Techniques & Devices for Enhancing (Tele)Communication Capabilities

Moderator – Stan McClellan
Texas State University, USA

SPACOMM/ICDT Panel
NexComm 2013, Venice, Italy
22 April 2013

TEXAS ★ STATE
UNIVERSITY
SAN MARCOS
The rising STAR of Texas

Panelists

- Jérémy Robert
  - Research Center for Automatic Control (CRAN)
  - University of Lorraine – Nancy, France

- Petre Dini
  - China Space Agency Center, China
  - Concordia University, Canada

- Stan McClellan
  - Ingram School of Engineering
  - Texas State University, USA

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Issues with IP Traffic
in Virtual Environments

S. McClellan

Texas State University, USA

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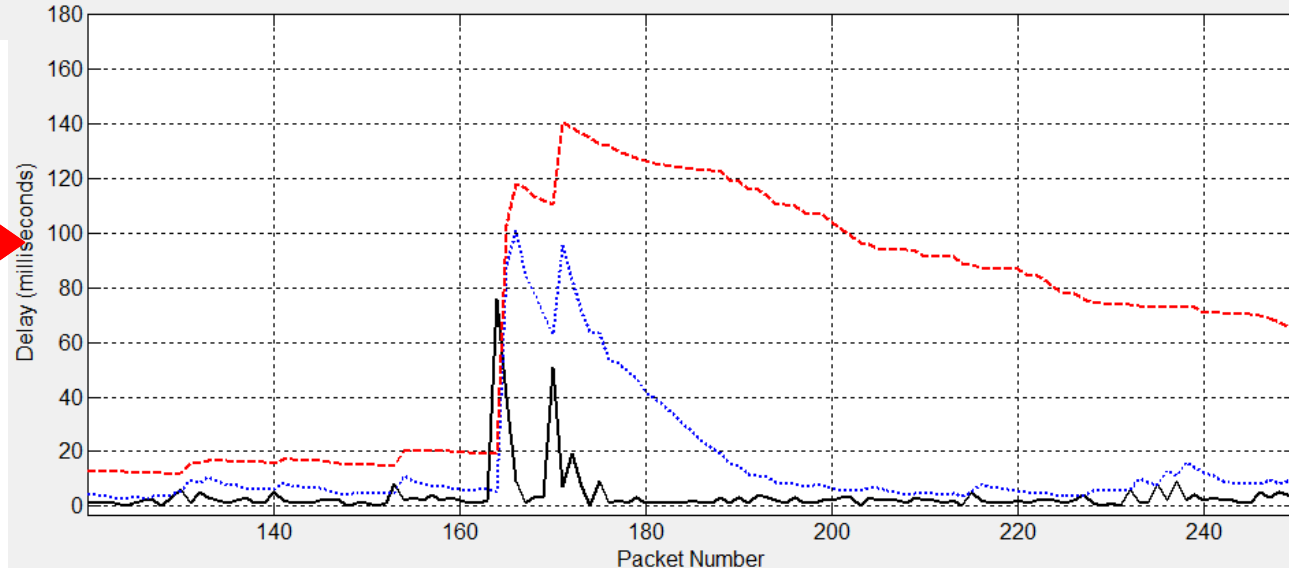# Network Characteristics

- Real Networks
  - Slow or high-latency links
  - IETF RFCs "tuned" for long time-of-flight

- Virtual Networks
  - Short, fat virtual links
  - Extremely fast time-of-flight
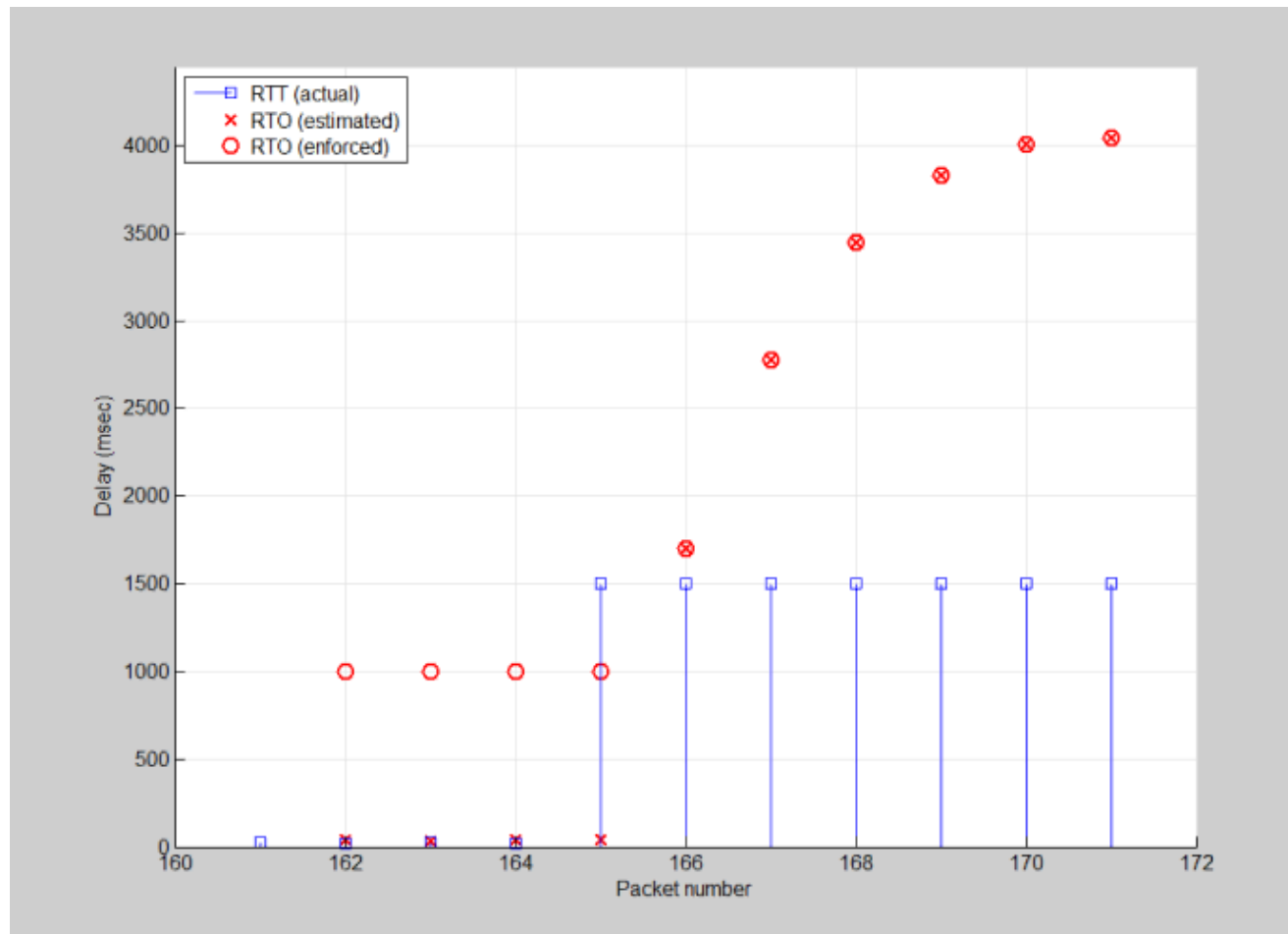
Virtualized Round Trip Times
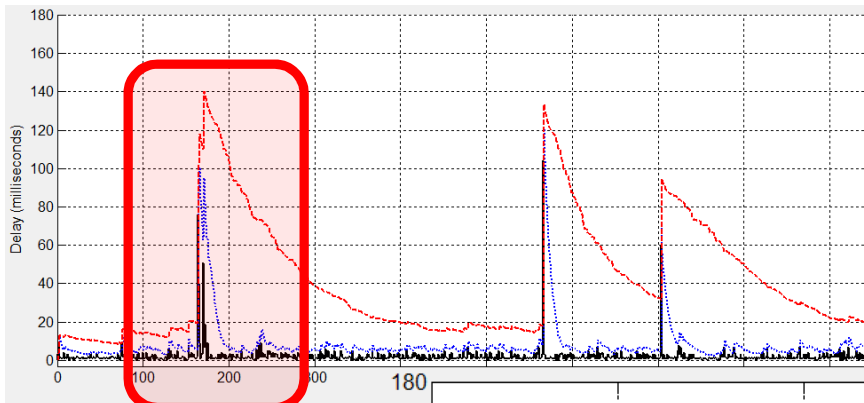
Note:

- RTT is almost zero
- Areas of "high" variance are still very low RTT compared to conventional minimum (1000 msec)
- Many induced timeouts

NexComm 2012

Video of RTT/RTO

PANEL ICDT/SPACOMM
Techniques and Devices for Enhancing (Tele)Communication Capabilities

Prof. Dr. Petre DINI

Concordia University, Canada

China Space Agency Center, China

IARIA Organization

petre@iaria.org

Marriage or ….

- **Up/Down Link vs. even rate**
  - **QoS**
  - **delays**
  - **DTN**
  - **bundling**

- **Content-based routing**

  Deep packet inspection

  Cryptographic (partially) messages

  Complexity and Processing Time

WWW.IARIA.ORG

Centre
de Recherche
en Automatique
de Nancy
UMR 7039

COTS-based vs. custom-built communication system

Jérémy ROBERT

Definition

COTS [Oberndorf, 1998] :
> something that one can buy, ready-made, from some manufacturer's store shelf (e.g. through a catalogue or from a price list)

COTS-based systems [Carney, 1997] :
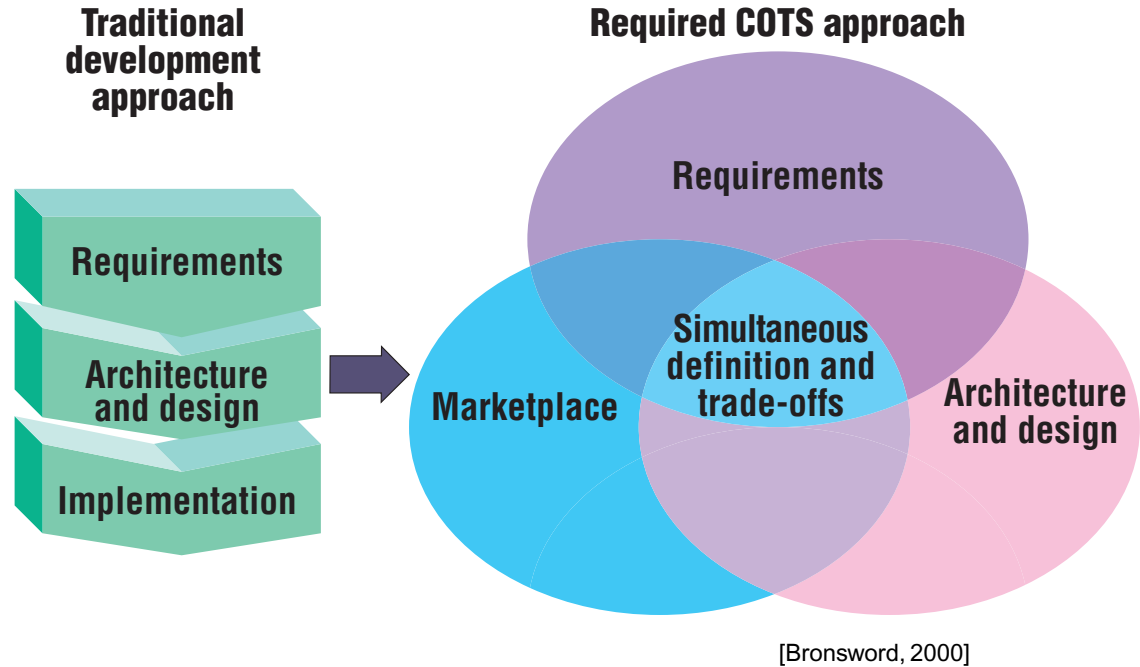> function of the number of COTS used and their influence on the final system :
>> - «turnkey systems» built around a (suite of) commercial product(s)
>> - «intermediate systems» : built around one COTS and others components (custom-build)
>> - «integrated systems» : by integrating several COTS

Custom-build systems [Fowler, 2004] :
> each subsystem is a in-house system developped from basic components.

Paradigm Shift

engineering
methodology :

Traditional development approach

Requirements

Architecture and design

Implementation

Required COTS approach

Requirements

Marketplace

Simultaneous definition and trade-offs

Architecture and design

[Bronsword, 2000]
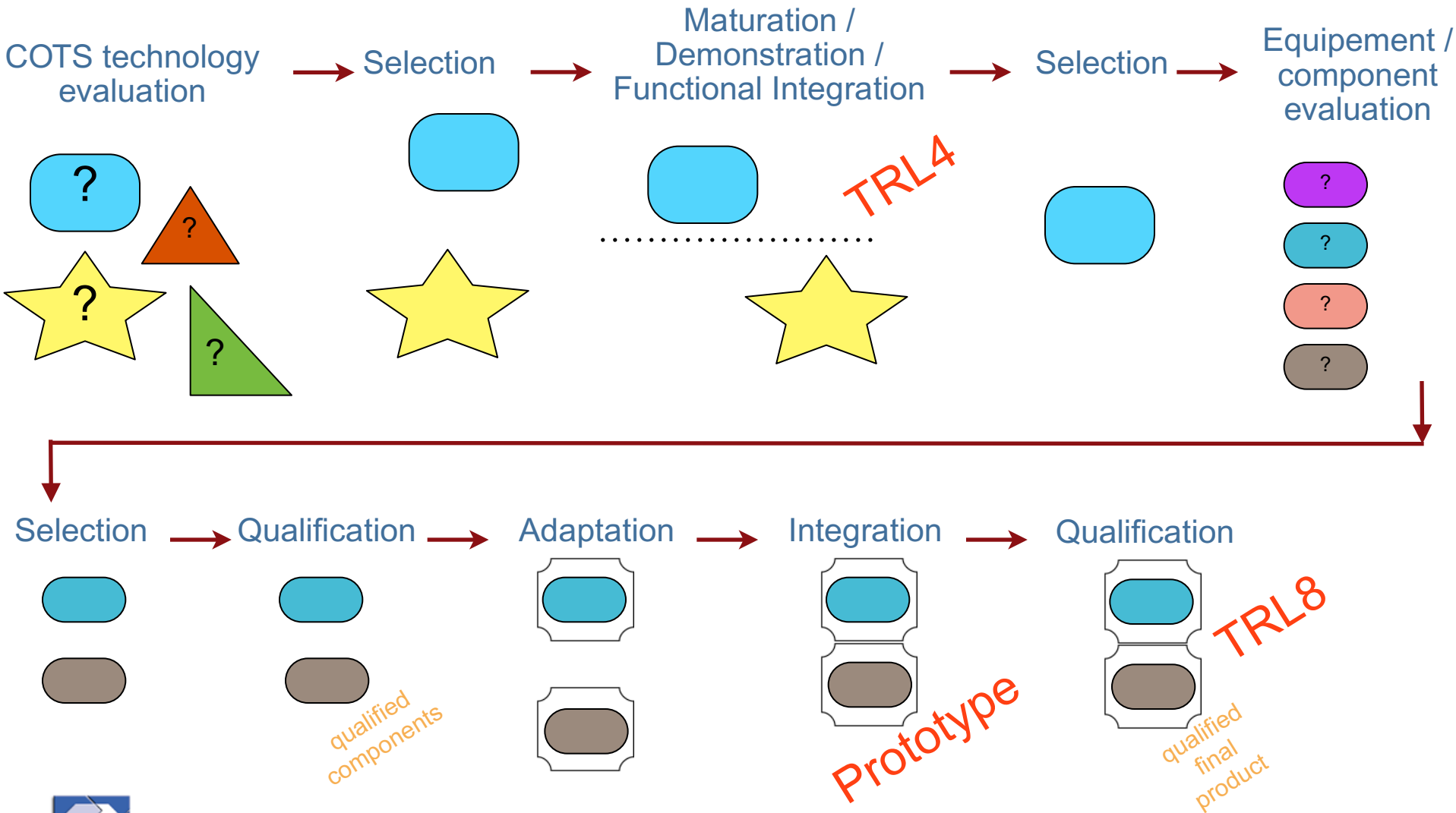
system engineer :

«producer of system» ⟶ «consumer and integrator of COTS components»

CRAN

COTS-based communication system life cycle

COTS technology evaluation → Selection → Maturation / Demonstration / Functional Integration → Selection → Equipement / component evaluation

TRL4

Selection → Qualification → Adaptation → Integration → Qualification

qualified components

Prototype

TRL8

qualified final product

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COTS Advantages and Disadvantages

Advantages :

- to reduce development cost

- to profit by product evolution

- to profit by maturity of each component

- hardware/software independance

- available in multiple vendors (no dependance with a unique vendor)

- interoperability (technology relies on standard)

Disadvantages :

- may not be suitable immediatly for the application

- black box product («when you want to control everything»)

- may be licensed (not prescribed)

- may contain useless functionnality (but which impact ?)

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Qualification paradigm ?

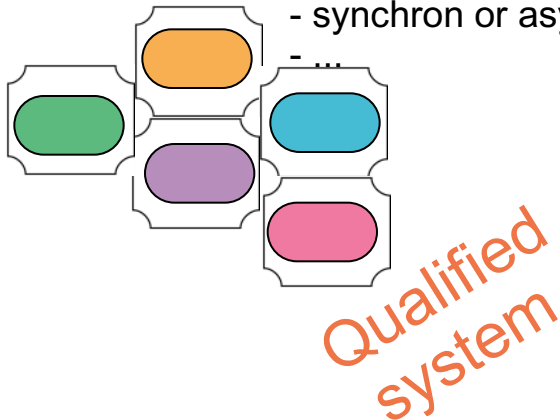## Custom-build system :

- dependant function
- synchron
- ...

Qualified system

Add a function →

Re-qualification of entire system

COTS-based systems :

- independant function
- synchron or asynchron
- ...

Qualified system

Add a function →

qualification of additionnal functions

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Questions for Audience

- [Stalker, 2003] :
    « Buy what you can, and build only what is unique to your problem»

    - What do you think about it ?
    - Is it true in all domains, in particular space systems ?

- Any recent operationnal COTS space applications ?

    - What are their characteristic ? some COTS or totally COTS ?
    - How long did it take to finalise this project ? (compared to a custom-build approach)
    - When did it happen ?

- Which is your method(s) to qualify a COTS-based system for space applications ? Is different that a custom-based approach ?