be needed, as there are limited measurements performance related capabilities agreed for Rel-16 IAB, but maybe theoretically it is fine. So agree with Samsung that [1] is not needed. is not needed. Change is more useful for Rel-17.  It seems there is a misalignment in the CR cover page which states the change is to cover the case when IAB-Mt is NOT configured with conditionalReconfiguration, while the change is opposite (proposes to suspend the BH RLC channels when the UE IS configured with conditionalReconfiguration) |
| Qualcomm Inc | No for [1], Yes for [2] | Same as Samsung |
| Apple | No for [1], Yes for [2] | CHO for eIAB has only been added in Rel-17 where it is supported for the IAB-MT in the context of intra- and inter-donor IAB-node migration and BH RLF recovery. |
| LGE | Yes | The actions triggered upon re-establishment should be consistent. In this sense, it seems that the same change should be applied to and Uu Relay RLC channels. |
| Lenovo | Yes for Rel-17 |  |
| Ericsson | No for [1], Yes for [2] | CHO for IAB is supported from Rel.17, hence not needed the fix for Rel.16. |
| Google | Yes | Proponent. Based on the majority’s comments, CHO is not supported for Rel-16 IAB. We are fine to only have the Rel-17 CR. |
| ZTE | No for [1], Yes for [2] | The same view as above that CHO is not supported in IAB in Rel16. So only the CR for Rel-17 is needed. |
| vivo | Yes for Rel-17 |  |
|  |  |  |
|  |  |  |

# 4 Conclusion

TBD.