INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

E.460
(03/2000)

SERIES E: OVERALL NETWORK OPERATION, TELEPHONE SERVICE, SERVICE OPERATION AND HUMAN FACTORS

Quality of service, network management and traffic engineering – Network management – Checking the quality of the international telephone service

Measurements and metrics for monitoring the performance of V.34 Group 3 facsimile

ITU-T Recommendation E.460

For further details, please refer to ITU-T List of Recommendations.

ITU-T RECOMMENDATION E.460

MEASUREMENTS AND METRICS FOR MONITORING
THE PERFORMANCE OF V.34 GROUP 3 FACSIMILE

Summary

This Recommendation describes measurements and metrics for monitoring the performance of V.34 group 3 facsimile. There are two options in T.30 for V.34 fax over the PSTN. These are described in Annexes C and F of T.30. At present no known implementations use Annex C/T.30; they use either Annex F/T.30 or some other proprietary method. It is possible to map many of the measurements and metrics from E.459 onto monitoring of V.34 fax.

FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

INTELLECTUAL PROPERTY RIGHTS

The ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. The ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, the ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

CONTENTS

Page

Introduction

This Recommendation describes measurements and metrics for monitoring the performance of V.34 group 3 facsimile. There are two options in T.30 for V.34 fax over the PSTN. These are described in Annexes C and F of T.30. At present no known implementations use Annex C/T.30; they use either Annex F/T.30 or some other proprietary method. It is possible to map many of the measurements and metrics from E.459 onto monitoring of V.34 fax. The important differences between normal G3 fax and T.30 Annex F are:

- error correction mode is mandatory;
- Annex F/T.30 uses the half duplex mode defined in V.34;
- the handshaking is performed over the duplex control channel defined in V.34;
- the transmission rate of the high speed image phase and the control channel handshaking is negotiated using V.34 procedures not T.30 fallback;
- the frame structure of the binary coded signals used over the control channel is the same as that used for normal G3 fax in error correction mode;
- the TCF and FTT frames are not used;
- rate changes in both primary and control channels can occur during a call using V.34 procedures;
- each call begins with a V.8 capabilities exchange (this also applies to T.30 Annex C calls).

In order to measure the performance of a V.34 fax call, it will be necessary to monitor and decode the V.8 start-up and the V.34 control channel. The V.8 information is transmitted using V.21 modulation. The V.34 control channel is transmitted using 1200 or 2400 bit/s QAM. The rates may be asymmetric.

This Recommendation assumes that it is possible to reliably extract information from the control channel.

The rest of this Recommendation suggests measurements and metrics appropriate for T.30 Annex F fax. Where possible they correspond to those already defined in E.459. Only protocol related measurements are described. Many of the image, analogue and signalling related call data measurements described in Annexes A, B and C of E.459 are also relevant.

The names of the measurements and metrics defined in this Recommendation are the same as those in E.459. However, in this case they apply only to V.34 fax calls according to T.30 Annex F.

T.30 Annex C measurements and metrics are for further study.

Recommendation E.460

MEASUREMENTS AND METRICS FOR MONITORING
THE PERFORMANCE OF V.34 GROUP 3 FACSIMILE

(Geneva, 2000)

1 Scope

This Recommendation describes measurements and metrics for monitoring the performance of V.34 group 3 facsimile. There are two options in T.30 for V.34 fax over the PSTN. These are described in Annexes C and F of T.30. At present no known implementations use Annex C/T.30; they use either Annex F/T.30 or some other proprietary method. It is possible to map many of the measurements and metrics from E.459 onto monitoring of V.34 fax. The important differences between normal G3 fax and T.30 Annex F are:

- error correction mode is mandatory;
- Annex F/T.30 uses the half duplex mode defined in V.34;
- the handshaking is performed over the duplex control channel defined in V.34;
- the transmission rate of the high speed image phase and the control channel handshaking is negotiated using V.34 procedures not T.30 fallback;
- the frame structure of the binary coded signals used over the control channel is the same as that used for normal G3 fax in error correction mode;
- the TCF and FTT frames are not used;
- rate changes in both primary and control channels can occur during a call using V.34 procedures;
- each call begins with a V.8 capabilities exchange (this also applies to T.30 Annex C calls).

In order to measure the performance of a V.34 fax call, it will be necessary to monitor and decode the V.8 start-up and the V.34 control channel. The V.8 information is transmitted using V.21 modulation. The V.34 control channel is transmitted using 1200 or 2400 bit/s QAM. The rates may be asymmetric.

This Recommendation assumes that it is possible to reliably extract information from the control channel.

The rest of this Recommendation suggests measurements and metrics appropriate for T.30 Annex F fax. Where possible they correspond to those already defined in E.459. Only protocol related measurements are described. Many of the image, analogue and signalling related call data measurements described in Annexes A, B and C of E.459 are also relevant.

The names of the measurements and metrics defined in this Recommendation are the same as those in E.459. However, in this case they apply only to V.34 fax calls according to T.30 Annex F.

T.30 Annex C measurements and metrics are for further study.

2 Call data measurements

The following measurements must be recorded for each call. Measurements are either "information", which can be extracted from T.30 protocol messages, or simple "yes/no" decisions on whether a condition was met. Where the type or contents of T.30 frames must be analysed, the frame must have a correct CRC.

Measurement	Type	Comments
TSI	Information	If present.
CSI	Information	If present.
CIG	Information	If present.
Last frame of the call in each direction	Information	To determine whether call is complete, and if not, to provide diagnostic information. Recording of frames immediately before the last frame in each direction may be necessary and is for further study.
Call complete	Yes/no	Detected MCF followed by DCN. "No" indicates an incomplete call.
Disconnect after DCS	Yes/no	Precise condition needs to be defined.
DCN from transmitter	Yes/no	
DCN from receiver	Yes/no	
NSS or NSC detected	Yes/no	Indicates a non-standard call.
CNG only	Yes/no	May indicate a misdialled fax call.
DIS or ANSam and DIS only	Yes/no	May indicate a misdialled voice call.
Pages sent at highest rate	Information	Number of pages sent at initially negotiated primary channel rate.
Pages sent at lower rates	Information	Number of pages sent after 1 or more retrains on primary channel.
1st choice primary channel transmission rate	Information	Extracted from MPh sequence.
Final primary channel transmission rate	Information	Extracted from MPh sequence.
1st choice control channel transmission rate	Information	Extracted from MPh sequence. Note the higher of the two rates if asymmetric.
Final control channel transmission rate	Information	Extracted from MPh sequence. Note the higher of the two rates if asymmetric.
T.30 Annex F	Yes/no	"yes" indicates T.30 Annex F procedures. "no" indicates T.30 Annex C procedures.
Caller transmits	Yes/no	Extracted from V.8 message. "no" indicates caller receives.
In ECM calls, capture PPR and corresponding PPS frames	Information	PPR and PPS frame information need not be captured beyond the 10th partial page.
64 octet frames	Yes/no	"yes" implies 64 octet frames. "no" implies 256 octet frames.

3 Cumulative data measurements

3.1 Cumulative data measurements based on T.30 protocol messages

The following data must be generated from the individual call data measurements. The cumulative data is used to generate the primary, secondary and optional metrics, as indicated in the columns headed P, S and O in the table below.

The following definitions are for the purposes of this Recommendation only:

A **fax call** is a call where the V.8 JM message indicates T.30 Annex F operation

i.e. ANSam + DIS without any fax signal from the calling end does not constitute a fax call as this may be a misdialled voice call.

Image quality as observed at the monitor point during transmission is defined as:

A	Pages with 3% or less errored frames (Note)
B	Pages with greater than 3% but less than 10% errored frames (Note)
C	Pages with 10% or greater errored frames (Note)
NOTE – A page may be made up of a number of partial pages.	

These definitions differ from E.453 which assumes knowledge of the number and distribution of errored lines in a test call image. The definitions are based only on information that can be extracted from protocol messages. See also Annex B/E.459.

Name	What	How	Comments	P	S	O
CALL COMPLETION DATA						
T	Total number of fax calls		See definition of fax call above			v
T_{STD}	Total number of standard fax calls	Calls in which NSS or NSC is **not** returned.	Defined to be all fax calls **except** those which use non-standard facilities	v	v	
T_C	Total number of standard facsimile calls which complete OK	Calls ending with MCF, DCN and do not contain NSS or NSC		v	v	
F_{1B}	Number of calls which disconnect after DCS	No CFR detected				v
F_m	Number of calls which fail after CFR	No post page response (MCF or PPR)				v
F_{TT}	Number of calls which completely fail to train	V.34 does not train	Identifies lines of extremely poor quality			v

Name	What	How	Comments	P	S	O
	TRANSMISSION RATE DATA					
C_1	Number of calls which connect at first choice transmission rate	V.34 trains at maximum rate (28.8 or above?)	Maximum rate is 33.6 kbit/s at present. However, many earlier V.34 implementations are only capable of 28.8 kbit/s	v		
C_R	Number of completed calls which connect at first choice transmission rate but retrain to lower rate after one or more pages sent	Primary channel retrains during call after initially connecting at max rate				v
C_B	Number of completed calls with fallback	Primary channel initially trains at below max rate and retrains during call				v
$C_{1;m;x}$	Number of calls which connect with first choice transmission rate using modulation type "m" and transmission rate "x"		"m" = V.34 in this case "x" varies from 2.4 to 33.6 kbit/s			v
$C_{B;m;x}$	Number of calls retrain to modulation type "m" and **minimum** transmission rate "x"		"m" = V.34 in this case "x" varies from 2.4 to 31.2 kbit/s			v
	IMAGE QUALITY DATA					
I_{EQ1}	Number of calls which have image quality A			v		
I_{EQ2}	Number of calls which have image quality B					v
I_{EQ3}	Number of calls which have image quality C					v
I_E	Number of ECM calls in which at least one partial page was sent and acknowledged	At least one MCF or PPR was detected		v		
	RATE AND QUALITY COMBINED DATA					
Q_{m1}	Number of calls completed at maximum speed with image quality A				v	
Q_{m2}	Number of calls completed at maximum speed with image quality B				v	
Q_{m3}	Number of calls completed at maximum speed with image quality C				v	

Name	What	How	Comments	P	S	O
	RATE AND QUALITY COMBINED DATA (continuation)					
Q_{f1}	Number of calls completed after retraining with image quality A				v	
Q_{f2}	Number of calls completed after retraining with image quality B				v	
Q_{f3}	Number of calls completed after retraining with image quality C				v	
O Optional metric						
P Primary metric						
S Secondary metric						

4 Metrics

4.1 Primary metrics

Service providers may desire to monitor performance on individual routes so that variation over time may be detected. They may also wish to compare performance of different routes. The principal metrics identified in clause 4/E.450 are facsimile call cutoffs (i.e. call completion), facsimile modem transmission rate and transaction times, and facsimile image quality. These metrics have been closely followed below in the definition of the three primary metrics suitable for the monitoring of large numbers of facsimile calls. These metrics are independent of each other.

metric 1:   % CALL COMPLETION $= (T_C/ T_{STD}) \times 100$

metric 2:   % CALLS USING MAXIMUM TRANSMISSION RATE $= (C_1/T_{STD}) \times 100$

metric 3:   % CALLS WITH GOOD IMAGE QUALITY $= (I_{EQ1}/I_E) \times 100$

4.2 Secondary metrics

The optional secondary metrics provide a comparison of the numbers of calls which meet the criteria for the seven types of transaction defined in clause 4/E.458.

metric 4:   % of calls completed at maximum speed and without transmission errors $= (Q_{m1}/T_C) \times 100$

(E.458 Transaction type I)

metric 5:   % of calls completed at maximum speed and with transmission errors $= (Q_{m2}/T_C) \times 100$

(E.458 Transaction type II)

metric 6:   % of calls completed at maximum speed and with severe transmission errors $= (Q_{m3}/T_C) \times 100$

(E.458 Transaction type III)

metric 7:	% of calls completed with retrain and without transmission errors	$= (Q_{f1}/T_C) \times 100$
	(E.458 Transaction type IV)	
metric 8:	% of calls completed with retrain and with transmission errors	$= (Q_{f2}/T_C) \times 100$
	(E.458 Transaction type V)	
metric 9:	% of calls completed with retrain and with severe transmission errors	$= (Q_{f3}/T_C) \times 100$
	(E.458 Transaction type VI)	
metric 10:	Incomplete call	$= ((T_{STD} - T_C)/T_{STD}) \times 100$
	(E.458 Transaction type VII)	

4.3   Optional metrics

% of non-standard facsimile calls	$= ((T - T_{STD})/T) \times 100$
% of calls which disconnect after DCS	$= (F_{1B}/T_{STD}) \times 100$
% of calls which fail after CFR	$= (F_m/T_{STD}) \times 100$
% of calls which completely fail to train	$= (F_{TT}/T_{STD}) \times 100$
% of completed calls which connect at first choice transmission rate but retrain to lower rate after one or more pages sent	$= (C_R/T_{STD}) \times 100$
% of completed calls with primary channel retrains	$= (C_B/T_{STD}) \times 100$
% of calls which connect with first choice transmission rate "x" (m = V.34)	$= (C_{1;m;x}/T_{STD}) \times 100$
% of calls which retrain to a minimum transmission rate "x" (m = V.34)	$= (C_{B;m;x}/T_{STD}) \times 100$
% calls with image quality B	$= (I_{EQ2}/I_E) \times 100$
% calls with image quality C	$= (I_{EQ3}/I_E) \times 100$

ITU-T RECOMMENDATIONS SERIES

Series A	Organization of the work of the ITU-T
Series B	Means of expression: definitions, symbols, classification
Series C	General telecommunication statistics
Series D	General tariff principles
Series E	**Overall network operation, telephone service, service operation and human factors**
Series F	Non-telephone telecommunication services
Series G	Transmission systems and media, digital systems and networks
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	Transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	Construction, installation and protection of cables and other elements of outside plant
Series M	TMN and network maintenance: international transmission systems, telephone circuits, telegraphy, facsimile and leased circuits
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Telephone transmission quality, telephone installations, local line networks
Series Q	Switching and signalling
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	Data networks and open system communications
Series Y	Global information infrastructure
Series Z	Languages and general software aspects for telecommunication systems

18198