EMERGENCY MEASURES RADIO GROUP	**EMERGENCY MEASURES RADIO GROUP**
AMATEUR RADIO RAC EMERGENCY SERVICE	**OTTAWA ARES**

Two Names - One Group - One Purpose

Amateur Radio Data Communications

Considerations & Options

INTRODUCTION

- The purpose of this presentation is to show some of the considerations and options that need to be taken into account when defining an effective, robust data emergency communications solution using Amateur Radio.
- While there are several options available for data on Amateur radio, it is assumed the solutions will be based on a backbone network of 1200B packet.

What Is The Objective?

OVERLAY (No Communications Failures):

- Provide data communications at a location that otherwise does not have it, or our client does not have access to the computers or network connection.

LOCAL COMMUNICATIONS FAILURE:

- Provide data communications from an area with working communications, into an area that has experienced local communications failure.

WIDE AREA COMMUNICATIONS FAILURE:

- Provide data communications over a wide area that has experienced communications failure. Assumes Internet connectivity is gone.

Data Requirements

Local Vs. Rest Of World

- Is all the data within the local area?
- Is there some data to the outside world?

Text Only Vs Text + Files (attachments)

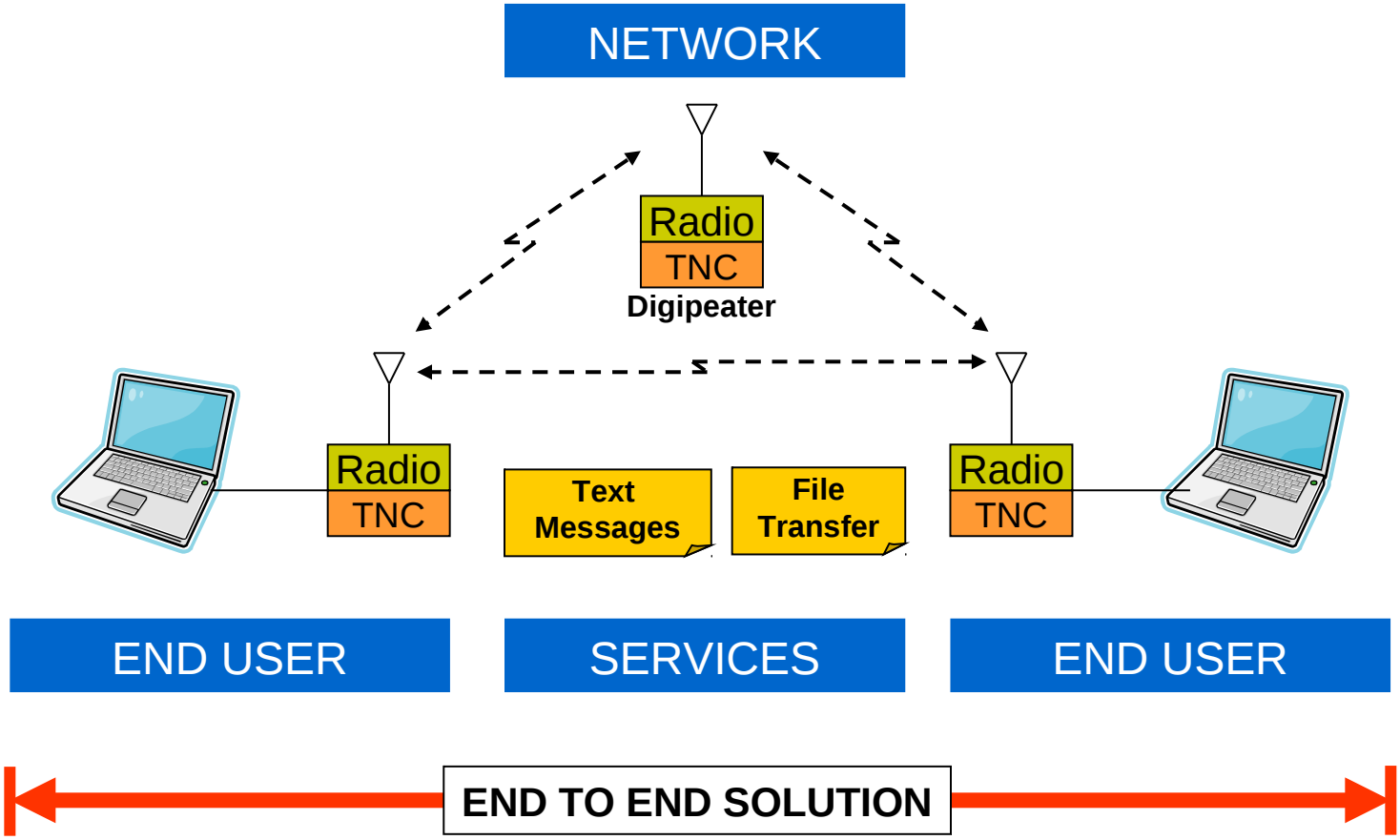
- Are messages text information only?
- Is there a need to move data files?

How much data is expected?

- Is packet for a few messages, or a lot of traffic?

END USER CONFIGURATION

- Are sites permanently wired, or are portable packet systems required (or both)?
- Do the users have access to local PCs or is it an overlay network requiring all equipment?
- Can the user interface be co-located with the radio, or is some type of extension technology required to get outside the building?


NETWORK
Radio
TNC
Digipeater
Radio
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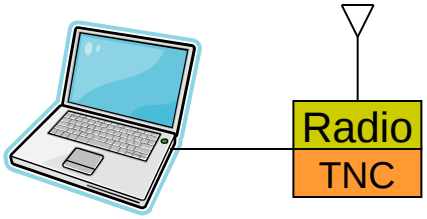
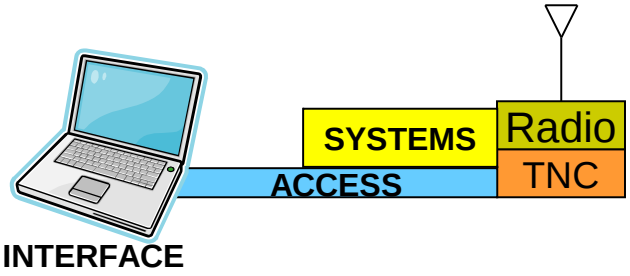
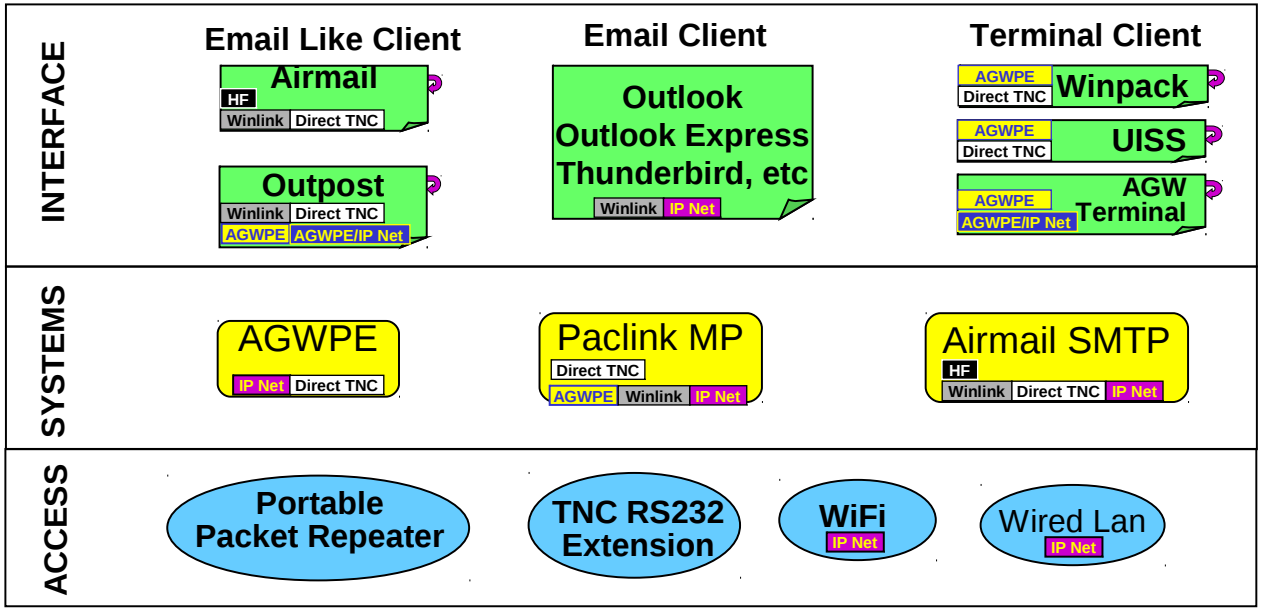
Text Messages
File Transfer
END USER
SERVICES
END USER
END TO END SOLUTION

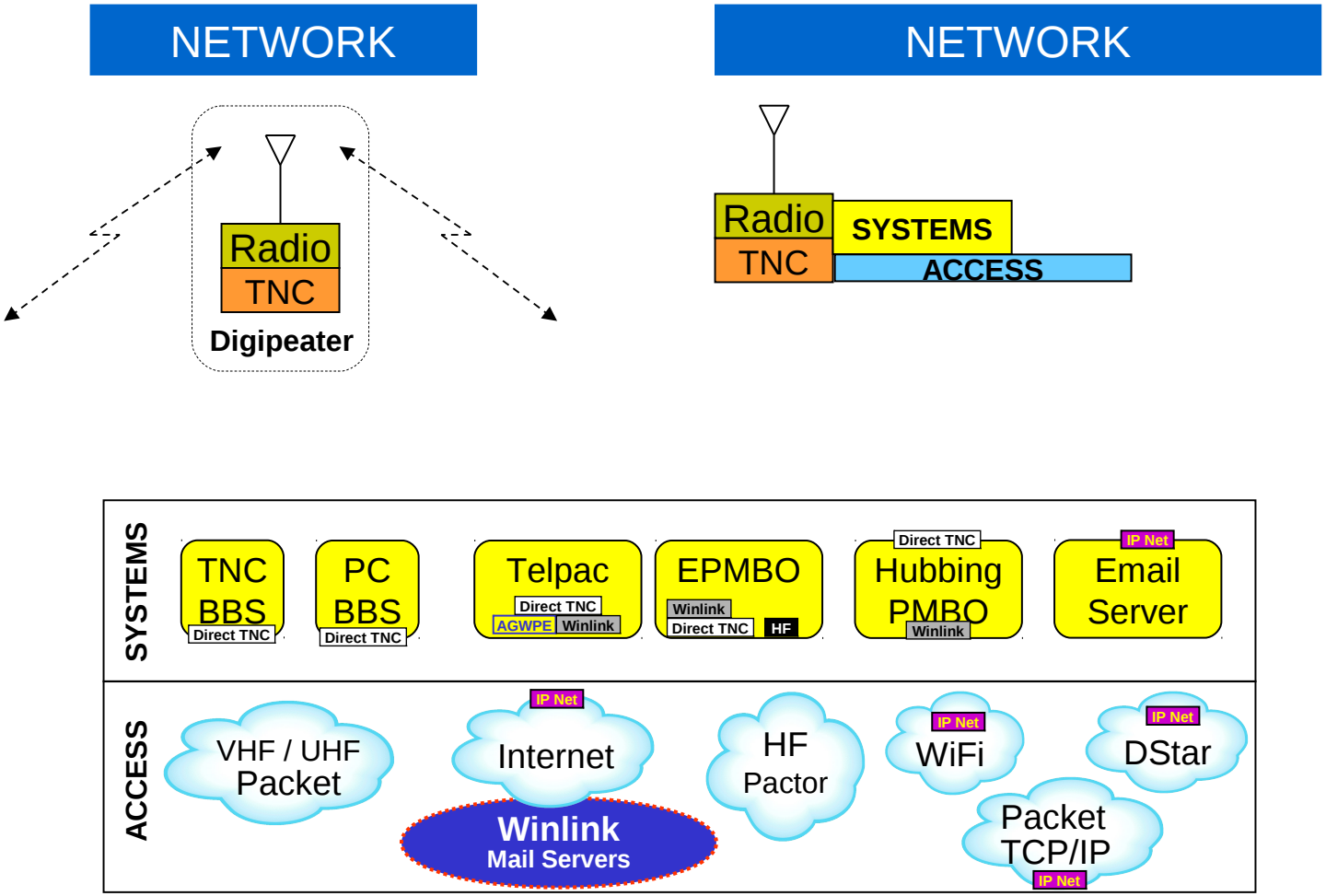




END USER

END USER(S)




NETWORK
Radio
TNC
Digipeater
NETWORK
Radio
TNC
SYSTEMS
ACCESS
SYSTEMS
TNC BBS
Direct TNC
PC BBS
Direct TNC
Telpac
Direct TNC
AGWPE
Winlink
EPMBO
Winlink
Direct TNC
HF
Direct TNC
Hubbing PMBO
Winlink
IP Net
Email Server
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DStar
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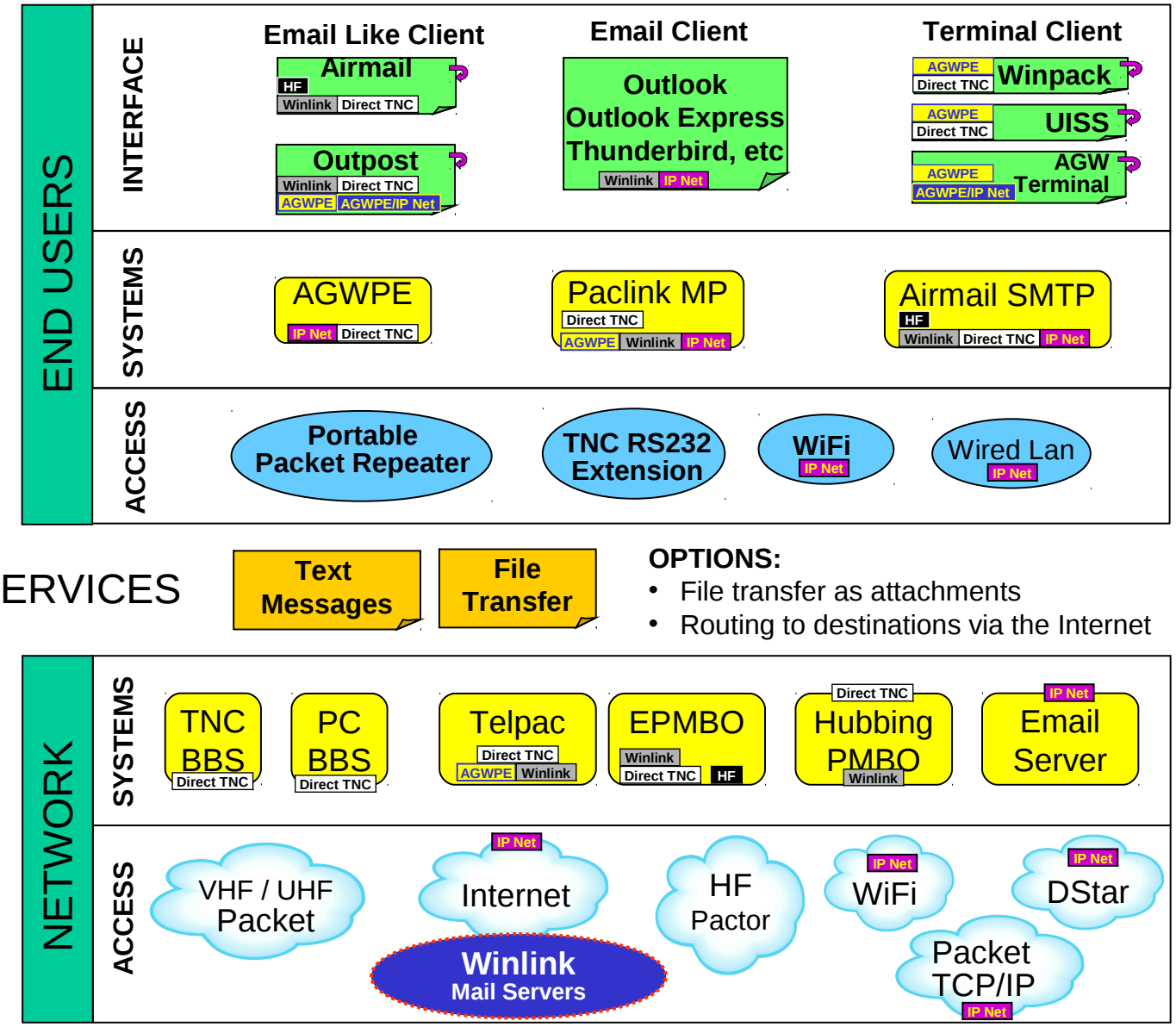

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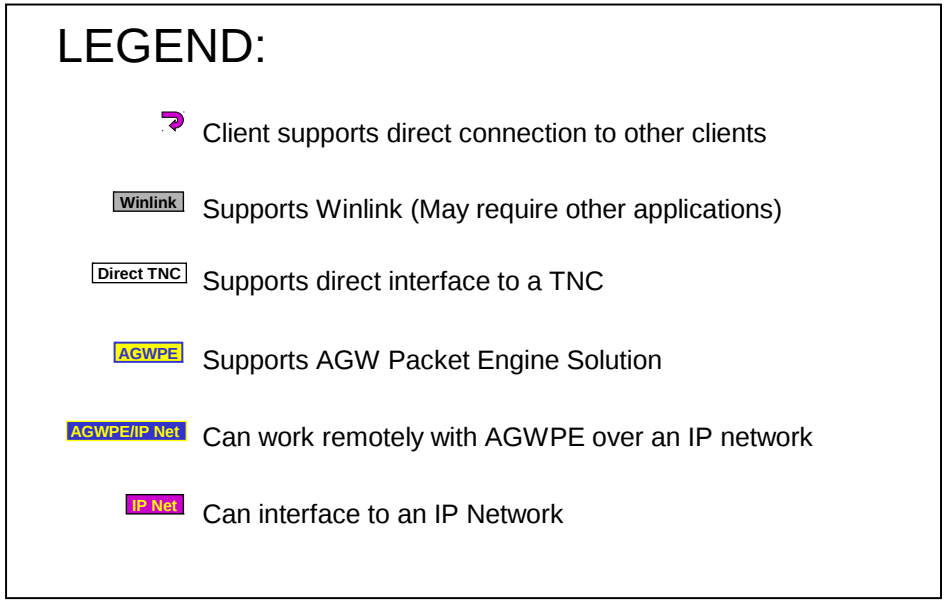


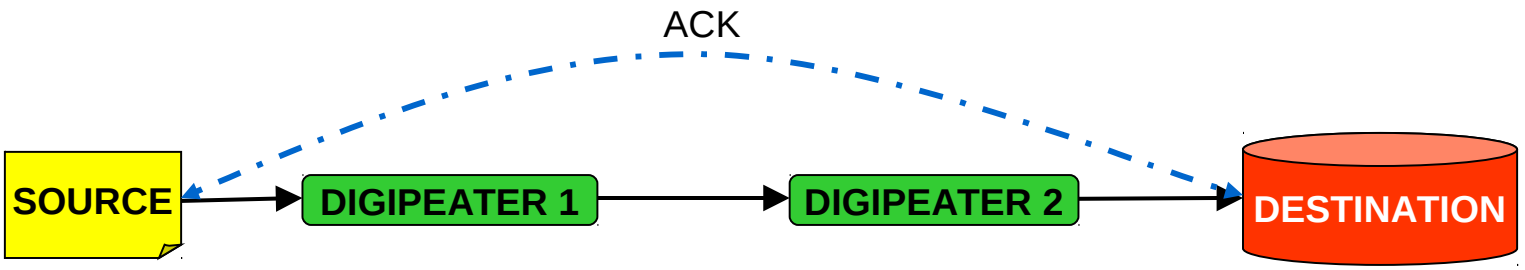
- Not all components will work with each other. While some can operate independently, others require a supporting component in order to function.
- Most of the components are software, which means they must run on a PC. If the software provides a gateway function, this PC may not be located with the users, but rather with the radio.

TNCs NOT ALL EQUAL

Not all TNCs are created equal. Assuming only 1200B, there are still some possible challenges to be encountered;

- Memory size (To support mailboxes)
- Connection Limits (How many simultaneous users can connect to, or through the TNC at one time)
- Support for KISS Mode (Some older TNCs don’t support it)
- KISS Mode Only (TNCx only supports KISS)
- PC Modems (Drivers may not be supported)

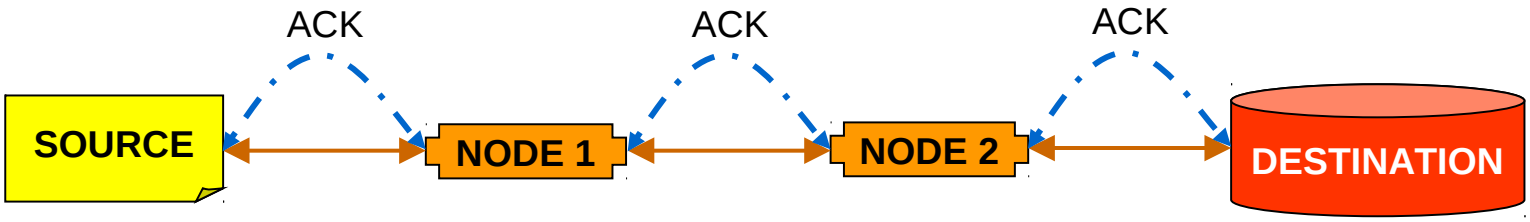
DIGIPEATERS



Digipeaters extend the range of data communications, by repeating the data over a wider area, but they have some specific limitations.

- Digipeaters do not listen for other digipeaters, so they cannot build a digipeater list. The user must know which digipeaters to use.
- Communications to a destination, through a digipeater is acknowledged at the destination, rather than for each hop. Failure of communications on one hop requires retransmission across the whole end to end path.

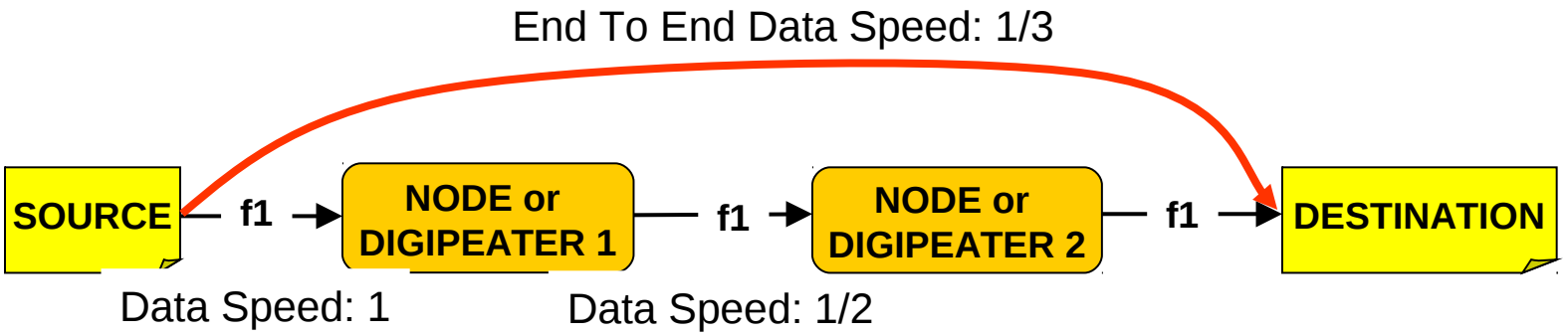
NODES



Nodes provide a similar function to a digipeater, but they have some specific functions that are different.

- Nodes listen for other nodes, so they can build a node list.
- Nodes decrement the source callsign SSID to make it unique for each hop of the end to end path. This is a problem when a specific callsign with SSID is expected at the destination.
- Communications to a node or between nodes is acknowledged at each node, rather than end to end. Failure of communications on one hop only requires retransmission on that hop.

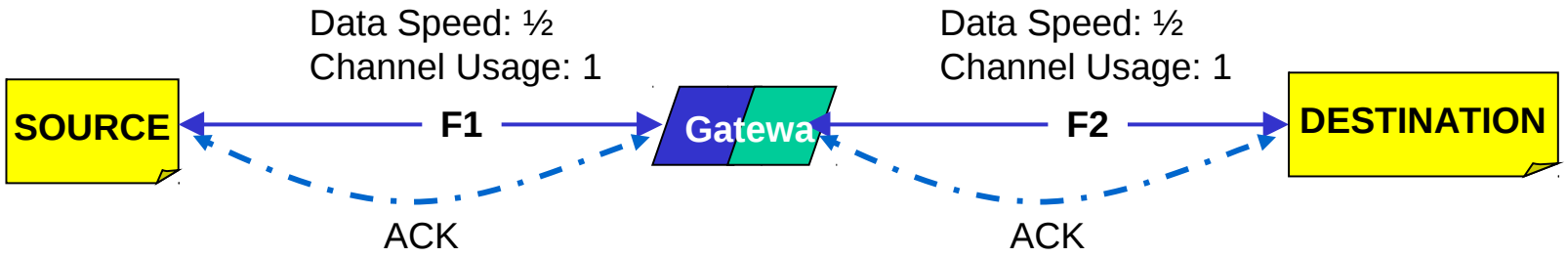
DATA SPEED



Data throughput is cut by a factor of 1 for each node/digipeater transition. The node/digi must receive the data and check that it is complete, then retransmit the data.

For example, when Node/Digi 1 is sending the message to Node/Digi 2, any source will see the channel as busy, When Node/Digi 2 is sending the message to the destination, Node/Digi 1 will see the channel as busy.

GATEWAYS

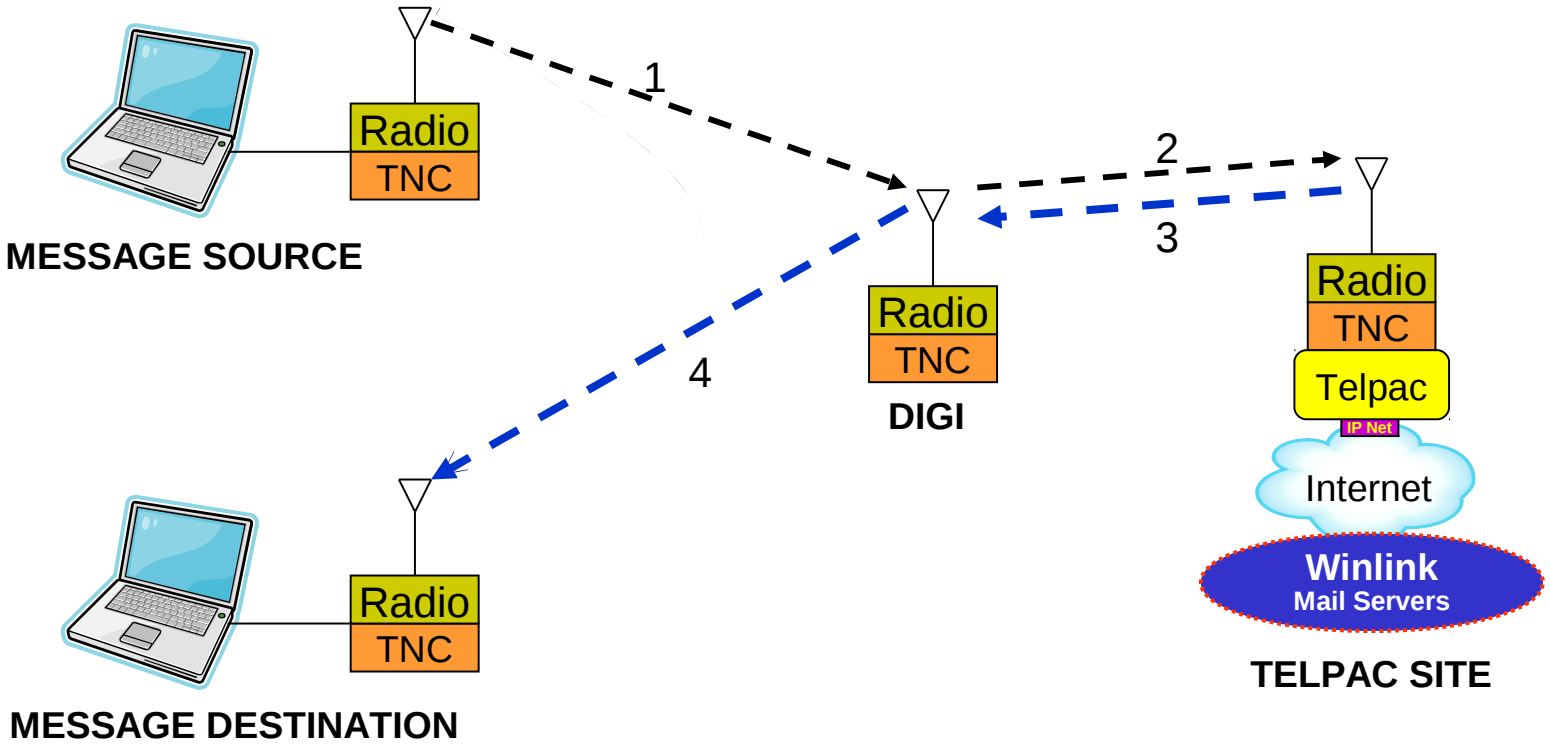


GATEWAY

Gateways are back to back nodes on different frequencies, that communicate directly node to node. The frequencies can be on the same band or different bands. The source can set up a path into the gateway on one node and out of the gateway on the other node. Gateways have some advantages and share the functionality of a node.

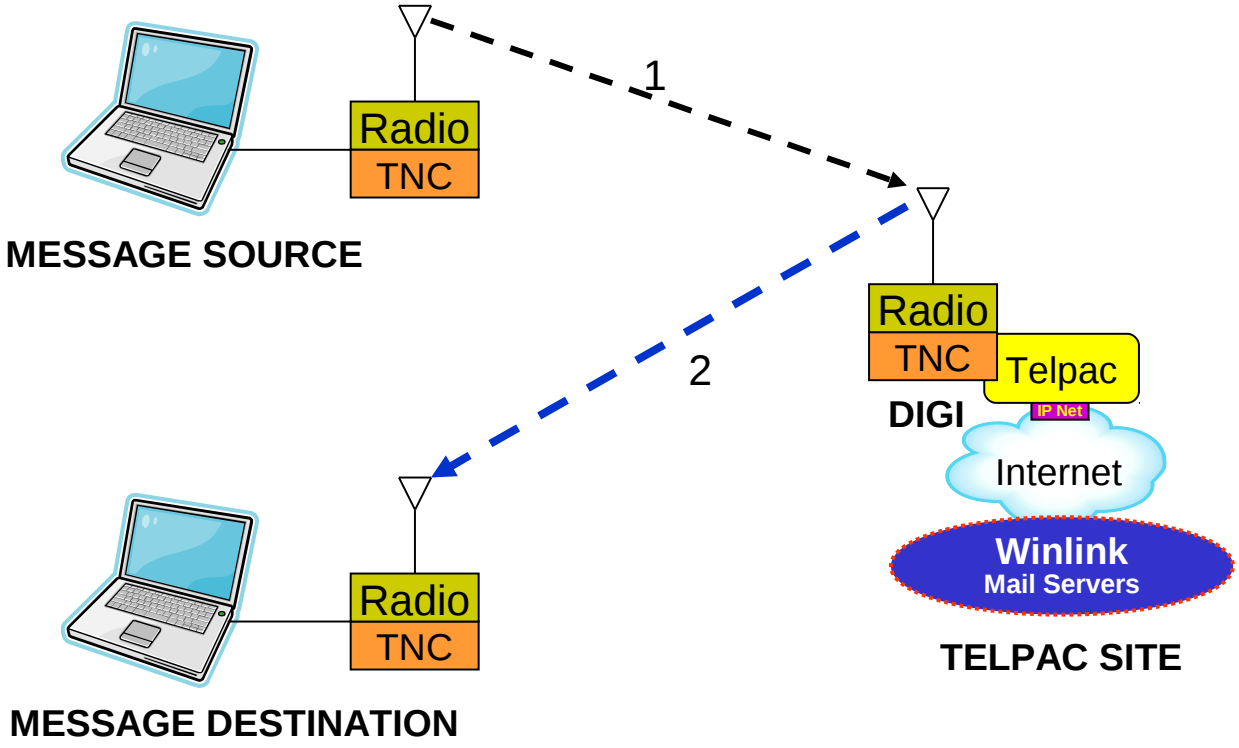
- With Gateways, the channel capacity is not reduced as a message makes it's way through the system. For example, when the gateway is sending the message to the destination, any source will see the channel as clear, because the path from the gateway to the destination is on a different frequency.

WINLINK & DIGIPEATERS



If it takes X minutes to send a message directly from the Source to the Destination, it will take 4X minutes if the message is sent via Winlink, through a digipeater. This means the frequency is not available for other use for 4X minutes.

IDEALY: DIGI=GATEWAY

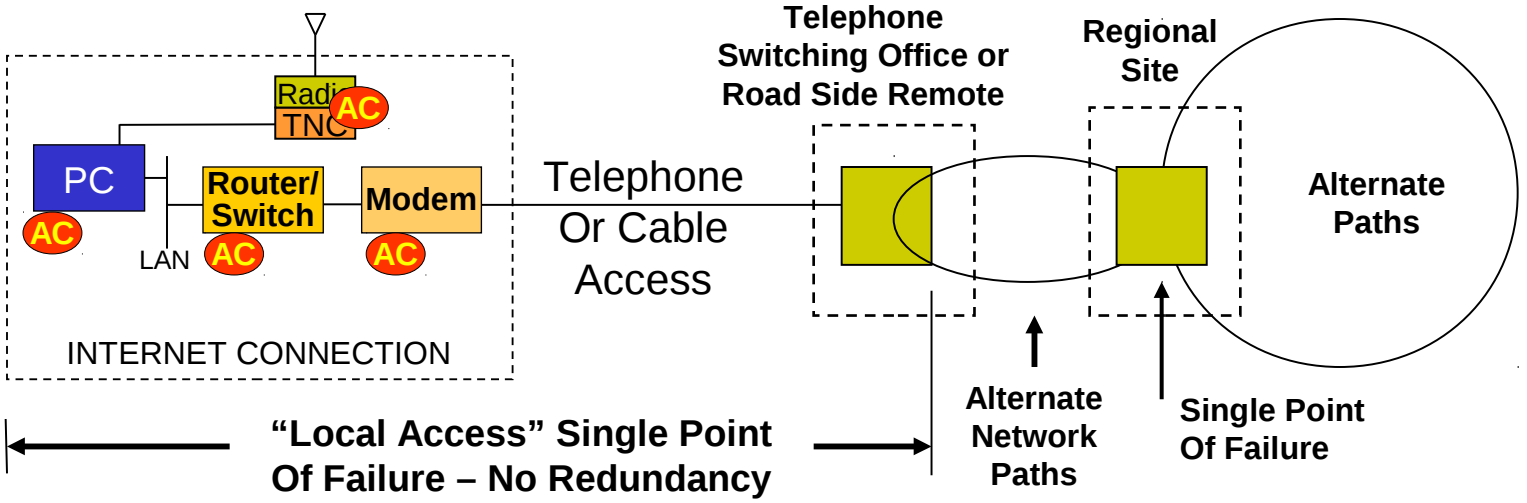


If the packet digipeater site is also the Winlink Telpac site, then Winlink messages take no longer than a message sent via the digipeater.

INTERNET CONNECTIVITY

- While the Internet protocol produces a self healing network, in order to heal, the network must have alternate routes to get to its destination.
- Networks that deliver internet connectivity, by design, have sections that do not have alternate routes, so failure of any portion of this section will result in loss of internet connectivity.
- There may be several single points of failure as the local internet connection routes to the high bandwidth Internet backbone.

INTERNET CONNECTIVITY



- The local access, from the Telephone/Cable Company interface to the home or business is the most vulnerable to failure.
- While most Telco equipment has battery backup and a generator back up option (local or portable), there can be failures due to loss of power, or loss of key equipment.
- All AC powered equipment must have backup power.

REDUCING COMPLEXITY

There are ways to reduce the complexity of Amateur data communications solutions.

- Standardize on hardware. Solve problems once.
- Standardize on software. Only learn 1 application.
- Keep It Simple Stupid. Self explanatory.
- TEST, TEST, TEST – Different people, different situations. Know your solution, how it works and what it’s limitations are!

Points To Ponder

- Digipeaters or Nodes are often required, but more than 1 makes packet nearly unusable for file transfers and for Winlink.
- All components in the network must have alternate power, which means UPS for AC powered devices. Most UPSs will only keep a PC going for about an hour, then what?.
- If Amateur radio is a backup in case of failure, the Amateur solution must be able to function with loss of Internet access.